Aliens in Antarctica

Biodiversity

Visitors

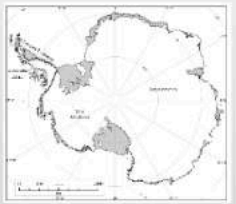
Threats

Research

Outcomes

The Future

Bioregions

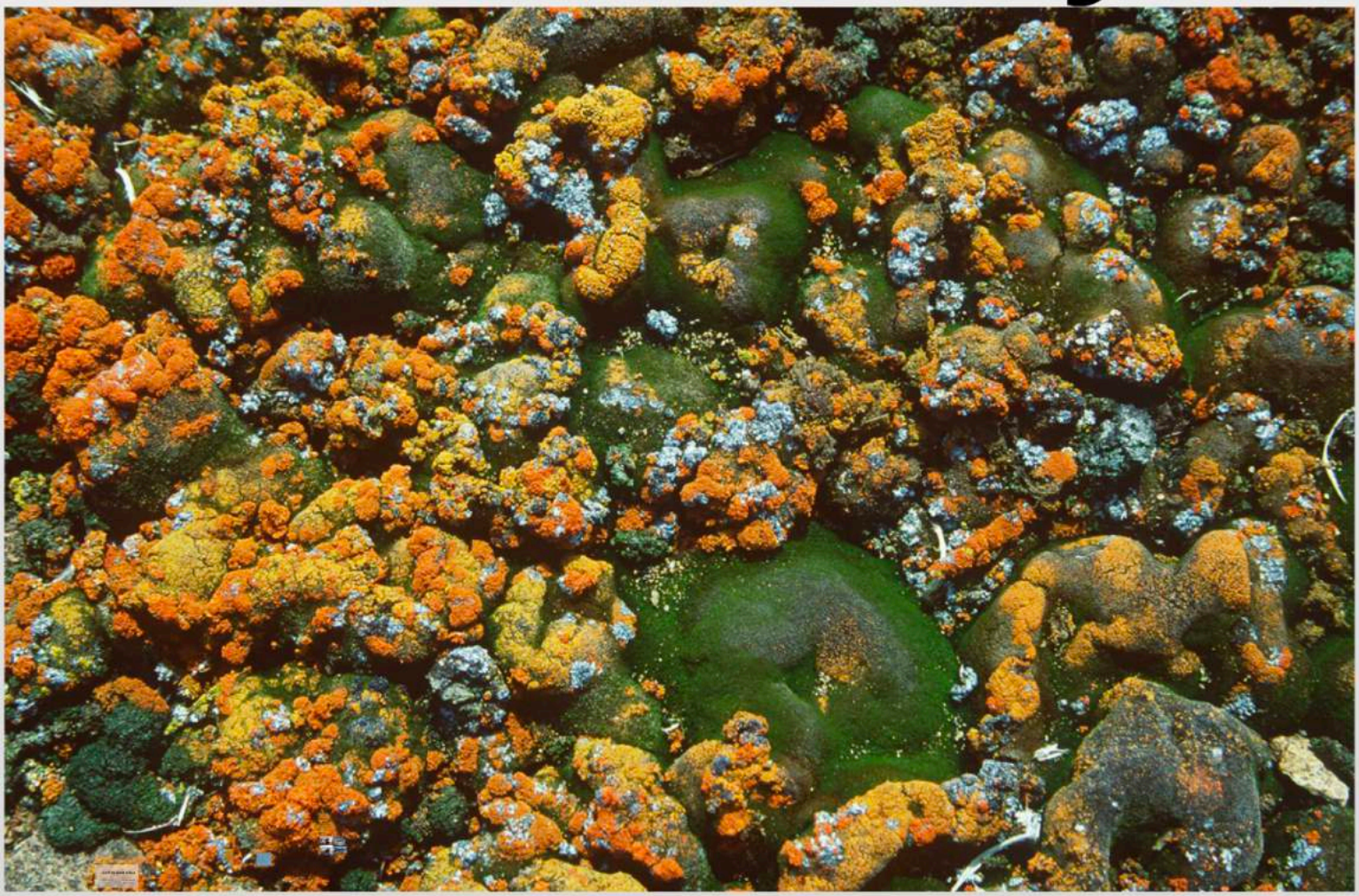


Implications

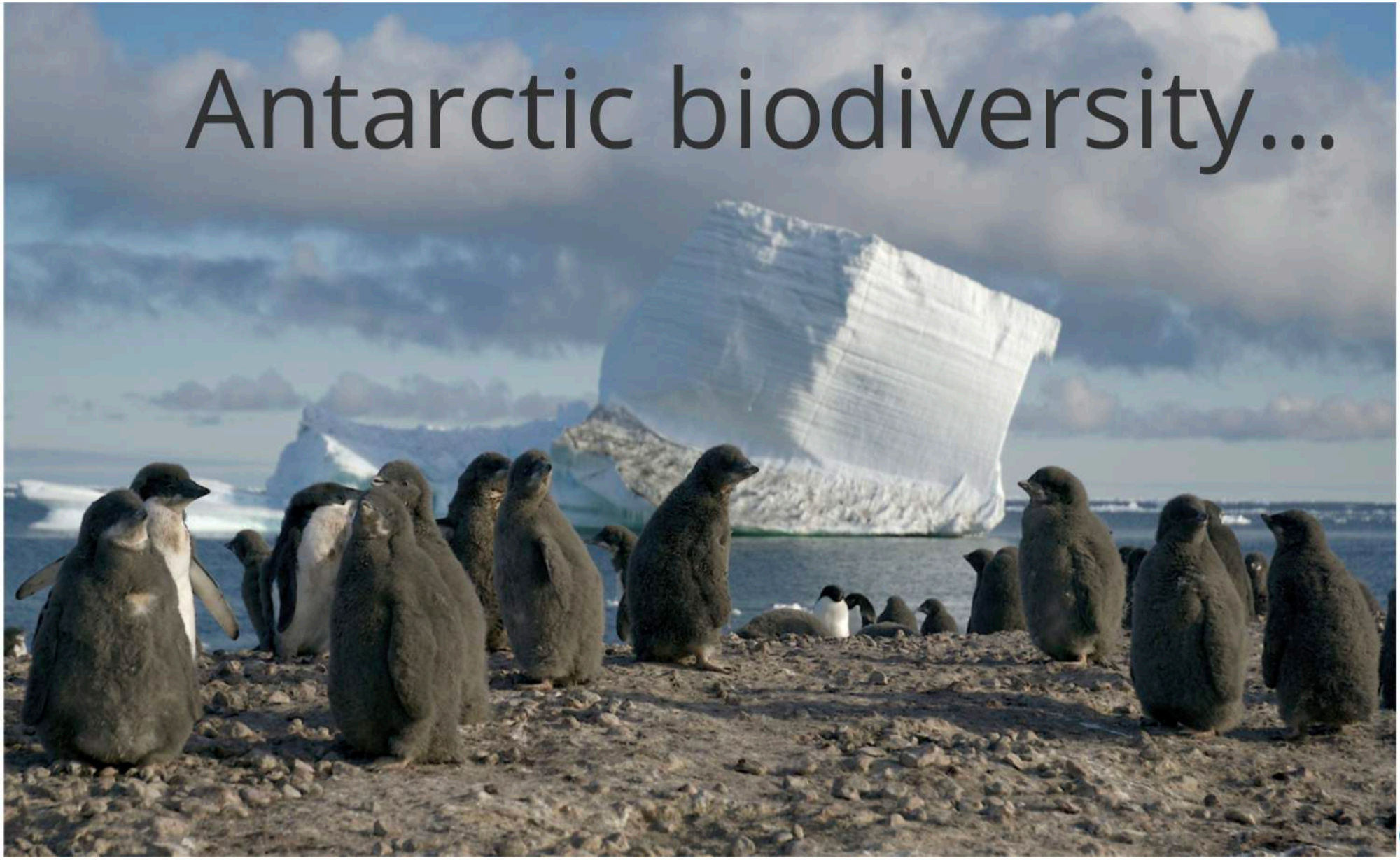
SCAR — The International Council for Science · Scientific Committee on Antarctic Research

