Book of Abstracts

V International young researchers Conference on Invasive Species

Vigo 6-7 May, 2025



V International young researchers Conference on Invasive Species

lyrCIS – 2025 Proceedings

lyrCIS – 2025 Online Conference hosted by Universidade de Vigo

and organized by

the Institute of Botany of the Czech Academy of Sciences and

the Department of Plant Biology and Soil Sciences – Universidade de Vigo.

Organizing committee: Luís González Rodríguez, Marta Pérez Diz, Noa Núñez González, Berea Rodríguez Addesso, Marina Brogi, Ana Novoa Pérez.

Scientific committee: Luís González Rodríguez, Ana Novoa Pérez, Jonatan Rodríguez Parra, Paula Lorenzo Rodríguez, Alessandro Nota, Florencia Yannelli, Zarah Pattison, Pablo Souza Alonso, Victoria Werenkraut, Marc Riera, Lorenzo Lazzaro, Paula Belén Gervazoni.

Edited by

Marta Pérez Diz | Noa Núñez González | Luís González | Berea Rodríguez Addesso

lyrCIS – 2025 Proceedings by Marta Pérez Diz, Noa Núñez González, Luís González, Berea Rodríguez Addesso is licensed under a Creative Commons Attribution-ShareAlike 4.0 International (CC BY-SA 4.0)



You are free to:

Share — copy and redistribute the material in any medium or format

Adapt — remix, transform, and build upon the material for any purpose, even commercially.

Under the following terms:

Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original.



This publication contributes to the Open Access movement by offering free access to its articles and permitting any users to read, download, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, and pass them as data to software. The authors and the lyrCIS share the copyright to maintain the integrity of their work and the right to be duly acknowledged and cited.

To view a copy of this licence, visit https://creativecommons.org/licenses/by-sa/4.0/legalcode

ISBN:

CONTACTS

Email: iyrcis.conference@gmail.com

Website: http://iyrcis.webs.uvigo.es

Twitter: https://x.com/iyrcis_congress

Youtube channel: <u>https://www.youtube.com/@iyrcisconference</u>

(EN) WELCOME

It is a great pleasure to welcome you to the *International young researchers Conference on Invasive Species* (lyrCIS – 2025). This conference serves as a unique and free platform specifically designed to foster collaboration, innovation, and knowledge exchange among young researchers in the field of invasive species.

The world faces numerous challenges regarding invasive species and their impacts on ecosystems, biodiversity, and human societies. It is crucial that you, as young researchers, come together to address these challenges head-on, exploring novel ideas, sharing your findings, and developing effective strategies for the management and mitigation of invasive species.

Throughout this conference, we will be able to delve into diverse topics, from the ecological and economic impacts of invasive species to the latest advancements in monitoring, prevention, and control methods. We will also be privileged to hear four presentations by young experts who will share their valuable insights and experiences.

Let this conference be a catalyst for inspiration, collaboration, and impactful research. Let us board on this exciting journey together to explore the intricate world of invasive species and chart a path toward a sustainable future.

We have curated an enjoyable social program to complement the academic program. You can embark on virtual excursions to the breathtaking locations of Galicia in the Northwest of Spain and explore the beauty of the Cathedral of Santiago (Santiago de Compostela – Galicia, Spain). Furthermore, we also recommend two concerts inspired by traditional Galician music, featuring renowned musician Carlos Núñez and the talented music band Tanxugueiras.

- Visit Galicia (link)
- Visit the Cathedral of Santiago de Compostela (link)
- Concert by Carlos Núñez (link)
- Concert by Tanxugueiras (link)

We sincerely hope that you have a wonderful experience at lyrCIS 2025! This is an excellent opportunity to enhance our education and enrich our lives. Your participation and the dedicated efforts of the organizing and scientific committees have made this event a reality.

Luís González,

on behalf of the Scientific and Organizing Committee.

(ES) **BIENVENIDOS**

Es un gran placer dar la bienvenida a la *International young researchers Conference on Invasive Species* (lyrCIS – 2025). Esta conferencia sirve como una plataforma única y gratuita diseñada específicamente para fomentar la colaboración, la innovación y el intercambio de conocimientos entre jóvenes investigadores en el campo de las especies invasoras.

El mundo enfrenta numerosos desafíos en cuanto a las especies invasoras y sus impactos en los ecosistemas, la biodiversidad y las sociedades humanas. Es crucial que ustedes, como jóvenes investigadores, se unan para abordar estos desafíos de frente, explorando ideas novedosas, compartiendo sus hallazgos y desarrollando estrategias efectivas para la gestión y mitigación de las especies invasoras.

A lo largo de esta conferencia, podremos adentrarnos en diversos temas, desde los impactos ecológicos y económicos de las especies invasoras hasta los últimos avances en métodos de monitoreo, prevención y control. También tendremos el privilegio de escuchar cuatro presentaciones de jóvenes expertos que compartirán sus valiosas ideas y experiencias.

Permitamos que esta conferencia sea un catalizador de inspiración, colaboración e investigación de impacto. Emprendamos juntos este emocionante viaje para explorar el intrincado mundo de las especies invasoras y trazar un camino hacia un futuro sostenible.

Hemos diseñado un agradable programa social para complementar el programa académico. Podrán disfrutar de excursiones virtuales a los impresionantes lugares de Galicia, en el noroeste de España, y explorar la belleza de la Catedral de Santiago (Santiago de Compostela, Galicia, España). Además, también les recomendamos dos conciertos inspirados en la música tradicional gallega, con la destacada participación del reconocido músico Carlos Núñez y el talentoso grupo musical Tanxugueiras.

- Visita a Galicia (link)
- Visita a la Catedral de Santiago (link)
- Concierto de Carlos Núñez (link)
- Concierto de Tanxugueiras (link)

¡Esperamos sinceramente que tengan una maravillosa experiencia en lyrCIS 2025! Esta es una excelente oportunidad para mejorar nuestra educación y enriquecer nuestras vidas. Su participación y los esfuerzos dedicados de los comités organizador y científico han hecho posible este evento.

Luís González,

en nombre del Comité Científico y Organizador.

(GL) BENVIDOS

É un gran pracer dar a benvida á *International Young Research Conference on Invasive Species* (lyrCIS - 2025). Esta conferencia serve como unha plataforma única e de balde deseñada especificamente para fomentar a colaboración, a innovación e o intercambio de coñecementos entre mozos investigadores no campo das especies invasoras.

O mundo enfronta numerosos desafíos en canto ás especies invasoras e aos seus impactos nos ecosistemas, na biodiversidade e nas sociedades humanas. É crucial que vós, como mozos investigadores, vos unades para abordar estes desafíos de fronte, explorando ideas novidosas, compartindo os vosos achados e desenvolvendo estratexias efectivas para a xestión e mitigación das especies invasoras.

A través desta conferencia, poderemos mergullarnos en diversos temas, dende os impactos ecolóxicos e económicos das especies invasoras ata os últimos avances en métodos de monitorización, prevención e control. Tamén teremos o privilexio de escoitar catro presentacións de mozos e mozas expertas que compartirán as súas valiosas ideas e experiencias.

Permitamos que esta conferencia sexa un catalizador de inspiración, colaboración e investigación de impacto. Emprendamos xuntos esta emocionante viaxe para explorar o intrincado mundo das especies invasoras e trazar un camiño cara a un futuro sostible.

Deseñamos un programa social agradable para complementar o programa académico. Poderedes gozar de excursións virtuais aos impresionantes lugares de Galicia, no noroeste de España, e explorar a beleza da Catedral de Santiago (Santiago de Compostela, Galicia, España). Ademais, tamén vos recomendamos dous concertos inspirados na música tradicional galega, coa destacada participación do recoñecido músico Carlos Núñez e do talentoso grupo musical Tanxugueiras.

- Visita a Galicia (<u>link</u>)
- Visita á Catedral de Santiago (link)
- Concerto de Carlos Núñez (link)
- Concerto de Tanxugueiras (link)

Esperamos sinceramente que teñas unha marabillosa experiencia en lyrCIS 2025! Esta é unha excelente oportunidade para mellorar a nosa educación e enriquecer as nosas vidas. A túa participación e os esforzos dedicados dos comités organizador e científico fixeron posible este evento.

Luís González,

en nome do Comité Científico e Organizador.

Content – Contenido – Contido

Keynotes	11
Tracking public engagement and ecological patterns of invasive species through di data	gital 12
The evolutionary biology of plant invasions	13
Genomic and cytogenetic approaches to understanding the role of hybridization in plant invasion capacity	13
Feral horses in Tornquist Park: a socio-environmental challenge	15
Effects of invasive species	16
Impacts of <i>Tradescantia fluminensis</i> in riparian areas: vegetation and edaphic microorganisms	17
Damage and economic impact of wood-borers (Bivalvia, Teredinidae) on artisanal fishing in Morocco: a case study	18
Preliminary results on the effects of the California poppy (<i>Eschscholzia californica</i> Cham.) and the Fairy crassula (<i>Crassula multicava</i> Lem.) on the island of Tenerife (Canary Islands)	19
Impact of the invasive <i>Sargassum muticum</i> on restoration efforts of the endangered fucoid <i>Gongolaria nodicaulis</i> along Morocco's Atlantic coast	d 20
Winter predatory efficiency and periodicity of the non-native brown bullhead Amer nebulosus	<i>iurus</i> 21
Caught in the crossfire: host shifts or evolutionary traps in invaded ecosystem	22
The massive economic burden of the invasive Fall Armyworm Spodoptera frugiper	da
	23
Global economic impacts of invasive termites	24
Global economic costs of invasive social wasps	25
Invasion process	_ 26
First arrival of the tropical <i>Sargassum natans</i> and <i>Sargassum fluitans</i> to the Morocc Atlantic coast: climatic event and ecological threats	an 27
Exploring the link between selection criteria and predictive performance in invasive species distribution models	28
Unraveling the complex genetic structure and demographic expansion of invasive jellyfish <i>Blackfordia virginica</i> and <i>Carybdea brevipedalia</i> along Korean coasts	29
Leveraging Google Street View for monitoring invasive plant dynamics in the Guadalfeo Watershed (Southern Spain): patterns of <i>Ailanthus altissima</i> expansion a <i>Opuntia ficus-indica</i> regression	nd 30
Slope to summit: altitudinal ambitions of invasive species	31
Does population density affect the traits modulation ability of Hyptis suaveolens?	32

Further expansion of <i>Aedes japonicus</i> (Theobald, 1901) (Diptera: Culicidae) in Poland
Where are they and where did they came from? Understanding the global dynamics of non-native Lepidopterans
Biotic resistance modulated by traits? Comparing functional structure between shrub- invaded and neighboring non-invaded communities
The use of ground-level imagery to determine fleshy-fruited invasive alien shrub populations change over time along roadsides of South African grasslands
Management37
Could the invasive willow removal improve the regeneration of native woody species in a Patagonian riparian ecosystem?
Assessing the prevalence of natural enemies (<i>Spanolepis selloanae</i>) on <i>Cortaderia selloana</i> (Pampas grass) populations
Investigating gene editing and silencing techniques to mitigate <i>Eichhornia crassipes</i> (Mart.) solms invasions: assessing biochemical processes, physiological responses, and ecological impacts in freshwater ecosystems40
Modulation of <i>Heracleum sosnowskyi</i> endogenous gibberellins levels and gene expression by exogenous GA341
Preventive management of invasive aquatic species introduced by maritime transport: a case study of the Port of Santander42
Control methods applied to invasive exotic species in subtropical forests of Yungas, Tucumán, Argentina43
Halting an invasion: exploring the potential of traps to protect rivers from non-native Chinese mitten crabs44
Invasive species know no borders: the complete Western expansion of <i>Pseudorasbora parva</i> and challenges of its ineffective management45
Vegetative multiplication and resilience of <i>Crassula multicava</i> Lem.: challenges for mechanical eradication in the Canary Islands46
Spatial recognition and population dynamics of an invasive cactus using multi- temporal aerial imagery and machine learning47
Relationship with the environment48
Many plants naturalized as aliens abroad have also become more common within their native regions49
Overlooked but invasive: a case study on land snail diversity and alien species spread in Oxfordshire woodlands
Evidence for the Leading-Edge Hypothesis: a systematic literature review51
Comparison of flowering phenology between native and invasive plants at ecoregional level

Acknowledgements	68
Species list	67
Assessing youth awareness and attitudes toward invasive species in Jóvenes pe Botánica Española (JxBE)	or la 66
Holding grounds for citizen science through niche overlap analysis in <i>Lantana</i> invasion	<i>camara</i> 65
Utilization of Invasive Plants by Indigenous Communities in the Southern West Ghats, Kerala, India	tern 64
Beyond pet stores: a whole market approach to evaluate exotic turtle propagu pressure	le 63
Understanding public perceptions of <i>Harmonia axyridis</i> (Harlequin ladybird) us conservation culturomics: Implications for management	sing 62
Social aspects	61
Assessing biofouling communities between sheltered and exposed sites in fals yacht club, Simons Town, South Africa	e bay 60
Influence of salinity on non-indigenous fouling species in marine and brackish marina	59
Recipient community structure mitigates the impacts of a range-shifting preda	ator58
Assessing the state of plant invasion in the South of the Iberian Peninsula: how invasion affecting native diversity?	v is 57
Physiological response of an invasive species: a proteomic study on salinity tol in the New Zealand mud snail	lerance 56
The stress test: how soil depth and aphid herbivory shape <i>Carpobrotus</i> physiol responses	logical 55
First report on the parasite fauna of invasive raccoons (<i>Procyon lotor</i>) in Lithua	ania54
Global evaluation of native and introduced populations of <i>Cortaderia selloana</i> grass)	(Pampas 53



Tracking public engagement and ecological patterns of invasive species through digital data

<u>Susan Canavan 1</u>

¹ University of Galway Sucanavan@gmail.com

Digital data from online platforms provide valuable insights into the ecological and societal dimensions of biological invasions. Tools such as iEcology leverage digital data generated for non-ecological purposes to analyze species distributions and ecological patterns, while culturomics examines public interest and cultural shifts related to invasive species through online content. Here, I present case studies where social media platforms and geotagged imagery have been used to track seasonal changes in invasive species, assess public perception, and identify regions of concern. For example, geotagged photographs have helped document the flowering phenology of invasive *Carpobrotus* taxa across multiple regions, while social media analyses highlight the cultural and economic factors driving demand for invasive species. Furthermore, our findings demonstrate how digital data can support early detection efforts by identifying trends and predicting potential new invaders which contributes to horizon scanning initiatives. By integrating digital data into invasion science, we provide a scalable and cost-effective approach that complements traditional methods, offering potential for proactive management and policy development.

Keywords: digital data, ecological patterns, species distribution.

The evolutionary biology of plant invasions

Ingrid Parker¹

¹ University of California, Santa Cruz , USA imparker@ucsc.edu

Invasive plants are a major challenge to land management and the conservation of biodiversity. In addition, they are a fascinating subject for the study of evolution, from genes to traits to species interactions. In this talk I will present some highlights from the 25 years of research in my lab on the evolutionary ecology of plant invasions, including work in progress on stinkwort (*Dittrichia graveolens*), a rapidly spreading invader that is also expanding its native range northward in a changing climate.

