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Institut für Botanik und Botanischer Garten

Alpine Seed Conservation & Research Network

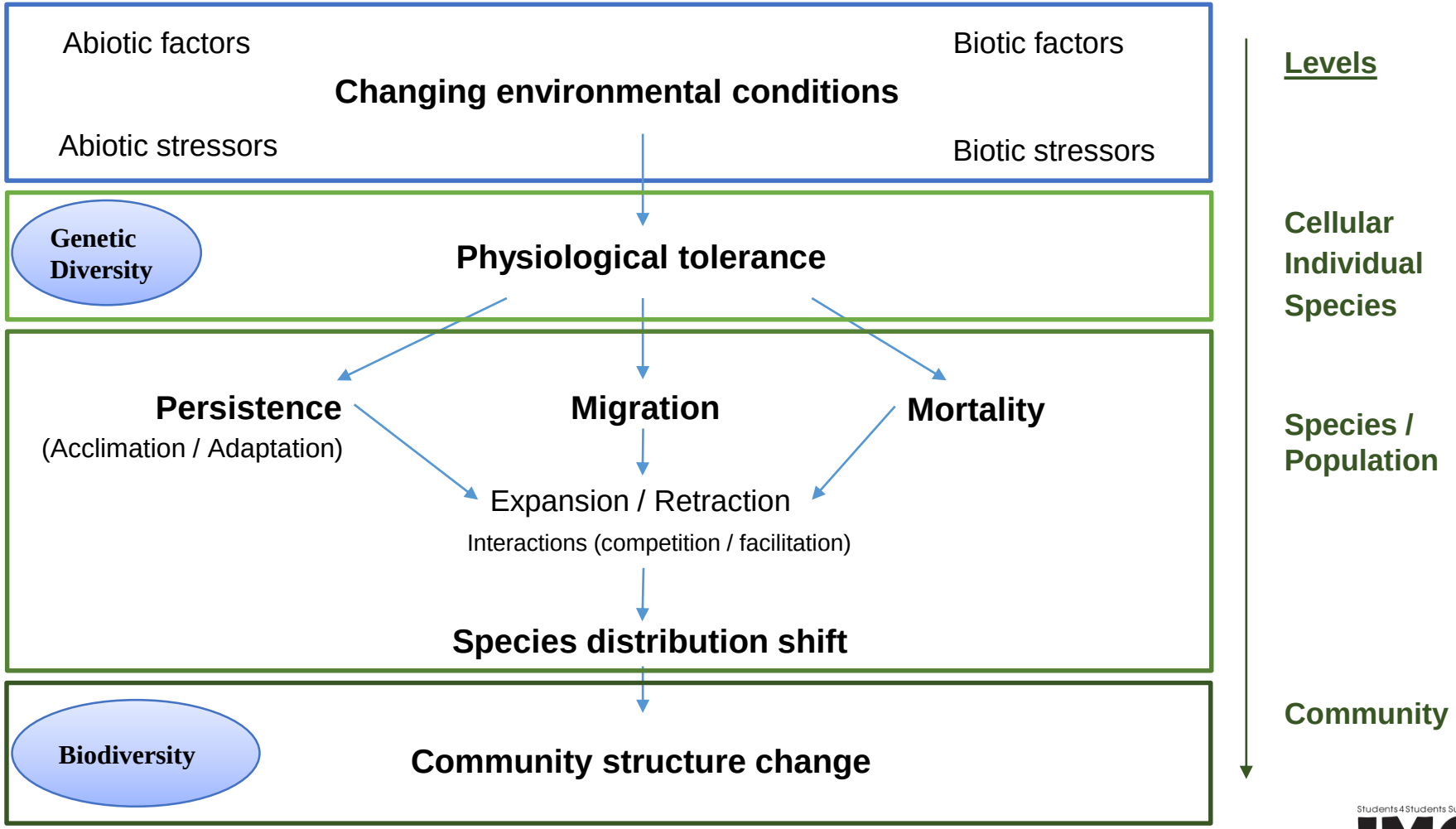
MILLENNIUM SEED BANK PARTNERSHIP Kew

DAVID AND CLAUDIA HARDING FOUNDATION

Students4Students Summer School
IMC Innsbruck 2019
International Mountain Conference

Recruitment of alpine species along an altitudinal gradient in the Central Alps

Vera Margreiter
Department of Botany, University Innsbruck
Brigitta Erschbamer, Janette Walde



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→ We see vegetation changes in higher altitudes

1994

Climate effects on mountain plants

SIR — Temperature-limited environ- ... such as boreal regions, arctic re- ... thought to yet been reported.