COMNAP — Council of Managers of National Antarctic Programs

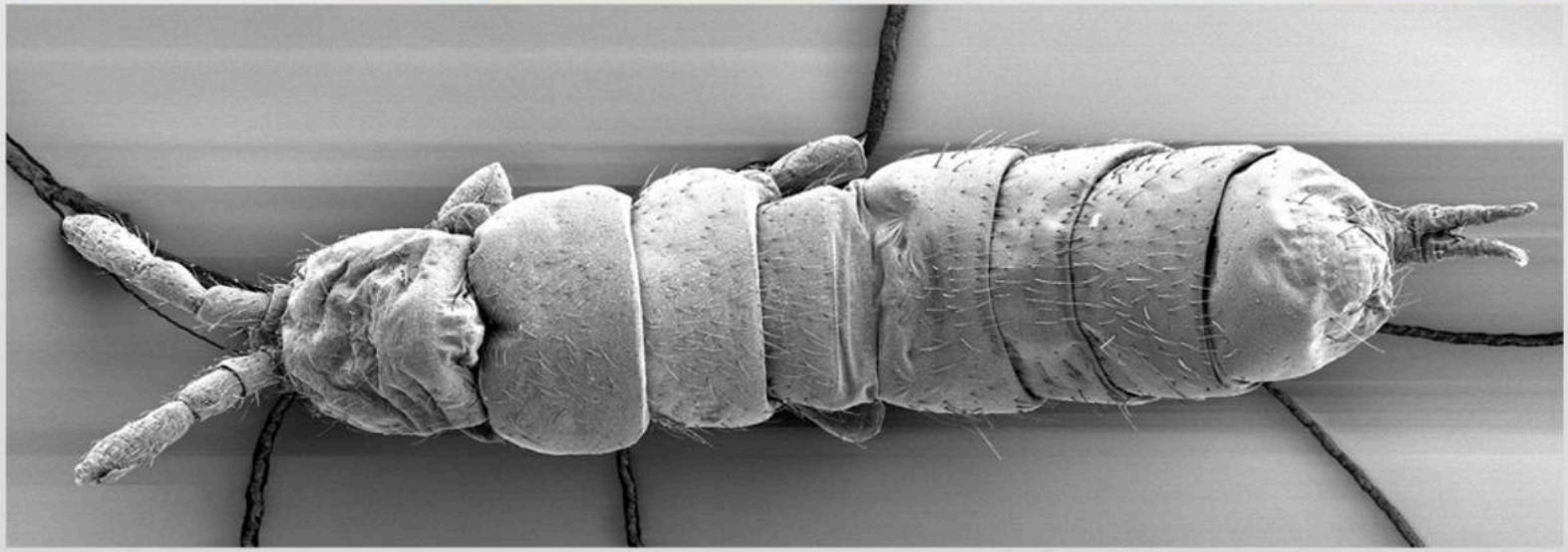
Biodiversity

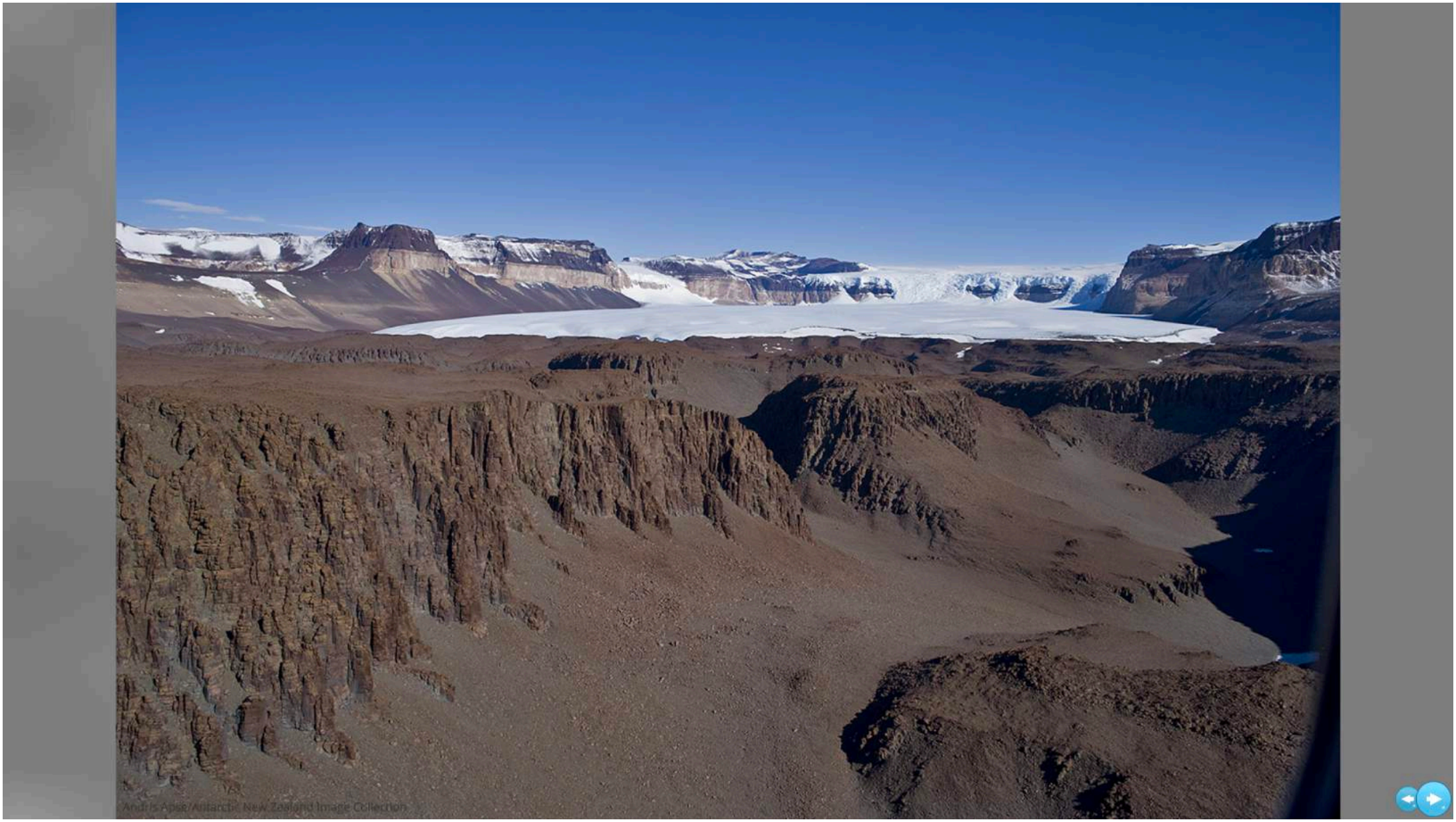


Antarctic biodiversity...



