Understanding mountain ecosystems in a changing climate

5 lessons learned from collaborative research and education between China and Norway

International Mountain Forum, November 12, 2024

Dagmar Egelkraut, Aud Halbritter & Vigdis Vandvik

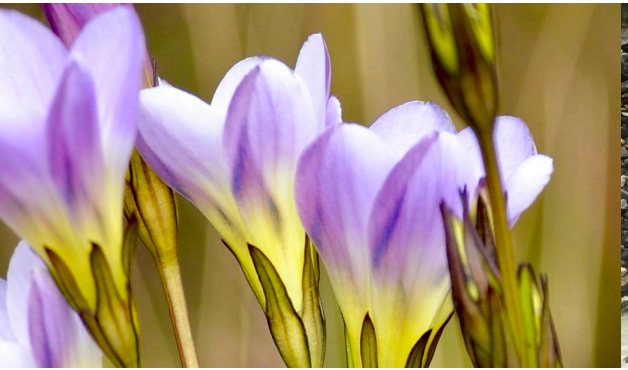
Between the Fjords research group
University of Bergen, Norway

BETWEEN THE FJORDS

UNIVERSITAS BERGENSIS

Climate change in mountain ecosystems

- The climate crisis and biodiversity crisis are interlinked



- Mountains are especially sensitive to global changes
  Kohler T, Maselli D, et al., 2009.

Climate change in mountain ecosystems

To address these major issues, we need to

- Understand **ecological mechanisms** on small and large scales through monitoring and field experiments
- Develop capacity by **educating good scientists**
- **Collaborate** by sharing data and methods, working across boundaries, and focus more on holistic and transdisciplinary approaches
- **Communicate** our findings back to society to foster implementation of better management and policy.

Approaches

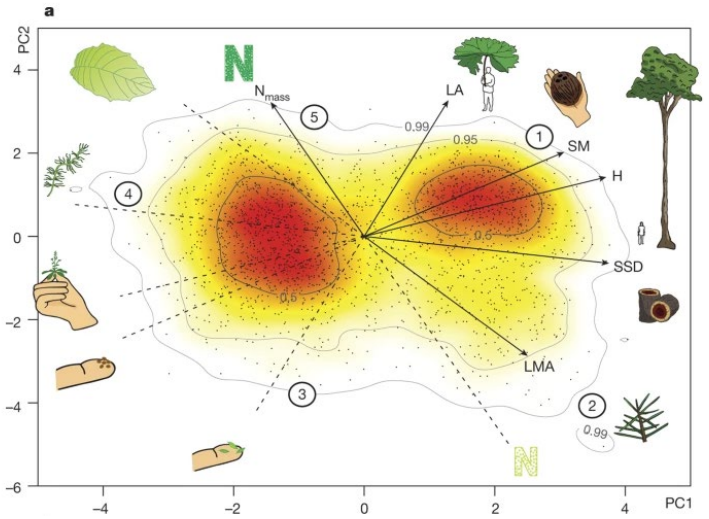
Approaches

- **TransPlant experiments**

- **Functional trait ecology**

  Functional trait: Any type of characteristic of an organism that define it in terms of their ecological roles

Figure 2: The global spectrum of plant form and function.



Díaz, S., Kattge, J., Cornelissen, J. et al., Nature, 2016

Approaches

- **Student-active learning**

  E.g., ‘Flipped classroom’, and actively taking part in research process.

Approaches

- **Student-active learning**

  E.g., 'Flipped classroom', and actively taking part in research process.

- **International collaborations**

  >10 years between IMHE (China) and University of Bergen (Norway)

Lesson 1

Experiments and gradient studies are more informative when combined

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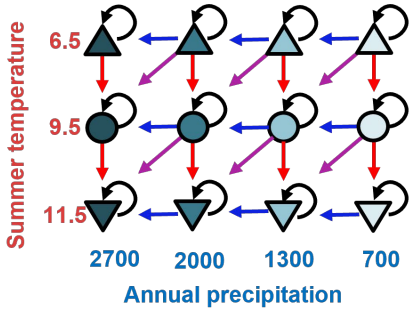
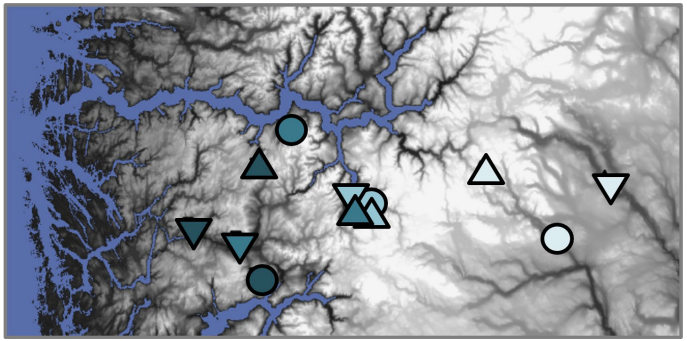
Experiments and gradient studies are more informative when combined