Keywords: evolution, management, conservation.

Genomic and cytogenetic approaches to understanding the role of hybridization in plant invasion capacity

Daniel Vitales¹

¹ Institut Botànic de Barcelona (IBB, CSIC-CMCNB), Barcelona, Spain

daniel.vitales@ibb.csic.es

Why certain plant species become invasive in certain areas, while others do not, remains one of the most compelling questions in evolutionary biology. Hybridization is frequently involved in biological invasions, often driving increased fitness through mechanisms such as heterosis (hybrid vigour) and the purging of genetic load. While these aspects have been extensively studied in terms of fitnessrelated traits, the potential of hybridization to generate genomic innovation-contributing to or enabling invasiveness—remains comparatively underexplored. Structural changes in the genome, particularly at the chromosomal level, can influence gene expression and phenotypic traits, potentially affecting a species' invasive potential. Notably, cytogenomic tools can be employed to investigate key processes such as polyploidy, repeatome dynamics (i.e., changes in the repetitive DNA content), and chromosomal rearrangements. In this talk, I will present the genomic and cytogenetic approaches we are applying to explore the consequences of hybridization in two case studies of invasive plant taxa. First, I will discuss our recent findings on the invasion history of Kalanchoe ×houghtonii, a polyploid hybrid initially propagated as an ornamental plant, which has become a global invader in under a century. I will then introduce our ongoing research on Carpobrotus spp., a plant complex where hybridization has also played a key role in the invasion of ecosystems across three continents (America, Australia and Europe), yet whose evolutionary history remains largely unresolved. Both case studies will help us understand the importance of investigating evolutionary processes in order to better elucidate the mechanisms underlying invasiveness and potentially improve risk management strategies for invasive hybrid species.

Keywords: hybridization, cytogenomics, genome evolution, polyploidy, chromosome rearrangements.

Feral horses in Tornquist Park: a socio-environmental challenge

Franco Bostal¹

¹ GEKKO (Grupo de Estudios en Conservación y Manejo), Departamento de Biología, Bioquímica y Farmacia, Universidad Nacional de Sur, Bahía Blanca, Argentina franco.bostal@uns.edu.ar

Feral horse management is a contentious issue worldwide that arouses different, and sometimes antagonistic, opinions in society. A population of feral horses inhabits a protected area, Tornquist Park, in the Argentinean Pampas, where they pose a serious threat to the conservation of mountain grassland biodiversity. Between 2006 and 2007, nearly 50% of the horses were captured using corral-traps, some of them were euthanized, while others were relocated—all without any supporting communication strategy. In the following years, horse protectionists expressed their discontent regarding this intervention. Since then, no further management actions have been undertaken and the population slowly increased, currently reaching densities similar to those of the pre-management years. Any new management plan for this population must address not only ecological factors but also the human dimension of the problem. This presentation explores how conservation biology research can be integrated into a socio-ecological framework to respond to this complex challenge. My research includes a stakeholder analysis to characterize different positions on population management, alongside a written questionnaire to assess public knowledge and perceptions of feral horses, and the level of acceptance for various management options. The majority support for the need to manage the population-along with the openness of some animal rights groups to accept interventions that ensure animal welfare—offers a promising starting point for future action. These results will be key to designing more effective and enduring conservation policies, as well as a communication strategy to support their implementation.

Keywords: management, social aspects, biodiversity conservation.



Impacts of *Tradescantia fluminensis* in riparian areas: vegetation and edaphic microorganisms

<u>Felipe González-Outeiriño¹</u>, Nerea Piñeiro-Juncal^{2,3}, Sandra Francés-Alcántara¹, Jonatan Rodríguez⁴

¹ Department of Functional Biology, Faculty of Biology, Universidade de Santiago de Compostela, 15782, Universidade de Santiago de Compostela, Spain

felipeglezou@gmail.com

 ² CRETUS, EcoPast, Faculty of Biology, Universidade de Santiago de Compostela, Spain
 ³ Department of Marine Geosciences and Territorial Planning, Facultaty of Ocean Sciences, Universidade de Vigo, Spain

⁴ CRETUS, Department of Functional Biology, Faculty of Biology, Universidade de Santiago de Compostela, 15782, Universidade de Santiago de Compostela, Spain

Tradescantia fluminensis is a clonal perennial plant species that primarily occupies riparian zones and degraded environments on all continents. In areas where it has been introduced, it is known to cause severe changes in ecosystem functioning by altering nutrient cycling and affecting the conservation of native plants and arthropods. However, whether these alterations could affect the functional diversity of soil microorganisms remains unclear. Here, we provide information on the impact of *T. fluminensis* on riparian vegetation in the northwestern Iberian Peninsula, and its effects on soil properties and soil microbial functionality. The study was conducted in four riparian areas in the province of A Coruña, where five transects were established in each area. In each transect, five quadrants were placed to delimit the plots following a gradient of *T. fluminensis* cover. Vegetation and soil data from 100 plots included species richness, diversity, biomass, soil properties (temperature, moisture, pH, and conductivity), and functionality of soil microbial communities analyzed by their carbon source consumption using Biolog® Ecoplates™. Our results confirm the dominance of *T. fluminensis*, reducing plant richness and increasing biomass compared to less invaded areas. It also alters soil properties and the average well consumption (AWCD), which varied according to the invasion gradient, mainly driven by differences in the consumption of carboxylic acids and miscellaneous compounds. Moderately to highly invaded plots had the highest AWCD values, indicating potential changes due to invasion. This study demonstrates that *T. fluminensis* has a measurable impact on soil heterotrophic microorganisms and provides novel information on its effects on soil microbial communities. This knowledge of plant-soil interactions based on this study system has potential implications not only for understanding the impacts, but also for designing restoration strategies for areas invaded by T. fluminensis.

Keywords:: Commelinaceae, invasive alien plant, invasion ecology, plant-soil interaction, soil microorganisms.

Damage and economic impact of wood-borers (Bivalvia, Teredinidae) on artisanal fishing in Morocco: a case study

Jazila El Jamaai¹, Ahmed Taheri^{1,2}, Bilal El Ajjouri¹, Mohammed Said Adlan Merini², Luísa M. S. Borges³

¹ Laboratory of Plant Biotechnology, Ecology and Ecosystem Valorization. Faculty of Sciences of El Jadida, Chouaïb Doukkali University, P.O. Box 20, El Jadida 24000, Morocco.
² LESCB URL-CNRST N° 18, FS, Abdelmalek Essaadi University, Tétouan, Morocco.
³ L3 Scientific Solutions, Runder Berg 7E, Geesthacht, Germany.

This study provides the first comprehensive assessment of the economic impact of woodboring bivalves (Teredinidae) on artisanal fishing in Tangier, Morocco, following the establishment of a new fishing port in 2018. Since the port's opening, infestations have increased significantly, threatening wooden fishing boats. Through a survey of over 40 artisanal shipowners, we evaluated the extent of shipworm-induced damage and associated repair costs. Our findings reveal that 77.5% of the fleet was affected, with moderate damage being the most frequently reported. Wood sample analysis identified two dominant teredinid species, Lyrodus cf. pedicellatus and Teredo bartschi, both recorded in Morocco for the first time, marking them as newly introduced alien invasive species. The susceptibility of wooden boats, especially those constructed from softwoods (Picea sp. and Pinus sp.), contrasted sharply with the resilience of polyester boats, which remained unaffected. Economic losses were substantial, with annual repair costs exceeding MAD 4.7 million (US\$ 470,000), amounting to over 6% of the artisanal fishery's annual value. The introduction of these shipworms is likely linked to increased shipping activity through the Strait of Gibraltar, highlighting the role of maritime traffic in the spread of marine wood borers. Given their adaptability and the influence of rising sea temperatures, teredinids are expected to expand their range, posing ongoing risks to fishing infrastructure. These findings emphasize the urgent need for targeted management strategies, including improved boat construction materials, early detection programs, and regional biosecurity measures, to mitigate the economic and ecological consequences of these invasive species on artisanal fishing communities.

Keywords: Biological invasion, economic impacts, invasive species, *Lyrodus pedicellatus*, teredinids, *Teredo bartschi*, traditional fishing.

Preliminary results on the effects of the California poppy (*Eschscholzia californica* Cham.) and the Fairy crassula (*Crassula multicava* Lem.) on the island of Tenerife (Canary Islands)

<u>Ruymán David Cedrés-Perdomo</u>¹, Agustín Naranjo Cigala², Cristina González-Montelongo¹, José Ramón Arévalo Sierra¹

¹ Department of Botany, Ecology and Plant Physiology, University of La Laguna, San Cristóbal de La Laguna, Spain

rcedresp@ull.edu.es

² Geography Department, University of Las Palmas de Gran Canaria, Las Palmas de Gran Canaria,

Spain

Due to their distinctive ecosystems and the presence of endemic species with restricted ranges, archipelagos are particularly vulnerable to emerging threats like invasive species. This research project aims to assess the invasive potential of the California poppy (Eschscholzia californica) and the pink crassula (Crassula multicava) on the island of Tenerife, Canary Islands. The California poppy, native to North America, was introduced to the Canary Islands as an ornamental plant during the 19th century. It is commonly found along paved areas and clearings within the Canarian pine forest. The pink crassula, native to South Africa, was introduced during the 20th century and thrives in Canarian laurel forest areas near urban settlements. The main objective of this project is to map and monitor the populations of these species on the island of Tenerife, determine their responses to different environmental conditions, as well as to various eradication treatments, and assess their invasive impact on native and/or endangered flora. Fieldwork has shown a broader than previously thought distribution of both species, with increasing populations observed in new areas. In addition, 30% of the records show direct competition with other plant species, while 17% demonstrate competition with endemic species. Eschscholzia californica reproduces effectively through sexual means, establishing a long-term seed bank. Crassula multicava establishes itself successfully through vegetative multiplication, easily invading areas through the fall of propagules. Both species have shown a capacity to form new seedlings continually, making eradication efforts challenging. These findings indicate a high invasive potential for both species on Tenerife, underlining the need for effective management and control measures to prevent further spread. In conclusion, this research highlights the growing concern over these invasive species and their impact on Tenerife's ecosystems, emphasizing the importance of ongoing monitoring and intervention.

Keywords: biodiversity, competitiveness, ecology, invasive plants, islands.

Impact of the invasive *Sargassum muticum* on restoration efforts of the endangered fucoid *Gongolaria nodicaulis* along Morocco's Atlantic coast

<u>Khaoula Khaya</u>¹, Zahira Belattmania¹, Khansae Kamal¹, Ester Serrão², Annalisa Falace³, Brahim Sabour¹

¹ Phycology, Blue Biodiversity and Biotechnology RU, URL CNRST 10 Laboratory of Plant Biotechnology, Ecology and Ecosystem Valorization, Faculty of Sciences, University Chouaib Doukkali, PO Box 20, 24000 El Jadida, Morocco khaya.k@ucd.ac.ma
² Centre of Marine Sciences, CCMAR/CIMAR-LA, Campus de Gambelas, Universidade do Algarve, 8005-139 Faro, Portugal
³ Department of Life Sciences, University of Trieste, Via L. Giorgieri 10, 34127 Trieste, Italy

Biological invasions represent a significant threat to biodiversity, with the potential to disrupt ecosystem functioning and alter community. Invasive species (IS) can hinder restoration efforts by outcompeting native species, altering habitat conditions, and disrupting ecological interactions. Understanding the effects of invasive species on the recovery and sustainability of native populations is critical for developing effective conservation and management strategies. Since its first report in 2011 on the Atlantic coast of Morocco, the invasive species Sargassum muticum has formed extensive populations and significantly impacted local ecosystem dynamics, highlighting the urgent need for effective coastal management strategies to mitigate its effects on native species. This study investigates the impact of S. muticum on the ex-situ recruitment and outplanting of the endangered fucoid Gongolaria nodicaulis by assessing changes in density and thalli growth under two field experimental conditions: one with co-occurrence of the invader *S. muticum* and the other after its removal. Both treatments began with similar initial densities (70.8 \pm 3.1 ind/tile) and lengths (4.53 \pm 0.88 mm) of G. nodicaulis' outplanted seedlings. After three months, the presence of S. muticum led to a significant decrease in density (5.4 ± 9.3 ind/tile) and limited growth (8.95 ± 3.70 mm) of *G. nodicaulis* juveniles, compared to the treatments without the invader. Indeed, in the absence of S. muticum, the recruits' density remained substantially higher $(20.3 \pm 9.2 \text{ ind/tile})$ than in those outplanted with co-concurrence of invader. Additionally, G. nodicaulis recruits in the absence of S. muticum exhibited greater productivity and significant growth (26.74 ± 10.02 mm), reaching of up to 50 mm. These results demonstrate the negative impact of invasive species S. muticum on G. nodicaulis recovery within a restoration action, and provide valuable insights to optimize the success of restoration efforts for this endangered fucoid species under marine invasion.

Keywords: Gongolaria sp., invasive impact, conservation efforts, species competition.

Winter predatory efficiency and periodicity of the non-native brown bullhead *Ameiurus nebulosus*

<u>Alan Fritsch¹</u>, Pavel Staněk¹, Miloš Buřič¹, Antonín Kouba¹, Lukáš Veselý¹, Paride Balzani¹

¹ Faculty of Fisheries and Protection of Waters, University of South Bohemia in České Budějovice, Vodňany, Czech Republic afritsch@frov.cz

Winter poses severe challenges for fish in temperate regions, as it is likely to create a bottleneck for small-bodied fish due to starvation. For non-native fish, the ability to sustain feeding activity at low temperatures may play a crucial role in their establishment success. Nevertheless, little is known about the feeding behaviour and related impacts of non-native fish in cold conditions. In this study, we aimed to assess the hunting periodicity, functional response (*i.e.* resource consumption depending on resource availability) and estimate the potential predation impact of a non-native brown bullhead (Ameiurus nebulosus) European population under winter conditions. We therefore tested the prey consumption of young (mean \pm se total length = 123 \pm 4 mm) *A. nebulosus* on *Pseudorasbora parva* (2-3 cm total length) at different prey abundances (1, 3, 6, 12, 20). We first compared predation between day and night, then assessed the functional response on a 24-hour timescale at two different temperatures, 3 and 4.5 °C. Based on our results, we estimated the theoretical maximal feeding rate that, in conjunction with field abundance data, was used to approximate the impact potential on local fish communities. Our results provide evidence of predation at temperatures as low as 3 °C, while the hunting periodicity was clearly identified as nocturnal. Furthermore, a marginally significant decrease in handling time was observed at 3 °C compared to 4.5 °C, suggesting that this temperature could be a thermal threshold in A. nebulosus' ecophysiology. These findings highlight the potential for A. nebulosus to exert predation pressure on juvenile fish even in winter, potentially harming other species' recruitment. Ultimately, our results suggest that predation at low temperature could have an important role in the establishment success of non-native A. nebulosus populations.