more than meets the eye




Andris Apse/Antarctic New Zealand Image Collection

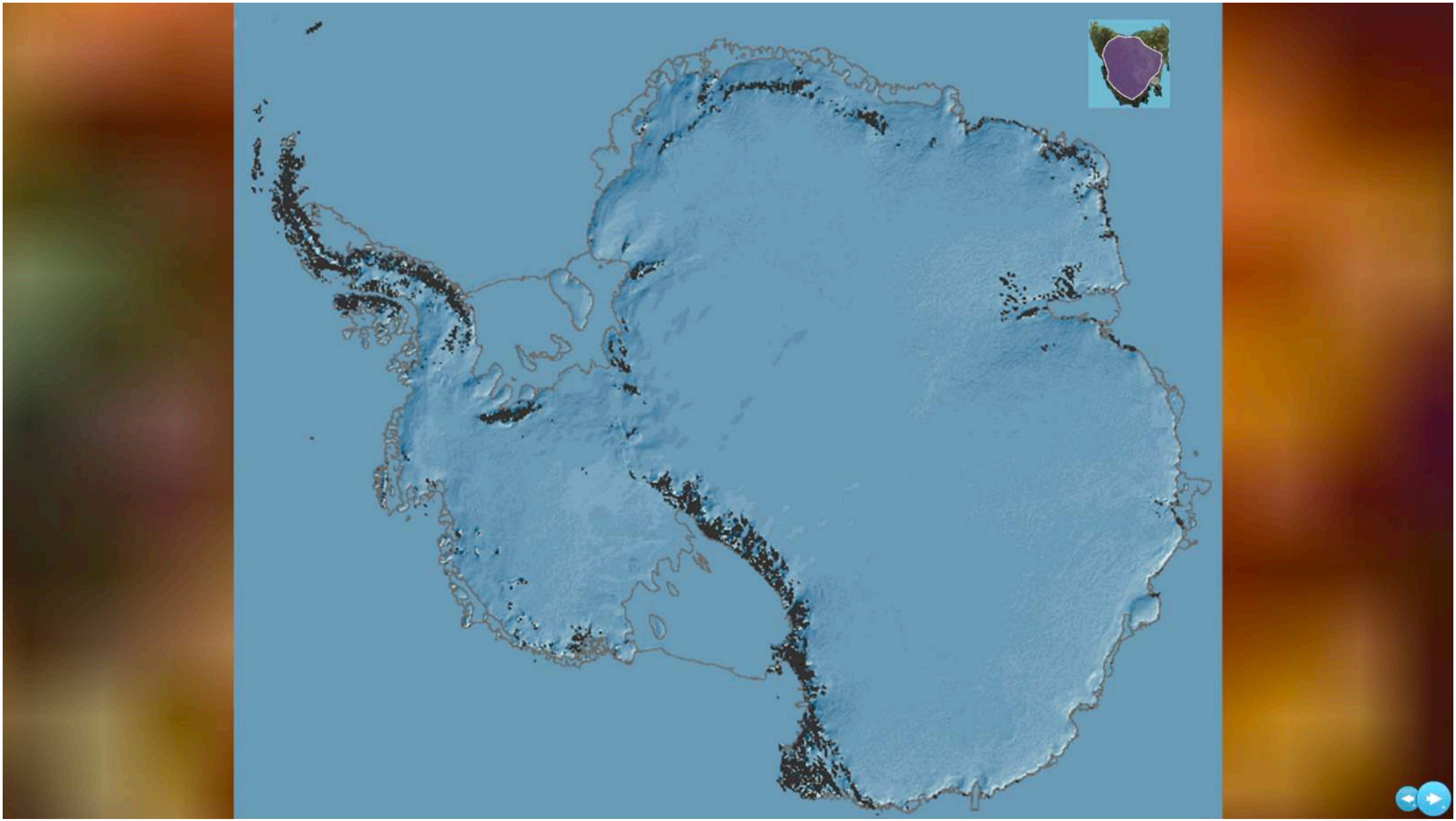
Ice-free Antarctica

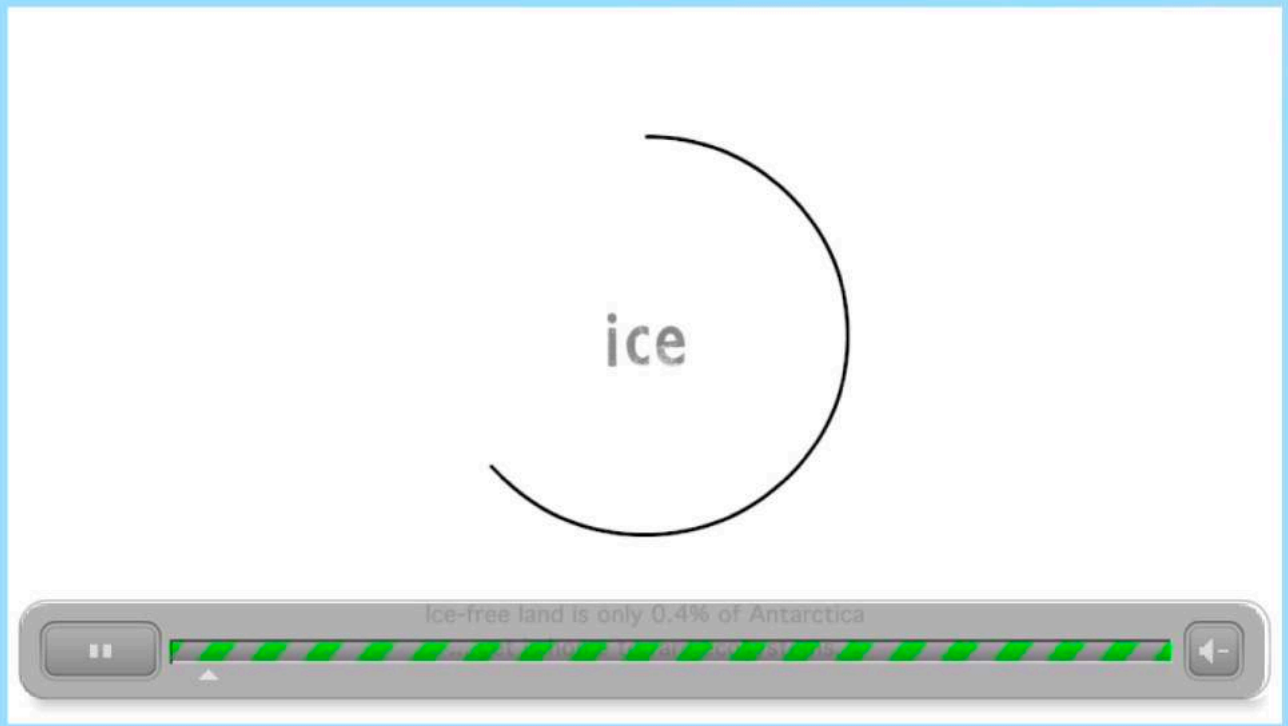
0.4 % of the total area

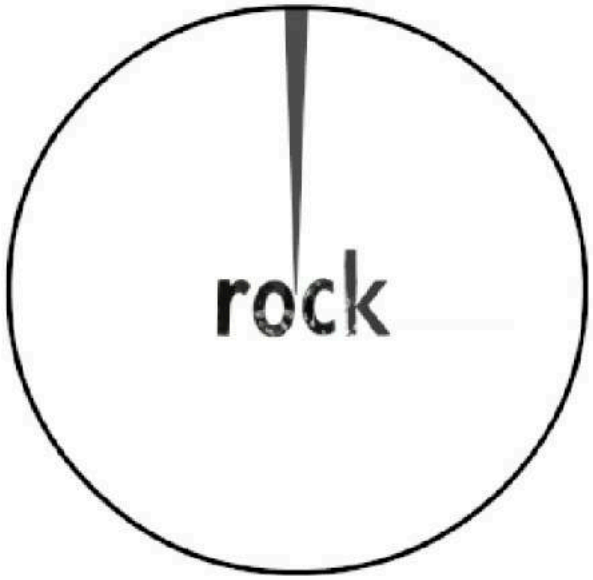
46 000 square kilometres

0.4 % of the total area

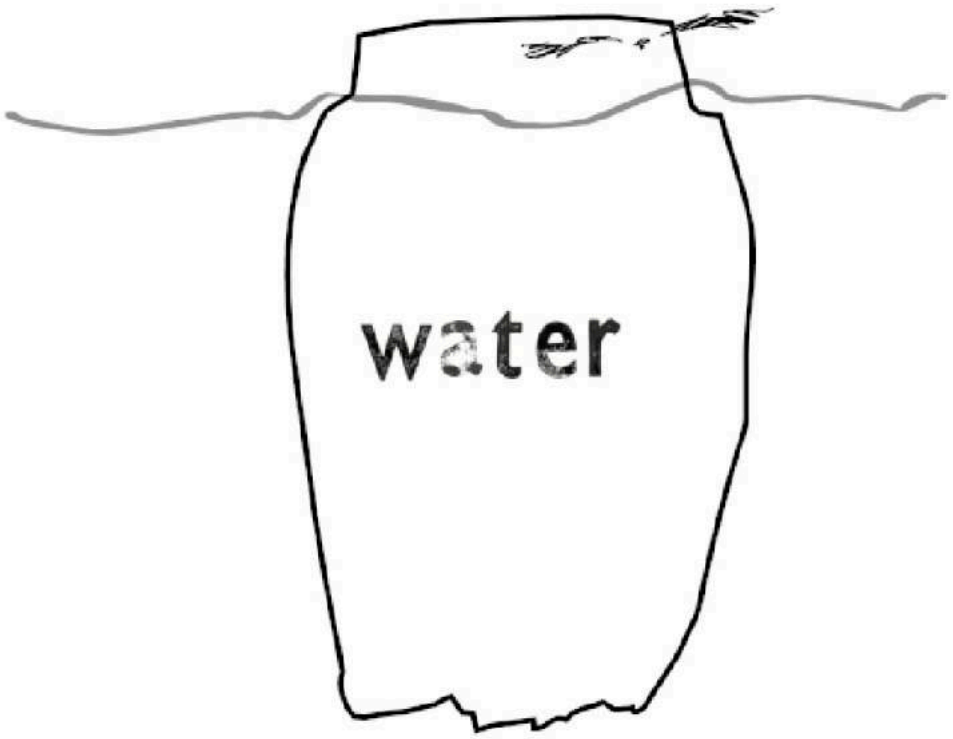
46 000 square kilometres



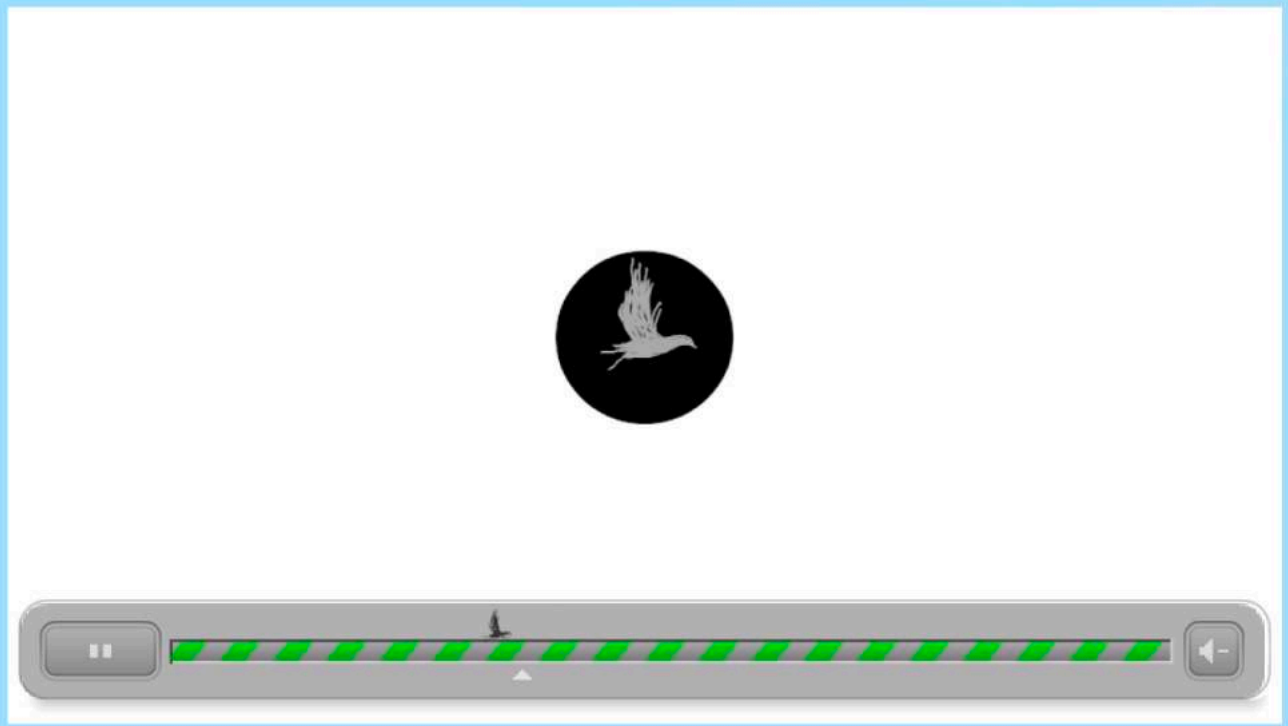

ice
Ice-free land is only 0.4% of Antarctica



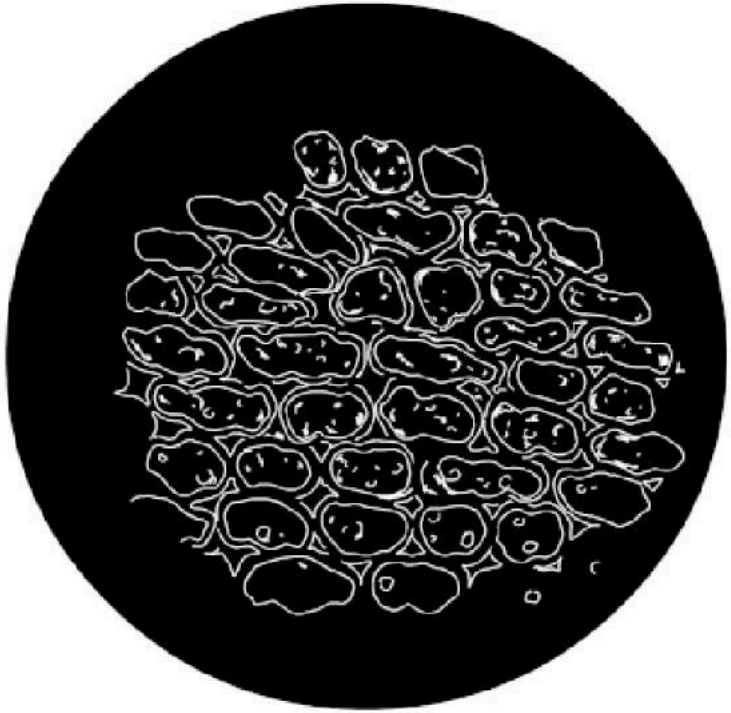
Ice-free land is only 0.4% of Antarctica
... yet is home to rare ecosystems.