During the summer of 1992, we col- lected data on the state of the flora at 26

Georg Grabherr, Michael Gottfried
Harald Pauli
Department of Vegetation Ecology and Conservation Biology, University of Vienna, PO Box 285, A1091 Vienna, Austria

2012

Recent Plant Diversity Changes on Europe's Mountain Summits

Harald Pauli,[1*] Michael Gottfried,[2†] Stefan Dullinger,[2,3*] Otari Abdaladze,[4] Maia Akhalkatsi,[4] José Luis Benito Alonso,[5] Gheorghe Coldea,[6] Jan Dick,[7] Brigitta Erschbamer,[8] Rosa Fernández Calzado,[9] Dany Ghosn,[10] Jarle I. Holten,[11] Robert Kanka,[12] George Kazakis,[10] Jozef Kollár,[12] Per Larsson,[13] Pavel Moiseev,[14] Dmitry Moiseev,[14] Ulf Molau,[13] ... [15,16] Giovanni Peling ... [17] Mihai Puscas,[18] Graziano Rossi,[19] ... [22]

2018

Climate change leads to accelerated transformation of high-elevation vegetation in the central Alps

Andrea Lamprecht[1,*], Philipp Robert Semenchuk[1,2], Klaus Steinbauer[1,*], Manuela Winkler[1] and Harald Pauli[1]
[1]GLORIA Coordination, Center for Global Change and Sustainability, University of Natural Resources and Life Sciences, Vienna & Institute for Interdisciplinary Mountain Research, Austrian Academy of Sciences, Vienna 1190, Austria; [2]Institute for Arctic and Marine Biology ...