TransPlant studies in Norway…

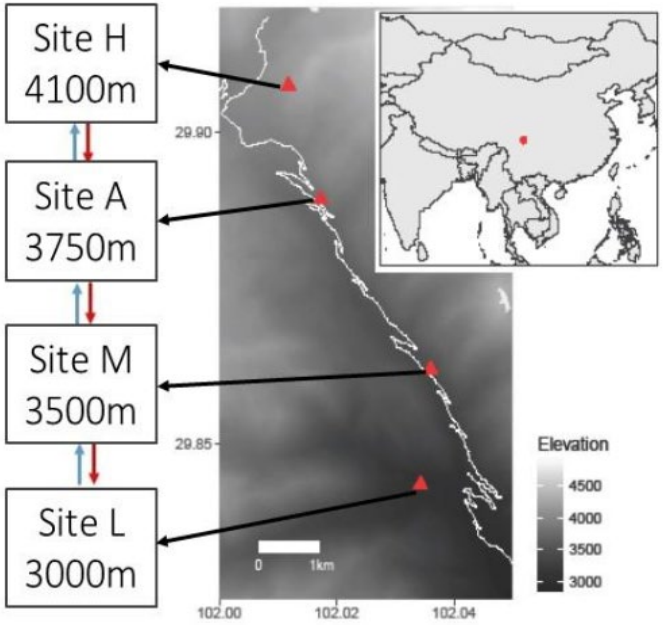




Lesson 1

Experiments and gradient studies are more informative when combined

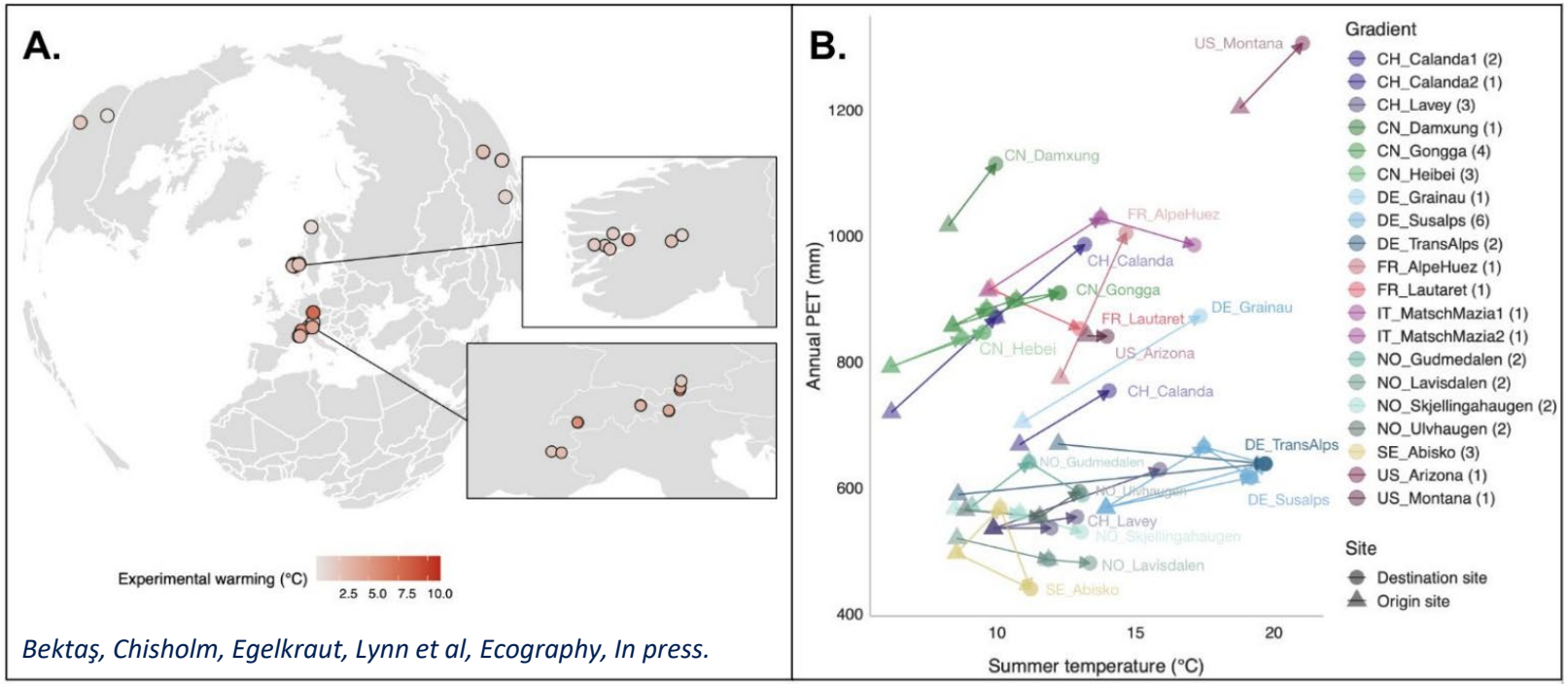
TransPlant studies in Norway… China…



Lesson 1

Experiments and gradient studies are more informative when combined

TransPlant studies in Norway… China… and globally



Bektaş, Chisholm, Egelkraut, Lynn et al, Ecography, In press.

Lesson 1

Experiments and gradient studies are more informative when combined

Three-D Project: Warming, Grazing and Nitrogen deposition *(PI: Halbritter)*

Lesson 2

Involving students in the research process is a ‘win-win-win’