water


life

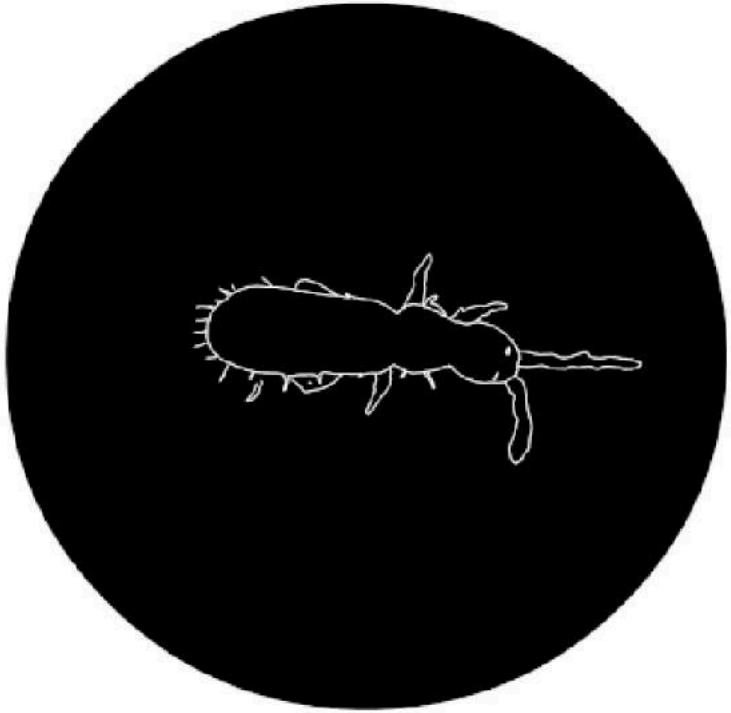


viruses and bacteria

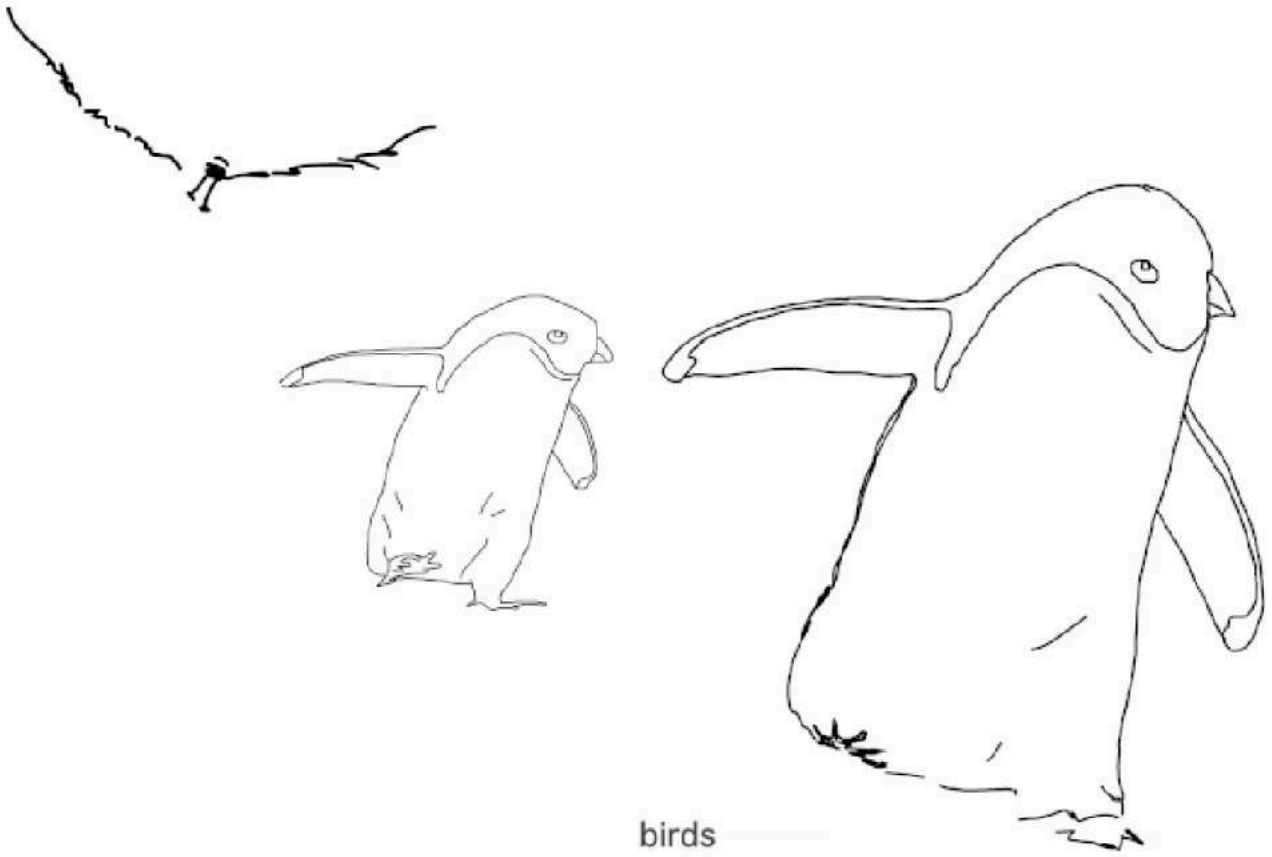


lichens and mosses

tardigrades (water bears)



collembola (springtails)