Peter Unterluggauer, Martin Mallaun & Brigitta Erschbamer

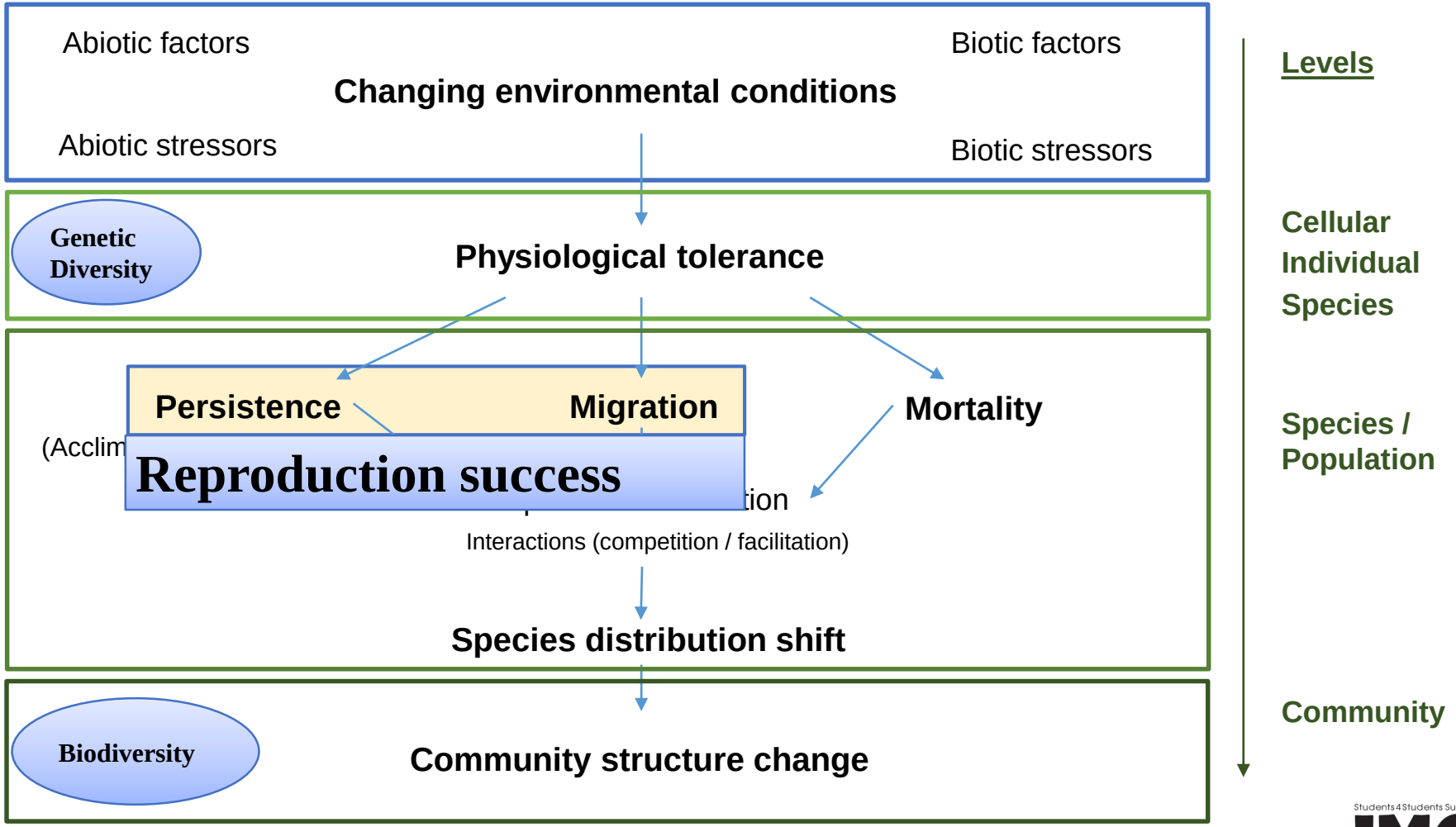
2016

The higher the summit, the higher the diversity changes – Results of a long-term monitoring project in the Dolomites

2018

Accelerated increase in plant species richness on mountain summits is linked to warming

Manuel J. Steinbauer[1,2*], John-Arvid Grytnes[3], Gerald Jurasinski[4], Aino Kulonen[3,5], Jonathan Lenoir[6], ... [12,13], Christian Rixen[5], Manuela Winkler[7,8], Manfred Bardy-Durchhalter[7,8], Elena Barni[9], Anne D. Bjorkman[10], Sarah Burg[5], Patryk Czortek[14], Melissa A. Dawes[5,13], Anna Delimat[15], Stefan Dullinger[16], Brigitta Erschbamer[17], Vivian A. Felde[3], Olatz Fernández-Arberas[18], Kjetil F. Fossheim[3], Daniel Gómez-García[18], Damien Georges[1,19], Erlend T. Grindrud[20], Sylvia Haider[11,21], Siri V. Haugum[3], Hanne Henriksen[20], María J. Herreros[18], Bogdan Jaroszewicz[14], Francesca Jaroszynska[5,22], Robert Kanka[23], Jutta Kapfer[24], Kari Klanderud[20], Ingolf Kühn[11,21,25], Andrea Lamprecht[7,8], Magali Matteodo[5,26], Umberto Morra di Cella[27], Signe Normand[1,28], Arvid Odland[29], Siri L. Olsen[30], Sara Palacio[18], Martina Petey[27], Veronika Piscová[23], Blazena Sedlakova[31], Klaus Steinbauer[7,8], Veronika Stöckli[5,32], Jens-Christian Svenning[1,28], Guido Teppa[9], Jean-Paul Theurillat[33,34], Pascal Vittoz[26], Sarah J. Woodin[22], Niklaus E. Zimmermann[13,35] & Sonja Wipf[5*]