Mt. Gongga, Sichuan, China, 2015

Lesson 2

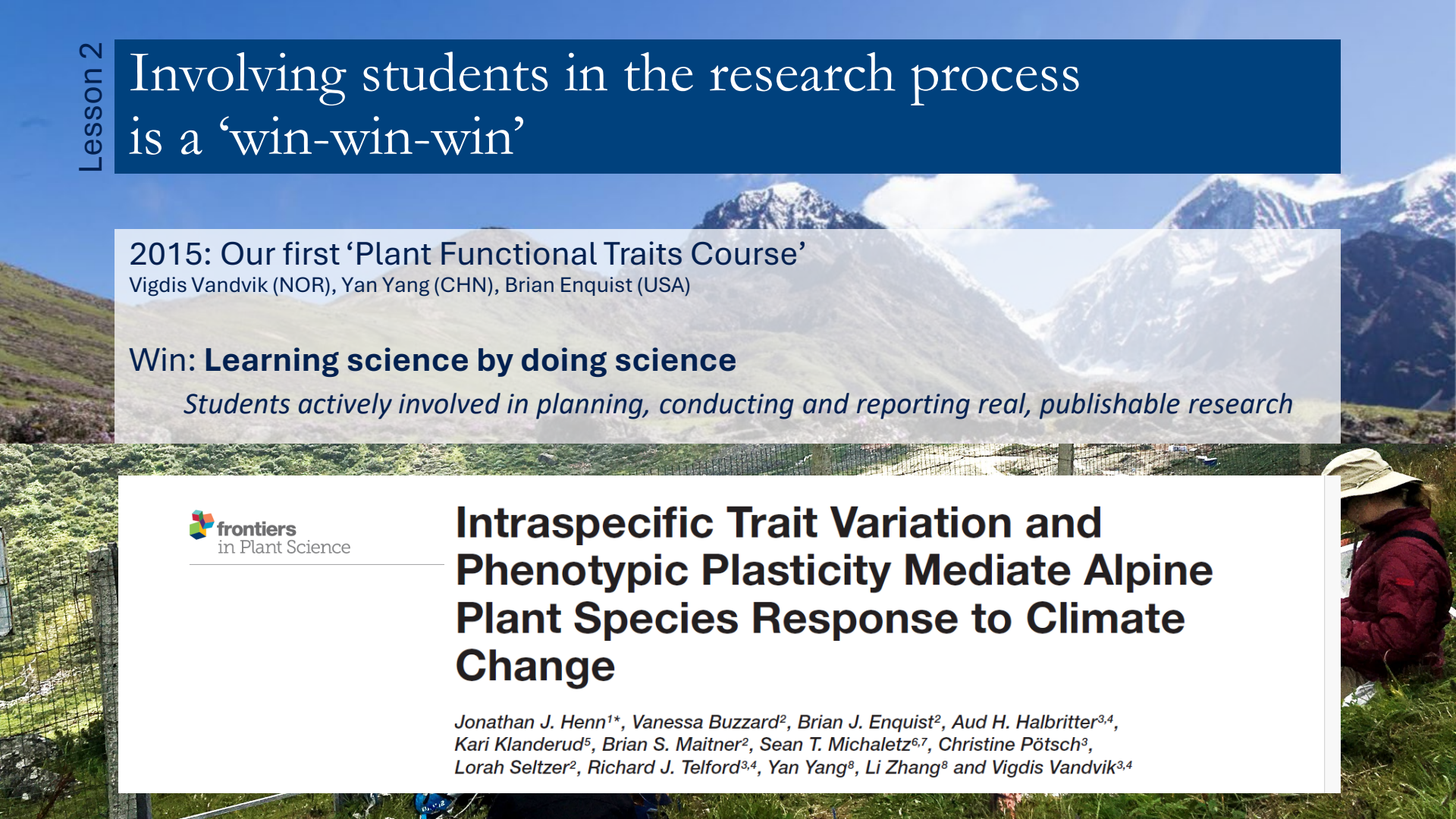
Involving students in the research process is a 'win-win-win'

2015: Our first 'Plant Functional Traits Course'

Vigdis Vandvik (NOR), Yan Yang (CHN), Brian Enquist (USA)

Win: **Learning science by doing science**

Students actively involved in planning, conducting and reporting real, publishable research



frontiers in Plant Science

Intraspecific Trait Variation and Phenotypic Plasticity Mediate Alpine Plant Species Response to Climate Change

Jonathan J. Henn[1], Vanessa Buzzard[2], Brian J. Enquist[2], Aud H. Halbritter[3,4], Kari Klanderud[5], Brian S. Maitner[2], Sean T. Michaletz[6,7], Christine Pötsch[3], Lorah Seltzer[2], Richard J. Telford[3,4], Yan Yang[8], Li Zhang[8] and Vigdis Vandvik[3,4]*

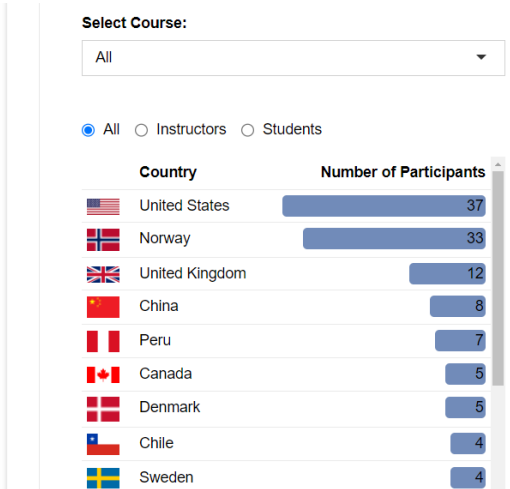
Lesson 2

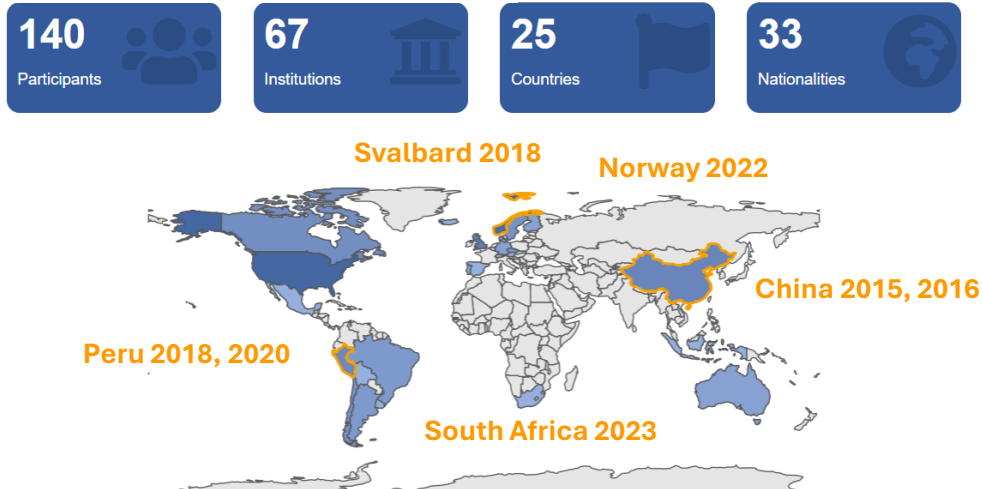
Involving students in the research process is a 'win-win-win'

Win: Building the (scientific) **community**

Wide range of nationalities, expertise, and local community involvement

https://plantfunctionaltraitscourses.w.uib.no/





Lesson 2

Involving students in the research process is a ‘win-win-win’

