



News from the Mountain Invasion Research Network

Feb 2023

Dear MIREN friends and colleagues,

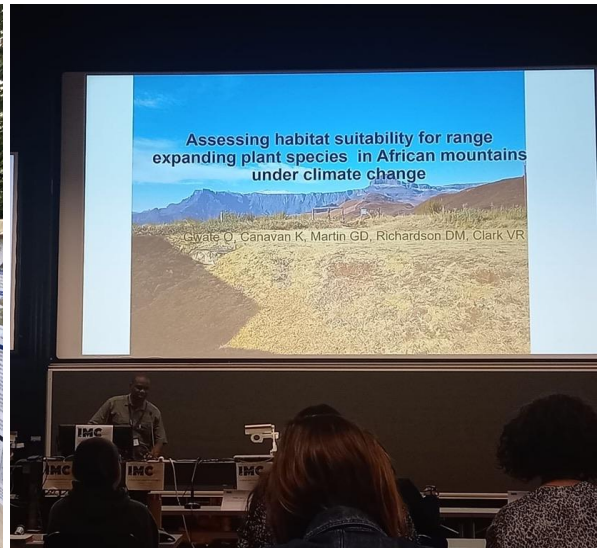
We wish you all a happy new year. During 2022 we accomplished a lot. We published the MIREN road survey protocol paper, we published the MIREN road survey data from 2007 to 2019. These data were used in a publication in Nature Ecology and Evolution led by Evelin Iseli. All the links can be found below. In September we organised a symposium at the International Mountain Conference, and in late November we met for the first time since the onset of the covid pandemic. We are very thankful for being able to conduct research and outreach. In 2023 we look forward to many opportunities to collate more data on plant diversity in mountains, conduct new research especially in South Africa, and continue our great collaboration. MIREN steering committee members will be present at different meetings around the world including EMAPi, ESA, and Species on the Move. Please reach out if you would like to connect at one the meetings

Welcome to our new co-chair and coordinator

In late autumn 2022, we rotated co-chairs. Sylvia Haider stepped down as co-chair after multiple years of service. Thank you Syliva, she will remain part of the steering committee. Tim Seipel will remain co-chair and we welcomed Agustina Barros from CONICET in Argentina who will serve as new co-chair. In addition, we welcomed Eduardo Fuentes from IEB in Chile; he will be serving as co-coordinator along with Jonas Lembrechts.

Focus session at the IMC in Innsbruck, Austria

In September 2022, we organised a session at the International Mountain Conference on [non native species expansions in mountains](#). The session focused on process-based understanding of range expansions, and a shared understanding of this issue between researchers, natural resource managers and policymakers. It brought together presentations on plant invasion in mountains from Kashmir, South Africa, Europe, and North and South America.



MIREN meeting in Chile

In November last year, we had a small-scale MIREN-meeting in Chile, under the beautiful backdrop of the Malalcahuello volcano. The main goal of the meeting was to proceed with ongoing paper projects using the MIREN road survey data. For a summary of the event, check out [this blogpost written by Jonas Lembrechts.](#)



Second version of MIREN road survey data published

The second version of the MIREN road survey data was published on Zenodo at doi: [10.5281/zenodo.7495407](https://doi.org/10.5281/zenodo.7495407). It includes just over 100,000 records of plants and about 5000 species. The data was used in [Iseli et al. \(2023\)](#). The data were collated, organised, and checked by Sylvia Haider, Meike Buhaly, Chris Larson, Tim Seipel.

MIREN website up to date !/?

The new coordinator team of Jonas Lembrechts and Eduardo Fuentes-Lillo are doing their absolute best to keep the MIREN website (www.mountaininvasions.org) up to date. But you can help! Feel free to send us MIREN-related papers for the MIREN paper list, check the member list and verify the MIREN regions on the map. Requests for changes or additions can be sent to miren.contact@gmail.com.

MIREN regional news

Italy

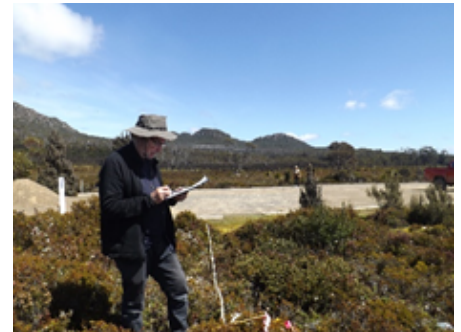
Italy joined the MIREN road survey! In 2022 Greta La Bella, Lucia Antonietta Santoianni, Marta Carboni, and Angela Stanisci from Roma Tre University and University of Molise established and surveyed new permanent plots along three mountain roads in the Central Apennine. They also installed paired (road and natural plots) soil temperature data-loggers to contribute to the SoilTemp global microclimate project. The survey will help to assess the degree of invasion along the elevation gradients of central Italy and to contribute to the MIREN project with new data from the Mediterranean region.