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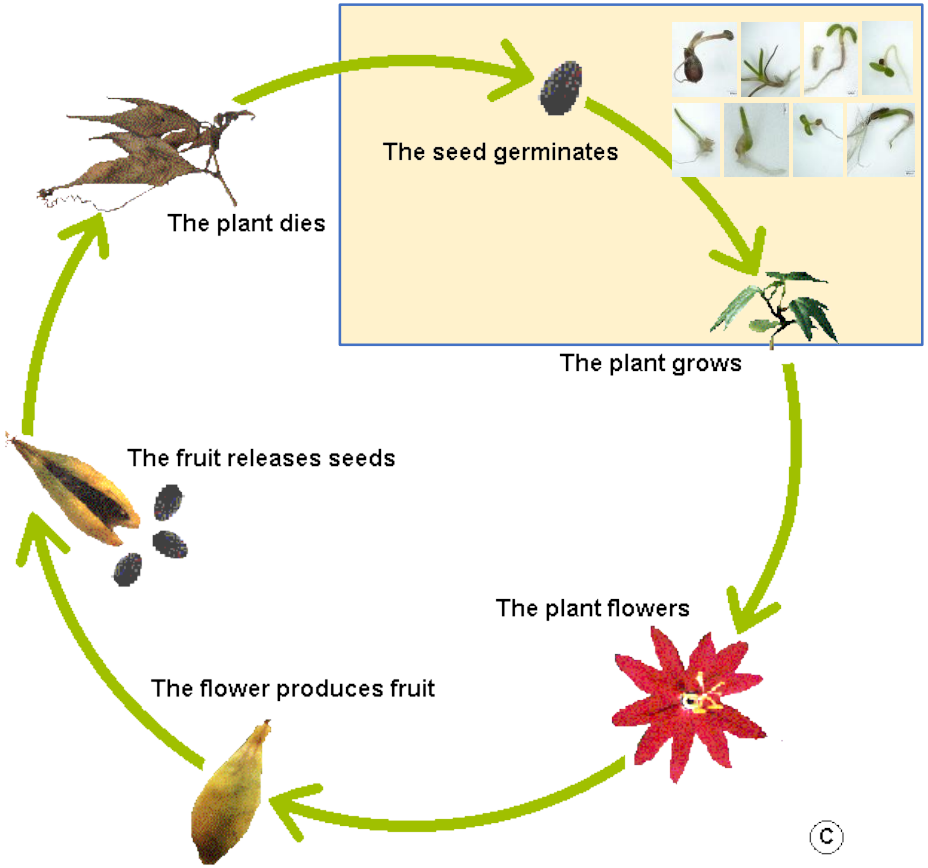
Plants

Persistence / Migrating (Colonizing)

→ Good germination ability is required

→ Seedlings have to survive

→ Recruitment success



http://theseedsite.co.uk/lifecycle.html

Plants

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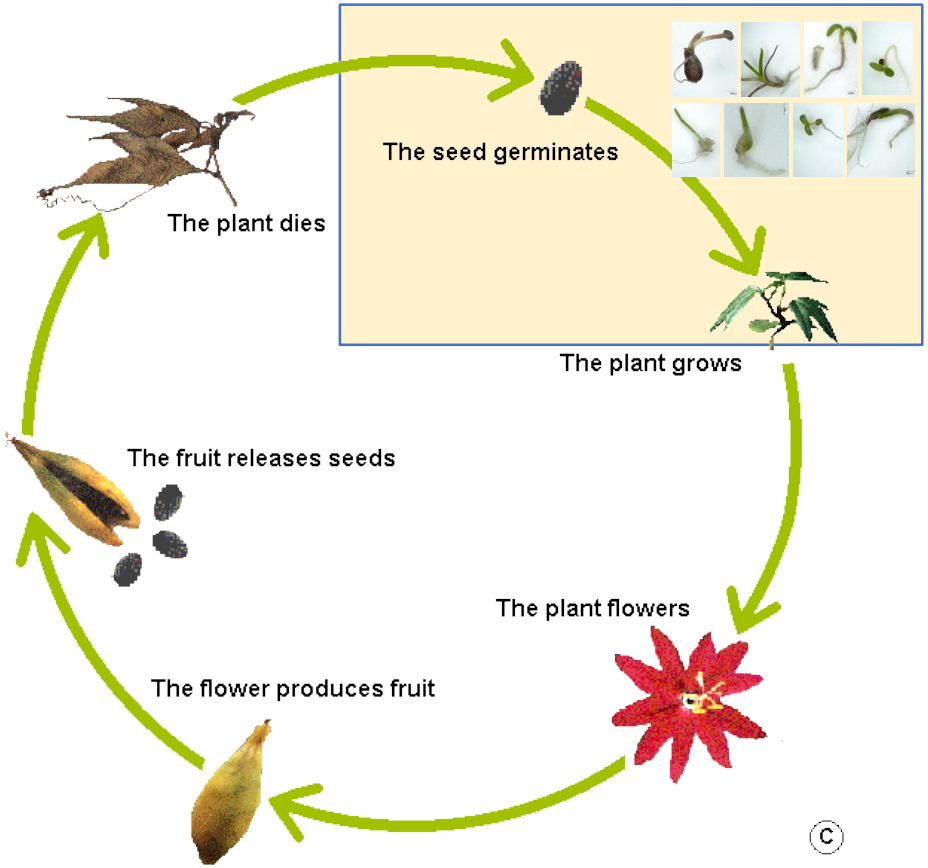
STRESS-GRADIENT-HYPOTHESIS

