

Grant Proposal

Strengthening the National Management System for Invasive Alien Species in Romania in Compliance with EU Requirements (COMPLIAS)

Nicolae Manta^{‡,§}, Cristina Preda[¶], Laurentiu Rozyłowicz[¶], Steluta Manolache[¶], Ioana-Minodora Sirbu[#], Marius Skolka[¶], Cristian I. Ioja[¶], Iulia V. Miu[¶], Andreea Nita[¶], Mihai R. Nita[¶], Iulian M. Niculae[¶], Mihaela M. Urziceanu[#], Eugenia Nagoda[□], Alina G. Cislariu[#], Petronela Camen-Comanescu[□], Marian D. Mirea[¶], Lavinia C. Pindaru[¶], Marius M. Matache[¶], Paulina Anastasiu^{□,#}

‡ Ministry of Environment, Waters and Forests, Bucharest, Romania

§ University of Bucharest, Doctoral School in Geography Simion Mehedinti, Bucharest, Romania

¶ Ovidius University of Constanta, Research Center of the Department of Natural Sciences, Faculty of Natural and Agricultural Sciences, Constanta, Romania

¶ University of Bucharest, Center for Environmental Research, Bucharest, Romania

University of Bucharest, Faculty of Biology, Department of Botany and Microbiology, Bucharest, Romania

□ University of Bucharest, Dimitrie Brândză Botanical Garden, Bucharest, Romania

Corresponding author: Cristina Preda (cristina.preda@univ-ovidius.ro)

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Abstract

Invasive alien species (IAS) represent one of the most significant threats to biodiversity in Romania and across the European Union. Despite the adoption of EU Regulation 1143/2014 on the prevention and management of the introduction and spread of IAS, its effective implementation at national level requires substantial institutional, scientific and operational capacity building. Here, we present a comprehensive national project, COMPLIAS *Consolidarea Sistemului National de Management al Specilor Alogene Invazive din Romania in Conformitate cu Cerintele UE / Strengthening the National Management System for Invasive Alien Species in Romania in Compliance with EU Requirements*, SMIS 337191, funded under the Sustainable Development Programme

(PDD/216, Priority 2, Specific Objective RSO 2.7) and implemented by the University of Bucharest in partnership with the Ministry of Environment, Waters and Forests of Romania. The project addresses all major obligations under EU Regulation 1143/2014 through seven interconnected work packages: (WP1) updating the regulatory and strategic framework, including the revision of the Invasive Alien Species Action Plan (IAS action plan); (WP2-WP4) comprehensive inventory and mapping of invasive alien species (plants, vertebrates and invertebrates) across Romania; (WP5) developing an early detection and border control system for IAS; (WP6) species distribution modelling, impact assessment and piloting eradication and control techniques for priority IAS; and (WP7) public awareness and stakeholder engagement campaigns. The project will also produce legally binding outputs, including a revised IAS action plan approved by Ministerial Order and mandatory country reports to the European Commission. This paper describes the project's objectives, methodological approach, expected outcomes and its contribution to the EU Biodiversity Strategy for 2030.

Keywords

EU Regulation 1143/2014, surveillance system, action plan, species distribution modelling, eradication, biodiversity strategy

Participants

Ministry of Environment, Waters and Forests, Romania (Beneficiary)

University of Bucharest, Romania (Partner)

State of the art and preliminary work

The global and European context

Invasive alien species (IAS) are globally recognised as one of the main direct causes of biodiversity loss, alongside habitat change, overexploitation, climate change and pollution (Roy et al. 2024b). The recent assessment by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) found that over 37,000 alien species have been introduced worldwide, with more than 3,500 being invasive and representing serious threats to biodiversity, ecosystem services and human well-being (Roy et al. 2024a, Roy et al. 2024b). The global economic costs of biological invasions have been estimated to exceed 1.288 trillion USD over the past few decades, with annual costs reaching at least 26.8 billion USD and increasing approximately threefold every decade (Diagne et al. 2021). The rate of new alien species introductions continues to accelerate across all taxonomic groups and regions worldwide, likely leading to increasingly severe outcomes in the future (Seebens et al. 2026).

Biological invasions are amongst the main threats to European biodiversity, alongside land-use change and overexploitation (Hochkirch et al. 2023). The European Alien Species Information Network (EASIN) documents widespread invasion of European ecosystems, with IAS of EU concern found in all biogeographical regions (Polce et al. 2023). Marine ecosystems face specific challenges, as most EU countries lack dedicated monitoring programmes for marine IAS and the standardisation of monitoring methods remains necessary (Katsanevakis et al. 2023).

The European Union has addressed this challenge through Regulation (EU) No 1143/2014 of the European Parliament and of the Council on prevention and management of the introduction and spread of invasive alien species (hereinafter the "IAS Regulation"). This landmark legislation establishes a comprehensive framework requiring Member States to implement prevention measures, establish surveillance systems, conduct early detection and rapid eradication of newly-detected IAS of Union concern, as well as manage widely spread IAS (European Parliament and Council 2014). The list of IAS of Union concern has increased from an initial 37 species in 2016 to 114 species at present (Commission Implementing Regulation (EU) 2025/1422), highlighting the evolving nature of biological invasions and the growing scientific evidence base.

However, the effective implementation of the IAS Regulation at the national level faces significant challenges. A comparative assessment of Austria and Romania identified obstacles related to the creation, updating and maintenance of the Union List, distribution of competences influencing national cooperation and coordination, insufficient financial resources and gaps in customs controls and national legislation (Roman and Mauerhofer 2021). Similar implementation challenges have been documented across other EU Member States (Krämer 2021). Germany's experience with developing its first national IAS action plan demonstrated the complexity of coordinating relevant ministries, authorities, scientists and stakeholders in a multi-sector process (Mayer et al. 2023).

The Kunming-Montreal Global Biodiversity Framework (KM-GBF), adopted in December 2022, further strengthened the international mandate for IAS management through Target 6, which aims to reduce the rate of introduction and establishment of known or potential IAS by at least 50% by 2030. Achieving this target in protected areas requires coordination with various other Global Biodiversity Framework targets related to tourism, urban development, agriculture and climate change (Hulme et al. 2025, Nita et al. 2025).

Romanian context

Romania, situated at the crossroads of major biogeographical regions (i.e. Continental, Steppic, Alpine, Pannonian and Black Sea) and traversed by the Danube River, one of Europe's most significant corridors for IAS dispersal, faces distinct challenges in IAS management. The country's diverse ecosystems, including the Danube Delta UNESCO Biosphere Reserve, extensive Carpathian forests and Black Sea coastal habitats, harbour rich native biodiversity that is increasingly threatened by biological invasions (Cogalniceanu et al. 2020, Anastasiu et al. 2024, Stanciu et al. 2023). Romania's first comprehensive national-level effort to address IAS management was undertaken through

a national project funded under the EU Cohesion Policy's Large Infrastructure Operational Programme (Invasive species management in Romania according to REGULATION (EU) 1143/2014 on the prevention and management of the introduction and spread of invasive alien species, project number SMIS 120008). That project produced the first national-scale inventory of alien species, established the web-based surveillance system, developed the Action Plan for Addressing the Priority Pathways of Introduction of Invasive Alien Species (IAS action plan; MMAP (2022)) and implemented a national-scale awareness campaign. At the regional scale, the South European Network for Invasive Alien Species (ESENIAS), coordinated by the Institute of Biodiversity and Ecosystem Research (IBER-BAS, Bulgaria), has laid important groundwork for the present project by fostering cross-border scientific cooperation and knowledge exchange on IAS management in south-eastern Europe (Trichkova et al. 2025).