Win: Group effort collecting **high quality & quantity** functional traits data

‘Trait Wheel’

Trait wheel™

Peru, 2018

Lesson 3

We need open science, common protocols, streamlined workflows

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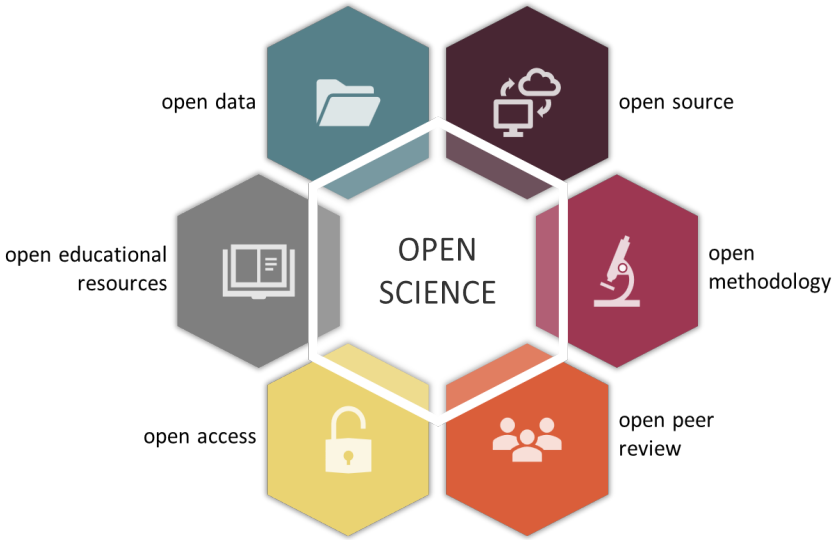
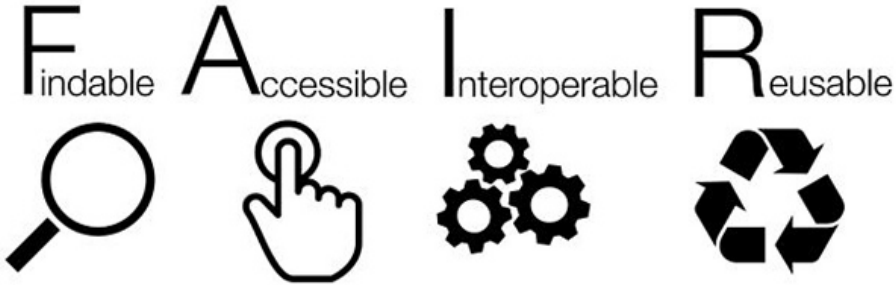
We need open science, common protocols, streamlined workflows

- Open and FAIR workflows, protocols, data.

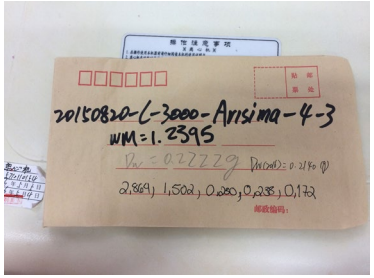


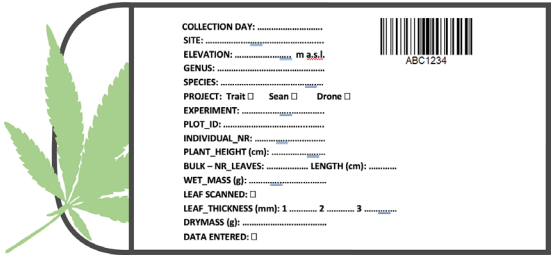


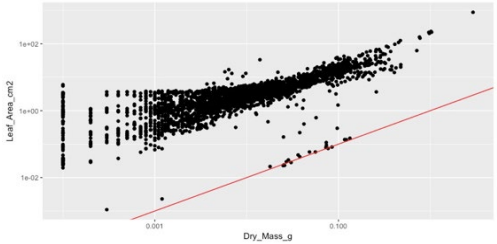
Lesson 3

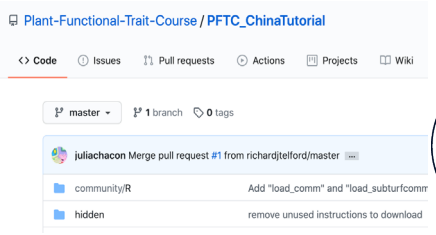
We need open science, common protocols, streamlined workflows

- Early iteration of PFTC taught us valuable lessons about optimizing workflows









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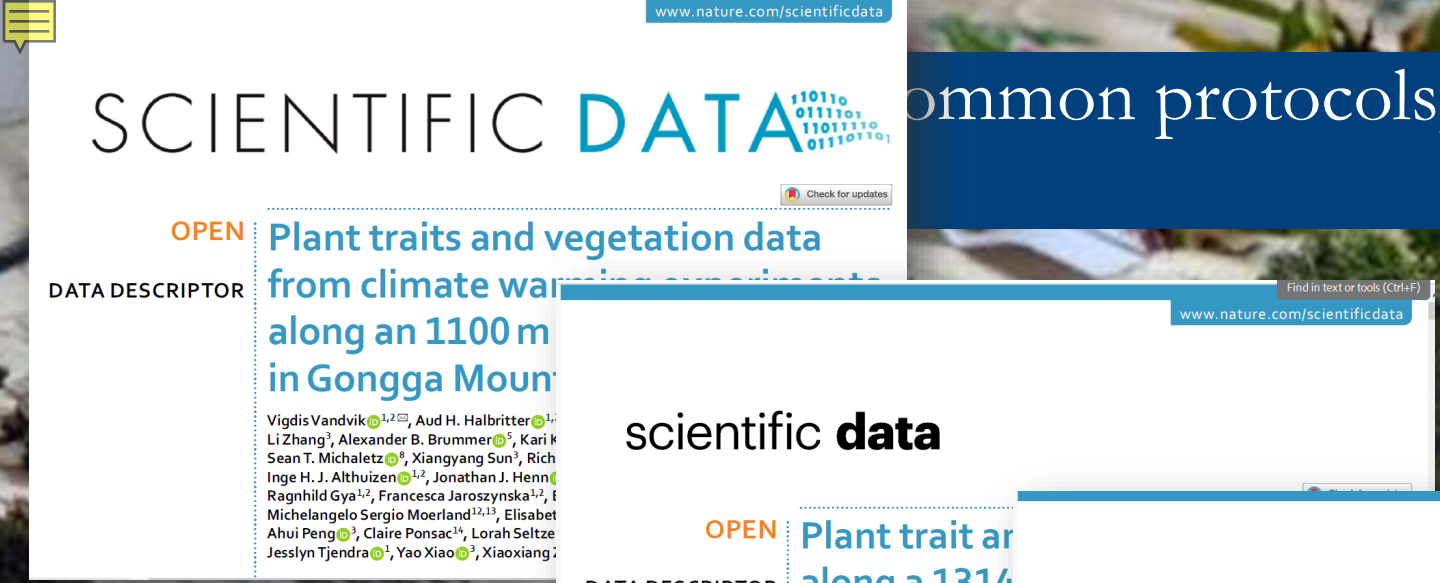