Letter | Published: 20 June 2002

Positive interactions among alpine plants increase with stress

Ragan M. Callaway, R. W. Brooker, Philippe Choler, Zaal Kikvidze, Christopher J. Lortie, Richard Michalet, Leonardo Paolini, Francisco I. Pugnaire, Beth Newingham, Erik T. Aschehoug, Cristina Armas, David Kikodze & Bradley J. Cook

Nature **417**, 844–848 (2002) | Download Citation



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Seed sowing experiment along an altitudinal gradient

100 Seeds / Bulbils
- per Ring
- Species

4 replicates
- per Treatment

+ Altitude

Poster

Bulbils

Herbs

Grasses

Cushions

Seedlings pictured under a digital microscope by Pernfuß B.

Competition

Facilitation

Soil (non-local)

Seed sowing experiment along an altitudinal gradient

Experiment Sites in Central Alps, Austria

Results

$$\textbf{Germination} = \frac{\text{Max. number of counted individuals during the experiment} * 100}{\text{Initial number of seeds sown}}$$

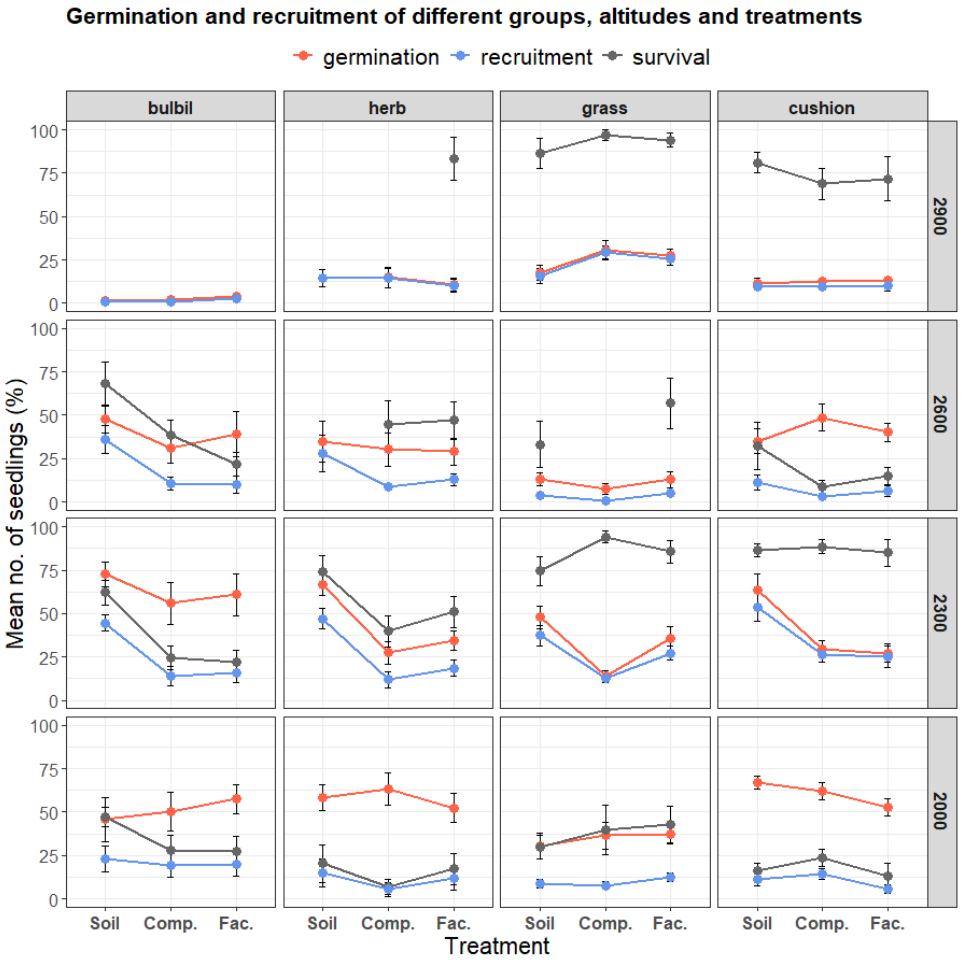
$$\textbf{Survival} = \frac{\text{Number of survived seedlings at the end of the experiment} * 100}{\text{Germination}}$$

$$\textbf{Recruitment} = \frac{\text{Survival} * 100}{\text{Initial number of seeds sown}}$$