Australia

Status of non-native plants in alpine regions of Tasmania

Unlike mainland Australia, there is limited research about the role of biotic factors and human disturbance on non-native plants in alpine regions of Tasmania. The literature suggests that exotic plants are absent from most alpine vegetation. To assess the nature and possible causes of this unusual absence, a research project was developed by Jamie Kirkpatrick from University of Tasmania (UTAS) and Agustina Barros from CONICET that i) integrated Natural Values Atlas (NVA) species records of vascular plants (60,000 records) with land use databases, ii) reanalyzed data from a 30 year grazing enclosure experiment and, iii) conducted field assessments in paired roadside and undisturbed quadrats 5 m apart. During spring 2022 a total of 59 paired plots were randomly located along roads that passed through alpine vegetation. Preliminary results show that only 1% (659) of the NVA records from alpine vegetation were non-native plants. These were mainly concentrated on the Central Plateau, an area grazed by domestic livestock in the past. Exotic occurrence and cover was almost nil in the grazing enclosure experiment, particularly in those plots open to full native grazing pressure. Very few non-native plants were recorded in the control pair of the plots on roadsides. These preliminary results suggest that the absence of non-natives plants from most of alpine Tasmania could be the combined effect of naturally high natural vegetation cover, the selective consumption of exotic plants by native grazers and remoteness. This project is being funded by a research scholarship provided by CONICET to Agustina and has the support from the School of Geography, Planning, and Spatial Sciences at the University of Tasmania.



Field survey along road in Hartz Mountains National Park.

Norway

After a few years of Covid-hiccups, the Norwegian team led by Jonas Lembrechts was determined to have no travel issues to the north this year. A massive strike at Scandinavian Airlines decided otherwise, and the solution included a last-minute two-day roadtrip all the way through Sweden. You can read all about the epic trip [here](#).

In the end, the team of enthusiastic students managed to [complete the whole resurvey](#), although some of the anticipated add-on projects unfortunately had to be cut short. Now, the five master students who joined in the field are each trying to answer their own research question, hopefully resulting in some more cool insights in 10 years of vegetation change in northern Norway.

Argentina

Argentinean MIREN member Alisa Alvarez defended her PhD at the University Nacional de Cuyo under the supervision of Diego Vazquez, Valeria Aschero and Agustina Barros. In her PhD thesis she analyzed patterns of abundance and distribution of non-native plants in relation to trails and livestock abundance in elevation gradients in the Andes. In addition, she evaluated whether non-natives are facilitated by a cushion shrub (*Azorella monantha*) and whether the trail affects such interaction. Finally, he experimentally analyzed the effect of livestock and human trampling on the establishment of an invasive alien species in the Andes: *Taraxacum officinale*.

See for example the recent paper: Alvarez, M.A, Barros A, Vázquez D.P , Bonjour L, Lembrechts, J. Wedegätner R. & Aschero V. 2022. Hiking and livestock favor non-native plants in the High Andes." *Biological Invasions.*, 1–22. doi:<https://doi.org/10.1007/s10530-022-02851-1>.



Vegetation sampling in the Andes of Argentina along trails, alpine meadows and cushion plants.

Chile

Resampling South Central Chile

During the summer of 2022-2023, the roads of south-central Chile were resampled for the fourth time (photo 1). During this survey we have observed an increase in urban expansion and road construction towards the highlands which may be facilitating the establishment of non-native plants.



Seed addition experiment

During this summer 2022-2023 we have completed a seed addition experiment where we evaluated germination and growth of non-native plants (*Pinus radiata*, *Acacia dealbata*, *Lupinus arboreus*, *Rosa moschata*, *Leucanthemum vulgare*, *Trifolium repens*, *Agrostis capillaris* and *Poa annua*) under elevation (500-3000 m.a.s.l.) and latitudinal (32°S-54°S) gradients.