Keywords: functional response, low temperature, fish, biological invasion.

Caught in the crossfire: host shifts or evolutionary traps in invaded ecosystem

Purnima Singh¹, Swati Diwakar¹, Gyan Prakash Sharma¹

¹Department of Environmental Studies, University of Delhi, India psingh1@es.du.ac.in

The ecological research on invasive species is limited to their abundance, spread, ability to alter invaded habitats, compete with native plants for resources, and potentially drive them to extinction. The ecological consequences of invasive plant species extend beyond the displacement of native flora, influencing interspecies interactions and reshaping community dynamics. Among these interactions, the associations between herbivorous insects and their host plants are understudied. Plant invasions are known to alter the behaviour and choice of host plant selection in insects. Most of the studies are from the order Lepidoptera or Coleoptera, no previous research has yet explored Orthoptera interaction with invasive plants. Hence this study focuses on Oecanthus indicus, a native tree cricket species, to examine how host plant associations are affected by the introduction of invasive plants. Oecanthus indicus was chosen as a model organism as it is acoustically active, which facilitates its study, and its choice of host plant is directly linked to its reproductive fitness. We first investigated whether the calling behavior of O. indicus vary between invasive and native host plants and the olfactory cues of the invasive host plants act as attractants for this native herbivore. To do this, O. indicus calling from native and invasive plants were recorded at various field sites in the Central Indian landscape. The call parameters of the native tree cricket species were compared on both native and invasive plants in field and controlled lab conditions. We also examined the preference of O. indicus to particular invasive host plants, namely Lantana camara and Hyptis suaveolens. To do this, we conducted behavioural Ytube choice trials The findings of this study are crucial in understanding the ecological adaptation and behavioral flexibility of native insects in the context of altered host plants. The ecological consequences of invasion could lead to host shifts or evolutionary traps for the native insect herbivores.

Keywords: plant invasions, plant-insect interactions, *Lantana camara, Hyptis suaveolens*, treecrickets, host plant selection.

The massive economic burden of the invasive Fall Armyworm Spodoptera frugiperda

<u>Neha Yadav¹</u>, Alok Bang^{1,2}

¹ Biology group, Azim Premji University, Bhopal 462022, India neha.yadav23_ug@apu.edu.in
² InvaCost Consortium

Spodoptera frugiperda (J.E. Smith) has emerged as a globally problematic agricultural pest in the last decade. This pest is native to tropical and subtropical regions of America and has invaded many tropical and subtropical countries in Africa, Oceania and Asia. Our research is the first attempt to investigate the global impacts of S. frugiperda, with geographical, sectoral and typological distribution of the economic impacts. We used the InvaCost database, which is a global database of economic impacts of invasive alien species. Based on highly reliable data published in peer-reviewed journals and technical reports, S. frugiperda has costed at least USD 2.9 billion in the five-year period 2017-2021, with additional potential impacts of USD 16 billion. Out of the highly reliable estimates of USD 2.9 billion, 98% of costs have occurred in 12 African nations in the agriculture sector. 2% of the costs have come from Asia and have affected the agriculture, and authorities and stakeholders sector, *i.e.*, government and institutional spending on management and research. Of the total costs, less than 1% of economic impacts are management-related, and more than 99% of economic impacts are related to damages. S. frugiperda serves as a classic case-study in the cost of inaction, pointing out that timely pre-invasion interventions as strict surveillance and security, and post-surveillance interventions such as eradication programmes, may bring down damage-related costs to a significant extent. In conclusion, our work underscores the enormity of the economic impacts of S. frugiperda. Since the hotspots of this invasion and its impacts are occurring in economically developing and demographically most populous regions of the world, our results also highlight the need for an international effort to invest in the management of the pest.

Keywords: agriculture, biosecurity, biological invasion, economic cost, Invacost, management, surveillance

Global economic impacts of invasive termites

<u>K P Akilan^{1, 2}, Alok Bang^{1, 3}</u>

¹ Biology group, Azim Premji University, Bhopal, India ² Wildlife Institute of India, Dehradun, India kpakilan2012@gmail.com ³ InvaCost Consortium

Biological invasions are one of the topmost drivers of anthropogenic biodiversity loss, occurring at an unprecedented rate, without saturation in their numbers and their ecological and economic impacts. Social insects like termites are highly invasive, owing to their short generation time, generalist habit and adaptations to new environments. Despite the increasing awareness about widespread negative ecological impacts of invasive termites, there are massive gaps in our understanding related to their economic impacts. In this study, we explore the magnitude and distribution of economic impacts of invasive termites, by investigating spatial, temporal, taxonomic, sectoral and typological distribution of economic impacts. We gathered impact data from peer-reviewed literature and technical reports in multiple languages. We also performed targeted searches, by contacting researchers working on invasive termites to acquire unpublished data and their research funding details. We found that nine of the 28 known invasive termites have potentially incurred global costs up to USD 335 billion over past 57 years, across four continents and 14 of the 42 invaded countries. The highly reliable and observed costs are much lower but still massive: six invasive termites have cost at least USD 627 million over the past 57 years from seven of the 42 invaded countries, of which USA incurs maximum costs. Coptotermes formosanus is the maximum cost-incurring species. The sectors that have been impacted are authoritiesstakeholders, *i.e.*, government or organisations spending on management and research; and public and social welfare sector, *i.e.*, any damage or management costs related to human goods and infrastructure. Most of the observed costs are towards management, which include post-invasion control and research funding. Our findings highlight the massive economic costs incurred by invasive termites but also point out that it is an underestimate of the actual costs, pointing to the knowledge gaps present at multiple levels. It is the first global synthesis on the economic impacts of invasive termites.

Keywords: invasive alien species, InvaCost, biological invasions, termites, socioeconomic impacts.

Global economic costs of invasive social wasps

Aashi Agrawal¹, Alok Bang^{1,2}

¹ Biology Group, Azim Premji University, Bhopal 462022, India aashi.rai.agrawal@gmail.com
² InvaCost Consortium

Earth is undergoing a sixth mass extinction, driven by the Anthropocene and its dysregulated impacts on the planet. Irreversible biodiversity loss and species extinction, steeply rising global temperatures, changing atmospheric composition, disappearing glaciers, acidified oceans, and toxic pollution everywhere pose an unmitigable threat to the ecosystem and human well-being with severe long-term consequences. Monetization of ecological impacts of these global change processes is an important tool in ecological research as well as for biodiversity losses that show no saturation- wreak havoc vis-à-vis their detrimental ecological, financial, and human impacts. In this study, we investigated, for the first time, the economic costs associated with invasive social wasps, at a global scale. Using the InvaCost database, and sifting through peer-reviewed literature and online technical reports in multiple languages, as well as contacting relevant scientists involved to acquire unpublished data and research funding details, we created a database of all costs incurred by humans world-wide due to the invasive nature of social wasps. Exploring the magnitude and distribution of economic impacts over a spatial, temporal, taxonomic, sectoral, and divisional scale, we observed costs incurred tentatively as 106M USD (2017), including high-reliability sources attributable to 8 species only. This is a severe under-estimation of the actual costs, owing to poor data availability, and knowledge gaps present at various levels. Gross economic losses (calculated in terms of *high-reliability only* but potential as well as observed costs) is well over 300M USD (2017) which is approximately 400M USD today. The costliest species is Vespa velutina which is responsible for 12M USD of losses (but potentially \$112M), with most costs borne by the agricultural sector-over 278M USD (2017). We hope the accessibility of such information would direct policymaker's attention to the widespread repercussions of uncontrolled spread and establishment of invasive species.

Keywords: economic impact, invasive wasps, InvaCost, invasive alien species, biological invasions



First arrival of the tropical *Sargassum natans* and *Sargassum fluitans* to the Moroccan Atlantic coast: climatic event and ecological threats

<u>Khansae Kamal ¹</u>, Zahira Belattmania¹, Khaoula Khaya¹, Abdellatif Chaouti¹, Joao Neiva², Aschwin Engelen², Ester Serrão², Brahim Sabour¹

¹ Phycology, Blue Biodiversity and Biotechnology RU, URL CNRST 10 Laboratory of Plant Biotechnology, Ecology and Ecosystem Valorization, Faculty of Sciences, University Chouaib Doukkali, PO Box 20, 24000 El Jadida, Morocco kamal.khansae@ucd.ac.ma
² Centre of Marine Sciences, CCMAR/CIMAR-LA, Campus de Gambelas, Universidade do Algarve, 8005-139 Faro, Portugal

The spread of non-native species around the world had led to biological invasions, which are both causes and effects of environmental change. In 2024, unusually significant biomass of pelagic *Sargassum* were observed drifting along the Atlantic coast of Morocco, North Africa. The morphological analysis of the drifting *Sargassum* biomass identified three morphotypes belonging to: *Sargassum natans* (types I and VIII) and *Sargassum fluitans* (type III). The beached biomass in the Moroccan Atlantic coast was mainly dominated by *Sargassum natans VIII* (58%). This study documents the first recorded presence of holopelagic *Sargassum* in this region. Their occurrence arising after the manifestation of Nelson storm highlights the role of extreme climatic and hydrodynamic events in facilitating their dispersal and their possible pathways transportation from the tropical Atlantic to the North Atlantic coast of Africa. As climate change continues to alter ocean conditions, the intensity and severity of pelagic *Sargassum* blooms and storm events are projected to increase. This study provides valuable insights into the forces driving ecological change offering the need for continued monitoring of *Sargassum* influxes in Moroccan coast to better understand their potential threats and the related ecological impacts the to the local marine ecosystems.

Keywords: tropical *Sargassum*, ocean drift, Nelson storm, Northeastern Atlantic coast, Morocco.

Exploring the link between selection criteria and predictive performance in invasive species distribution models

Sergio Luna¹, Alexander Peña-Peniche², Roberto Mendoza¹

¹Universidad Autónoma de Nuevo León, Facultad de Ciencias Biológicas, Laboratorio de Ecofisiología, Nuevo León, México. sergio.lunap@gmail.com, roberto.mendoza@yahoo.com lpenap@uanl.edu.mx

²Centro de Investigación Científica de Yucatán, A. C., Unidad de Recursos Naturales, Mérida, Yucatán, México.

Biological invasions are a major driver of global biodiversity loss, making it essential to identify regions at higher risk of species invasions. Species distribution models (SDMs) represent an essential tool for this purpose but face challenges that influence their accuracy. Here, we have evaluated the relationship between SDM accuracy and different selection metrics through virtual species simulations. Using bioclimatic variables, 100 virtual species were generated based on environmental suitability, spatial sampling bias, and accessible areas. A cellular automaton was programmed to define native and non-native ranges. For each species replicate, SDMs were built using Maximum Entropy under 400 different model configurations by varying the extent of calibration area, spatial thinning of occurrences, predictor collinearity treatment, and regularization multiplier. True model performance was assessed in terms of functional accuracy in the native and non-native ranges, using five different model selection metrics with random and non-random partitioning schemes (ROC-AUC, TSS, Boyce index, PR-AUC, AICc). Models showed higher functional accuracy in the native (median = 0.66) compared to the non-native range (med. = 0.24), but these values were weakly correlated (r = 0.326). Nevertheless, the best models performed well in both the native (med. = 0.847) and non-native ranges (med. = 0.691). There were considerable differences in the native range accuracy of models selected with the different metrics evaluated, with ROC-AUC and TSS showing the best (med. = 0.762) and AICc the worst performance (med. = 0.304). In the case of non-native range accuracy, better models were selected with blocking data partitioning, with TSS being the best (0.315) and AICc the worst (0.139). While SDM are effective within their non-native range, the poor relationship between traditional evaluation measures and actual model performance makes it difficult to choose these models appropriately, necessitating more thorough evaluation techniques to enhance risk assessments for invasive species.

Keywords: species distribution models, virtual species, biological invasions, model transferability, model selection.

Unraveling the complex genetic structure and demographic expansion of invasive jellyfish *Blackfordia virginica* and *Carybdea brevipedalia* along Korean coasts

Buhari Lawan Muhammad¹, Jinho Chae², Jang-Seu Ki¹

¹ Department of Life Science, Sangmyung University, Seoul, 03016, South Korea buharilawan20@gmail.com ² Marine Environmental Research and Information Laboratory, Gunpo, 15850, South Korea

Biological invasions pose significant threats to marine biodiversity, disrupting ecosystems and altering community structures. However, the genetic mechanisms facilitating the establishment, adaptation, and expansion of invasive species remain poorly understood. This study explores the population genetic structure and demographic history of two invasive jellyfish species: Blackfordia virginica, a global invader native to the Black Sea, and Carybdea brevipedalia, a venomous species native to the coastal waters of Japan. Both species have recently been reported in Korean coastal waters. We analyzed mitochondrial cytochrome c oxidase subunit I (COI) sequences from 91 B. virginica and 113 C. brevipedalia individuals collected from multiple invaded sites along the Korean coast. Our findings revealed high haplotype diversity, with 16 and 42 unique haplotypes identified in B. virginica and C. *brevipedalia*, respectively. Genetic differentiation analyses in *B. virginica* ($F_{st} = 0.6$) indicated significant divergence between the two sampled locations, suggesting multiple independent introduction events. A broader comparison incorporating COI sequences from global B. virginica populations including samples from the USA, China, India, and the Baltic Sea, highlighted the complexity of its invasion history. The Korean population exhibited considerable genetic divergence from other regions, suggesting localized adaptations or unique introduction sources. For C. brevipedalia, population structure analyses revealed two distinct genetic clades (A and B), with a significant correlation between genetic differentiation and geographic distance, as indicated by Mantel tests. Demographic analyses and a star-like haplotype network suggest recent population expansion, likely driven by favorable environmental conditions or human-mediated dispersal. These findings provide critical insights into the genetic diversity, dispersal patterns, and adaptive potential of invasive jellyfish in Korean coastal ecosystems. Understanding these genetic dynamics is crucial for predicting future invasions, assessing ecological impacts, and developing effective management strategies for marine bioinvasions.

Keywords: cytochrome c oxidase subunit I (COI), genetic diversity, jellyfish species, phylogeography, population expansion, marine invasion.