Lesson 4

Long-term collaborations are valuable and essential

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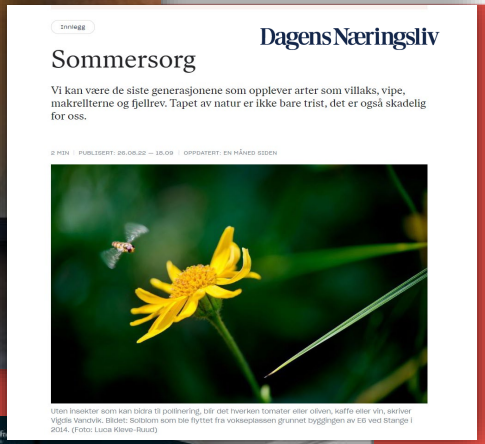
Long-term collaborations are valuable and essential

- Learning from each other: novel systems, methods, expertise.
- Developing networks to lift our research outputs to higher levels
- Internships to aid mobility, valuable research experience for early career researchers
- Building on previous collaborations to develop new relevant research questions and projects

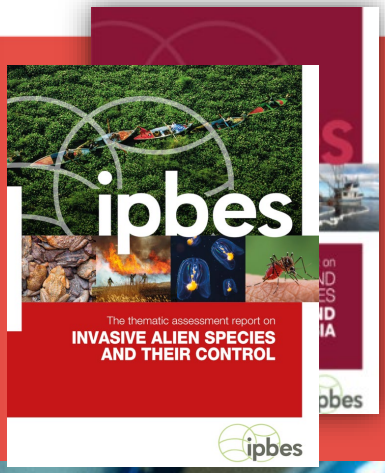
Lesson 5

International collaborations foster effective and impactful science communication.


RENDALSUKA


Innlegg
Dagens Næringsliv
Sommersorg
Vi kan være de siste generasjonene som opplever arter som villaks, vipe, makrellterne og fjellrev. Tapet av natur er ikke bare trist, det er også skadelig for oss.
2 MIN | PUBLISERT: 26.08.22 — 16.09 | OPPDATERT: EN MÅNED SIDEN
Uten insekter som kan bidra til pollinering, blir det hverken tomater eller oliven, kaffe eller vin, skriver Vigdis Vandvik. Bildet: Solblom som ble flyttet fra voksestassen grunnet byggingen av E6 ved Stange i 2014. (Foto: Luca Kleve-Ruud)


NOU
Norges offentlige utredninger 2024: 2
I samspill med naturen
Naturrisiko for næringer, sektorer og samfunn i Norge


ipbes
The thematic assessment report on
INVASIVE ALIEN SPECIES AND THEIR CONTROL
ipbes


KUNMING MONTREAL GLOBAL BIODIVERSITY FRAMEWORK
VERNE
UNNGÅ
SIKRE
GJØRE
Naturhensyn inn i all politikk / forvaltning
Rapportere og synliggjøre i næringslivets
Bærekraftig forbruk, halvere matsvinn
Fase ut perverse subsidier, øko finansiering
kapasitet, urfolk, lokalsamfunn, kvinner
Fire overordna mål
A. Ressursane kan av natur
B. Bærekraftig bruk
C. Fordeling av naturgoder
D. Ressurser til gjennomføring
skal oppfyllas innen 2050


KBK
Norsk klimastiftelse
Hva betyr Naturrisikoutvalgets anbefalinger for kommunene?


Etikkrådet
for Statens pensjonsfond utland
Årsmelding 2023


Meny
MORGENBLADET
Nyhetsbrev
Min side
Aktuelt
Ideer
Kultur
Bøker
Kviss og påfyll
Podkast
FORSKNING
Jo, folk flest ønsker faktisk klimahandling
Et stort globalt flertall ønsker en mer kraftfull klimapolitikk. Problemet er at de undervurderer andres vilje til klimakamp.


Hvem bestemmer verdien av et naturområde?
Vigdis Vandvik professor i biologi, Universitetet i Bergen
NRK Nyheter


OPINION: IF WE WORK TOGETHER, 2020 CAN BE A TRUE "SUPER YEAR" FOR BIODIVERSITY
7 ways researchers and policymakers can make the start of this new decade a turning point for protecting the future of life on Earth.

Lesson 5

International collaborations foster effective and impactful science communication.

1. Experiments and gradient studies are more informative when combined
2. Involving students in the research process is a ‘win-win-win’
3. We need open science, common protocols, streamlined workflows
4. Long-term collaborations are valuable and essential
5. International collaborations foster effective and impactful science communication.