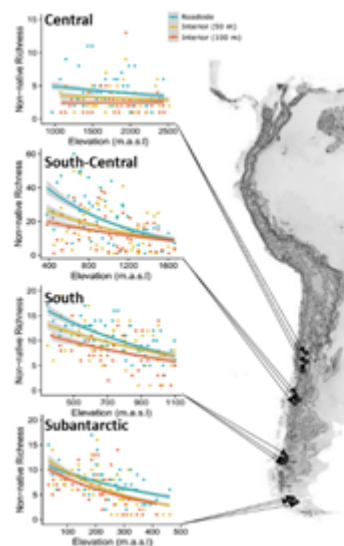
The idea of this experiment is to evaluate the main drivers that contribute to explain the success of establishment and growth (biomass production) of non-native plants both altitudinally and latitudinally. In this opportunity we focus on understanding the importance of functional traits (nitrogen fixation and growth form), disturbances and climate (temperature and humidity). We hope with these results to further understand the importance of disturbance in determining the success of invasions, especially in

the local context of the Andes. Because it is a particular ecosystem where climatic conditions such as aridity and volcanic activity play a role in preventing the establishment of non-native plants in the highlands.



Nine new roads in Chile!

During the last 4 years (since 2018) we have been installing and monitoring nine roads that cross a wide latitudinal range in the Andes, which offers us a wide climatic gradient (Mediterranean to temperate). With the inclusion of these nine roads, we currently have 13 MIREN roads (32°S to 54°S).



Tenerife

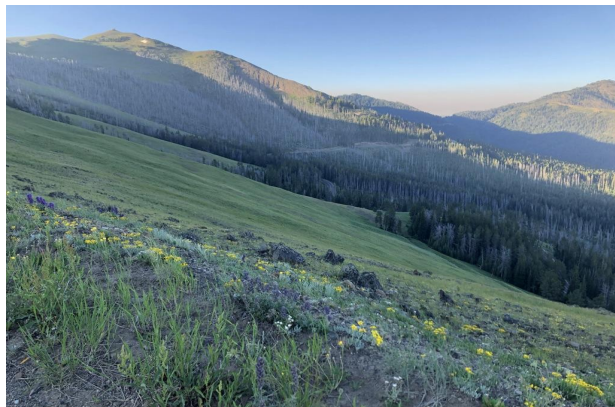
A new paper, led by Amanda Ratier Backes and Sylvia Haider, explaining the mechanisms behind elevational species richness patterns by using leaf functional traits in Tenerife has just been published in Journal of Vegetation Science. We used a trait-based approach to disentangle the role of potential mechanisms (filtering by temperature and precipitation, area and disturbance). With increasing elevation, the plant communities shifted from acquisitive to conservative strategies, and functional diversity decreased. Roadside communities were also more acquisitive than those more distant from the roads. Hence, we concluded that filtering by temperature and disturbance are the most important mechanisms acting there and shaping the observed elevational species richness pattern ([link to the paper](#)).



Roadside vegetation near Mt Teide on Tenerife

Montana

During 2022, 2 of 3 roads in the Greater Yellowstone Ecosystem were resampled for the fourth time. [Major flooding washed](#) away portions of one road and closed access to the park for a period during the summer of 2022. In 2023 we will resample the road where portions were washed out and this year we sampled one road that was affected by road construction. These should shed light on how disturbance and road construction affect roadside plant communities.



The view of burned *Pinus contorta* forest and open meadow near treeline on Mt Washburn in Yellowstone National Park and *Mimulus guttatus* growing along a streambank.

South Africa

The year 2022 was a turning point for South Africa as it saw the pioneering and completion of a new MIREN road survey and a first MIREN trail in the transboundary Maloti-Drakensberg by Onalenna

Gwate (Afromontane Research Unit, University of the Free State postdoc) and Marc Achermann (University of Bologna, Italy / Afromontane Research Unit MSc candidate, under the supervision of Ralph Clark, Afromontane Research Unit). The road protocol was applied in the South African side of the Maloti-Drakensberg at Witsieshoek (Phuthaditjhaba, Free State Province; 1973 - 2577 m amsl), with elevational beams of 30 m. Thereafter, the MIREN trail protocol was applied up to 3125 m amsl with elevational beams of 60 m. In the Lesotho part of the Maloti-Drakensberg a full MIREN trail protocol was applied in Tsehlanyane National Park (1981 - 2653 m amsl) with elevational beams of ~33 m. The process of identification of species and data analysis is ongoing, thanks to the kind assistance of Clinton Carbutt (Ezemvelo KZN Wildlife). We are grateful to the MIREN coordinators who donated soil and moisture probes and also helped in data sorting and analysis. We also managed to collect soil samples (and participated in the tea bag experiment) along our MIREN road sent to the Swedish University of Agricultural Sciences under the auspices of the RangeX project Task 2.2.