Leveraging Google Street View for monitoring invasive plant dynamics in the Guadalfeo Watershed (Southern Spain): patterns of *Ailanthus altissima* expansion and *Opuntia ficus-indica* regression

Jessica Bernal-Borrego¹, Laura Bayas-Barrientos¹, Pablo González-Moreno¹

¹ Department of Forest Engineering, University of Córdoba, Córdoba, Spain z12beboj@uco.es

Monitoring invasive plant species in mountains and remote areas remains a critical challenge for biodiversity management. We explored the potential of Google Street View (GSV) as a virtual sampling tool to monitor the spatiotemporal dynamics of two contrasting invasive species—Ailanthus altissima (Mill.) Swingle and Opuntia ficus-indica (L.) Mill.—along a 66 km stretch in the Guadalfeo watershed (Southeast Spain). The analysis utilized historical GSV imagery from 2008 to 2023, capturing key variables such as patch size, roadside location, altitude, infrastructure coverage percentage, height categories, and observable damage levels. The data collection also recorded zones with high extensions beyond the initial 10meter observation buffer and areas subjected to management measures. The 10-meter limit was selected based on practical considerations related to GSV image resolution, general visibility constraints, and comparability with previous roadside survey studies. Preliminary observations indicate that A. altissima patches densify and increase in height within short timeframes, especially in road curves coinciding with runoff pathways, under bridges, and near infrastructure. Rapid post-disturbance re-sprouting was observed in regions affected by a major fire in Sierra de los Guájares (2022), highlighting the species' resilience. In contrast, O. ficus-indica exhibited a regression pattern associated with Dactylopius opuntiae, its biological control agent. However, some areas adjacent to agricultural lands showed better conservation of O. ficus-indica, likely due to human care, reflecting its cultural value in the region. Manual removal efforts were also observed in certain areas. While manual delineation of patches in GSV remains time-intensive, this approach effectively captures diverse invasion dynamics, complementing traditional field-based surveys. The method shows scalability potential for monitoring other plant species with distinct roadside traits. Future developments will integrate AI-based automation for patch delineation, enhancing efficiency and the development of dynamic spatio-temporal models. This research highlights GSV's value for tracking invasive species and informing adaptive management in semi-arid, fireprone ecosystems.

Keywords: *Ailanthus altissima, Opuntia ficus-indica,* Google Street View, invasive species monitoring, spatiotemporal dynamics, Guadalfeo Watershed, post-fire resilience, biological control, virtual sampling methodology.

Slope to summit: altitudinal ambitions of invasive species

Harshita Pant¹, Gyan Prakash Sharma¹

¹ Department of Environmental Studies, University of Delhi, Delhi-110007, India Harshita.evs@gmail.com

It has been documented that invasive species proliferate in mountainous environments with diverse environmental circumstances. As climate is getting warmer invasive species are significantly changing their ranges and move upward to occupy their climatic niches and adapt to continuous human disruptions. In mountain ecosystems, where species can traverse significant environmental gradients over comparatively short intervals, these changes are especially evident. Studies evaluating the plant performance of invasive species along an altitudinal gradient are limited. This study aims at evaluating the performance of invasive plant species along an altitudinal gradient in terms of plant functional traits. A common garden experiment was setup to assess the growth, reproduction, and survival of the two key invasive species, Prosopis juliflora and Leucaena leucocephala. The study was conducted at three distinct elevations, Delhi (216 m), Haldwani (424 m) and Pantgaon (1500 m) each representing different climatic and ecological conditions. Data on key plant performance metrics such as plant height, above-ground biomass, number of leaves, number of branches, leaf area were collected over the course of the growing season. Additionally, environmental variables such as temperature, precipitation and soil characteristics were monitored at each site. The preliminary results indicated that plant performance of both P. juliflora and L. leucocephala varied significantly along an altitudinal gradient, with both species performing better at lower elevations. This is indicative of strategic variations in plant traits and resource allocation strategy at changing altitudes. Gaining knowledge on the rapid development and performance-spread of these invasive species in these sensitive habitats will help us understand how this would affect the native biodiversity. To comprehend the behavior and adaptive tactics of invasive plant species, data about reproductive and eco-physiological plant characteristics is awaited.

Keywords: plant performance, invasive plant, common garden study, altitudinal gradient.

Does population density affect the traits modulation ability of *Hyptis suaveolens*?

Kanhaiya Shah¹, Gyan P. Sharma¹

¹Department of Environmental Studies, University of Delhi, Delhi–110 007, India kanhaiyashah111@gmail.com

Biological invasions significantly threaten global biodiversity (Richardson et al. 2011). During the initial 'lag phase,' invasive species frequently encounter negative growth rates, which can result in Allee effects-a density-dependent phenomenon. Allee effects diminish species fitness due to low-density populations (Stephens et al. 1999). Among the fast-spreading invasive species, Hyptis suaveolens (L.) Poit. is a noxious plant invader of Vindhyan highlands, India (Shah and Sharma 2024). The current study investigates how different population densities of *H. suaveolens* affect its vegetative trait performance, reproductive output, and density-dependent population regulation. Gaining insights into how population density affects the trait modulation of *H. suaveolens* at both fine and coarse scales may aid in developing effective management strategies. The study was conducted in monospecific H. suaveolens patchs exhibiting low-, medium-, and high- population density in dry deciduous regions of Vindhyan highlands, India. Vegetative traits, reproductive traits, and plasticity response index (PI) were estimated at fine scale (plant traits, PITs) and at coarse scale (patch traits, PaTs). PITs were significantly different across densities, with medium-density showing maximum plant height and plant biomass whereas high-density exhibiting a higher number of seeds per plant. PaTs such as plant biomass per patch (PBP) were similar for medium- and high- density, whereas number of seeds per patch (NSP) was similar in low- and mediumdensity. PI values of PITs showed low, medium, and high plastic responses, while PaTs exhibited low and high plastic responses. Results showed that H. suaveolens exhibits densitydependent population regulations, i.e. Allee effects dynamics. Thus, rapidly growing lowdensity populations cause decline in native population and in due course of time give rise to high-density population exhibiting high seed output. Low-density population should be considered as high-priority to control local spread whereas high-density populations should be monitored and controlled to prevent long-distance regional expansion of *H. suaveolens*.

Keywords: Allee effects, Invasive species, fine and coarse scales, plant functional traits, trait modulation ability.

Further expansion of *Aedes japonicus* (Theobald, 1901) (Diptera: Culicidae) in Poland

Kamil Słomczyński¹

¹ Department of Invertebrate Zoology and Hydrobiology, Faculty of Biology and Environmental Protection, University of Lodz, Banacha St. 12/16, 90-237 Łódź, Poland kamil.slomczynski@edu.uni.lodz.pl

Aedes japonicus (Theobald, 1901) is an invasive mosquito species and a vector of arboviruses, such as West Nile Virus (WNV) and dengue virus. Although its native distribution range is Eastern Asia, it forms stable populations in Europe. The species was recorded in European countries, including Austria, Croatia, the Czech Republic, Germany, Hungary, Italy, Liechtenstein, the Netherlands, Romania, Slovakia, Slovenia, Spain and Switzerland. In 2023, it was also observed for the first time in Poland. First literature records of Ae. japonicus in Poland come from Mikołów and Kielce (southern Poland). All records of this species in Poland found on iNaturalist (researach grade only) are from the southern part of the country - mainly near Katowice, Kielce and Kraków. This study presents the first records of Aedes japonicus in Lodz (central Poland) and thereby confirms its northward range extension in Poland. Six adult mosquito individuals from five locations in Lodz were collected by individual sampling and then morphologically identified as Ae. japonicus. Furthermore, in the rainwater bucket in one of the locations also the larvae of the species were recorded. In order to identify the collected larval specimens, molecular techniques applying ONT sequencing were used. Further research into the distribution, ecology and reproductive success of this species in Poland may prove crucial in developing monitoring and prevention strategies.

Keywords: invasive alien species, vector mosquito, Asian bush mosquito, new records, range extension.

Where are they and where did they came from? Understanding the global dynamics of non-native Lepidopterans

Henrique Couto¹, Rui Rebelo¹, José Grosso-Silva^{2,3}, César Capinha^{4,5}

 ¹ cE3c Centre for Ecology, Evolution and Environmental Changes & CHANGE - Global Change and Sustainability Institute, Faculdade de Ciências da Universidade de Lisboa, Lisboa, Portugal henriquenunocouto@gmail.com
 ² Museu de História Natural e da Ciência da Universidade do Porto. Porto; Portugal
 ³ Faculdade de Ciências da Universidade do Porto. Porto; Portugal
 ⁴ Centre of Geographical Studies, Institute of Geography and Spatial Planning, Universidade de Lisboa, Lisboa, Portugal
 ⁵ Associate Laboratory Terra, Portugal

Lepidopterans (moths and butterflies) represent one of the most diverse insect groups. Like many other taxa, they have been widely introduced beyond their native ranges due to human activities. To better understand the patterns of these introductions, we compiled and analysed a global database of established non-native lepidopterans, integrating data from scientific literature and existing databases. For each species, we recorded the region of introduction, native distribution, introduction pathway (intentional, accidental, or unknown), the year of first detection, and whether an established population is known. We then identified the most widely distributed non-native species and analysed global intercontinental introduction flows. Additionally, we examined spatial patterns of species richness and tested macroecological predictors, including human activity levels, climate, and land use. Temporal trends in first records were also analysed. Our findings reveal that at least 765 lepidopteran species have successfully established populations worldwide, with 68 species reported in over 10 distinct regions. The most prominent intercontinental introduction patterns include a high number of species moving from Asia to North America, Europe, and Oceania, as well as from Europe to North America. Our region-specific model indicates that established species richness is higher on islands and in regions with higher GDP, while a negative relationship was observed for area in squared kilometres, population density and mean annual temperature. Overall, our results highlight an extensive dispersal of moths and butterflies facilitated by human activities, primarily driven by global trade.

Keywords: Lepidoptera, temporal trends, global invasion, distribution, establishment.

Biotic resistance modulated by traits? Comparing functional structure between shrub-invaded and neighboring non-invaded communities

Sofía Cingolani¹, Jaime Moyano², Karina L. Speziale¹

 ¹ Grinbic Conservation Biology Group, INIBIOMA (CONICET-Universidad Nacional del Comahue), Ecotono Laboratory, Pje. Gutiérrez 1125, San Carlos de Bariloche, CP 8400, Argentina
 ² Grupo de Ecología de Invasiones, INIBIOMA(CONICET-Universidad Nacional del Comahue), Quintral 1250, San Carlos de Bariloche, CP 8400, Argentina

Understanding patterns and impacts of plant invasions is critical for managing them effectively and reducing their impacts on biodiversity and ecosystem services. Many invasive species are especially good at colonizing after disturbances, generally forming dense monospecific stands or co-occurring with other invaders. These invaded stands act as dispersal foci, facilitating further spread to nearby communities. However, the spread into less disturbed communities is not homogeneous, possibly due to differences in community structure and species traits --especially those associated with resource acquisition and competition— which favor their biotic resistance (i.e., the ability of species in a community to limit invasion). In this study, we analyze the functional structure of invaded and non-invaded neighboring communities to determine whether trait-based biotic resistance helps explain community susceptibility to invasion. We selected nine sites with invasion foci of the highly invasive non-native shrubs *Rosa rubiginosa* (rosehip) and *Cytisus scoparius* (Scotch broom) in Nahuel Huapi National Park, Patagonia, Argentina. In each site we placed 3 to 6 pairs of neighboring invaded and non-invaded plots. In each plot, we identified plant species, recorded their origin, and collected structural data such as cover and maximum height. We selected traits associated with resource acquisition strategies: potential maximum height, leaf area, specific leaf area, leaf dry matter content and leaf nitrogen and phosphorus content. For the most abundant species, these traits were either obtained measured from collected plant samples or from data bases. In order to assess the differences between invaded and non-invaded communities we calculated the community-weighted mean of each trait in each plot as the mean value across all species present, weighted by the species' relative abundance. Additionally, we calculated functional diversity indices. We then discuss whether differences exist in the functional structure of communities and how functional traits shape community susceptibility to invasion.

Keywords: acquisitive traits, community invasion resistance, functional structure, invasive plants, plant traits.

The use of ground-level imagery to determine fleshy-fruited invasive alien shrub populations change over time along roadsides of South African grasslands

<u>Lehlohonolo D. Adams^{1,2}</u>, Grant. D. Martin ^{3,4}, Sandy-Lynn Steenhuisen ³ and Colleen T. Downs ¹

¹Centre for Functional Biodiversity, School of Life Sciences, University of KwaZulu-Natal, Private Bag X01, Scottsville, Pietermaritzburg, 3209, South Africa

²South Africa National Biodiversity Institute, Kirstenbosch Research Centre, Cape Town, South Africa ³Afromontane Research Unit, Department of Plant Sciences, University of the Free State, Qwaqwa campus, Phuthaditjhaba, 9866, South Africa

⁴Centre for Biological Control, Department of Zoology and Entomology, Rhodes University, Makhanda, 6140, South Africa

⁵Centre for Invasion Biology, University of Stellenbosch, Stellenbosch, South Africa

The expansion of woody, fleshy-fruited invasive alien plants poses significant ecological risks to South African grasslands, necessitating effective, long-term monitoring. This study investigates the use of Google Street View to monitor invasive plant populations along South African roadsides. Using Google Street View-derived repeat photography, we assessed changes in abundance over 12 years for multiple invasive species. Plant species recorded included Cotoneaster pannosus Franch. (Rosaceae) (n = 15 points), Lantana camara (Verbanaceae) (n = 1), Ligustrum lucidium (Oleaceae) (n = 1), Melia azedarach (Meliaceae) (n = 6), Opuntia ficus-indica (Cactaceae) (n = 35), Prunus persica (Rosaceae) (n = 18), Pyracantha angustifolia (Franch.) C.K.Schneid. (Rosaceae) (n = 74), Pyracantha crenulata (Rosaceae) (n = 3), *Rosa rubiginosa* L. (Rosaceae) (n = 28), *Schinus molle* L. (Anacardiaceae) (n = 2), and *Solanum mauritianum* (Solanaceae) (n = 9). The study identified population increases in several species like Pyracantha angustifolia, Solanum mauritianum, and Prunus persica, while others like Opuntia ficus-indica decreased. Our findings showed that, while some species exhibit increases in abundance, most trends were not statistically significant. This study provides a foundation for using Google Street View in large-scale monitoring of invasive plant species.

Keywords: fruit-producing woody plants, Grassland Biome, plant invasions, street view imagery, South Africa.



Could the invasive willow removal improve the regeneration of native woody species in a Patagonian riparian ecosystem?

Torres M.D.M.¹, Blackhall, M.¹, Relva, M.A.¹

¹ Instituto de Investigaciones en Biodiversidad y Medioambiente (Consejo Nacional de Investigaciones Científicas y Técnicas - Universidad Nacional del Comahue), San Carlos de Bariloche, Argentina mdmilagrotorres@gmail.com

The removal of invasive woody species is widely recommended to mitigate damage and restore native ecosystems. However, such actions can lead to unexpected outcomes, especially in multi-invaded ecosystems. To understand these impacts, we assessed the effects of removing the invasive non-native willow (Salix × rubens) on understory woody vegetation in a riparian ecosystem inhabited by non-native ungulates. In autumn 2021, we established 20 plots in willow-invaded areas along the Chacabuco stream (NW Patagonia, Argentina): 10 with willow removal and 10 controls. After four years (summer 2025), we assessed tree (DBH >4 cm) and shrub cover, height, and ungulate browsing in 16 m² subplots. Likewise, we recorded height, counted, and identified each sapling (DBH <4 cm) and seedling (with cotyledons) species in 2 m² subplots to estimate species abundance, richness, and composition. We found that the removal treatment did not affect the height and richness of trees, shrubs, saplings, and seedlings, nor on tree and shrub cover. Likewise, composition of trees, shrubs, and saplings was unaffected. However, the abundance of nonnative saplings decreased in two-folds compared to control plots, with no effect on native saplings abundance. The native seedling abundance was three times higher in the removal treatment than in control plots, coinciding with changes in seedling species composition. Notably, a key native tree, Ochetophila trinervis, contributed most to these differences. The browsing of native trees, shrubs, and saplings was higher in the removal treatment than in control. This coincided with a greater browsing of non-native saplings in the removal, but not with non-native trees and shrubs, which was similar between treatments. In conclusion, the willow removal could improve the regeneration of understory woody native species by increasing seedling abundance and reducing non-native saplings. However, this regeneration could be threatened by increased browsing of non-native ungulates in these sites.