The present project, *Consolidarea Sistemului National de Management al Speciilor Alogene Invasive din Romania in Conformitate cu Cerintele UE / Strengthening the National Management System for Invasive Alien Species in Romania in Compliance with EU Requirements* (project number SMIS 337191), represents a major scaling-up of Romania's capacity to fulfil its obligations under the IAS Regulation and to contribute to the EU Biodiversity Strategy for 2030 target of reducing by 50% the number of Red List species threatened by IAS. The project is funded by the Ministry of Investments and European Projects under the Sustainable Development Programme (PDD/216, Priority 2, Specific Objective RSO 2.7) for biodiversity conservation to meet the requirements of EU environmental directives and is implemented by the University of Bucharest in partnership with the Ministry of Environment, Waters and Forests over a period of 48 months (2026-2029).

Goal and objectives

The overarching goal of the project is to strengthen Romania's national IAS management system to achieve full compliance with EU Regulation 1143/2014 and to contribute to the EU Biodiversity Strategy for 2030. This is pursued through five strategic objectives:

Objective 1: Update and complete the regulatory framework for IAS management by revising the IAS action plan in accordance with the latest EU guidance and the KM-GBF, updating the surveillance system and delivering mandatory country reports to the European Commission.

Objective 2: Generate comprehensive, up-to-date distribution data for alien species in Romania, with a particular focus on IAS of Union and national concern. This will be achieved through systematic inventory and mapping campaigns covering plants, vertebrates and invertebrates (including marine, freshwater and terrestrial taxa), employing both intensive and reduced-effort survey protocols.

Objective 3: Develop and implement an early detection system, including a professional network of botanical gardens and research stations, enhanced border

control capacity at customs points and citizen science platforms integrated into the national surveillance infrastructure.

Objective 4: Advance scientific tools for evidence-based IAS management through species distribution modelling for all IAS of Union concern under current and future climate scenarios, standardised impact assessment using Environmental Impact Classification for Alien Taxa (EICAT) and Socio-Economic Impact Classification for Alien Taxa (SEICAT) protocols and piloting eradication and control techniques for six priority species.

Objective 5: Increase public and institutional awareness and engagement through education campaigns, social media, workshops and targeted communication to authorities, protected area managers and the general public.

The project builds directly on the data, infrastructure and institutional relationships established during the preceding IAS project (SMIS 120008), ensuring continuity while substantially expanding the scope, resolution and policy impact of IAS management activities in Romania.

Work packages

The project is structured into seven work packages, designed to address all phases of the IAS management cycle, from developing the regulatory framework to surveillance, early detection, inventory, impact assessment, management actions and public engagement. These work packages are interconnected, with data and results flowing logically between them to ensure coherence and integration.

Work package 1: Updating and completing the regulatory framework

Work package 1 forms the policy backbone of the project, addressing the full cycle of strategic planning, monitoring and reporting obligations under EU Regulation 1143/2014. It comprises nine sub-activities that collectively deliver the updated regulatory and strategic framework for IAS management in Romania.

Analysis of monitoring and evaluation methodologies (WP1.1). A systematic review of the monitoring and evaluation methodologies used by other EU Member States in their pathway action plans will be conducted, drawing on scientific literature, administrative reports and questionnaire-based consultations with responsible institutions. The output will be a technical report on transferable best practices for monitoring pathway action plans, published as open-access on the EU Open Research Repository.

Monitoring and evaluation of IAS action plan implementation (WP1.2). The current status of implementation of the IAS action plan objectives and measures will be assessed through analysis of administrative reports, institutional questionnaires (both online and in-person) and field verification visits. This activity will track progress against the baseline established in the first plan iteration.

Efficiency and effectiveness analysis (WP1.3). A cost-effectiveness analysis of resources allocated to IAS management at national and local levels will be conducted, including the organisation of three stakeholder workshops. The output will include a good-practice guide for coordinating IAS management regulations across sectors. This activity is informed by evidence that management expenditure globally remain 1-2 orders of magnitude lower than documented damage costs and that pre-invasion management spending is over 25 times lower than post-invasion expenditure (Cuthbert et al. 2022).

IAS management guide for protected areas (WP1.4). Given the particular vulnerability of natural protected areas to biological invasions, a dedicated management guide will be developed addressing the challenges of prevention, early detection, control and eradication of IAS in protected areas. This guide will cover all stages of the invasion process, with specific recommendations for protected area administrators, in response to the recognition that effective IAS management in protected areas requires coordination across multiple biodiversity targets (Hulme et al. 2025).

Support activities for IAS action plan revision and coordination (WP1.5). A comprehensive evaluation of institutional preparedness at local and county levels for implementing IAS management measures will be conducted through fieldwork. This sub-activity also coordinates the integration of results from all other sub-activities into the revision process, including the inventory of potential funding sources from various programmes.

Revision of the IAS action plan (WP1.6). The pathway action plan will be revised in accordance with the European Commission protocol, incorporating results from all project activities. The revision will address: the strategic vision aligned with the KM-GBF; updated challenges for IAS management; revised measures; cost estimation, including cost-benefit analysis; and four stakeholder consultation workshops. The revised plan will be approved through a Ministerial Order, making it legally binding (Pindaru et al. 2026). The revision process draws on lessons learned from Germany's first pathway action plan development (Mayer et al. 2023) and the broader experience of EU Member States in pathway analysis (Arianoutsou et al. 2021).

Surveillance system update (WP1.7). The existing web-based geographic information system (webGIS) will be upgraded to include all IAS of Union concern (expanded from the initial 49), updated security standards, new functionalities for mobile field data collection and alignment with the latest provisions of Regulation 1143/2014, Article 14(2) (b), requiring systems sufficiently dynamic for rapid detection. The upgrade advances towards interoperability with the community-driven data exchange format for IAS management data (Reyserhove et al. 2022).

Mandatory EU reporting (WP1.8). The project will prepare and submit Romania's second mandatory country report to the European Commission (covering distribution data, surveillance system description, official control systems, eradication measures, management actions, costs and public information), as well as a preliminary version of the third country report.

Work package 2: Inventory and mapping of invasive alien plants

Work package 2 addresses the comprehensive inventory and mapping of alien plant species across Romania through five sub-activities following a logical workflow.

Species list update (WP2.1). The existing list of alien plant species (currently ~ 400 species) (Sirbu et al. 2022, Anastasiu et al. 2024) will be updated to include new records and species of Union concern not yet reported from Romania. Species nomenclature follows the Plants of the World Online (POWO) database strictly. Introduction pathways will be characterised following the Convention on Biological Diversity (CBD) classification framework, which has shown that ornamental and horticultural activities are the primary introduction pathways for alien plants into Europe (Arianoutsou et al. 2021).

Protocol development (WP2.2). Updated standardised inventory and mapping protocols will be developed in two variants: (i) an intensive survey protocol for IAS of Union concern (listed under Regulation 1143/2014) and IAS of national concern (additionally designated by Romania) and (ii) a reduced-effort survey protocol for all other alien species. The protocols will specify sampling methodologies, data collection standards, equipment requirements and a standardised mobile application for field data recording. A published digital guide will accompany the protocols.

Intensive inventory and mapping (WP2.3). For species of Union and national concern with confirmed presence in Romania, including *Ailanthus altissima*, *Asclepias syriaca*, *Elodea nuttallii*, *Heracleum sosnowskyi*, *Humulus scandens*, *Impatiens glandulifera*, *Ludwigia peploides*, *Ambrosia artemisiifolia*, *Ambrosia tenuifolia*, *Ambrosia trifida*, *Cyclachaena xanthiifolia*, *Phytolacca americana*, *Phytolacca acinosa* and *Verbesina encelioides*, intensive mapping will be carried out over three years in randomised plots ranging from 25 to 200 m², depending on habitat and growth form. The invasion risk of *Humulus scandens* through the Tisa Basin and Danube Corridor has been documented using ensemble distribution modelling and habitat connectivity analysis (Urziceanu et al. 2022), so special attention will be given to the Danube corridor. Pilot technologies will include the deployment of drones with multispectral and hyperspectral cameras and AI-based image recognition algorithms trained to identify spectral signatures of target species, building on advances in remote sensing for invasive plant detection (Roca et al. 2022, Malinowski et al. 2025). In addition, vehicle-mounted high-speed camera systems (CamAlien) will be tested for roadside monitoring of invasive plants along transport corridors, using deep learning for species recognition to enable rapid, large-scale surveys at traffic speed (Dyrmann et al. 2021, Dyrmann et al. 2024, Groom et al. 2025).