Thank you

Prof. Genxu Wang
Prof. Yan Yang, Institute of Mountain Hazards and Environment

PFTC team plus all students
All collaborators
Funders

INSTITUTE OF MOUNTAIN HAZARDS AND ENVIRONMENT,
CHINESE ACADEMY OF SCIENCES

The Research Council of Norway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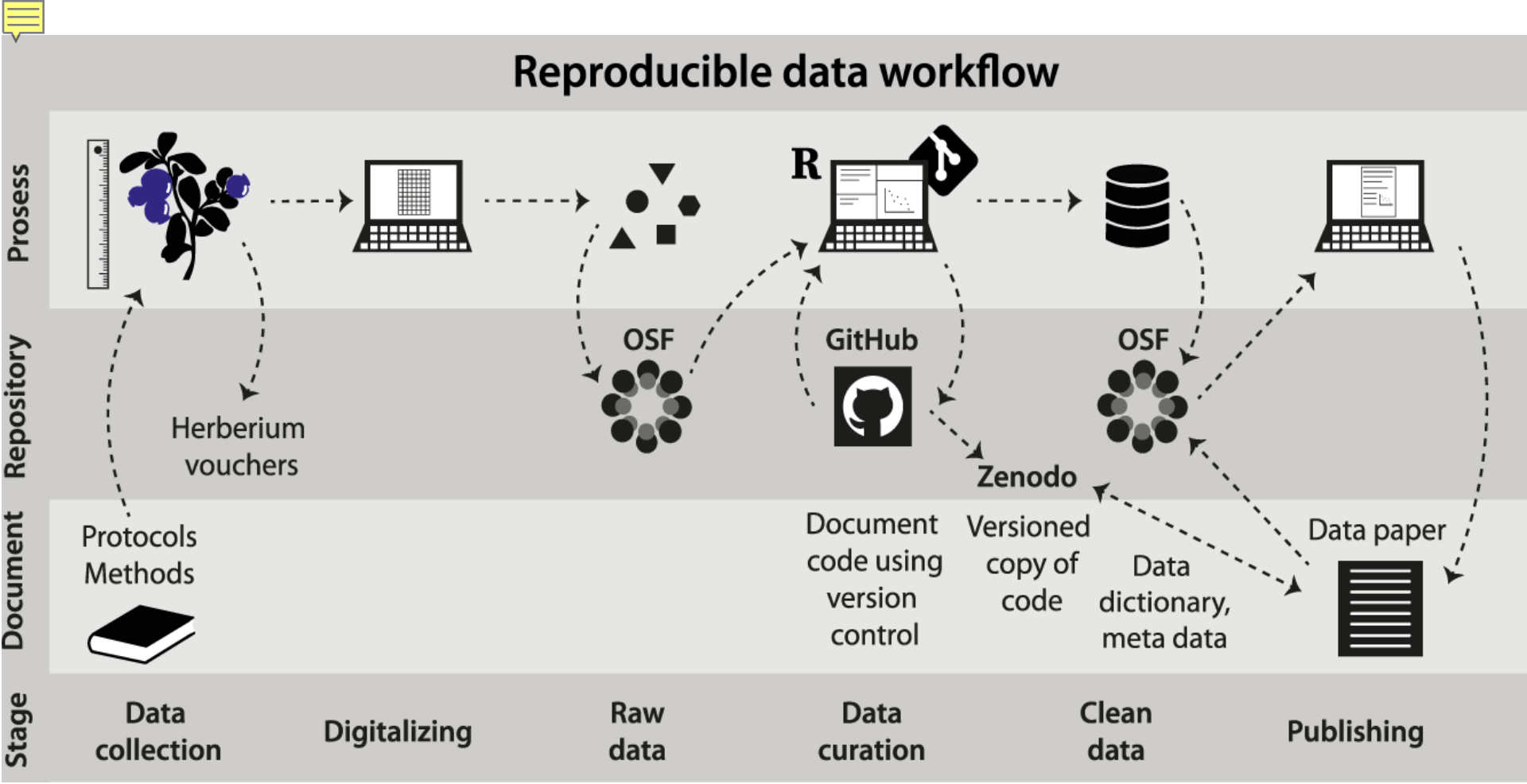


(Vandvik *et al*. 2022)

Methods in Ecology and Evolution
BRITISH ECOLOGICAL SOCIETY

RESEARCH ARTICLE | Full Access

The handbook for standardised field and laboratory measurements in terrestrial climate-change experiments and observational studies (ClimEx)