Keywords: Invasive species management, riparian ecosystem, non-native tree species, *Salix* × *rubens*, northwest Patagonia.

Assessing the prevalence of natural enemies (*Spanolepis selloanae*) on *Cortaderia selloana* (Pampas grass) populations

Natalia Córdoba Clavera¹, Adrián Lázaro-Lobo^{1,2}

¹ Department of Organismal and Systems Biology, University of Oviedo, Oviedo, Asturias, 33071 Spain natcordobaclavera@gmail.com
² Biodiversity Research Institute (IMIB), University of Oviedo-CSIC-Principality of Asturias, Mieres, Asturias, 33600 Spain

Cortaderia selloana (Pampas grass) is a highly invasive species causing significant environmental, economic, and social issues globally. Native to the moist habitats of Argentina, Brazil, and Uruguay, this perennial grass has become invasive in Europe, South Africa, Australia, New Zealand, and North America, where it was introduced for horticultural, landscaping, shelter, and soil stabilization purposes. Cortaderia selloana outcompetes native vegetation, disrupts ecological processes, and causes substantial aesthetic impacts, particularly in early-successional ecosystems. Once established, it requires considerable economic and human resources to manage. To date, no biological control agents have been introduced to control C. selloana. One potential agent is the recently identified gall midge, Spanolepis selloanae Gagné (Diptera: Cecidomyiidae), whose larvae feed on developing ovaries, replacing seeds at the time of dispersal and reducing seed production by nearly three-quarters. This species was first discovered in Galicia, NW Spain, in 2016, but it is believed to have spread along the same pathways as C. selloana. Although S. selloanae has not been successful in controlling C. selloana in Western Europe, it may play a crucial role in limiting the species' spread and seed bank. In this study, we sampled *C. selloana* populations along both its native and introduced ranges, with the collaboration of 26 researchers from five continents, to assess the proportion of flowers per individual containing S. selloanae larvae. We found that S. selloanae was widely distributed in northern Spain and southern France, infecting 10-60% of the flowers. However, this insect was absent in South Africa, Australia, New Zealand, and North America. We are currently investigating the potential to introduce this midge as a biological control agent in regions invaded by C. selloana, particularly in areas lacking native C. selloana congeners, such as Cortaderia or Austroderia species.

Keywords: biological control, *Cortaderia selloana*, natural enemy, seed production, *Spanolepis selloanae*.

Investigating gene editing and silencing techniques to mitigate *Eichhornia crassipes* (Mart.) solms invasions: assessing biochemical processes, physiological responses, and ecological impacts in freshwater ecosystems

Sikhakhane L.L.¹, Naidoo D.¹

¹ Department of Nature Conservation, Mangosuthu University of Technology, Durban, South Africa Iskhakhane7@gmail.com

Eichhornia crassipes (Mart.) Solms, commonly known as water hyacinth, is an invasive aquatic plant species that poses a significant threat to the freshwater ecosystems. Its rapid proliferation disrupts aquatic biodiversity, reduces water quality, and hampers ecosystems services. Current management strategies, including mechanical, chemical, and biological control methods, have shown varying degrees of effectiveness but also have limitations such as environmental risks and high maintenance costs. This study aims to explore innovative biotechnological approaches, specifically gene editing and silencing, as innovative methods for controlling the spread of *Eichhornia crassipes* in freshwater ecosystems. To investigate the allelopathic mechanisms of Eichhornia crassipes and their impact on native species. To identify upregulated genes responsible for allelochemical secretion in E. crassipes and determine the corresponding affected genes in other species through transcriptomics analysis. To explore the potential of CRISPR-Cas9 technology in altering gene sequences responsible for invasive traits. To evaluate gene silencing techniques, Host-Induced Gene Silencing (HIGS) and Spray-Induced Gene Silencing (SIGS), as methods of controlling water hyacinth. The study will employ a combination of genomic analysis and laboratory experiments. Using CRISPR-cas9 for gene editing and RNAi for gene silencing, specific genes involved in growth and reproduction will be targeted. Comparative growth trials will be conducted under controlled conditions to assess the effectiveness of these interventions. It is anticipated that gene editing and silencing will significantly reduce the plants growth rate, reproductive output, and resilience. Biotechnological interventions can serve as viable alternatives to traditional control methods with protentional lower environmental impact and long-term effectiveness. This research could provide a breakthrough in invasive species management by introducing molecular tools that offer targeted, efficient, and environmentally sustainable solutions. If successful, the findings could inform future policies, practises and conservation strategies for controlling invasive aquatic plants, thereby supporting biodiversity conservation and ecosystem restoration efforts.

Keywords: invasive species management, gene editing, gene silencing, allelopathy.

Modulation of *Heracleum sosnowskyi* endogenous gibberellins levels and gene expression by exogenous GA₃

Tautvydas Žalnierius¹, Dominykas Laibakojis¹, Jurga Būdienė², Sigita Jurkonienė¹

¹ Laboratory of Plant Physiology, Nature Research Centre, Akademijos str. 2, 08412 Vilnius, Lithuania tautvydas.zalnierius@gamtc.lt

² Laboratory of Chemical and Behavior Ecology, Nature Research Centre, Akademijos str. 2, 08412 Vilnius, Lithuania

Heracleum sosnowskyi is a noxious plant listed in List of invasive alien species of Union concern (according to EU Regulation 1143/2014). It's ability to destroy native ecosystems and toxicity for human health is worrying. This species propagates only by seeds and dies after flowering. Gibberellins (GAs) are crucial plant hormone that regulate growth and play a significant role in fruit development. This study aimed to identify the genes involved in GA metabolism and to modulate endogenous gibberellins levels and gene expression in H. sosnowskyi through exogenous gibberellic acid (GA3) application. We identified 27 GA oxidase (GAox) proteins in *H.sosnowskyi* genome, including nine GA20ox, thirteen GA2ox, and five GA3ox enzymes containing specific domains to GA 2-oxoglutarate dependent dioxygenases superfamily. We found GAox genes are distributed across eleven chromosomes, and their proteins exhibit cytoplasmic localization. Phylogenetic reconstruction clustered the H.sosnowskyi GAox proteins into three clades: GA20ox, C19-GA2ox, and GA3ox. However, no orthologs of the C20-GA2ox family were identified. The HsGA20ox1, HsGA3ox1, and HsGA2ox1 genes are cloned for the first time, they showed the highest expression in developing ovaries. Expression analysis of ovaries after GA₃-treatment revealed contrasting patterns: HsGA3ox1 was significantly upregulated at 10-days posttreatment, while HsGA20ox1 was downregulated. Ten-days after GA₃-treatment, GA₁ levels increased in the lateral umbel part but decreased in the central. GA-precursors (GA44, GA19, GA₂₀) were most abundant, while GA-catabolites (GA₈, GA₂₉) showed distinct accumulation. Phenotypically, GA₃ led to a significant decrease in ovary size and weight: in the central umbel part, length decreased by 21%, width by 30%, and weight by 59%; in the lateral part, length decreased by 20%, width by 31%, and weight by 41%. The reduction in ovary size and weight suggests the suppression of seed development mechanisms. In conclusion, the altered gene expression and endogenous GA fluctuations in response to GA₃ highlight their role in ovary development and seed formation. These findings contribute to a better understanding of GA regulation in invasive plant species and may inform future strategies for controlling *H.sosnowskyi* spread.

Keywords: Sosnowsky's hogweed, invasive plant, Apiaceae, plant hormone analysis, genomewide analysis.

Preventive management of invasive aquatic species introduced by maritime transport: a case study of the Port of Santander

Menéndez-Teleña, D.¹, García, S.², Trueba, A.³, Soto-López, V⁴

¹ Department of Marine Science and Technology, University of Oviedo, Gijón, Spain, menendezdeva@uniovi.es ² Department of Navigation Science, Techniques, and Naval Construction, University of Cantabria, Santander,

Spain

³ Department of Navigation Science, Techniques, and Naval Construction, University of Cantabria, Santander, Spain

⁴ Department of Marine Science and Technology, University of Oviedo, Gijón, Spain

Marine biological invasions are among the most serious threats to global biodiversity. Maritime transport significantly contributes to the introduction of non-native species into new environments through hull fouling-organisms attached to vessel hulls-and ballast water, which is taken on board to enhance stability and structural integrity. Once introduced, non-native species may became invasive, potentially displacing native species, disrupting ecological balance, and causing both biological and economic losses. This study presents a predictive tool that analyzes maritime traffic at a given port to identify potential invasive species introduced through shipping activities. A case study is conducted at the Port of Santander, one of the most significant ports in the Bay of Biscay, handling over 7 million tons of cargo annually. The prediction tool is divided into three parts. First, the risk of biological contamination for each vessel is assessed by analyzing vessel characteristics from two perspectives: hull fouling, considering vessel size and time in port, and ballast water, based on the volume transported. This risk calculation is then uploaded to a Power BI dashboard to facilitate easier, faster, and more visual access. Second, using the Global Invasive Species Database (GISD), potential invasive species that may originate from the geographical regions from which vessels at risk of biological contamination depart are identified. Finally, these species are categorized by risk level based on two key factors: environmental compatibilitymatching the salinity and temperature of the introduction site (obtained from PORTUS, Spain's State Ports information system) with each species' survival range (sourced from the Ocean Biodiversity Information System, OBIS)-and introduction events, quantified by the number of vessels arriving from the species' native region. This preventive management tool for invasive species can be easily implemented across ports, as it requires only data that Port Authorities already collect. In line with international policies, it is crucial to implement preventive measures, as they are far more effective than eradication once non-native species have become established.

Keywords: biological pollution, invasive species, maritime transport, ballast water, fouling, preventive management tool.

Control methods applied to invasive exotic species in subtropical forests of Yungas, Tucumán, Argentina

<u>Yesica Yuretic¹</u>, Lia Montti², Priscila Ana Powell^{1,3}

 ¹ Facultad de Ciencias Naturales e Instituto Miguel Lillo, Universidad Nacional de Tucumán, Tucumán, Argentina yureticyesica@gmail.com
 ² Instituto de Investigaciones Marinas y Costeras, Universidad Nacional de Mar del Plata-CONICET, Mar del Plata, Argentina

³Instituto de Ecología Regional (Universidad Nacional de Tucumán & CONICET)

There is increasing demand for studies optimizing the cost-effectiveness of invasive plant control strategies. In the Yungas of the San Javier Mountains (Tucumán, Argentina), Ligustrum lucidum (L. lucidum) and Morus alba (M. alba) have invaded young successional forests and abandoned lands, altering habitat structure and negatively impacting biodiversity. This study assessed the effectiveness of mechanical-chemical and chemical control treatments in subtropical montane forests. Survival of treated individuals, the relationship between diameter at breast height (DBH) and resprouting capacity (4-71 cm), and treatment costs were analyzed. In February and June 2021, the mechanical-chemical treatment was applied to 332 L. lucidum and 52 M. alba individuals by cutting the stem and applying herbicide Tocón Extra, with a second application in February 2022. The chemical treatment was applied once on 228 L. lucidum and 38 M. alba by drilling holes and injecting herbicide. Kaplan-Meier survival curves indicated that after one year, mechanical-chemical treatment reduced survival probability to 25% in L. lucidum and 50% in M. alba, while all chemicallytreated individuals survived. Box plots showed L. lucidum resprouting occurred mainly in individuals with a DBH of 25-45 cm, while *M. alba* resprouted in individuals with a DBH of 15-25 cm. Costs were \$10.81 USD per individual for the mechanical-chemical treatment and \$2.22 USD for the chemical. Early monitoring is recommended for mechanical-chemical treatments, as tree size influences resprouting and costs.

Keywords: Yungas, management strategies, invasive alien species, resprouting, treatments.

Halting an invasion: exploring the potential of traps to protect rivers from non-native Chinese mitten crabs

Oscar Jones¹, Dr Joe Ironside¹, Dr Daniel Mills¹

¹ Department of Life Sciences, Aberystwyth University, Aberystwyth, United Kingdom onj@aber.ac.uk

The Chinese mitten crab (CMC) Eriocheir sinensis is a catadromous crab species native to Southeast Asia and is a voracious Invasive Non-Native Species (INNS) across North America and Europe. E. sinensis breeds in estuaries, juveniles undertake long upstream migrations (Cohen and Weinstein 2001), maturing in freshwater habitats, before returning 1-5 years later to the estuary for Autumn spawning. Due to the crab's migratory behaviour and inability to swim a unique management opportunity exists, by deploying traps on the riverbed large numbers of migrating crabs can be captured and removed from the ecosystem. This approach has been successfully trialled in the Schelt River catchment in Belgium (Schoelynck et al. 2021). Our research covers three phases of a potential *E. sinensis* management plan, assessing site feasibility for CMC trapping, improving sampling methods and assessing the use of traps as a population control method. A site selection survey, aiming to identify appropriate locations for CMC trapping, has been developed and is currently being tested at locations in North Wales and Northeast England. Crab condo traps are small moveable traps which can be used to detect invasive crab species in marine environments (Hewitt and McDonald 2013). We have conducted refuge choice experiments aiming to refine condo traps specifically for *E. sinensis*, with initial results suggesting that the species prefers small spaces close to the riverbed. Effective sampling methods to detect E. sinensis in combination with a site selection survey will allow to determine which locations should be targeted to trap migrating crabs in invaded waterways. Finally, a fixed CMC trap has been designed for deployment in the river Dee, pending licensing approval from the Environment Agency (EA). This will be the first trap of its kind deployed in a main statutory river in the UK, marking an important milestone in the effort to manage this invasion.

Keywords: Chinese mitten crab (CMC), population control, site feasibility, sampling, trapping.