Reduced-effort national mapping (WP2.4). All alien plant species on the national list will be mapped at reduced intensity in 10 km × 10 km plots, selected through stratified random sampling across all counties. At least one botanical expert will be assigned per county, with data collected during June–October over three years. Additional data will be gathered through opportunistic sampling, reports from environmental authorities and protected area managers and social media monitoring.

Data validation and EU reporting preparation (WP2.5). All distribution data will be integrated into a GIS database, subjected to rigorous quality control (duplicate removal, GPS coordinate verification, taxonomic validation against POWO) and prepared in the formats required for EU reporting.

Work package 3: Inventory and mapping of invasive alien vertebrates

Work package 3 mirrors the structure of WP2, adapted for vertebrate taxa. The updated species list encompasses approximately 50 alien vertebrate species reported from Romania (Cogalniceanu et al. 2020, Stănescu et al. 2020, Dragan et al. 2024). Intensive mapping targets confirmed IAS of Union and national concern, including fish (e.g. *Lepomis gibbosus*, *Pseudorasbora parva*, *Gambusia holbrooki*, *Percottus glenii*, *Ameiurus melas*), birds (*Alopochen aegyptiaca*, *Threskiornis aethiopicus*), mammals (*Nyctereutes procyonoides*, *Procyon lotor*, *Ondatra zibethicus*, *Myocastor coypus*, *Neogale vison*) and reptiles (*Trachemys scripta*). Pilot technologies include motion-activated camera traps, thermal imaging drones, audio recorders with AI-based species identification and AI-powered image analysis of camera-trap data. To ensure interoperability, camera-trap data will be managed following the Camtrap DP open standard for FAIR data exchange and archiving, facilitating large-scale data sharing (Bubnicki et al. 2023). Passive acoustic monitoring combined with automated recognition has been demonstrated to be highly effective for detecting invasive amphibians in Europe, with detection rates exceeding 89% (Bota et al. 2024), providing a model for our acoustic surveillance approach.

Work package 4: Inventory and mapping of invasive alien invertebrates

Work package 4 addresses the most taxonomically diverse group, with approximately 450 alien invertebrate species (marine, freshwater and terrestrial) known from Romania (Băncilă et al. 2022, Popa et al. 2022, Popescu Mirceni et al. 2022, Adam et al. 2023a, Adam et al. 2023b, Popa et al. 2023, Popescu Mirceni et al. 2023). Species of Union and national concern targeted for intensive mapping include freshwater crayfish (*Orconectes limosus*, *Procambarus fallax* f. *virginalis*), the Chinese mitten crab (*Eriocheir sinensis*), the Chinese pond mussel (*Sinanodonta woodiana*), the marine blue crab (*Callinectes sapidus*), the tiger mosquito (*Aedes albopictus*) and terrestrial species, such as the land planarian *Obama nungara*. Novel detection technologies include environmental DNA (eDNA)-based monitoring of aquatic species, satellite remote sensing, colonisation panels for sessile marine organisms, pheromone traps for terrestrial invertebrates and automated light traps, equipped with computer vision-based tracking and deep learning for non-lethal monitoring of nocturnal insects (Bjerge et al. 2021, August et al. 2025).

eDNA has emerged as a powerful, non-invasive and cost-effective tool for detecting invasive species at low population densities in aquatic ecosystems (Larson et al. 2020). Active eDNA sampling has been shown to be considerably more cost-effective than conventional methods for detecting invasive freshwater fish (Morris et al. 2024) and eDNA metabarcoding has successfully detected new invasion records, including in Eastern European freshwater systems (Jeunen et al. 2022). Species-specific eDNA

assays have been validated for invasive crayfish detection and early warning across multiple European countries (Bommerlund et al. 2023). These approaches will be adapted for the Romanian context, particularly for monitoring the Danube and Black Sea coastal habitats (Preda et al. 2012).

Work package 5: Developing an early detection system

Work package 5 addresses the critical need for early detection of IAS through three complementary approaches. Early detection and rapid response (EDRR) strategies are recognised as one of the most effective ways to manage potential IAS, although their implementation in the EU remains challenging due to the division of regulatory responsibilities between phytosanitary and IAS legislation (de Groot 2020).

Professional early detection network (WP5.1). A national early detection network comprising nine botanical gardens, research stations and research centres will be established and implemented through five stages: (i) assessing the detection capacity of potential network members; (ii) developing a standardised detection protocol for IAS observations; (iii) formalising collaboration through inter-institutional agreements and training in detection equipment operation; (iv) active observations and data integration into project databases; and (v) developing a sustainability plan for the network's long-term operation. This approach aligns with early warning system design principles that emphasise the integration of automated surveillance, warning generation and dissemination to decision-makers (Rainford et al. 2020).

Border control enhancement (WP5.2). Building on the experience from the previous project (SMIS 120008), which revealed that Romanian customs effectively intercept IAS only when correctly declared by importers/exporters, this sub-activity will: inventory all customs points relevant for phytosanitary and environmental controls; create databases of environmental authorities and specialists for customs officers; produce and distribute a printed species identification guide for all IAS of Union and national concern; and establish formal collaboration protocols amongst customs, environmental authorities, phytosanitary services and research institutions. The need for enhanced biosecurity at borders is well documented, with frontline surveillance staff requiring actionable risk information and close collaboration between developers and end-users of early warning systems (Rainford et al. 2020).

Citizen science for early detection (WP5.3). A systematic approach to integrating citizen science into the national IAS surveillance system will be developed by: inventorying existing citizen science platforms used in Romania (e.g. iNaturalist, PlantNet); conducting a sociological analysis of motivations for nature observations and platform use; establishing a data integration workflow for incorporating citizen science observations into mandatory EU reporting; and securing Romania's accession to the GBIF (Global Biodiversity Information Facility) infrastructure through the establishment of an IAS focal point with GBIF publishing rights. Multi-species citizen science platforms have been shown to be a valuable source of information for the early detection of IAS, with citizen science observations documenting the presence of IAS earlier than, or in the same year

as, official surveillance databases in 50% of cases (González-Moreno et al. 2024). The LIFE RIPARIAS Early Alert tool, which aggregates data from diverse GBIF-mediated sources and sends tailored alerts to managers, provides a model for the integration workflow (Noe et al. 2022). Emerging tools that combine citizen science, eDNA, social media data mining and remote sensing are transforming IAS surveillance capabilities (Larson et al. 2020, Dias et al. 2025).

Work package 6: Impact assessment, modelling, and eradication techniques

Work package 6 provides the scientific evidence base for prioritising IAS management actions through three sub-activities:

Species distribution modelling (WP6.1). Current and future distributions will be modelled for all IAS of Union concern using an ensemble modelling approach (BRT, MaxEnt, Random Forest, GLM) applied in two phases. Phase 1 will use existing data from SMIS 120008 to produce preliminary models for the 22 species with confirmed presence. Phase 2 will integrate new field data from this project to refine models for confirmed species and extend predictions to all listed species, including future climate scenarios (Shared Socioeconomic Pathways SSP, SSP2-4.5, SSP3-7.0, SSP5-8.5) for 2050 and 2070 using Coupled Model Intercomparison Project Phase 6 (CMIP6) variables. Data will be organised on a 10 km × 10 km grid aligned with the European Environment Agency ETRS89-LAEA reference system. The reproducible WiSDM workflow for standardised IAS risk maps at 1 km² resolution across Europe provides a methodological template for our approach (Davis et al. 2024).