Results

Germination

- Highest germination at lowest altitude



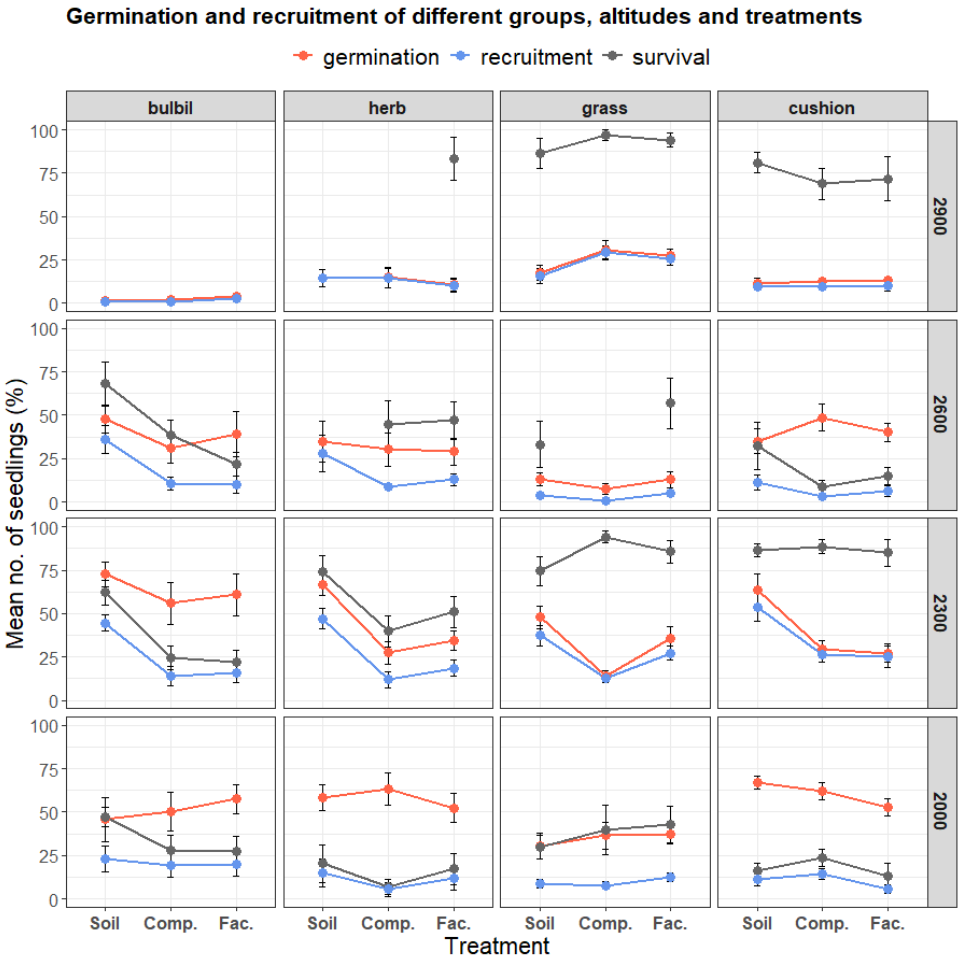
Results

Germination

- Highest germination at lowest altitude

Survival

- At low altitudes, lowest survival.
- Highest in grasses and cushion plants.
- Best in soil treatment (except grasses).
- High chance of survival in nival ecotone, if germination possible.