During the MIREN survey, critical lessons were learnt. For example, we realised that high species diversity in the Maloti-Drakensberg (c.3,000 plant taxa) made the MIREN plots quite ambitious to sample comprehensively for their size over an extended elevation gradient. Each plot was therefore very time-consuming to comprehensively document. Also, high temporal phenology during a single summer season means that ideally three repeats per season per plot / transect are necessary to capture all the diversity adequately - which is not always practical. Hence, MIREN plots in mega-biodiverse areas pose native diversity documentation challenges perhaps not experienced in more species-poorer areas.



Ascending the trail along which the protocol was implemented in Tsehlanyane National Park.

Switzerland

2022 saw the completion of the road re-survey in Switzerland by Camille Bioschi and two Masters students, Nathan Diaz Zeugin and Fiona Schwaller. Nathan and Fiona are well underway with the analysis of their data; Nathan is asking how the (native) plant communities have changed since the first

survey, while Fiona tested an “add-on” protocol (in collaboration with Fletcher Halliday at University of Zürich) to assess disease and herbivory incidence across elevation and away from roads. We’re excited to learn about the results early next year...



One of the three surveyed roads in Switzerland.

New Global Publications

Paper on non-native species richness and range shifts in 11 MIREN regions

Finally our paper on changes in species richness and upward spread of non-native species in mountains has been accepted for publishing. The analyses are based on survey data collected in 11 MIREN regions between 2007/ 08 and 2017/ 18. We found a significant average increase in non-native species richness of approximately 16% over the last 10 years across all regions and upper range limit shifts to higher elevations in 10 of 11 regions. An important part of the paper is the introduction of a null model to assess whether the observed range shifts are based on chance alone. It corrects for the statistical phenomenon of the regression toward the mean and the geometric constraint of finite environmental gradients such as the MIREN elevation gradients. We hope it will be useful for everyone working with range shifts!

For more details about the [paper](#) please visit

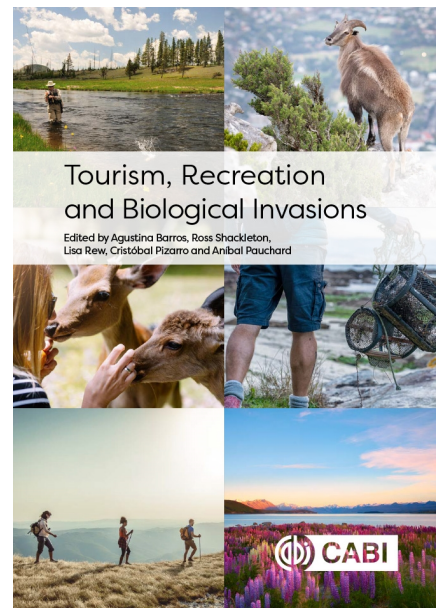
https://ecoevocommunity.nature.com/posts/long-term-monitoring-shows-the-upward-spread-of-non-native-plant-species-along-mountain-roads-around-the-world?channel_id=behind-the-paper

Full author list: Evelin Iseli, Chelsea Chisholm, Jonathan Lenoir, Sylvia Haider, Tim Seipel, Agustina Barros, Anna L. Hargreaves, Paul Kardol, Jonas J. Lembrechts, Keith McDougall, Irfan Rashid, Sabine B. Rumpf, José Ramón Arévalo, Lohengrin Cavieres, Curtis Daehler, Pervaiz A. Dar, Bryan Endress, Gabi Jakobs, Alejandra Jiménez, Christoph Küffer, Maritza Mihoc, Ann Milbau, John W. Morgan, Bridgett J. Naylor, Aníbal Pauchard, Amanda Ratier Backes, Zafar A. Reshi, Lisa J. Re, Damiano Righetti, James M. Shannon, Graciela Valencia, Neville Walsh, Genevieve T. Wright, Jake M. Alexander

A new book about Tourism, Recreation and Biological Invasions

Members of the MIREN group both authored and edited a new book that was published by CABI Publishing the 14th of Dec 2022 entitled “Tourism, Recreation and Biological Invasions”

The book aims to bring together the interrelationships between tourism, recreation and invasive species, including information on i) how tourism and recreation facilitate biological invasions, ii) how invasions impacts tourism and recreation and iii) the importance of integrating the social dimensions when managing invasions. The book consists of 18 chapters covering a vast array of climatic regions and ecosystems and different invasive organisms, including terrestrial and aquatic plants and animals and microorganisms. One of the chapters ‘The role of roads and trails for facilitating plant invasions’ (Chapter 3) provides an updated overview of MIREN road and trail surveys illustrating the interacting effects of elevation and disturbance on non native species at global and regional scales. For more details please visit: <https://www.cabidigitallibrary.org/doi/10.1079/9781800620544.0000>



Latest publications list

Adams LD, Martin GD, Downs CT, Clark VR, Thabethe V, Raji IA, Steenhuisen S-L (2022) Seed Dispersal by Frugivores and Germination Success of the Invasive Alien Shrub *Pyracantha angustifolia* (Franch.) C.K. Schneid. in Free State Province, South Africa. Biological Invasions, <https://doi.org/10.1007/s10530-022-02807-5>.