Impact assessment (WP6.2). A standardised impact assessment will be conducted for 114 species using EICAT and SEICAT protocols (Volery et al. 2020, Kumschick et al. 2023, Probert et al. 2023), supplemented by data from the InvaCost database (Diagne et al. 2020, Diagne et al. 2021). Each target species will be independently evaluated by three assessors, followed by three consensus workshops (for plants, animals and cross-taxa harmonisation). Results will provide the information for the revision of the IAS action plan through a prioritisation ranking, based on ecological, social and economic impacts.

EICAT, adopted as an IUCN standard, provides a robust tool to support the prioritisation and management of non-native species and to monitor progress towards KM-GBF Target 6 (Kumschick et al. 2023). Recent improvements to EICAT guidelines have clarified the distinction between impact severity levels and improved handling of uncertainty (Volery et al. 2020). SEICAT complements EICAT by measuring how alien taxa alter human activities across different constituents of human well-being (Probert et al. 2023). The IPBES Global Impacts Dataset of Invasive Alien Species (GIDIAS), which includes over 22,000 records of impacts linked to EICAT and SEICAT classifications, will serve as a key reference resource (Bacher et al. 2025). The InvaCost database, documenting global economic costs, provides essential supplementary data for cost-benefit analyses within the IAS action plan revision (Diagne et al. 2020, Diagne et al. 2021).

Eradication and control techniques (WP6.3). Practical eradication and control measures will be piloted for six priority species:

- *Heracleum sosnowskyi*. For this species, we will follow the European and Mediterranean Plant Protection Organisation (EPPO) Standard PM 9/9 (2), including mapping of affected areas, development of eradication plans (manual removal for small areas, chemical treatment with EU-approved herbicides, excluding neonicotinoids for larger areas), two years of treatment application and production of an eradication guide applicable to congeners (*Heracleum mantegazzianum*, *Heracleum persicum*);
- *Ailanthus altissima*. We will test chemical control methods using EU-approved herbicides for one of the most widespread IAS of Union concern in Romania and develop guidelines applicable to other invasive woody species;
- *Trachemys scripta*. The species was recently confirmed to have reproductive populations in Romania (Fănaru et al. 2024). To develop an efficient containment protocol, we will combine drone-based and remote-camera nest detection, destroy nests and live-trap mature individuals. The EU trade ban on *Trachemys scripta*, implemented through Regulation 1143/2014, ceased imports, but had minimal impact on established populations, highlighting the need for active management (Rato et al. 2025);
- *Procyon lotor*. We will document captive populations in zoos, wildlife rehabilitation centres and private collections, alert holders about mandatory sterilisation/castration and produce a prevention guide against population establishment. Adaptive management approaches integrating camera traps and live traps have been demonstrated to be successful for raccoon eradication in Europe (Mazzamuto et al. 2020);
- *Callinectes sapidus* and *Eriocheir sinensis*. For these species, we will develop documentation for inclusion in commercial fishing permits without quota restriction and produce eradication/control guides. *Callinectes sapidus* is a highly eurythermal and euryhaline species that has been rapidly expanding across Mediterranean lagoons, with salinity tolerance modelling providing tools for prioritising management areas (Marchessaux et al. 2024).

All eradication/control guides will be published on the Ministry of Environment, Waters and Forests website and distributed to the County Environmental Directorates, the Environmental Guard and protected area administrators.

Work package 7: Public awareness and stakeholder engagement

Work package 7 ensures broad dissemination and institutional capacity building through:

Web and social media campaign. A dedicated project website on the Ministry's web portal and social media accounts (Facebook, Instagram) will be maintained throughout the project, aiming to reach at least 5,000 people and gain 2,000 followers. Six press releases will be issued at key project milestones, distributed to 150 institutions.

Educational workshops and materials. Targeted workshops will be organised for environmental authorities, protected area administrators, customs officers and the scientific community to build capacity for IAS identification, reporting and management (Ferreira-Rodríguez et al. 2025). Campaigns addressing the general public and specific stakeholder groups will be designed to align with the EU Biodiversity Strategy's communication objectives, using both traditional and digital media.

Implementation framework

The project is implemented through a partnership between the Ministry of Environment, Waters and Forests (Ministerul Mediului, Apelor și Pădurilor, MMAP), as the beneficiary and the University of Bucharest (UB), as the partner, providing scientific coordination, institutional support, policy coordination and dedicated technical staff. Field inventory and mapping activities for all three taxonomic groups are subcontracted to specialised teams, ensuring national coverage with at least one expert per county for reduced-effort mapping.

The project timeline spans 48 months, with activities organised to ensure that foundational outputs (species lists, protocols, surveillance system updates) precede data-intensive activities (inventory, mapping, modelling), which, in turn, feed into management outputs (IAS action plan revision, eradication guides, EU reporting). Key temporal dependencies include:

- Species list updates (WP2.1, WP3.1, WP4.1) in months 1-11, preceding inventory protocol development;
- Protocol finalisation (WP2.2, WP3.2, WP4.2) in months 2-13, preceding field campaigns;
- Three-year field inventory campaigns (WP2.3-WP2.4, WP3.3-WP3.4, WP4.3-WP4.4) in months 13-46;
- Species distribution modelling (WP6.1) running across months 2-48;
- IAS action plan revision (WP1.6) incorporating all results, running across the full 48-month period with the Ministerial Order approval at the end;
- EU country reports (WP1.8) coordinating all data flows for the second report and a preliminary third report.

Quality assurance is ensured through standardised data collection applications, centralised GIS databases with systematic validation workflows (duplicate removal, GPS coordinate verification, taxonomic cross-referencing against authoritative databases) and scientific coordination by UB experts overseeing subcontracted field teams.

Expected outcomes and impact

The project will deliver a comprehensive set of legally binding, scientifically validated and operationally actionable outputs:

Regulatory outputs:

- Revised IAS action plan approved by Ministerial Order;
- Updated surveillance system compliant with Article 14 of the IAS Regulation;
- Second mandatory country report submitted to the European Commission;
- Preliminary 3rd country report approved by MMAP.

Scientific outputs:

- Updated species lists for alien plants, vertebrates and invertebrates;
- Three-year distribution databases (GIS) for all taxonomic groups;
- Species distribution models (current and future) for all IAS of Union concern species;
- Standardised impact assessments (EICAT/SEICAT) for all IAS of Union concern species;
- Inventory and mapping protocols and published digital guides for all three taxonomic groups.

Management outputs:

- Five eradication/control guides for priority species;
- Early detection network implemented across nine institutions;
- Border control capacity enhanced through customs databases, species identification guides and inter-institutional collaboration protocols;
- Citizen science integration workflow and GBIF publishing capability established.

Engagement outputs:

- Project website and social media presence reaching 5,000+ persons;
- Workshops for environmental authorities, protected area managers and customs officers;
- IAS of Union and national concern species guide.

All scientific results will be published as open-access on the EU Open Research Repository and integrated into the revised IAS action plan and mandatory EU reports, ensuring maximum transferability and policy uptake.

Contribution to EU policy objectives

The project directly supports the implementation of multiple EU policy instruments:

EU Regulation 1143/2014, by fulfilling Romania's obligations regarding surveillance systems (Art. 14), mandatory reporting (Art. 24), pathway action plans (Art. 13), official controls (Art. 15), eradication measures (Art. 17) and management measures (Art. 19).

EU Biodiversity Strategy for 2030, by contributing to the target of reducing by 50% the number of Red List species threatened by IAS, through comprehensive distribution data, predictive models, impact assessments and management prioritisation.