birds

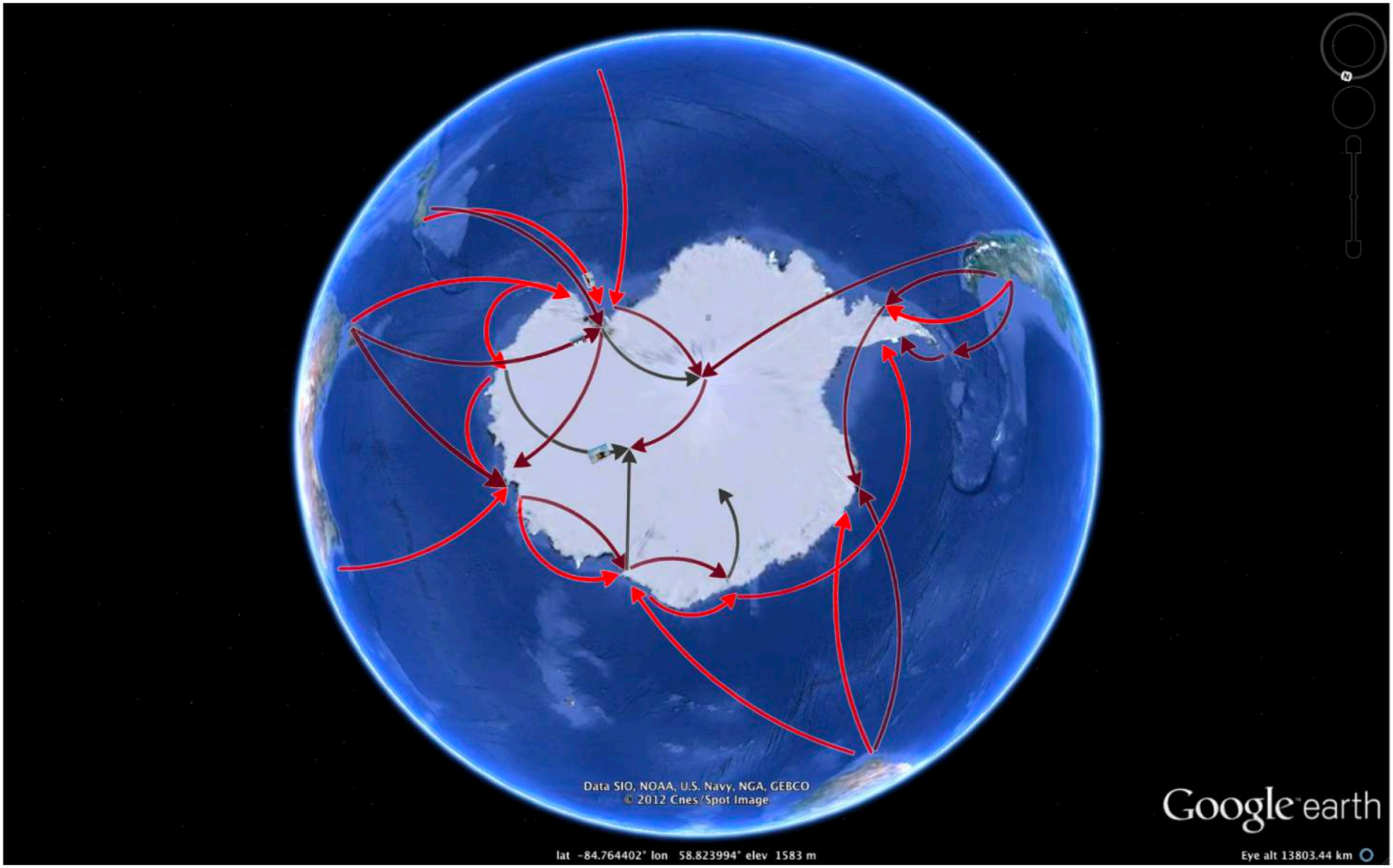
seals

humans

humans


Concentrated
human
activities

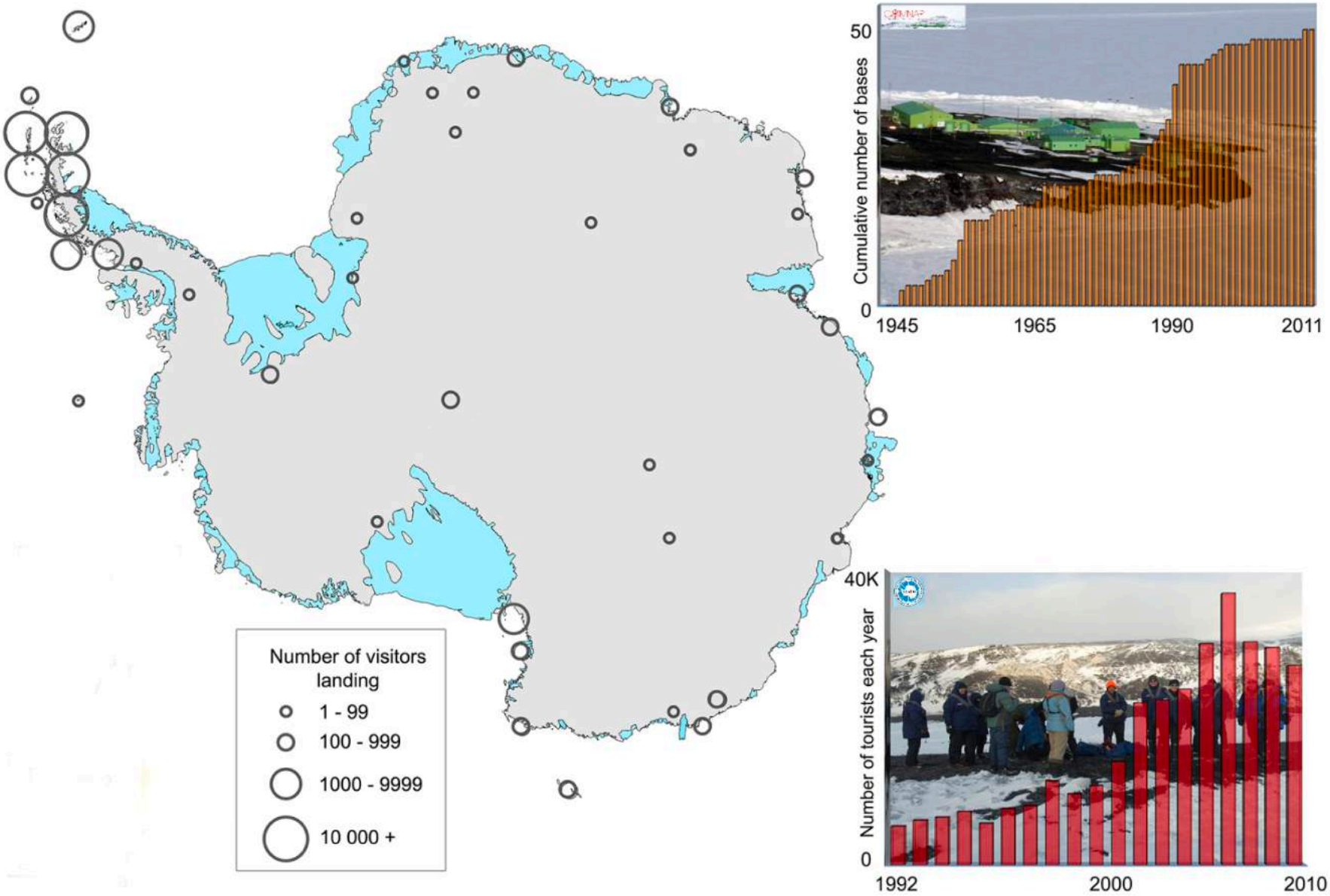
Visitors

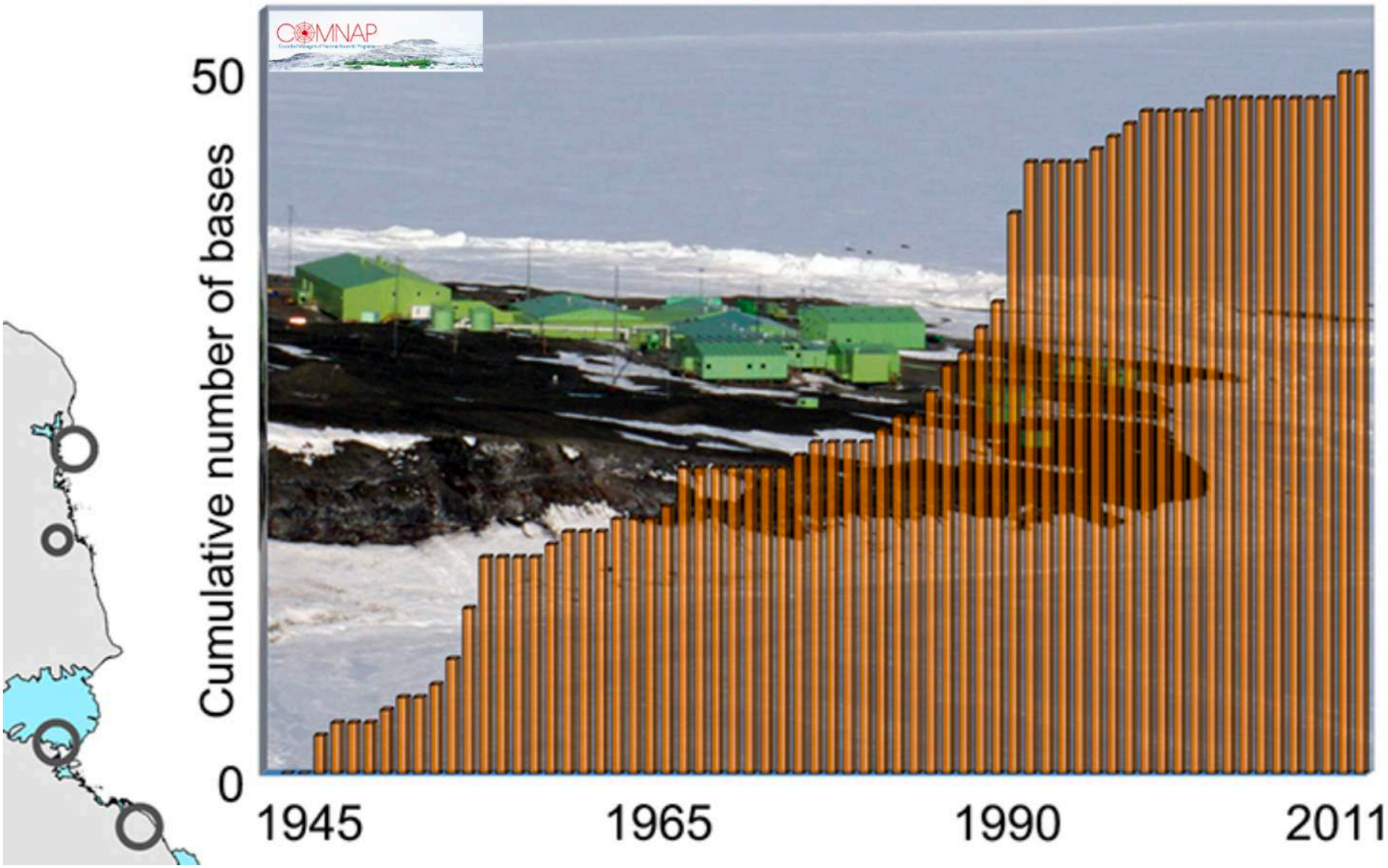

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2012 Cnes/Spot Image
Google earth
lat -84.764402° lon 58.823994° elev 1583 m
Eye alt 13803.44 km