Alvarez, M.A., Barros, A., Vazquez, D.P., Bonjour, L.J., Lembrechts, J., Wedegärtner, R., Aschero, V. 2022. Hiking and livestock favor non-native plants in the High Andes. *Biological Invasions*, 1–22. doi:<https://doi.org/10.1007/s10530-022-02851-1>.

Barros, A., Haider, S., Mullerova, J., Lembrechts, J.. 2022. The role of roads and trails for facilitating mountain plant invasions. In: Barros, A., Shackleton, R., Rew, L., Pauchard, A. (Eds.). *Tourism, Recreation and Biological Invasions*. CABI publishing, London. pp 14-26.

Barros, A., Shackleton, R., Rew, L., Pauchard, A (Eds.). 2022. *Tourism, Recreation and Biological Invasions*. CABI, London, 196 pp.

Canavan, K., Canavan, S, Clark, V.R., Gwate, O., Mapaura, A., Richardson, D.M., Steenhuisen, S., & Martin, G.D. 2022: Invasive Alien Plants in the Montane Areas of South Africa: Impacts and Management Options. In: Misiune, L., Depellegrin, D. & Vigl, L.E. (eds.). *Human-Nature Interactions. Exploring nature's values across landscapes*. Springer Nature, Switzerland.

Fuentes-Lillo E & Cuba-Diaz M. 2022. The role of human activities in the introduction of non-native plants to Antarctic and Subantarctic islands. In: Barros, A., Shackleton, R., Rew, L., Pauchard, A. (Eds.). *Tourism, Recreation and Biological Invasions*. CABI publishing, London. pp 36-48.

Goncalves, E., Herrera, I., Alexander, J., Duarte, M., Cavieres, L.A., Morales-Salinas, L. and Bustamante, R.O., 2022. The Upper Range Limit of Alien Plants Is Not in Equilibrium with Climate in the Andes of Central Chile. *Plants*, 11(18), p.2345.

Iseli, E., Chisholm, C., Lenoir, J. et al. 2023. Rapid upwards spread of non-native plants in mountains across continents. *Nat Ecol Evol* (2023). <https://doi.org/10.1038/s41559-022-01979-6>

Masole, P., Steenhuisen, S., Martin, G.D. 2022. Current status of the invasive shrub *Berberis julianae* C.K. Schneid. (Berberidaceae) in Golden Gate Highlands National Park (Free State Province, South Africa). *South African Journal of Botany*. 150: 99-105. <https://doi.org/10.1016/j.sajb.2022.07.010>

McDougall K & Cavieres L.A. 2022. Plant invasions associated with ski resorts. In: Barros, A., Shackleton, R., Rew, L., Pauchard, A. (Eds.). *Tourism, Recreation and Biological Invasions*. CABI publishing, London. pp 72-78.

Ratier Backes, Amanda, Christine Römermann, Jake M. Alexander, José Ramón Arévalo, Petr Keil, Miguel Antonio Padrón-Mederos, Stefan Trogisch, and Sylvia Haider. 2023. Mechanisms behind elevational plant species richness patterns revealed by a trait-based approach. *Journal of Vegetation Science*: e13171.

Rew, L. & Larson C. 2022. Managing invasive species in tourist and recreation areas of Montana, USA. In: Barros, A., Shackleton, R., Rew, L., Pauchard, A. (Eds.). *Tourism, Recreation and Biological Invasions*. CABI publishing, London. pp 158-166

Rossi, S.D., Alvarez, M.A., Aschero, V., Hellvig, M., Bonjour, L., Mazzolari, A., Scarpa, J.P, Barros, A. 2022. On visitors' minds: Knowledge and perceptions of invasive non-native plant species in mountain ecosystems. In: Barros, A., Shackleton, R., Rew, L., Pauchard, A. (Eds.). *Tourism, Recreation and Biological Invasions*. CABI publishing, London. pp 130-140.

Tovar, C., Carril, A.F., Gutiérrez, A.G., Ahrends, A., Fita, L., et al., 2022. Understanding climate change impacts on biome and plant distributions in the Andes: Challenges and opportunities. *Journal of Biogeography*, 49(8), pp.1420-1442