Invasive species know no borders: the complete Western expansion of *Pseudorasbora parva* and challenges of its ineffective management

Brandão, P.¹, Rato, J.^{1,2}, Gama, M.¹, Anastácio, P.^{1,3}, Banha, F.^{1,2}

¹ MARE – Marine and Environmental Sciences Centre; ARNET – Aquatic Research Network pedro.brandao@uevora.pt

² IIFA – Institute for Advance Studies and Research, University of Évora
 ³ Department of Landscape, Environment and Planning, University of Évora, Rua Romão Ramalho, 59,

Évora, Portugal

The topmouth gudgeon (Pseudorasbora parva) a small cyprinid native to East Asia, is considered one of Europe's most invasive fishes due to its high habitat plasticity, early maturity, and rapid reproductive cycle. Beyond outcompeting native species, the fish acts as an asymptomatic pathogen carrier that can severely impact the local ichthyofauna. Introduced accidentally through contaminated fish stocks, P. parva has rapidly expanded across Europe. The first Iberian record dates back to 2001 in the Ebro River (Spain), and the species was subsequently detected in the Guadiana River basin in 2010. Despite early eradication efforts in Spain, including rotenone treatments, the species continued to spread, reaching the Portuguese section of the Guadiana River. In 2024, during an electrofishing survey, seven individuals (total length: 4.0-7.5 cm) were captured, marking the first official record in Portugal. In this location, *P. parva* represented 2% of the ichthyofauna in a system already dominated by invasive species. This finding is particularly concerning due to the proximity of the site to the Alqueva reservoir, the largest artificial reservoir in Western Europe, where control efforts would be nearly impossible. The reservoir's connectivity with other basins, including the Sado River, further increases the risk of dispersal, threatening endemic and endangered leuciscid fishes, such as Iberochondrostoma lusitanicum. This study highlights the continued spread of this invasive fish throughout the Iberian Peninsula, emphasizing the need for managing biological invasions with transboundary cooperation. Beyond regulatory measures, improved communication and coordination between nations are crucial to reduce the likelihood of *P. parva* spread and prevent further biodiversity loss in Iberian freshwater ecosystems.

Keywords: invasive species, *Pseudorasbora parva*, eradication, international coordination, Guadiana.

Vegetative multiplication and resilience of *Crassula multicava* Lem.: challenges for mechanical eradication in the Canary Islands

<u>García Cabrera, C.¹</u>, Cedrés-Perdomo, R.D.¹, Naranjo-Cigala, A.², González-Montelongo, C.¹, Arévalo, J.R.¹

¹ Department of Botany, Ecology and Plant Physiology, University of La Laguna, San Cristóbal de La Laguna, Spain alu0101591599@ull.edu.es

² Geography Department, University of Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain

Biological invasions in oceanic archipelagos threaten island ecosystems due to the rich endemic biodiversity they support. Crassula multicava is a succulent species found in shaded environments along the subtropical coastline of South Africa. In the Canary Islands, this species invades zones within the Canarian laurel forest domain. Mechanical eradication tasks raise serious doubts about their effectiveness because this species is capable of regrowing from vegetative propagules. This work evaluates the regrowing capacity of leaves, leaf fragments, stems, and stem fragments of C. multicava under different treatments. For this purpose, 18 individuals of C. multicava were collected in a population inhabiting the Bosque del Adelantado (El Rosario, Tenerife), with 9 subjected to irrigation every two days and 9 subjected to natural environmental conditions, serving as controls. For each individual, 8 leaves and 8 stem sections were selected and subjected to darkness, burial and cutting treatments. After seven weeks, some propagules exhibited the ability to regrow, developing roots and/or shoots. However, the irrigated propagules showed a faster regrowth rate than the controls, with longer roots and larger shoots. This work demonstrates the high invasiveness of Crassula multicava due to its high vegetative multiplication and resilience under different temperature, light, and humidity scenarios. These results explain why mechanical eradication is not always effective and highlight the need for continuous monitoring at the action sites.

Keywords: exotic species, resilience, sprouting capacity, Tenerife.

Spatial recognition and population dynamics of an invasive cactus using multi-temporal aerial imagery and machine learning

Ga<u>rrett Cohen¹</u>, Roberto Salguero-Gómez², Erola Fenollosa²

¹ Unity Environmental University, New Gloucester, United States of America gcohen1999@gmail.com
² Department of Biology, Oxford University, Oxford, England

Invasive species pose significant environmental and ecological threats, particularly in regions like the Mediterranean, where the prickly pear cactus (Opuntia spp.), native to the Americas, has become a major invasive plant. The ability of Opuntia spp. to thrive in arid, rocky environments and reproduce both sexually and asexually contributes to its spread, outcompeting native flora and disrupting local ecosystems. This study focuses on the use of deep learning and aerial imagery to map the geographic expansion of Opuntia spp. in the Mediterranean Basin. The research aims to develop a machine learning framework to accurately identify Opuntia spp. populations using drone and satellite imagery, track their growth, and estimate expansion rates across various sites. By training a deep convolutional neural network on public and self-collected high-resolution aerial images (from 0.3 to 3 cm/pixel) and GPS data, the study achieves a 95% success rate in detecting Opuntia sp. in the studied area. The results demonstrate that incorporating image rotation and resolution optimization significantly improves model accuracy, which allows to reach >90% detection accuracy on aerial images from Google Earth services. However, limited availability of high resolution and low quality of public aerial images restricts the usage of deep learning tools to further detect and monitor invasive plants across space. Beyond offering a scalable tool for invasive species management using public images, our research discusses its transferability to other species, and the potential for monitoring across time. Our work provides practical tools for managers and critical insights into the dynamics of invasive plant spread, enabling more effective environmental monitoring and management.

Keywords: Opuntia, Deep-Learning, GIS, Machine Learning, Greece, invasive species.



Many plants naturalized as aliens abroad have also become more common within their native regions

<u>Rashmi Paudel¹</u>, Trevor S. Fristoe^{1,2}, Nicole L. Kinlock¹, Amy J.S. Davis¹, Weihan Zhao¹, Hans Van Calster³, Milan Chytrý⁴, Jiří Danihelka^{4,5}, Guillaume Decocq⁶, Luise Ehrendorfer-Schratt⁷, Zdeněk Kaplan^{5,8}, Jan Wild⁵, Wayne Dawson⁹, Franz Essl^{7,10}, Holger Kreft^{11,12,13}, Jan Pergl¹⁴, Petr Pyšek^{14,15}, Marten Winter¹⁶ & Mark van Kleunen^{1,17}

1Ecology, Department of Biology, University of Konstanz, Universitätsstrasse 10, 78464 Konstanz, Germany. 2Department of Biology, University of Puerto Rico - Rio Piedras, San Juan, Puerto Rico. 3Research Institute for Nature and Forest, Havenlaan 88 bus 73, 1000 Brussel, Belgium. 4Department of Botany and Zoology, Faculty of Science, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic. 5Department of Taxonomy, Institute of Botany, Czech Academy of Sciences, Zámek 1, 252 43 Průhonice, Czech Republic. 6Ecologie et Dynamique des Systèmes anthropisés (UMR CNRS 7058 EDYSAN), University of Picardie Jules Verne, 1 rue des Louvels, F-80037 Amiens Cedex 1, France. 7Department of Botany and Biodiversity Research, University of Vienna, Vienna, Austria. 8Department of Botany, Faculty of Science, Charles University, Prague, Czech Republic. 9Department of Evolution, Ecology and Behaviour, Institute of Infection, Veterinary and Ecological Sciences, University of Liverpool, Liverpool, UK. 10Centre for Invasion Biology, Department of Botany and Zoology, Stellenbosch University, Stellenbosch, South Africa. 11Biodiversity, Macroecology and Biogeography, University of Göttingen, 37077 Göttingen, Germany. 12Centre of Biodiversity and Sustainable Land Use (CBL), University of Göttingen, 37077 Göttingen, Germany. 13Campus-Institut Data Science (CIDAS), University of Göttingen, Goldschmidtstraße 1, 37077 Göttingen, Germany. 14Department of Invasion Ecology, Czech Academy of Sciences, Institute of Botany, 25243 Průhonice, Czech Republic. 15Department of Ecology, Faculty of Science, Charles University, 12844 Prague, Czech Republic. 16German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, 04103 Leipzig, Germany. 17Zhejiang Provincial Key Laboratory of Plant Evolutionary Ecology and Conservation, Taizhou University, Taizhou 318000, China rashmi.paudel@uni-konstanz.de

Throughout the history of life, natural processes have driven changes in species' range size and occupancy. In the last centuries, and particularly since the start of the Anthropocene, these dynamics have accelerated in response to anthropogenic changes occurring across species' native distributions. At the same time humans have introduced thousands of species beyond their historic range limits, and some of these establish self-sustaining populations (i.e. become naturalized). Although it is well documented that particularly plant species that are common in their native range have become naturalized elsewhere, how dynamics in native distributions relate to global naturalization remain unclear. To fill this knowledge gap, we retrieved grid-cell occupancy data of 3920 vascular plant species for 10 European regions that had such data for at least two periods, spanning decades to more than one century. For each of these regions, we calculated an occupancy-change index for each native species. We used hurdle models to relate this change index along with occupancy in the early period to the number of regions around the globe where the species is a naturalized alien (i.e. global naturalization). We found that global naturalization increased significantly with both the early-period occupancy and the occupancy-change index for nine of the ten native regions. Moreover, for three regions, the positive effect of the occupancy-change index was strongest for species that already had high occupancies during the early period. Our results provide the first evidence that many of the plant species that have expanded their global distributions as naturalized aliens are also expanding within their native ranges. These findings strongly suggest that many of the drivers of a species' global naturalization are the same as those that allow the species to thrive at home. Keywords: declining species, expanding species, European native regions, global naturalization, naturalization extent.

Overlooked but invasive: a case study on land snail diversity and alien species spread in Oxfordshire woodlands

Alessandro Nota^{1,2}, Thomas Hesselberg¹

¹ Department for Continuing Education, University of Oxford, Oxford, UK ² Department of Veterinary Sciences, University of Turin, Turin, Italy alessandro.nota@unito.it

Land snails represent a highly diverse yet understudied group of organisms, with many species still being described. However, numerous extinctions have occurred over the last centuries, largely due to the introduction of alien counterparts. Urbanisation and habitat disturbance are well-known to promote the spread of opportunistic and alien species, but their effect on alien land snails has seldom been investigated. This research analysed the diversity and abundance of native and alien land snails in eight woodland sites across Oxfordshire, including four urban and four rural sites. The study aimed to evaluate how alien snail populations are influenced by environmental variables, such as proximity to road, water sources, and human structures, as well as site size and presence of native counterparts. Snail populations were surveyed using systematic quadrat sampling, and species identification was based on morphological characteristics, complemented by molecular analyses for taxonomically ambiguous species. A total of 24 species (grouped into 23 taxa) were identified, including five known aliens: the Garden snail Cornu aspersum, the Kentish snail Monacha cantiana, the Girdled snail Hygromia cinctella, the Swiss glass snail Oxychilus navarricus, and the Draparnaud's glass snail Oxychilus drapanuardi. Notably, H. cinctella appears to be expanding throughout Oxfordshire, suggesting an ongoing invasion process. Results indicate that alien snails are more prevalent in smaller and disturbed areas, with their abundance decreasing with increasing distance from roads. The presence of native species appears to exert biotic resistance against invasions, particularly in larger and less disturbed sites. These results highlight the critical role of human activities in shaping land snail communities, evidencing that roadsides can act as important corridors for alien species dispersal. In contrast, larger rural sites, with richer native communities, provide biological resistance against invasions. Given the growing trends of urbanisation and habitat alteration, future conservation strategies should focus on mitigating anthropogenic disturbances and preserving larger, contiguous natural areas to support native biodiversity and limit biological invasions.

Keywords: alien species, gastropods, land snails, Oxfordshire, human disturbance.

Evidence for the Leading-Edge Hypothesis: a systematic literature review

Ffion Anthony¹, Josie South¹

¹Faculty of Biological Sciences, University of Leeds, Leeds, Yorkshire <u>bs21fa@leeds.ac.uk</u>

Invasive species are one of the main drivers for biodiversity loss, especially in freshwater ecosystems. When non-native species become established and later disperse across novel ecosystems, they can negatively impact native ecology. The leading-edge hypothesis describes how individuals at the front of the expanding range will experience different selective pressures than those at the core of the invasion. Understanding what drives dispersal dynamics of invasive species and how invasion gradients form is crucial when predicting their spread and impacts. The objective of this systematic literature review was to evaluate evidence of morphological and behavioural variation along invasion gradients in freshwater. A systematic search and screening of 319 studies was conducted following PRISMA (2020) guidelines in Google Scholar, Web of Science, and Hi-Knowledge invasion science database and appropriate studies were selected based on specific criteria. All studies had to involve a freshwater aquatic invasive species and have at least two distinct data samples from different parts of the invasion gradient. Most studies indicated a morphological or behavioural difference in populations along the invasion gradient but the absence of a clear spatial trend in specific behaviours or morphologies suggests local context dependency. Further research in invasion science should explore the link between behaviour and morphology as these phenotypic traits are often interconnected and can shape dispersal ability. Understanding the relationship between key traits is crucial for predicting future range expansions and can in turn inform management strategies on how to control or prevent the spread of invasive species.

Keywords: freshwater, invasions, invasion gradients.

Comparison of flowering phenology between native and invasive plants at ecoregional level

<u>Víctor González-García</u>^{1,2}, Adrián Lázaro-Lobo^{1,2}, Borja Rendueles Fernández^{1,2}, Eduardo Fernández-Pascual^{1,2}, Borja Jiménez-Alfaro^{1,2}

¹ Biodiversity Research Institute (IMIB), University of Oviedo-CSIC-Principality of Asturias, Mieres, Asturias, 33600 Spain

² Department of Organismal and Systems Biology, University of Oviedo, Oviedo, Asturias, 33071 Spain

Flowering phenology has been proposed to be an important factor in explaining invasions by non-native plant species. Invasive species success may be improved by flowering at different times ("vacant niche hypothesis"), flowering earlier ("priority effects hypothesis") or flowering for longer periods ("niche breath hypothesis") than native species. However, comprehensive regional assessments of the flowering phenology of invasive and native flora are lacking in the literature. In this study, we evaluated the flowering phenology invasive and native plant species pools at the ecoregional level, to test the above-mentioned hypotheses within a biogeographically and ecologically meaningful region. We compared the start, end and length of flowering time between the invasive and native vascular plants that occur at the same altitudinal range in the Cantabrian Mixed Forests ecoregion (NW Iberian Peninsula), accounting also for habitat preferences and climatic and biogeographic origin of the invasive species. We found a mismatch in flowering time between the invasive and native plants within the studied ecoregion. Invasive species had a delayed and longer flowering phenology compared to native species, said differences in flowering time were more pronounced in man-made habitats and among invaders from temperate and tropical regions. These results are consistent with the vacant niche hypothesis: the asynchrony in flowering time could allow invaders to exploit a temporally empty niche. However, we found that invaders flower later than natives, contrasting with the priority effects hypothesis, suggesting that patterns of flowering phenology may vary with the environmental conditions of the recipient ecosystem. Lastly, our results agree with the niche breath hypothesis, suggesting that invasive species exhibit a longer flowering period than natives, which may allow them to have prolonged access to resources.