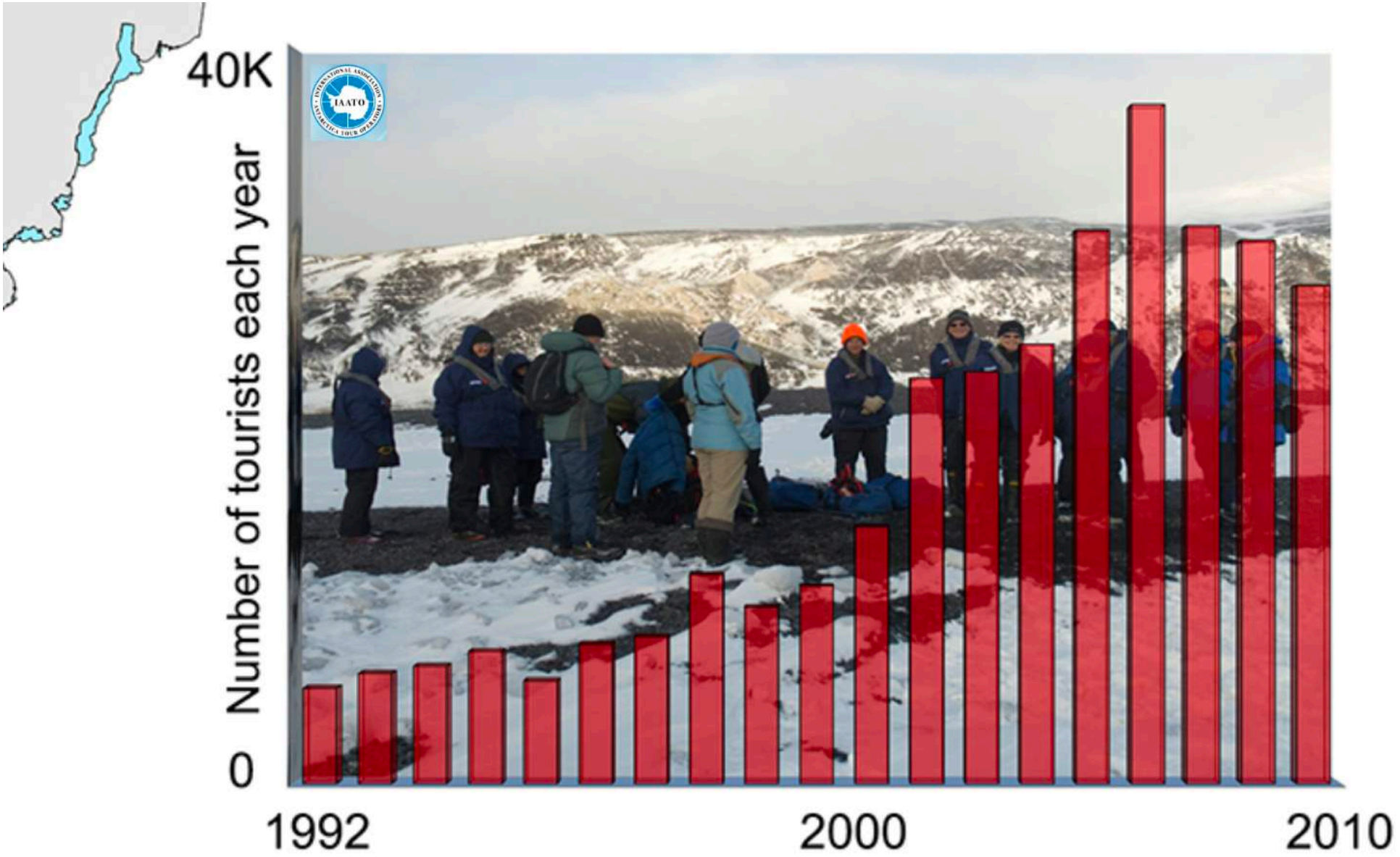

P&O


U.S. AIR FORCE
9210


Antarctica New Zealand


Number of visitors landing
1 - 99
100 - 999
1000 - 9999
10 000 +
50
0
Cumulative number of bases
1945
1965
1990
2011
40K
0
Number of tourists each year
1992
2000
2010


COMNAP
50
0
Cumulative number of bases
1945
1965
1990
2011


40K
Number of tourists each year
0
1992
2000
2010
IAATO

The reality of transfer

En route to Antarctica

12 live insects

20 seeds

One expeditioner

2 grams plant material

503 seeds

En route to Antarctica

12 live insects

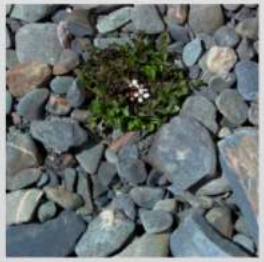
20 seeds

One expeditioner

2 grams plant material

503 seeds

Threats



Antarctic Science page 1 of 2 *(2011)* © Antarctic Science Ltd 2011 doi:10.1017/S0954102010000982

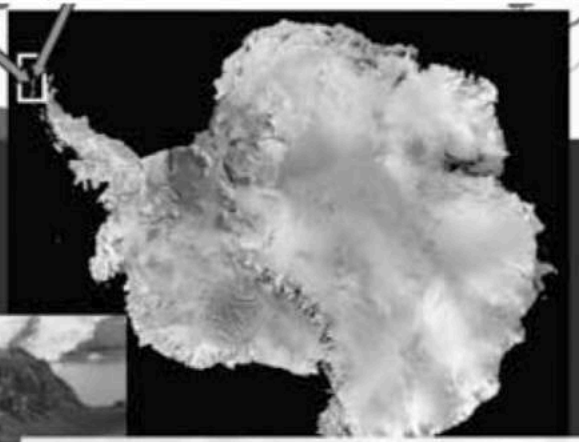
Short Note

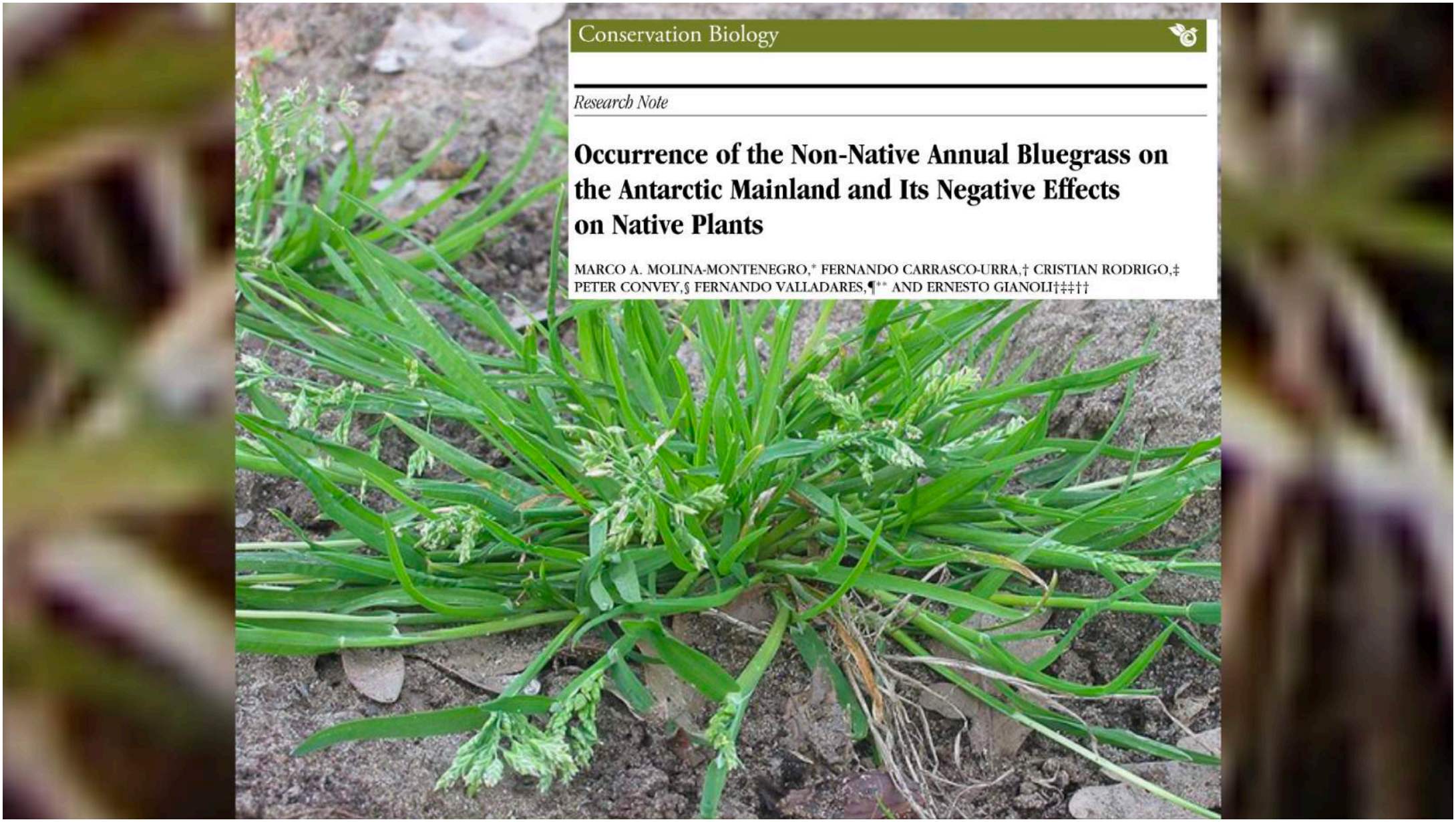
The first appearance and establishment of an alien vascular plant in natural habitats on the forefield of a retreating glacier in Antarctica

MARIA OLECH[1,2] and KATARZYNA J. CHWEDORZEWSKA[1]*

[1]Department of Antarctic Biology, Polish Academy of Science, Ustrzycka 10/12, 02-141 Warsaw, Poland
[2]Institute of Botany, Jagiellonian University, Kopernika 27, 31-501 Cracow, Poland
**Corresponding author: kchwedorzewska@go2.pl*