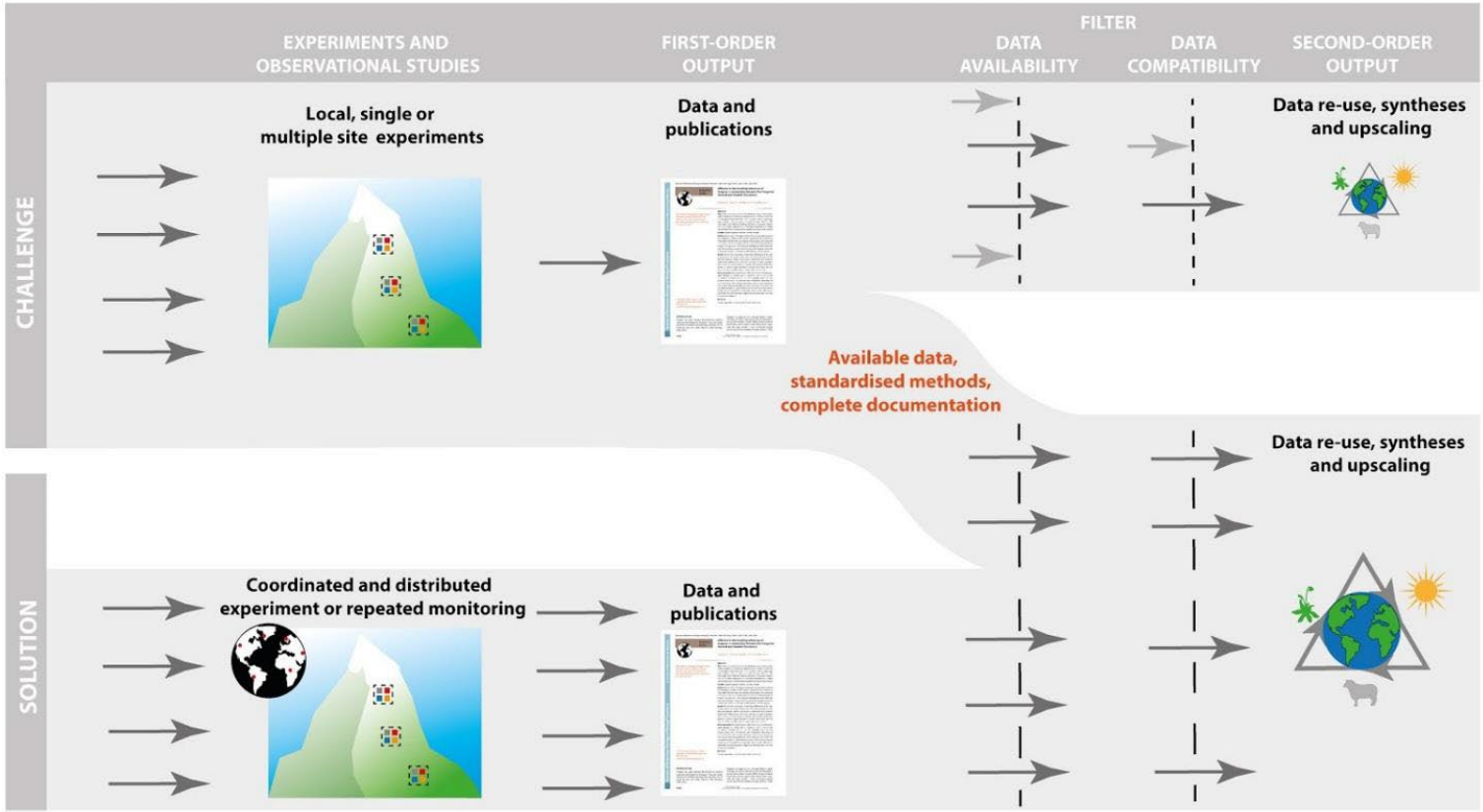
Aud H. Halbritter, Hans J De Boeck, Amy E. Eycott, Bernd Berauer, Casper T. Christiansen, Marc Estiarte, Anke Jentsch, Hanna Lee, Sune Linder, John Marshall, Stuart-Haëntjens, Peter Wilfahrt, The ClimMani wor
... See fewer authors

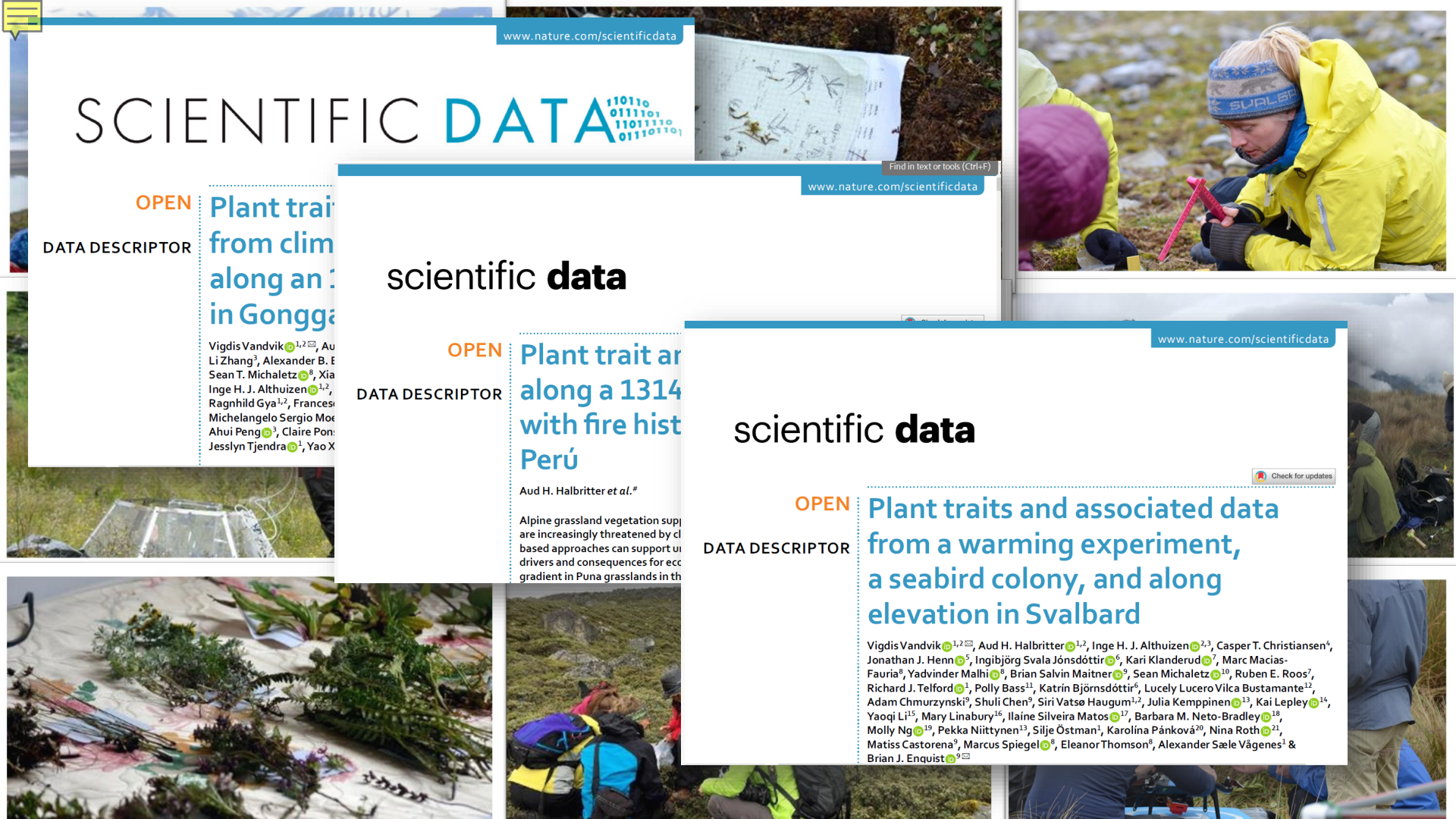
First published: 05 November 2019 | https://doi.or