Keywords: ecoregion, flowering phenology, habitat, invasive–native comparison, invasive alien species pool.

Global evaluation of native and introduced populations of *Cortaderia selloana* (Pampas grass)

Tomás Folgueras de la Iglesia¹, Adrián Lázaro-Lobo^{1,2}

¹ Department of Organismal and Systems Biology, University of Oviedo, Oviedo, Asturias, 33071 Spain tomasfolgueras@gmail.com

² Biodiversity Research Institute (IMIB), University of Oviedo-CSIC-Principality of Asturias, Mieres,

Asturias, 33600 Spain

The success of invasive plants in the introduced areas largely depends on both the biological attributes of the species and the novel environmental conditions. Invasive species have to adapt to the new biotic (e.g., herbivory, predation) and abiotic (e.g., climate, soil, resource availability) environment if they are to persist over time. *Cortaderia selloana* (Pampas grass) is a highly adaptable species that produces numerous viable seeds and can grow in a wide range of environments, although it prefers wet areas with mild temperatures. However, to date, there are no studies evaluating the ecological adaptations that may have helped the species succeed globally. Previous research found that the main limiting factors for the species persistence are low temperatures and water availability, which constrain seed germination and seedling establishment, however, we very little is known about the ecological differentiation between native and invaded regions. In this study, we evaluated the regeneration niche of C. selloana populations from its native (South America) and introduced (Europe, South Africa, Australia, New Zealand, and North America) ranges, with the collaboration of 26 international researchers. We evaluated the species germination and growth under different temperature and water treatments to identify climate constraints that would limit invasion by C. selloana along latitudinal and altitudinal gradients. We found that introduced populations had faster germination and early growth than native populations, especially under stressful conditions. Our results also suggest that C. selloana can tolerate a wide range of temperature and water availability conditions. These findings can enhance management programs by identifying areas at high risk of invasion and those that are unsuitable for the regeneration of *C. selloana*.

Keywords: *Cortaderia selloana*, global distribution, germination ecology, greenhouse experiment, seedling establishment.

First report on the parasite fauna of invasive raccoons (*Procyon lotor*) in Lithuania

<u>Evelina Maziliauskaite¹</u>, Evelina Juozaityte-Ngugu¹, Zivile Strazdaite-Zieliene¹, Elena Serviene¹, Muza Kirjusina², Dalius Butkauskas¹, Petras Prakas¹

¹ Nature Research Centre, Vilnius, Lithuania evelina.maziliauskaite@gamtc.lt ² Department of Ecology, Daugavpils University, Daugavpils, Latvia

The raccoon was introduced from North America to Europe in the 20th century. In 2010, they were also spotted in western Lithuania, and the population of these animals is now increasing. Due to the close association of raccoons with humans and pets, it is important to study the parasites transmitted by these predators. The objective of the study was for the first time to examine the composition of parasites in invasive raccoons from Lithuania. Thirteen raccoon samples (muscles and intestine) were collected in northwest Lithuania. We analysed samples for protozoan Sarcocystis spp., which form sarcocysts in muscles of intermediate host (IH) and develop sporocysts/oocysts in intestines of definitive hosts. Furthermore, muscles and faeces of animals were examined for helminths. Parasite species were identified using PCR and Sanger sequencing of amplified products. Five of the 13 raccoons were positive for at least one parasite. Based on the comparison of 285 rRNA and ITS1 sequences obtained, Sarcocystis lutrae was confirmed in leg muscles of single raccoon. According to the current knowledge this is sole Sarcocystis species detected in muscles of raccoons. Four different Sarcocystis species (S. bovifelis, S. rileyi and two genetically new Sarcocystis spp.) were found in intestines of animals. Phylogenetic results suggested birds and ungulates of families Bovidae and Cervidae as IHs of these Sarcocystis species. No helminths were observed in muscles of raccoons. Based on morphological characteristics cestodes were determined in faeces, and parasite species were established using 125 rRNA. We detected two different cestode species, Atriotaenia incisa in 15.38% and Mesocestoides sp. in 7.69% of the 13 examined raccoons. Thus, raccoons serve as IH of *S. lutrae* and can transmit numerous Sarcocystis spp. using different IHs. For the first time in Lithuania, A. incisa and Mesocestoides sp. have been genetically defined from raccoons.

Keywords: invasive raccoon, Sarcocystis spp., cestodes, molecular identification.

The stress test: how soil depth and aphid herbivory shape *Carpobrotus* physiological responses

<u>Noa Núñez-González¹</u>, Silvia Rodríguez¹, Marta Pérez-Diz¹, Jonatan Rodríguez², Luís González¹

¹CISPAC, Department of Plant Biology and Soil Sciences, Faculty of Biology, Universidade de Vigo, 36310, Vigo, Spain. <u>noanunhez@gmail.com</u>

²CRETUS, Department of Functional Biology, Faculty of Biology, Universidade de Santiago de Compostela, 15782, Santiago de Compostela, Spain.

Invasive plants of the genus Carpobrotus have a high phenotypic plasticity, allowing them to live in many coastal environments, such as dunes, littoral forests and cliffs, and to support biotic stress from herbivore pressure. For example, in Galicia (Spain), invasive Carpobrotus spp. N.E.Br. can be found in both deep and shallow soils, where native generalist herbivores like aphids feed on them. However, the interaction between herbivory and soil depth is not well studied. To investigate how soil depth and herbivory affect Carpobrotus, we conducted an experiment under controlled conditions, using sixty plant fragments collected from natural populations in Baiona (Pontevedra, Spain). Thirty plants were planted in deep soil (pots filled with sand) and thirty in shallow soil (pots with a plastic barrier and 2 cm of sand on top, thus reducing the depth by 70%) in the greenhouse. After the acclimatation period (eleven weeks), Carpobrotus plants were subjected to one of three treatments in the growth chamber: aphid infestation with Aphis fabae (Scopoli, 1763), simulated herbivory by mechanical puncture, or no damage (control). At the end of the experiment, we measured morphological (e.g., shoot and root biomass), photosynthetic (e.g., ϕ // and ϕ NPQ), and biochemical (e.g., pigments and enzymes activity) parameters. Our findings revealed that Carpobrotus plant growth was more affected by soil depth, especially particularly in shootrelated traits, which were reduced in deeper soils. Mechanical damage affected photosynthetic parameters more than aphid herbivory, regardless of soil depth. Pigment concentrations did not show any differences among treatments, and the enzymatic markers were slightly higher in response to aphid infestation. These results suggest that Carpobrotus has a complex and efficient tolerance or compensation mechanisms when it is under biotic (herbivory), abiotic (soil depth), or a combination of both stressors.

Keywords: soil depth, actual herbivory, simulated herbivory, abiotic and biotic stress, phenotypic plasticity.

Physiological response of an invasive species: a proteomic study on salinity tolerance in the New Zealand mud snail

Alejandra García-López^{1,2}, Ángel P. Diz^{1,2}, Paula Sánchez-Marín³

¹Marine Research Center (CIM), University of Vigo, Vigo, Spain <u>alejandra.garcia.lopez2@uvigo.gal</u>

² Department of Biochemistry, Genetics and Immunology, University of Vigo, Vigo, Spain
 ³ Oceanographic Center of Vigo, Spanish Institute of Oceanography, Vigo, Spain

Biological invasions represent a major ecological and economic challenge worldwide. Due to their close connection with humans and their activities, continental aquatic ecosystems are particularly vulnerable to the introduction of invasive alien species. The New Zealand mud snail, Potamopyrgus antipodarum (Gray, 1843), is one of the most widespread aquatic invaders, significantly impacting ecosystem structure and function. Its invasive success is attributed to traits such as a high reproductive rate, low susceptibility to parasites and predation, high dispersal capacity, and broad tolerance to varying physicochemical conditions. Notably, its ability to acclimate to different salinities facilitates long-distance transport and colonization of diverse habitats; however, the physiological processes that enable this adaptability remain poorly understood. As human activity and climate change continue to alter aquatic habitats, promoting the spread of invasive species, uncovering the molecular mechanisms behind P. antipodarum's physiological adaptation is essential for predicting and managing its distribution. In this study, we examined its response to increasing salinity levels (from freshwater to seawater) and employed high-throughput quantitative proteomics to assess changes in protein expression associated with salinity stress. Our results show that 80% of individuals exposed to high salinity (30 PSU) survived for 28 days and continued to reproduce. Using isobaric labeling (TMT-10plex[™]) combined with LC-MS/MS analysis, we identified and quantified proteins differentially expressed in response to salinity changes. Proteomic analysis revealed that P. antipodarum modulates its protein expression, with more pronounced effects as salinity and exposure time increase. The initial response seems to involve stress-related and oxidative stress protection proteins, followed by the activation of osmoregulatory mechanisms during prolonged exposure.

These findings suggest that *P. antipodarum* possesses efficient osmoregulatory mechanisms, allowing it to thrive in environments with fluctuating salinity conditions. Understanding the molecular pathways underlying this resilience will be crucial for predicting and mitigating its ecological impact.

Keywords: *Potamopyrgus antipodarum*, invasive species, salinity, proteomics, osmoregulation.

Assessing the state of plant invasion in the South of the Iberian Peninsula: how is invasion affecting native diversity?

<u>Navarro-López, Sara</u>^{1,2,3}, Onoszko, Katherine^{1,2,3}, Bernal-Borrego, Jessica^{1,2,3}, Nieto-Lugilde, Diego³, González-Moreno, Pablo^{1,2}

¹ ERSAF - Evaluación y restauración de sistemas agrícolas y forestales. Andalusian Institute for Earth System Research (IISTA), University of Córdoba, Spain ² PhD Programme in Biosciences and Agri-Food Sciences. University of Cordoba ³ Department of Forestry Engineering. University of Cordoba, Spain ⁴ Department of Botany, Plant Phyisiology and Ecology. University of Cordoba, Spain

An important consequence of human activities at global scale is species' (un)intentional migration, facilitating access of non-native species to new habitats. The naturalization of non-native species might negatively affect native species, altering the functioning of the ecosystems, and causing biodiversity loss. Ecosystems located at the extremes of environmental gradients are among the few ecosystems in the world that have not yet been heavily invaded by non-native plants. However, studies based on the Mountain Invasion Research Network (MIREN) show that non-native species are increasingly reaching higher altitudes. The aim of this work was to assess the occurrence of plant invasion and its relation to plant diversity in Mediterranean mountains considering both a large elevation (from 600 to 3100 m a.s.l) and aridity gradient (from 0.26 to 2.41). We set 94 sites along four roads in Sierra Nevada (Granada) and two roads in Sierra de Filabres (Almeria). At each site we surveyed three plots (50 m each); one parallel to the road and two traversals from the road edge (N=280), recording the abundance and cover of all plant species. We found plant invasion in 18% of the sites, all located at low and mid-elevation. We analysed the relationship of Shannon diversity index, species richness and evenness with the invasive species occurrence, local and landscape environmental variables using Generalized Linear Mixed Models. Invasive species occurrence and higher soil temperatures were associated with species richness and Shannon index, but not evenness. In contrast, evenness seems to be related to higher soil moisture at local scale. These findings suggest a spatial overlap between invaded and species-rich areas, with habitats at higher altitudes showing a limited effect of plant invasion.

Keywords: invasive plants, global change, mountains, MIREN.

Recipient community structure mitigates the impacts of a range-shifting predator

Kyle J. Suen¹, Ryan A. Beshai², Cascade J.B. Sorte²

¹ Department of Ecology and Evolutionary Biology, University of California, Irvine USA, kjsuen@uci.edu

² Department of Ecology and Evolutionary Biology, University of California, Irvine USA

Global biodiversity is undergoing a grand reshuffling with species across taxa and biomes shifting their ranges in response to climate change. Research on the ecological impacts of range-shifting species has prioritized linking the traits of the range-shifting species themselves to impacts, with studies giving more limited attention to the characteristics of the recipient community. Understanding how environmental contexts can alter the impact of novel species is important for predicting and managing ecological changes. We used the range-shifting predatory whelk Mexacanthina lugubris as a case study to investigate how recipient community structure - in particular, the relative abundance and distribution of shellfish prey - might influence range shift impacts. Specifically, we hypothesized that relative abundance and distribution of shellfish prey (mussels and barnacles) would influence Mexacanthina lugubris' consumptive effects. We tested this hypothesis via a field experiment in southern California, where we caged whelks at a gradient of densities and observed their predation on mussels, barnacles living on bare rock, and barnacles living on mussels over 8 weeks. We found that Mexacanthina lugubris consumed barnacles on bare rock preferentially before consuming barnacles on mussels and mussels themselves. Our findings demonstrate a mechanism involving an apparent facilitation between shellfish prey through which characteristics of the recipient community can mitigate the effects of a range-shifting predator. Considering these environmental contexts with broader impact assessments can help inform management efforts and create effective responses to disruptive range-shifting species.

Keywords: environmental context, range shift, Mexacanthina lugubris, impact, indirect effect.

Influence of salinity on non-indigenous fouling species in marine and brackish marinas

<u>Jesús Fernández-Gutiérrez^{1,2},</u> Marcos Rubal², Leandro Sampaio¹, Juan Moreira³, Fran Ramil⁴, Puri Veiga¹

¹ CIIMAR/CIMAR LA, Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Terminal de Cruzeiros do Porto de Leixões, 4450-208 Matosinhos, Portugal jgutierrez@ciimar.up.pt

² Centre of Molecular and Environmental Biology (CBMA/ARNET), Department of Biology, University of Minho, 4710-057, Braga, Portugal

³ Departamento de Biología (Unidad de Zoología) & Centro de Investigación en Biodiversidad y Cambio Global (CIBC-UAM), Universidad Autónoma de Madrid, Madrid, Spain

⁴ CIM-UVigo - Centro de Investigación Mariña, Facultade de Ciencias do Mar, Universidade de Vigo, E-36310 Vigo, Spain

The number of recreational marinas is globally increasing due to the growing demand for leisure boating. Marinas significantly alter the original ecosystem conditions, impacting native communities and ecosystem functioning. While their submerged artificial structures (e.g., piles, floating pontoons) create novel habitats for fouling assemblages, these are often dominated by non-indigenous species (NIS), considered a source of biocontamination (BC). Marinas are thus hotspots of NIS contributing to its introduction and spread. Hence, understanding the factors shaping NIS assemblages is crucial for its effective management. Although salinity strongly shapes the distribution of benthic organisms in natural environments, its influence on BC levels and NIS assemblages on floating pontoons remains understood. the project poorly То explore this, in 'Marina-Forests' (http://doi.org/10.54499/2022.06806.PTDC), fouling communities on pontoons were studied in marinas of North Portugal under brackish and marine salinities. BC levels were assessed through the Site-specific Biocontamination Index (SBCI), and univariate and multivariate analyses were applied to determine the effect of salinity on BC levels and NIS assemblage structure. A total of 159,183 individuals and 217 taxa were collected, including 24 NIS. Results showed that NIS assemblage structure was influenced by salinity. Indeed, NIS richness and the ratio NIS richness/total richness were significantly lower in brackish marinas than in marine ones. Regarding BC levels, SBCI values also varied significantly between both studied habitats, being higher in marine habitats. Our study highlights the influence of salinity on NIS fouling assemblages and BC levels. These findings offer valuable insights for stakeholders to develop more effective NIS management strategies, promoting the conservation of native biodiversity and ecosystem wellbeing.