Results / Conclusions

Germination

- Highest germination at lowest altitude

Survival

- At low altitudes, lowest survival.
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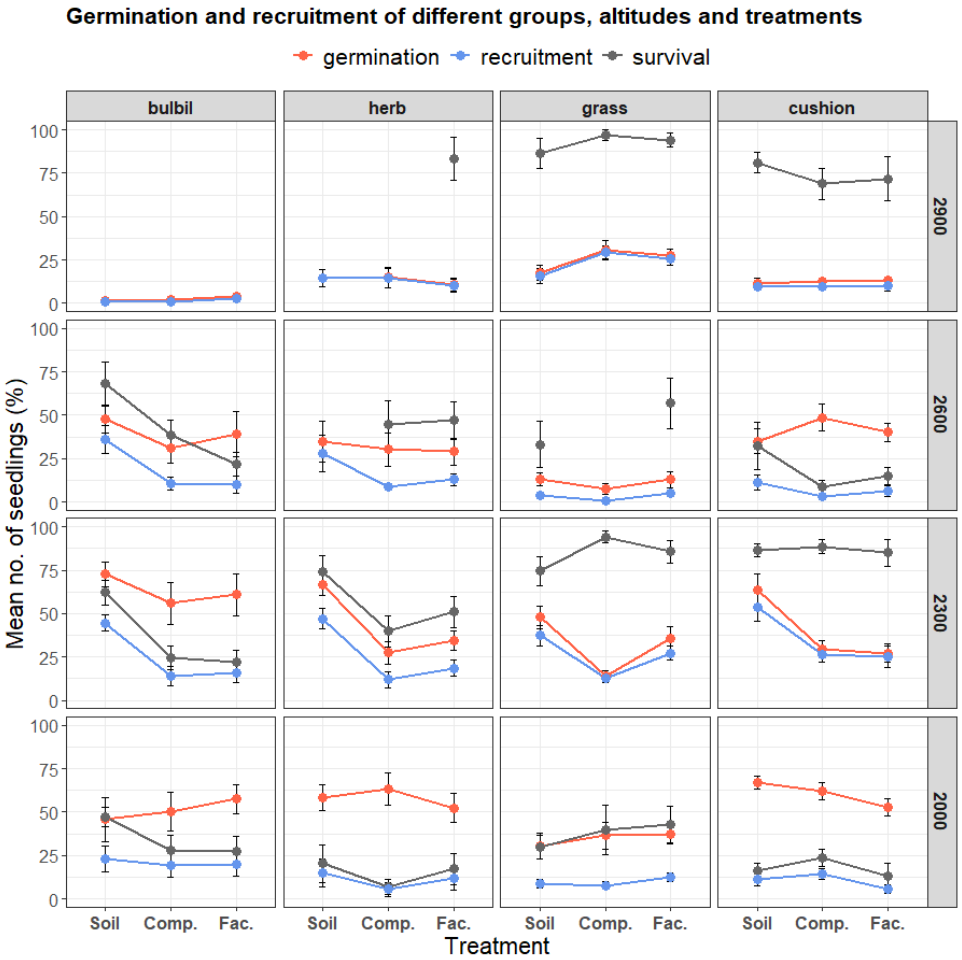
- Best in soil treatment (except grasses).
- High chance of survival in nival ecotone, if germination possible.

Recruitment

- Low recruitment from initial seed number at all altitudes.



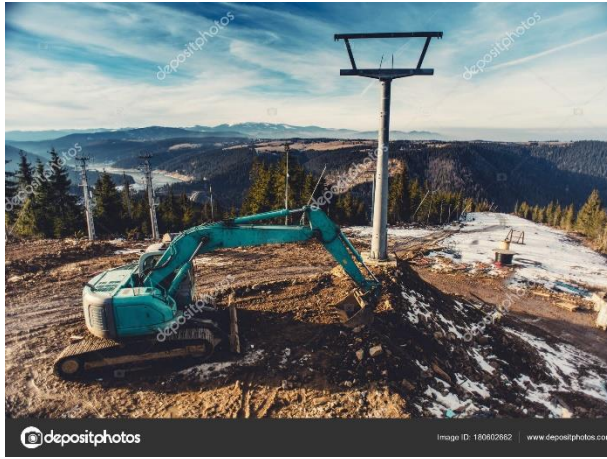
Important knowledge

Regeneration of plant cover

- Natural regeneration
- Seeding regeneration
  - Seed mixtures

→ autochthonous

- Slope stability
  - Steep slopes



Conservation

- Population dynamics

Modelling

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My Parents

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Alpine Forschungsstelle Obergurgl

Tiroler Wissenschaftsfonds
tirol Unser Land