Go here for SFX

The Handbook

> 500 page of detailed methods descriptions to help ensure data, approaches are as standardized and comparable as possible





www.nature.com/scientificdata

SCIENTIFIC DATA

OPEN

DATA DESCRIPTOR

Plant trai
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Vigdis Vandvik[1,2]✉, Au
Li Zhang[3], Alexander B. E
Sean T. Michaletz[8], Xia
Inge H. J. Althuizen[1,2],
Ragnhild Gya[1,2], Frances
Michelangelo Sergio Moe
Ahui Peng[3], Claire Pons
Jesslyn Tjendra[1], Yao X

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OPEN

DATA DESCRIPTOR

Plant trait ar
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Perú

Aud H. Halbritter *et al.*#

Alpine grassland vegetation supp
are increasingly threatened by cl
based approaches can support u
drivers and consequences for ecc
gradient in Puna grasslands in th

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DATA DESCRIPTOR

Plant traits and associated data from a warming experiment, a seabird colony, and along elevation in Svalbard

Vigdis Vandvik[1,2]✉, Aud H. Halbritter[1,2], Inge H. J. Althuizen[2,3], Casper T. Christiansen[4], Jonathan J. Henn[5], Ingibjörg Svala Jónsdóttir[6], Kari Klanderud[7], Marc Macias-Fauria[8], Yadvinder Malhi[8], Brian Salvin Maitner[9], Sean Michaletz[10], Ruben E. Roos[7], Richard J. Telford[1], Polly Bass[11], Katrín Björnsdóttir[6], Lucely Lucero Vilca Bustamante[12], Adam Chmurzynski[9], Shuli Chen[9], Siri Vatsø Haugum[1,2], Julia Kemppinen[13], Kai Lepley[14], Yaoqi Li[15], Mary Linabury[16], Ilaíne Silveira Matos[17], Barbara M. Neto-Bradley[18], Molly Ng[19], Pekka Niittynen[13], Silje Östman[1], Karolína Pánková[20], Nina Roth[21], Matiss Castorena[9], Marcus Spiegel[8], Eleanor Thomson[8], Alexander Sæle Vågenes[1] & Brian J. Enquist[9]✉

Aud H. Halbritter, Julia Chacon Labella, Richard J. Telford, Deborah E. Goldberg, Sehoya Cotner, Brian J. Enquist, Jake Alexander, Adam Ccahuana, Adam Chmurzynski, Agustina Barros, Ahui Peng, Alexander Byers Brummer, Alexander Sæle Vågenes, Alyssa Smith, Anders Isaksen, Andrea Palomino Cardenas, Andrea Sánchez-Tapia, Aud Halbritter, Bárbara Javiera Seaman Espinosa , Barbara M. Neto-Bradley, Blake Lee Joyce, Brian Salvin "BS" Maitner, Casper Christiansen, Christien Steyn, Christine Pötsch, Claire Ponsac, Dagmar Egelkraut, Eleanor Thomson, Elisabeth Nesheim Hauge, Elke Jongejans, Erickson Giomar Urquiaga Flores, Erik Kusch, Eugenia Sanchez Diaz, Eva Lieungh Eriksen, Fei Ran, Fernanda Chiappero, Fiorella Gonzales, Francesca Jaroszynska, Frida Knoop, Hanna Lee, Hilde Rut, Ilaíne Silveira Matos, Imma Oliveras, Inge Althuizen, Jess Rickenback, Jesslyn Tjendra, Jhon del Aguila Pasquel, Jhonatan Sallo Bravo, Joachim Töpper, Jocelyn Navarro, Jonathan Henn, Jonathan von Oppen, Josef Garen, Joseph Gauard, Josh Lynn, Julia Chacon, Julia Kemppinen, Kai Lepley, Kari Klanderud, Karolína Pánková, Katrín Björnsdóttir, Kine Blom, Korina Ocampo-Zuleta Kristine Birkeli, Kristýna Kuncová, Laura Jessup, Leonardo Hamachi, Li Zhang, Linda Hoyde Nordås, Linn Vassvik, Lohengrin Cavieres, Lorah Patterson, Lorelei Patrick, Lucely Lucero Vilca Bustamante, Mackenzie Lift, Marc Macias-Fauria, Marcus Spiegel, Maria Elisa Pierfederici, Mary Linabury, Matiss Castorena Salaks, Megan Kathleen Sullivan, Michelangelo Sergio Moerland, Mickey Boakye, Miguel Muñoz Mazon, Molly Ng, Siri L. Olsen, Natalia L Quinteros Casaverde, Nina Roth, Olav Skarpaas, Paul Efren Santos Andrade, Pekka Niittynen, Pernille Bronken Eidesen, Polly Bass, Ragnhild Gya, Rebecca Lehman, Richard Telford, Ruben Roos, Rudi Cruz, Samuel Pastor Ploskonka, Sandra Duran, Sara Middleton, Sean Michaletz, Sehoya Cotner, Shuli Chen, Signe Maskell Knudsen, Silje Östman, Siri Vatsø Haugum Sonya Geange, Tanya Strydom, Tasha-Leigh J. Gauthier, Trace Martyn, Vanessa Buzzard, Verónica Noemí Zepeda Martínez, Verónica Pinelli, Will Johnson, William Farfan-Rios, William Garcia, Xiangyang Sun, Xiaoxiang Zhao, Yadvinder Mahli Yan Yang, Yao Xiao, Yaoqi Li.

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