Kunming-Montreal Global Biodiversity Framework, particularly Target 6 on reducing the rate of introduction and establishment of known or potential IAS by at least 50%, through enhanced border controls, early detection networks and pathway management.

Nature Restoration Law, by providing baseline distribution data and management tools essential for designing restoration actions in areas affected by IAS.

The project also contributes to Romania's broader obligations under the Water Framework Directive, the Marine Strategy Framework Directive and the Birds and Habitats Directives, as IAS are recognised as a pressure on the ecological status of water bodies and the conservation status of habitats and species under these directives.

In the broader European context, the project complements initiatives such as the GuardIAS project (Guarding European Waters from Invasive Alien Species), which focuses on aquatic IAS at the pan-European scale through innovative detection technologies, citizen science and systematic conservation planning (Katsanevakis et al. 2024) and the OneSTOP project (OneBiosecurity Systems and Technology for People, Places and Pathways), which pioneers joined-up biosecurity approaches for terrestrial IAS (Groom et al. 2025). While these Horizon Europe projects develop pan-European tools and methodologies, the present project delivers the national-scale, all-taxa data infrastructure and regulatory framework updates necessary for effective ground-level implementation of the IAS Regulation. This complementarity between European-level innovation and national-level implementation is essential for translating the EU Biodiversity Strategy and the KM-GBF into tangible conservation outcomes.

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Grant title

Consolidarea Sistemului National de Management al Speciilor Alogene Invazive din Romania in Conformitate cu Cerintele UE, SMIS 337191

Conflicts of interest

The authors are employed to carry out the activities of the project *Consolidarea Sistemului National de Management al Speciilor Alogene Invazive din Romania in Conformitate cu Cerintele UE*, SMIS code 337191.

References

- Adam C, Constantinescu IC, Drăghici AC, Fusu L, Fusu MM, Gheoca V, Iorgu IS, Irimia AG, Maican S, Mancu CO, Manu M, Mitroiu MD, Oloşutean HG, Perju M, Petrescu AM, Pintilioaie AM, Popa AM, Popescu IE, Popovici OA, Prunar FV, Radac IA, Ruicănescu A, Sahlean CT, Sitar C, Stanciu CR, Szekeley L, Tăușan I, Tomozii IB, Török SC, Zaharia LG (2023a) Raport final privind distribuția speciilor de nevertebrate terestre alogene din hot-spot-uri și căile prioritare de pătrundere (an 3 cartare). Zenodo <https://doi.org/10.5281/ZENODO.8224465>
- Adam C, Constantinescu IC, Cristescu M, Drăghici AC, Fusu L, Fusu MM, Gheoca V, Ilie DM, Iorgu IȘ, Irimia AG, Maican S, Mancu CO, Manu M, Mitroiu MD, Petrescu AM, Pintilioaie AM, Popa AF, Popescu IE, Popovici OA, Prunar FV, Rădac IA, Ruicănescu A, Ruști DM, Sahlean CT, Sitar C, Stanciu CR, Szekeley L, Șerban C, Tăușan I, Tomozii IB, Török SC, Urák I, Zaharia LG (2023b) Raport final privind distribuția speciilor de nevertebrate terestre alogene rezultată din activitatea de inventariere cu efort redus (an 3 cartare). Zenodo <https://doi.org/10.5281/ZENODO.8224579>
- Anastasiu P, Miu I, Gavrilidis A, Preda C, Rozyłowicz L, Sirbu C, Oprea A, Urziceanu M, Camen-Comanescu P, Nagoda E, Memedemin D, Barbos M, Boruz V, Cislariu A, Don I, Fagaras M, Frink J, Georgescu I, Haruta O, Hurdu B, Matis A, Milanovici S, Muncaciu S, Neacsu A, Neblea M, Nicolin A, Niculescu M, Oroian S, Pop O, Radutoiu D, Samarghitan M, Simion I, Soare L, Steiu C, Stoianov E, Strat D, Szabo A, Szatmari P, Tanase C, Mirea M, Manta N, Sirbu I (2024) Alien plant species distribution in Romania: a nationwide survey following the implementation of the EU Regulation on Invasive Alien Species. Biodiversity Data Journal 12 <https://doi.org/10.3897/bdj.12.e119539>
- Arianoutsou M, Bazos I, Christopoulou A, Kokkoris Y, Zikos A, Zervou S, Delipetrou P, Cardoso AC, Deriu I, Gervasini E, Tsiamis K (2021) Alien plants of Europe: introduction pathways, gateways and time trends. PeerJ 9 <https://doi.org/10.7717/peerj.11270>
- August T, Balzan M, Bodesheim P, Brehm G, Cantú-Salazar L, Castro S, Chipperfield J, Ghisbain G, Gomez-Segura A, Goulnik J, Groom Q, Hogeweg L, Huijbers C, Kamilaris A, Kazlauskis K, Koch W, Korsch D, Loureiro J, Martin Y, Martinou A, McFarland K, Mestdagh X, Michez D, Outhwaite C, Pegoraro L, Pernat N, Pettersson L, Pipek P, Preda C, Rolnick D, Roth T, Roy D, Roy H, Runnel V, Sasic M, Schigel D, Sheard J, Svenningsen C, Teixeira H, Titeux N, Tscheulin T, Tzirkalli E, van der Velde M, van Klink R, Vereecken N, Vray S, Høye TT (2025) Using Image-based AI for insect monitoring and conservation - InsectAI COST Action. Research Ideas and Outcomes 11 <https://doi.org/10.3897/rio.10.e134825>
- Bacher S, Ryan-Colton E, Coiro M, Cassey P, Galil B, Nuñez M, Ansong M, Dehnen-Schmutz K, Fayvush G, Fernandez R, Hiremath A, Ikegami M, Martinou A, McDermott S, Preda C, Vilà M, Weyl OF, Aravind NA, Angelidou I, Athanasiou K, Atkore V, Barney J, Blackburn T, Brouckerhoff E, Carbutt C, Carisio L, Castro-Díez P, Céspedes V, Christopoulou A, Cisneros-Heredia D, Cooling M, de Groot M, Demetriou J, Dickey JE, Duboscq-Carra V, Early R, Evans T, Flores-Males P, Gallardo B, Gruber M, Hui C, Jeschke J, Joelson N, Khan MA, Kumschick S, Lach L, Lapin K, Liou S, Liu C, MacMullen Z, Mazzitelli M, Measey J, Mrugała-Koese A, Musseau C, Nahrung H, Pepori A, Pertierra L, Pienaar E, Pyšek P, Rivas Torres G, Rojas Martinez H, Rojas-Sandoval J, Ryan-Schofield N, Sánchez R, Santini A, Santoro D, Scalera R, Schmidt L, Shivambu