Received 17 September 2010, accepted 26 November 2010





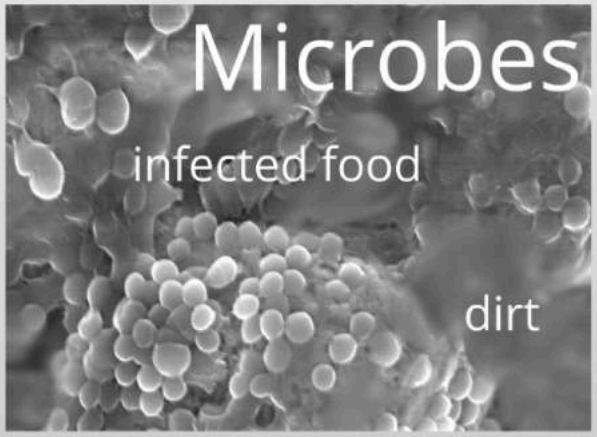
Conservation Biology

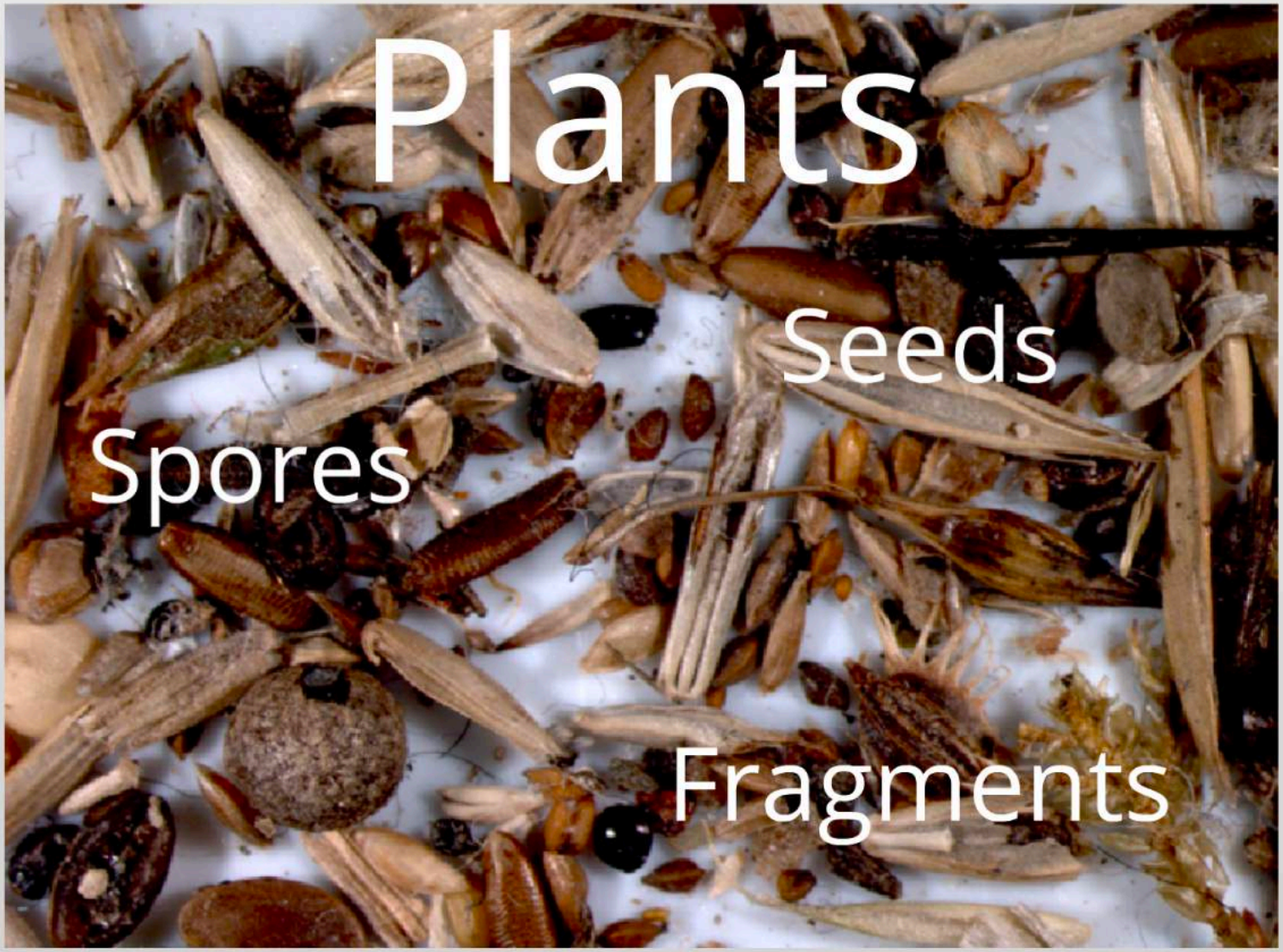
Research Note

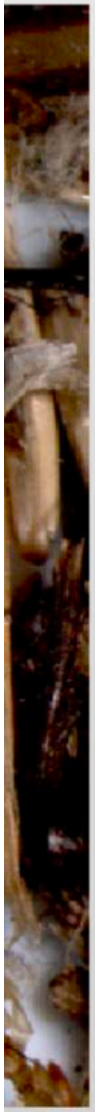
Occurrence of the Non-Native Annual Bluegrass on the Antarctic Mainland and Its Negative Effects on Native Plants

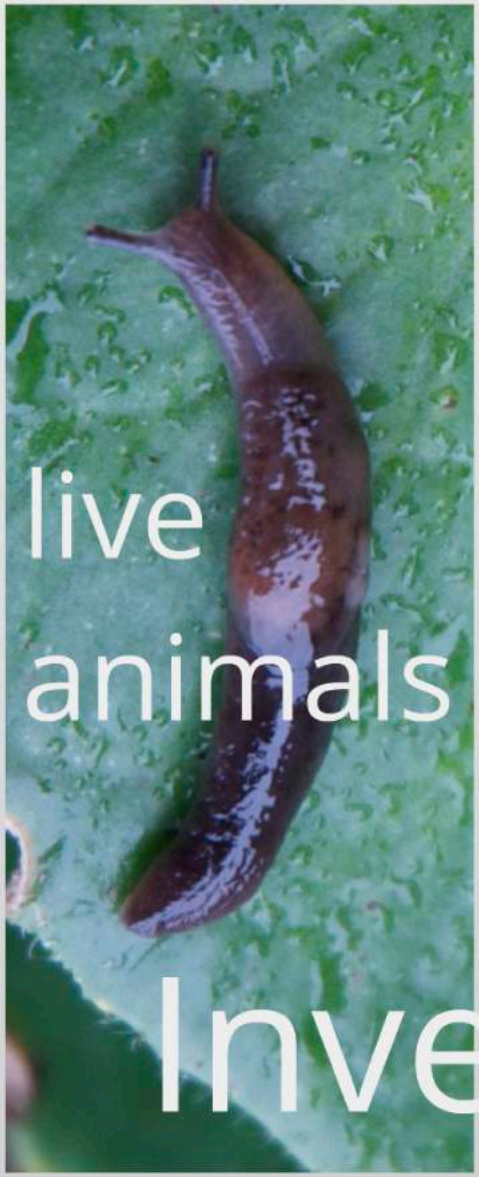
MARCO A. MOLINA-MONTENEGRO,* FERNANDO CARRASCO-URRA,† CRISTIAN RODRIGO,‡ PETER CONVEY,§ FERNANDO VALLADARES,¶** AND ERNESTO GIANOLI†‡‡††