Keywords: fouling, NIS, SBCI, marine, brackish.

Assessing biofouling communities between sheltered and exposed sites in false bay yacht club, Simons Town, South Africa

<u>Yibanathi Marasi¹</u>, Koebraa Peters¹, Jaime Johnson¹

¹ Department of Conservation and Marine Sciences, Cape Peninsula University of Technology, Cape Town, South Africa

220334145@mycput.ac.za

Human-transport hubs such as marinas, harbours, and ports are important foci for the introduction of marine species. Marine alien species are transferred worldwide predominantly by commercial and recreational vessels. Species settle on artificial, submerged structures such as jetties, seawalls, and aquaculture infrastructure through biofouling. Biofouling plays a critical role in driving global biodiversity change of coastal ecosystems, particularly in and around marinas/harbours. However, comprehensive knowledge of how varying regions in a marina could influence the types of biofouling communities occurring in these spaces is limited. The current study takes place in False Bay Yacht Club in Cape Town, South Africa, comparing species richness, diversity, and abundance of established fouling communities between sheltered and exposed sites. We also aim to distinguish between native, alien, and cryptogenic species, to compare their abundances between the two sites and compare the community structure. This study is currently ongoing, where 36 white Polyvinyl Chloride (PVC) plates of 10 × 10 cm were deployed in March 2024 to develop a one-year-old biofouling community. The community therefore experienced all four austral seasons during the settlement period. Arrays will be retrieved in March 2025, where samples will be scraped off and preserved in 90% ethanol. All organisms will be identified to the lowest taxonomic level possible in the laboratory. Univariate statistics will be undertaken to make comparisons between the two sites and multivariate statistics will be used to delineate community structure patterns. Based on prior observations of the plates, we expect the two communities to host distinct fouling communities as a result of varying conditions related to water flow and vessel types, however, more specific preliminary results will be available at the time of the conference.

Keywords: biofouling, marine alien species, marina, vector, pathway, artificial structures.



Understanding public perceptions of *Harmonia axyridis* (Harlequin ladybird) using conservation culturomics: implications for management

<u>Ruth Wright¹</u>, Katharina Dehnen-Schmutz², Aileen Mill³, Ana Novoa⁴, Heather Price ¹, Zarah Pattison¹

¹ Biological and Environmental Science, University of Stirling, Stirling, United Kingdom r.k.wright@stir.ac.uk

² Centre for Agroecology, Water and Resilience, Coventry University, Coventry, United Kingdom

³ School of Natural and Environmental Sciences, Newcastle University, Newcastle, United Kingdom

⁴ Experimental Station of Arid Zones of the Spanish National Research Council in Almeria,

Spain

Invasive non-native species are one of the five main drivers of global biodiversity loss and must be managed to reduce their impacts. With limited resources available, management efforts should be directed to the areas that most effectively benefit people and the environment. The views of humans determine how invasive non-native species are managed. Therefore, understanding public awareness and perceptions of invasive non-native species is vital to achieving biodiversity goals. We present the example of Harmonia axyridis (Harlequin ladybird), which was introduced to the United Kingdom in 2004 and now causes negative impacts, such as outcompeting and predating native ladybirds. Using Google Trends data, we explore public internet search interest in *H. axyridis* in the United Kingdom. Interest in the Google search term 'harlequin ladybird' is highest in autumn when H. axyridis individuals enter homes and appear in news articles. Peak Google search interest in 'Harmonia axyridis' is shown in 2004, when the species was first introduced to the United Kingdom. To assess public perceptions of *H. axyridis*, we perform sentiment analysis on text from online media. Negative public sentiment towards H. axyridis on online platforms, such as news outlets and BlueSky, suggests that harlequin ladybird management campaigns will receive public support. We expand our inquiry into public perceptions of H. axyridis to include 132 invasive non-native species in the United Kingdom. This enables us to predict species characteristics associated with high/low public awareness and positive/negative public sentiment. This information will allow public education campaigns to be directed towards topics where public awareness is lacking and management campaigns to be carried out with public support.

Keywords: UK invasive species, Google Trends, awareness, perceptions, sentiment analysis, *Harmonia axyridis.*

Beyond pet stores: a whole market approach to evaluate exotic turtle propagule pressure

João Rato^{1,2}, Pedro Brandão¹, Filipe Banha^{1,2}, Pedro Anastácio^{1,3}

¹ MARE – Marine and Environmental Sciences Centre; ARNET – Aquatic Research Network d55794@alunos.uevora.pt

 ² IIFA – Institute for Advanced Studies and Research, University of Évora, Portugal
 ³ Department of Landscape, Environment and Planning, University of Évora, Rua Romão Ramalho, 59, Évora, Portugal

Turtles are popular pets globally, making them among the most introduced exotic species. Their success depends on propagule pressure — the number and frequency of released individuals. However, measuring it remains challenging. As the pet trade drives most introductions, trade data may serve as a proxy. Although CITES regulates certain species, much international trade remains unrecorded, particularly for non-CITES-listed turtles. Illegal and unregulated trade, including black-market and private sales, also contributes significantly but is difficult to quantify. This study examines exotic pet turtle availability across legal and illegal markets in Portugal. The objectives include: (1) assessing species diversity in physical and online markets, (2) analyzing illegal trade on social media, (3) examining propagule pressure's link to wild occurrences, and (4) evaluating whether online trade reflects overall activity. Data were collected from pet stores, online marketplaces, and a Facebook group on aquatic turtles. A Relative Market Pressure (RMP) index was developed to estimate propagule pressure based on species frequency across trade channels. Results revealed significant differences in species composition and trade dynamics. Online platforms, particularly social media, played a dominant role, with many prohibited species sold. Human population density strongly predicted exotic turtle occurrence and abundance of turtle sale, identifying urban areas as introduction hotspots. These findings highlight the need to monitor multiple trade channels, as pet store data alone may underestimate propagule pressure. Stronger enforcement and better management are crucial to mitigating invasive turtle introductions. The RMP index offers a valuable tool for tracking propagule pressure. Additionally, we recommend adoption programs for unwanted turtles and size regulations on sales to reduce releases into the wild.

Keywords: invasive species, pets, index, pond turtle, tortoise.

Utilization of Invasive Plants by Indigenous Communities in the Southern Western Ghats, Kerala, India

<u>Aleem Yoosuf N¹., Angel Treesa Mathew², Aishwarya Narayanan M²</u>

¹KSCSTE-Malabar Botanical Garden and Institute for Plant Sciences (MBGIPS), Kozhikode, Kerala, India aleemneermunda@gmail.com

² Post Graduate and Research Department of Botany, Sacred Heart College, Thevara, Ernakulam, Kerala, India.

Invasive alien plant species pose significant ecological and socio-economic challenges upon their introduction to new ecosystems. However, many of these species also hold ethnomedicinal value, particularly among indigenous communities who have integrated them into their traditional healing practices. In the biodiverse region of Kerala, located in the southern Western Ghats-one of the 36 global biodiversity hotspots recognized by the IUCN-these non-native species have gradually become part of the local ecosystem. The tribal communities of Kerala primarily rely on forest resources, especially plants, for treating various ailments, and their ethnobotanical practices, deeply rooted in ancient traditions, have incorporated invasive plants into medicinal use despite their ecological impact. This study explores the ethnobotanical significance of invasive plant species in Kerala state of Southern Western Ghats, with a focus on their medicinal applications among local tribal communities. Through extensive literature surveys, we identified 50 invasive plant species belonging to 22 families, with Fabaceae being the most represented, followed by Asteraceae. These plant species are predominantly used for treating 39 distinct ailments, with a total of 146 documented medicinal applications, with leaves (n=81) being the most frequently utilized and paste (n=15) as the common mode of application. The findings provide an ethnopharmacological basis for selecting species for future phytochemical and pharmacological investigations.

Keywords: invasive plant, Western Ghats, India, ethnobotany, biodiversity.

Holding grounds for citizen science through niche overlap analysis in Lantana camara invasion

Riya Pakhre¹, Arunava Datta², Gyan Prakash Sharma¹

¹ Department of Environmental Studies, University of Delhi, New Delhi, India riyapakhre5@gmail.com
² Department of Botany, Raja Narendralal Khan Women's College, Vidyasagar University, Midnapore, West Bengal, India

The growing popularity of citizen science has made it a valuable tool in invasion ecology research by providing real-time, extensive and diverse data with open access. However, the authenticity of the data remains under scrutiny because of the lack of standard operating procedures in data collection and the limited expertise of the volunteers. This study evaluated the credibility of citizen science data through niche hypervolume analysis for notoriously invasive Lantana camara L. in India. It has robustly invaded a wide spatial range in the Indian mainland, threatening the megadiversity. Citizen science data from iNaturalist was compared with expert-curated herbarium and field data for L. camara. Climatic niche overlap was assessed through the niche hypervolume package in R. It was found that the herbarium and citizen science data show a remarkable overlap of 94.89%, inferring that citizen science data is at par with verified research-grade data. In comparison, the field data occupied 32.35% overlap with citizen science data and 32.64% with herbarium data, indicating lesser volume occupied in localised environmental space of less diverse field samples. The study presents evidence for the research-grade authenticity of unsupervised citizen science data and encourages its use in scientific studies, particularly invasion ecology. In invasion ecology, citizen science data provides easy access to real-time processes, making it an early warning and a risk-assessment tool for learning and arresting the initial trajectory of invasive species.

Keywords: Lantana, niche overlap, niche hypervolume, citizen science.

Assessing youth awareness and attitudes toward invasive species in Jóvenes por la Botánica Española (JxBE)

<u>Rodríguez-Buján I.^{1,2,3}</u>; Fraga-Meizoso M.⁴; García-Rodríguez A. ⁵; González-García V.^{6,7}; Cires E.^{6,8}; Madrazo-Frías L.M.^{6,8} Estrada-Fernández A.^{6,8}; González-Toral C.⁹; Lázaro-Lobo A. ^{6,7}; Fernández-Fernández J.¹⁰; Cedrés-Perdomo R.D.¹¹; Martínez-Veiga E.^{2,3}; González-Outeiriño F.¹²; Rodríguez J.¹²

¹ Research Center in Information and Communication Technology (CITIC), Elviña Campus, s/n, 15008 A Coruña, Spain. ² Department of Biology, Faculty of Sciences, University of A Coruña, 15071, A Coruña, Spain. ³ Interuniversity Research Center for Atlantic Cultural Landscapes (CISPAC), Fontán Building, City of Culture of Galicia, Monte Gaiás, s/n, 15702 Santiago de Compostela, Spain. ivan.bujan@udc.es

⁴ Fauna Útil S.L., Ctra. A Guarda-Tui Km. 194, 36740 Tomiño, Pontevedra, Spain. ⁵ Tecnologías y Servicios Agrarios S.A., S.M.E., M.P. (TRAGSATEC), Departamento de Medio Natural. ⁶ Department of Organismal and Systems Biology, University of Oviedo, Oviedo, Asturias, Spain. ⁷ Biodiversity Research Institute (IMIB), University of Oviedo-CSIC-Principality of Asturias, Mieres, Asturias, Spain. ⁸ Institute of Natural Resources and Territorial Planning (INDUROT), University of Oviedo. Mieres, Asturias, Spain. ⁹ Royal Botanic Gardens Kew, Kew Gardens TW9 3AB, Richmond, Reino Unido. ¹⁰ Tecnologías y Servicios Agrarios S.A., S.M.E., M.P. (TRAGSATEC), Departamento de Sistemas de la Información Geográfica. ¹¹ Department of Botany, Ecology and Plant Physiology, University of La Laguna, San Cristóbal de La Laguna, Spain. ¹² CRETUS, Departament of Functional Biology, Faculty of Biology, Universidade de Santiago de Compostela, 15782, Universidade de Santiago de Compostela, Spain

Jóvenes por la Botánica Española (JxBE) is a free association dedicated to connecting youth with botany and mycology, while combating plant awareness disparity through an inclusive, transdisciplinary approach. With over 400 members across Spain and regional branches in several communities, it is the largest youth network in its field. Despite numerous initiatives in recent decades to study and manage invasive species in Spain, little is known about the sociological context of biological invasions from the perspective of young people's awareness of plants. This study explores the interest and attitudes toward invasive species among JxBE members through a dual approach: analyzing a database and conducting a member survey. The database review of all registered members revealed that only 13 listed invasive or non-native species as their primary area of interest. In contrast, the survey, completed by 82 members, revealed that 62% have experience working with invasive species, and a significant proportion foresee engaging with them in future projects. The results also show that vascular plants are the most frequently studied taxonomic group, followed by animals and non-vascular plants, with the genera Carpobrotus and Cortaderia being the most studied. Additionally, approximately 30% of participants contribute to digital platforms, primarily iNaturalist, by uploading new location data for species. There was unanimous support for the eradication of invasive plants, with manual removal identified as the preferred method, followed by cutting and biological control. Notably, these results provide a valuable insight into the plant awareness and attitudes of young people towards invasive species and their views on how to address the challenge of plant invasions, underscoring the latent potential within JxBE members in this area.

Keywords: JxBE, invasive species, survey

Species list - Lista de especies - Lista de especies

Aedes japonicus	Mexacanthina lugubris
Ailanthus altissima	Monacha cantiana
Ameiurus nebulosus	Morus alba
Blackfordia virginica	Opuntia ficus-indica
Carpobrotus spp.	Oxychilus drapanuardi
Carybdea brevipedalia	Oxychilus navarricus
Coptotermes formosanus	Potamopyrgus antipodarum
Cornu aspersum	Procyon lotor
Cortaderia selloana	Prosopis juliflora
Cotoneaster pannosus	Prunus persica
Crassula multicava	Pseudorasbora parva
Cytisus scoparius	Pyracantha angustifolia
Eichhornia crassipes	Pyracantha crenulata
Eriocheir sinensis	Rosa rubiginosa
Eschscholzia californica	Salix × rubens
Harmonia axyridis	Sargassum fluitans
Heracleum sosnowskyi	Sargassum muticum
Hygromia cinctella	Sargassum natans
Hyptis suaveolens	Schinus molle
Lantana camara	Solanum mauritianum
Leucaena leucocephala	Spodoptera frugiperda
Ligustrum lucidium	Teredo bartschi
<i>Lyrodus</i> cf. <i>Pedicellatus</i>	Tradescantia fluminensis
Melia azedarach	

Acknowledgements - Agradecimientos -Agradecementos





Institute of Botany of the Czech Academy of Sciences

Dpto. Bioloxía Vexetal e Ciencia do Solo Plant Ecophysiology | Universidade de Vigo

Universida_{de}Vigo