- TC, Sohrabi S, Tricarico E, Trillo A, van't Hof P, Volery L, Zengeya T (2025) Global Impacts Dataset of Invasive Alien Species (GIDIAS). *Scientific Data* 12 (1). <https://doi.org/10.1038/s41597-025-05184-5>
- Băncilă R, Skolka M, Ivanova P, Surugiu V, Stefanova K, Todorova V, Zenetos A (2022) Alien species of the Romanian and Bulgarian Black Sea coast: state of knowledge, uncertainties, and needs for future research. *Aquatic Invasions* 17 (3): 253-273. <https://doi.org/10.3391/ai.2022.17.3.02>
 - Bjerge K, Nielsen JB, Sepstrup MV, Helsing-Nielsen F, Høye TT (2021) An Automated Light Trap to Monitor Moths (Lepidoptera) Using Computer Vision-Based Tracking and Deep Learning. *Sensors* 21 (2). <https://doi.org/10.3390/s21020343>
 - Bommerlund J, Baars J, Schröder-Nielsen A, Brys R, Mauvisseau C, de Boer H, Mauvisseau Q (2023) eDNA-based detection as an early warning tool for detecting established and emerging invasive amphipods. *Management of Biological Invasions* 14 (2): 321-333. <https://doi.org/10.3391/mbi.2023.14.2.09>
 - Bota G, Manzano-Rubio R, Fanlo H, Franch N, Brotons L, Villero D, Devisscher S, Pavesi A, Cavaletti E, Pérez-Granados C (2024) Passive acoustic monitoring and automated detection of the American bullfrog. *Biological Invasions* 26 (4): 1269-1279. <https://doi.org/10.1007/s10530-023-03244-8>
 - Bubnicki J, Norton B, Baskauf S, Bruce T, Cagnacci F, Casaer J, Churski M, Cromsigt JGM, Farra SD, Fiderer C, Forrester T, Hendry H, Heurich M, Hofmeester T, Jansen P, Kays R, Kuijper DJ, Liefing Y, Linnell JC, Luskin M, Mann C, Milotic T, Newman P, Niedballa J, Oldoni D, Ossi F, Robertson T, Rovero F, Rowcliffe M, Seidenari L, Stachowicz I, Stowell D, Tobler M, Wieczorek J, Zimmermann F, Desmet P (2023) Camtrap DP: an open standard for the FAIR exchange and archiving of camera trap data. *Remote Sensing in Ecology and Conservation* 10 (3): 283-295. <https://doi.org/10.1002/rse2.374>
 - Cogalniceanu D, Skolka M, Stanescu F, Tudor M, Memedemin D, Preda C, Wong L, Pagad S (2020) Global Register of Introduced and Invasive Species - Romania. *Invasive Species Specialist Group ISSG*. URL: <https://cloud.gbif.org/griis/resource?r=griis-romania&v=1.3>
 - Cuthbert R, Diagne C, Hudgins E, Turbelin A, Ahmed D, Albert C, Bodey T, Briski E, Essl F, Haubrock P, Gozlan R, Kirichenko N, Kourantidou M, Kramer A, Courchamp F (2022) Biological invasion costs reveal insufficient proactive management worldwide. *Science of The Total Environment* 819 <https://doi.org/10.1016/j.scitotenv.2022.153404>
 - Davis AS, Groom Q, Adriaens T, Vanderhoeven S, De Troch R, Oldoni D, Desmet P, Reyserhove L, Lens L, Strubbe D (2024) Reproducible WiSDM: a workflow for reproducible invasive alien species risk maps under climate change scenarios using standardized open data. *Frontiers in Ecology and Evolution* 12 <https://doi.org/10.3389/fevo.2024.1148895>
 - de Groot M (2020) Challenges and solutions in early detection, rapid response and communication about potential invasive alien species in forests. *Management of Biological Invasions* 11 (4): 637-660. <https://doi.org/10.3391/mbi.2020.11.4.02>
 - Diagne C, Leroy B, Gozlan RE, Vaissière A-, Assailly C, Nuninger L, Roiz D, Jourdain F, Jarić I, Courchamp F (2020) InvaCost, a public database of the economic costs of biological invasions worldwide. *Scientific Data* 7 (1). <https://doi.org/10.1038/s41597-020-00586-z>

- Diagne C, Leroy B, Vaissière A, Gozlan R, Roiz D, Jarić I, Salles J, Bradshaw CA, Courchamp F (2021) High and rising economic costs of biological invasions worldwide. *Nature* 592 (7855): 571-576. <https://doi.org/10.1038/s41586-021-03405-6>
- Dias D, Batista S, Nogueira S, Curto M, Ribeiro D, Rivaes R, Ribeiro F (2025) Integrating social media and environmental DNA records to enhance surveillance and improve early detection of invasive species. *NeoBiota* 102: 209-226. <https://doi.org/10.3897/neobiota.102.151710>
- Dragan O, Rozyłowicz L, Ureche D, Falka I, Cogalniceanu D (2024) Invasive fish species in Romanian freshwater. A review of over 100 years of occurrence reports. *NeoBiota* 94: 1-16. <https://doi.org/10.3897/neobiota.94.113280>
- Dyrmann M, Mortensen AK, Linneberg L, Høye TT, Bjerger K (2021) Camera Assisted Roadside Monitoring for Invasive Alien Plant Species Using Deep Learning. *Sensors* 21 (18). <https://doi.org/10.3390/s21186126>
- Dyrmann M, Skovsen SK, Christiansen PH, Kragh MF, Mortensen AK (2024) High-speed camera system for efficient monitoring of invasive plant species along roadways. *F1000Research* 13: 360. <https://doi.org/10.12688/f1000research.141992.2>
- European Parliament and Council (2014) Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species. *Official Journal of the European Union* L317: 35-55.
- Fănară G, Petrovan S, Băncilă R, Vizireanu M, Drăgan O, Vlad S, Rozyłowicz L, Cogalniceanu D (2024) Nesting ecology and confirmed breeding of the invasive pond slider *Trachemys scripta* in an urban environment, Romania. *European Journal of Wildlife Research* 70 (3). <https://doi.org/10.1007/s10344-024-01815-1>
- Ferreira-Rodríguez N, Černecký J, Dołęga J, Drăgan O, Elmlund A, Ercoli F, Halabowski D, Ilarri M, Kaźmierczak S, Labecka AM, Memedemin D, Mioduchowska M, Osterling M, Ożgo M, Palmik-Das K, Piria M, Preda C, Rock S, Shumka S, Teixeira A, Urbańska M, Varandas S, Varela C, Zlatković S, Sousa R (2025) Knowledge and uses of freshwater mussels in Europe. *Ambio* <https://doi.org/10.1007/s13280-025-02288-5>
- González-Moreno P, Anđelković A, Adriaens T, Botella C, Demetriou J, Bastos R, Bertolino S, López-Cañizares C, Essl F, Fišer Ž, Glavendekić M, Herremans M, Hulme P, Jani V, Katsada D, Kleitou P, La Porta N, Lapin K, López-Darias M, Lozano V, Martinou A, Oldoni D, Per E, Rorke S, Roy H, Schweinzer K, Swinnen K, Tricarico E, Vicente J, de Groot M, Pocock MO (2024) Citizen science platforms can effectively support early detection of invasive alien species according to species traits. *People and Nature* 7 (1): 278-294. <https://doi.org/10.1002/pan3.10767>
- Groom Q, Adriaens T, August T, Capinha C, Cardoso A, Dehnen-Schmutz K, Essl F, Franklin A, Golivets M, Gonçalves J, Hendrickx L, Hodgson D, Høye T, Hulme P, Kumschick S, Lenzner B, Malta-Pinto E, Martinou A(K), Meeus S, Myers T, Noé N, Novoa A, Pocock M, Poimala A, Preda C, Pyšek P, Reyserhove L, Rozyłowicz L, Sapundzhieva A, Vale C, Vicente J, Yovcheva N, Zolyomi A, Roy H (2025) OneSTOP: OneBiosecurity systems and technology for people, places and pathways. *Research Ideas and Outcomes* 11 <https://doi.org/10.3897/rio.11.e165316>
- Hochkirch A, Bilz M, Ferreira C, Danielczak A, Allen D, Nieto A, Rondinini C, Harding K, Hilton-Taylor C, Pollock C, Seddon M, Vié J, Alexander KA, Beech E, Bischoff M, Braud Y, Burfield I, Buzzetti FM, Cáliz M, Carpenter K, Chao NL, Chobanov D, Christenhusz MM, Collette B, Comeros-Raynal M, Cox N, Craig M, Cuttelod A, Darwall WT, Dodelin B,

- Dulvy N, Englefield E, Fay M, Fettes N, Freyhof J, García S, Criado MG, Harvey M, Hodgetts N, Ieronymidou C, Kalkman V, Kell S, Kemp J, Khela S, Lansdown R, Lawson J, Leaman D, Brehm JM, Maxted N, Miller R, Neubert E, Odé B, Pollard D, Pollom R, Pople R, Presa Asensio JJ, Ralph G, Rankou H, Rivers M, Roberts SM, Russell B, Sennikov A, Soldati F, Staneva A, Stump E, Symes A, Telnov D, Temple H, Terry A, Timoshyna A, Swaay Cv, Väre H, Walls RL, Willemsse L, Wilson B, Window J, Wright EE, Zuna-Kratky T (2023) A multi-taxon analysis of European Red Lists reveals major threats to biodiversity. *PLOS ONE* 18 (11). <https://doi.org/10.1371/journal.pone.0293083>
- Hulme P, Lieurance D, Richardson D, Robinson T (2025) Multiple targets of the Global Biodiversity Framework must be addressed to manage invasive alien species in protected areas. *NeoBiota* 99: 149-170. <https://doi.org/10.3897/neobiota.99.152680>
 - Jeunen G, Lipinskaya T, Gajduchenko H, Golovenchik V, Moroz M, Rizevsky V, Semenchenko V, Gemmell N (2022) Environmental DNA (eDNA) metabarcoding surveys show evidence of non-indigenous freshwater species invasion to new parts of Eastern Europe. *Metabarcoding and Metagenomics* 6 <https://doi.org/10.3897/mbmg.6.e68575>
 - Katsanevakis S, Olenin S, Puntilla-Dodd R, Rilov G, Stæhr PU, Teixeira H, Tsirintanis K, Birchenough SR, Jakobsen H, Knudsen SW, Lanzén A, Mazaris A, Piraino S, Tidbury H (2023) Marine invasive alien species in Europe: 9 years after the IAS Regulation. *Frontiers in Marine Science* 10 <https://doi.org/10.3389/fmars.2023.1271755>
 - Katsanevakis S, Zaiko A, Olenin S, Costello MJ, Gallardo B, Tricarico E, Adriaens T, Jeschke J, Sini M, Burke N, Ellinas K, Rutten S, Poursanidis D, Marchini A, Brys R, Raeymaekers J, Noé N, Hermoso V, Blaaid R, Lucy F, Verbrugge L, Staehr P, Vandepitte L, de Groot D, Elliott M, Reuver M, Maclaren J, Li M, Oldoni D, Mazaris A, Trygonis V, Hablützel P, Everts T, Pistevos J, Dekeyzer S, Kimmig S, Rickowski F, Panov V (2024) GuardIAS – Guarding European Waters from Invasive Alien Species. *Management of Biological Invasions* 15 (4): 701-730. <https://doi.org/10.3391/mbi.2024.15.4.14>
 - Krämer L (2021) Managing Invasive Alien Species by the European Union: Lessons Learnt. *Managing Wildlife in a Changing World* <https://doi.org/10.5772/intechopen.94548>
 - Kumschick S, Bertolino S, Blackburn T, Brundu G, Costello K, de Groot M, Evans T, Gallardo B, Genovesi P, Govender T, Jeschke J, Lapin K, Measey J, Novoa A, Nunes A, Probert A, Pyšek P, Preda C, Rabitsch W, Roy H, Smith K, Tricarico E, Vilà M, Vimercati G, Bacher S (2023) Using the IUCN Environmental Impact Classification for Alien Taxa to inform decision-making. *Conservation Biology* 38 (2). <https://doi.org/10.1111/cobi.14214>
 - Larson ER, Graham BM, R A (2020) From eDNA to citizen science: emerging tools for the early detection of invasive species. *Frontiers in Ecology and the Environment* 18 (4): 194-202. <https://doi.org/10.1002/fee.2162>
 - Malinowski R, Krupiński M, Skórka P, Mikołajczyk Ł, Chuda K, Lenda M (2025) Harnessing remote sensing and machine learning techniques for detecting and monitoring the invasion of goldenrod invasive species. *Scientific Reports* 15 (1). <https://doi.org/10.1038/s41598-025-17440-0>
 - Marchessaux G, Barré N, Mauclert V, Lombardini K, Durieux EH, Veyssiere D, Filippi J, Braconi J, Aiello A, Garrido M (2024) Salinity tolerance of the invasive blue crab *Callinectes sapidus*: From global to local, a new tool for implementing management strategy. *Science of The Total Environment* 954 <https://doi.org/10.1016/j.scitotenv.2024.176291>

- Mayer K, Heger T, Kühn I, Nehring S, Gaertner M (2023) Germany's first Action plan on the pathways of invasive alien species to prevent their unintentional introduction and spread. *NeoBiota* 89: 209-227. <https://doi.org/10.3897/neobiota.89.106323>
- Mazzamuto MV, Panzeri M, Bisi F, Wauters LA, Preatoni D, Martinioli A (2020) When management meets science: adaptive analysis for the optimization of the eradication of the Northern raccoon (*Procyon lotor*). *Biological Invasions* 22 (10): 3119-3130. <https://doi.org/10.1007/s10530-020-02313-6>
- MMAP (2022) Planul National de Actiune pentru Abordarea Cailor de Introducere Prioritare a Speciilor Alogene Invazive din Romania. Ordinul nr. 3.008/2022. Monitorul Oficial al Romaniei, Partea I, nr. 1172 bis, 7 December 2022.
- Morris L, Beesley L, Stevens E, Gwinn D, Hyde J, Thompson S, Gleeson D, Douglas M (2024) Active eDNA Is More Cost-Effective Than Fyke Nets or Passive eDNA Collection When Monitoring the Invasion of an Alien Freshwater Fish. *Environmental DNA* 6 (5). <https://doi.org/10.1002/edn3.70010>
- Nita A, Zamorano M, Caro-Gonzalez A, Rozyłowicz L (2025) Driving climate action: brokers as catalysts in EU policy networks. *Applied Network Science* 10 (1). <https://doi.org/10.1007/s41109-025-00732-9>
- Noe N, Reyserhove L, Desmet P, D O (2022) LIFE RIPARIAS Early Alert: using GBIF-mediated data to better manage invasive alien species. *Biodiversity Information Science and Standards* 6: 93879. <https://doi.org/10.3897/biss.6.93879>
- Pindaru L, Manolache S, Rozyłowicz L (2026) Building governance for nature conservation: legislative development of Romanian protected areas before and after EU accession. *Frontiers in Sustainability* 7 <https://doi.org/10.3389/frsus.2026.1797353>
- Polce C, Cardoso AC, Deriu I, Gervasini E, Tsiamis K, Vigiak O, Zulian G, Maes J (2023) Invasive alien species of policy concerns show widespread patterns of invasion and potential pressure across European ecosystems. *Scientific Reports* 13 (1). <https://doi.org/10.1038/s41598-023-32993-8>
- Popa OP, Popa LO, Sahlean TC, Banaduc AM, Banaduc DS, Brezeanu AM, Cioboiu O, Cupsa D, Gavril V, Ilie MD, Iurgu IE, Irimiea AG, Krapal AM, Motoc MR, Olosutean H, Parvulescu L, Perju M, Petrescu AM, Petrescu I, Petrovici M, Popescu Mirceni RV, Surugiu V, Stanciu RC, Stefan A, Zaharia R (2022) Raport final privind distribuția speciilor de nevertebrate de apă dulce alogene din hotspot-uri și căile prioritare de pătrundere (an 3). Zenodo <https://doi.org/10.5281/zenodo.7345137>
- Popa OP, Popa LO, Sahlean TC, Banaduc AM, Banaduc DS, Brezeanu AM, Cioboiu O, Cupsa D, Gavril V, Ilie MD, Iurgu IE, Irimiea AG, Krapal AM, Motoc MR, Olosutean H, Parvulescu L, Perju M, Petrescu AM, Petrescu I, Petrovici M, Popescu Mirceni RV, Surugiu V, Stanciu RC, Stefan A, Zaharia R (2023) Raport final privind distribuția speciilor de nevertebrate de apă dulce alogene rezultată din activitatea de inventariere cu efort redus (an 3). Zenodo <https://doi.org/10.5281/zenodo.8224394>
- Popescu Mirceni VR, Surugiu V, Petrescu AM, Petrescu I, Balcu M, Sahlean TC, Zaharia R (2022) Raport final privind distribuția speciilor de animale marine alogene rezultată din activitatea de inventariere cu efort redus (an 3 cartare). Zenodo <https://doi.org/10.5281/zenodo.7155672>
- Popescu Mirceni VR, Surugiu V, Petrescu AM, Petrescu I, Balcu M, Sahlean TC, Zaharia R (2023) Raport final privind distribuția speciilor de animale marine alogene din hot-spot-uri și căile prioritare de pătrundere (an 3 cartare). Zenodo <https://doi.org/10.5281/zenodo.8224948>

- Preda C, Memedemin D, Skolka M, Cogălniceanu D (2012) Early detection of potentially invasive invertebrate species in *Mytilus galloprovincialis* Lamarck, 1819 dominated communities in harbours. *Helgoland Marine Research* 66 (4): 545-556. <https://doi.org/10.1007/s10152-012-0290-7>
- Probert A, Vimercati G, Kumschick S, Volery L, Bacher S (2023) Clarification and guidance on the use of the Socio-Economic Impact Classification for Alien Taxa (SEICAT) framework. *NeoBiota* 89: 45-70. <https://doi.org/10.3897/neobiota.89.109911>
- Rainford J, Crowe A, Jones G, van den Berg F (2020) Early warning systems in biosecurity; translating risk into action in predictive systems for invasive alien species. *Emerging Topics in Life Sciences* 4 (5): 453-462. <https://doi.org/10.1042/etls20200056>
- Rato J, Brandão P, Gama M, Banha F, Anastácio P (2025) Effectiveness of legislative tools to stop biological invasions: freshwater turtles' invasion in Europe as a study case. *NeoBiota* 102: 313-329. <https://doi.org/10.3897/neobiota.102.143330>
- Reyserhove L, Hillaert J, Adriaens T, Desmet P, D'hondt B, Groom Q, Oldoni D (2022) manIAS: A community-driven data model and data exchange format for the management of invasive alien species and wildlife. *Biodiversity Information Science and Standards* 6 <https://doi.org/10.3897/biss.6.93453>
- Roca M, Dunbar MB, Román A, Caballero I, Zoffoli ML, Gernez P, Navarro G (2022) Monitoring the marine invasive alien species *Rugulopteryx okamurae* using unmanned aerial vehicles and satellites. *Frontiers in Marine Science* 9 <https://doi.org/10.3389/fmars.2022.1004012>
- Roman AI, Mauerhofer V (2021) Sustainable development and invasive alien species: Implementation challenges of an EU Regulation. *Sustainable Development* 30 (4): 477-488. <https://doi.org/10.1002/sd.2217>
- Roy H, Pauchard A, Stoett P, Renard Truong T, Bacher S, Galil B, Hulme P, Ikeda T, Sankaran K, McGeoch M, Meyerson L, Nuñez M, Ordonez A, Rahlao S, Schwindt E, Seebens H, Sheppard A, Vandvik V (2024a) IPBES Invasive Alien Species Assessment: Summary for Policymakers. Zenodo <https://doi.org/10.5281/zenodo.7430692>
- Roy H, Pauchard A, Stoett P, Renard Truong T, Meyerson L, Bacher S, Galil B, Hulme P, Ikeda T, Kavileveettil S, McGeoch M, Nuñez M, Ordonez A, Rahlao S, Schwindt E, Seebens H, Sheppard A, Vandvik V, Aleksanyan A, Ansong M, August T, Blanchard R, Brugnoli E, Bukombe J, Bwalya B, Byun C, Camacho-Cervantes M, Cassey P, Castillo M, Courchamp F, Dehnen-Schmutz K, Zenni RD, Egawa C, Essl F, Fayvush G, Fernandez R, Fernandez M, Foxcroft L, Genovesi P, Groom Q, González AI, Helm A, Herrera I, Hiremath A, Howard P, Hui C, Ikegami M, Keskin E, Koyama A, Ksenofontov S, Lenzner B, Lipinskaya T, Lockwood J, Mangwa D, Martinou A, McDermott S, Morales C, Müllerová J, Mungi NA, Munishi L, Ojaveer H, Pagad S, Pallewatta NKTS, Peacock L, Per E, Pergl J, Preda C, Pyšek P, Rai R, Ricciardi A, Richardson D, Riley S, Rono B, Ryan-Colton E, Saeedi H, Shrestha B, Simberloff D, Tawake A, Tricarico E, Vanderhoeven S, Vicente J, Vilà M, Wanzala W, Werenkraut V, Weyl OF, Wilson JU, Xavier R, Ziller S (2024b) Curbing the major and growing threats from invasive alien species is urgent and achievable. *Nature Ecology & Evolution* 8 (7): 1216-1223. <https://doi.org/10.1038/s41559-024-02412-w>
- Seebens H, Meyerson L, Richardson D, Lenzner B, Tricarico E, Courchamp F, Aleksanyan A, Keskin E, Saeedi H, Akite P, Alexander J, Bailey S, Biancolini D, Blackburn T, Boehmer HJ, Haider S (2026) Biological invasions: a global assessment of geographic distributions, long-term trends, and data gaps. *Medien- und*

Informationszentrum, Leuphana Universität Lüneburg <https://doi.org/10.48548/pubdata-2997>

- Sirbu C, Miu I, Gavrilidis A, Gradinaru S, Niculae I, Preda C, Oprea A, Urziceanu M, Camen-Comanescu P, Nagoda E, Sirbu I, Memedemin D, Anastasiu P (2022) Distribution and pathways of introduction of invasive alien plant species in Romania. *NeoBiota* 75: 1-21. <https://doi.org/10.3897/neobiota.75.84684>
- Stanciu E, Iojă IC, Tintarean M, Pop ME (2023) Romania. In: Tucker G (Ed.) *Nature Conservation in Europe: Approaches and Lessons*. Cambridge University Press, Cambridge, 534-554 pp. <https://doi.org/10.1017/9781108654647.028>
- Stanescu F, Rozyłowicz L, Tudor M, Cogalniceanu D (2020) Alien vertebrates in Romania - a review. *Acta Zoologica Bulgarica* 72 (4): 583-595.
- Trichkova T, Csányi B, Skolka M, Kvach Y, Ivanova P, Kalcheva H, Paunović M (2025) Chapter 9 - Invasive alien species (IAS) in the Danube River Basin and Western Black Sea Coast. In: Bloesch J, Cyffka B, Hein T, Sandu C, Sommerwerk N (Eds) *The Danube River and The Western Black Sea Coast*. Elsevier <https://doi.org/10.1016/B978-0-443-18686-8.00013-5>
- Urziceanu MM, Cișlariu AG, Nagodă E, Nicolin AL, Măntoiu DȘ, Anastasiu P (2022) Assessing the Invasion Risk of *Humulus scandens* Using Ensemble Species Distribution Modeling and Habitat Connectivity Analysis. *Plants* 11 (7). <https://doi.org/10.3390/plants11070857>
- Volery L, Blackburn T, Bertolino S, Evans T, Genovesi P, Kumschick S, Roy H, Smith K, Bacher S (2020) Improving the Environmental Impact Classification for Alien Taxa (EICAT): a summary of revisions to the framework and guidelines. *NeoBiota* 62: 547-567. <https://doi.org/10.3897/neobiota.62.52723>