Types of propagules

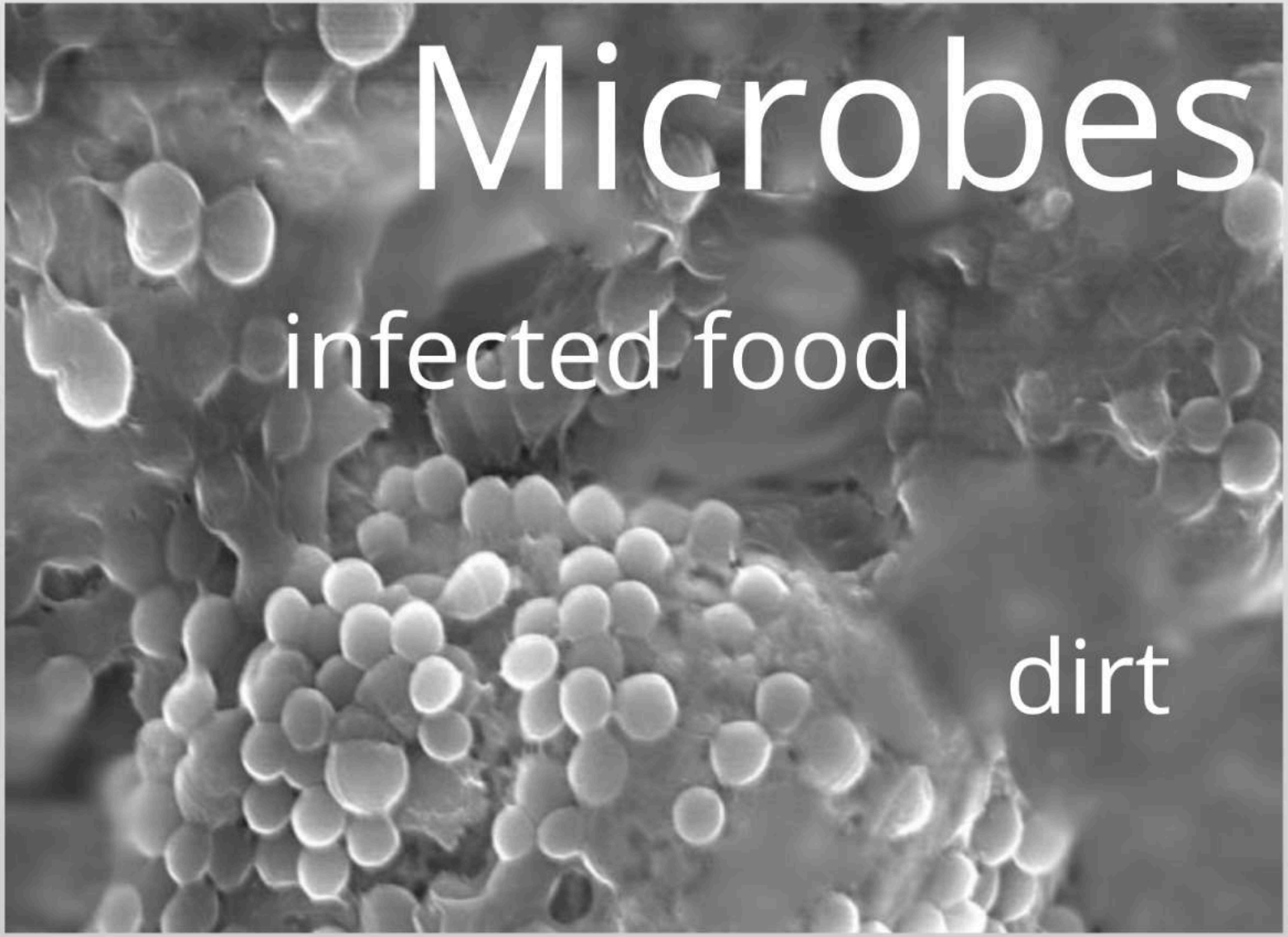



Plants
Seeds
Spores
Fragments

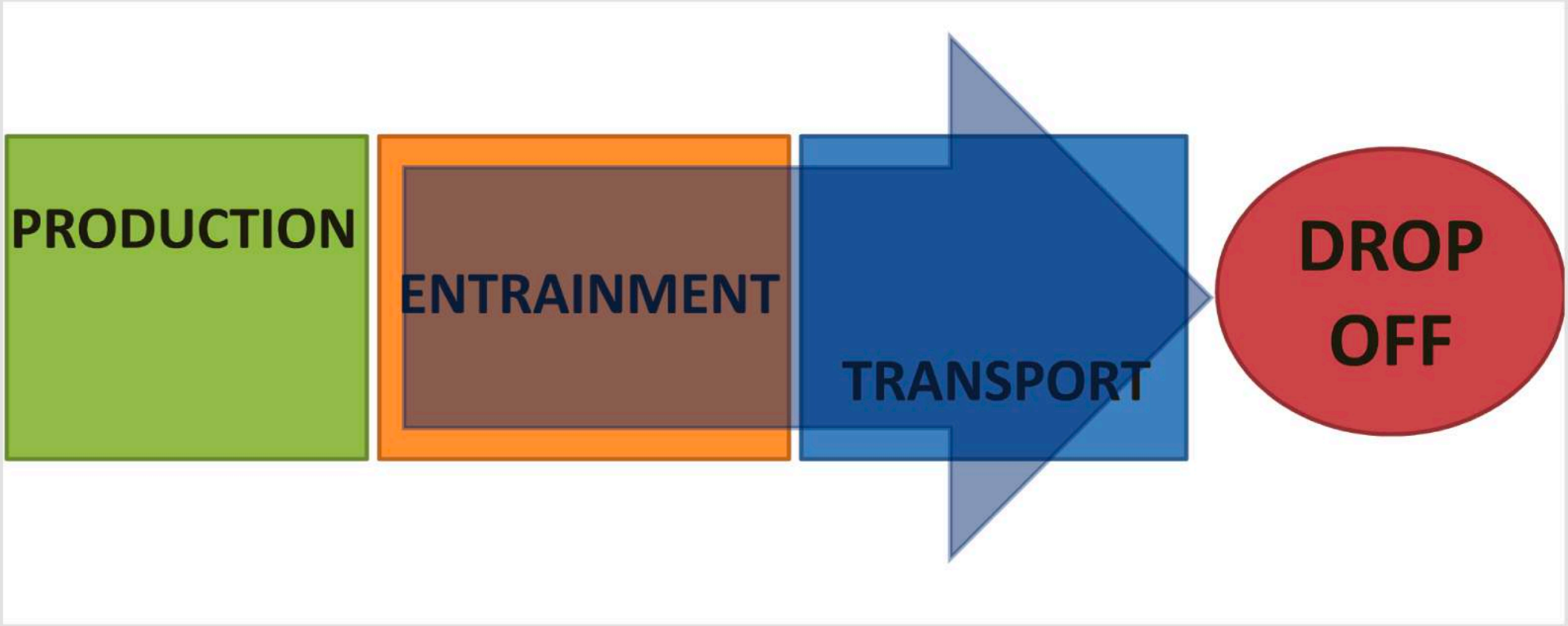




Invertebrates


Microbes
infected food
dirt


Vertebrates


PRODUCTION
ENTRAINMENT
TRANSPORT
DROP OFF

Vectors

Human

Transport

Cargo

Food

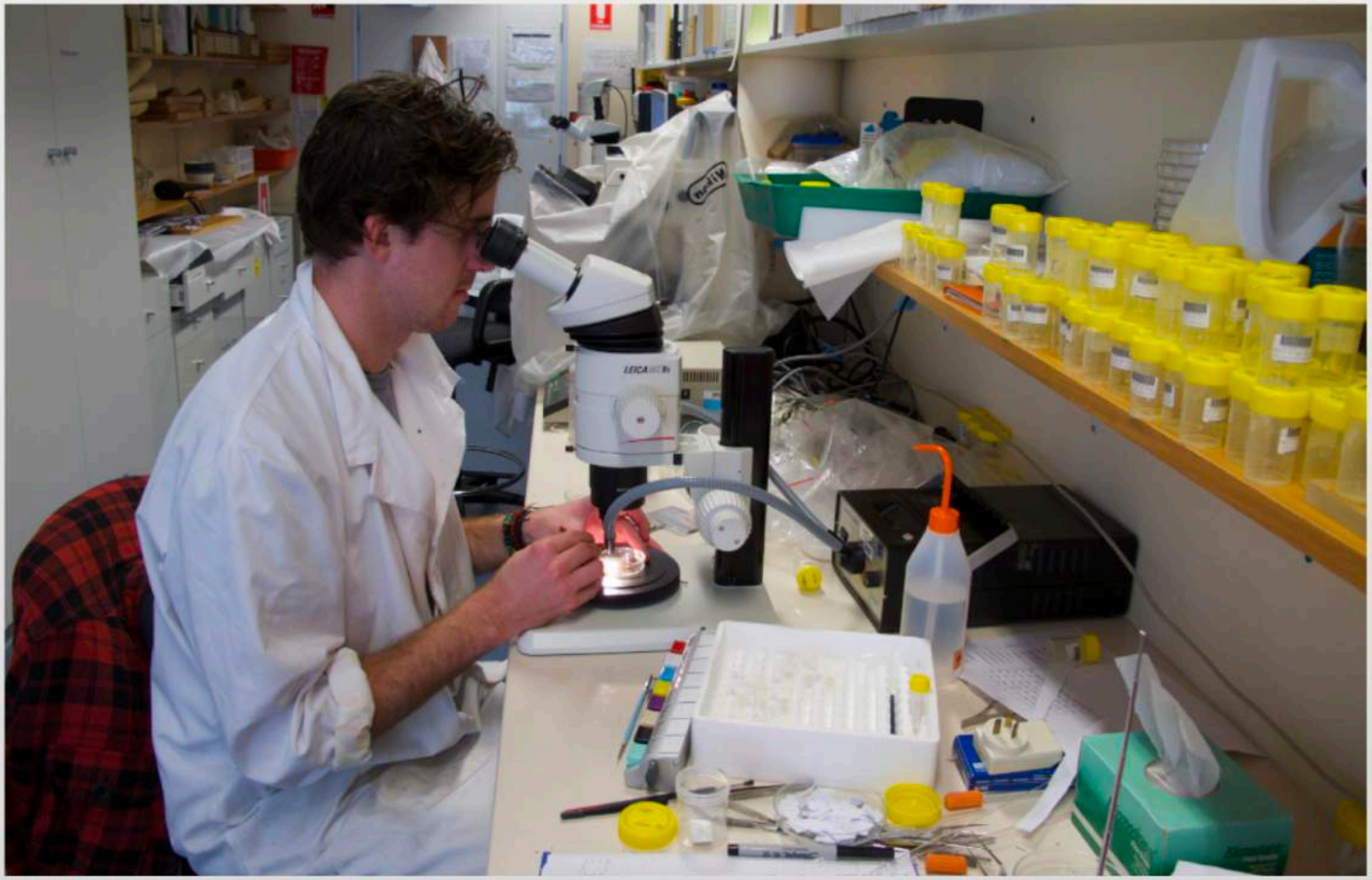
Human

Transport

Cargo


Food

Research



First steps...

REVIEWS

Life at the front: history, ecology and change on southern ocean islands

Dana M. Bergstrom and Steven L. Chown

Polar Biol (2005) 28: 568–570
DOI 10.1007/s00300-005-0720-y

SHORT NOTE

Kevin A. Hughes · Shaun Walsh · Peter Convey
Sarah Richards · Dana M. Bergstrom

Alien fly populations established at two Antarctic research stations

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Biological Conservation 121 (2005) 207–219
BIOLOGICAL CONSERVATION
www.elsevier.com/locate/biocon

Subantarctic hitchhikers: expeditioners as vectors for the introduction of alien organisms

J. Whinam [a,*], N. Chilcott [b,1], D.M. Bergstrom [b]

[a] Nature Conservation Branch, Department of Primary Industries, Water and Environment, GPO Box 44, Hobart 7001, Tasmania, Australia
[b] Australian Government, Department of Environment and Heritage, Australian Antarctic Division, Channel Highway, Kingston, Tasmania 7150, Australia

Biol. Rev. (2005), **80**, pp. 45–72. © *Cambridge Philosophical Society*
DOI: 10.1017/S1464793104006542 *Printed in the United Kingdom*

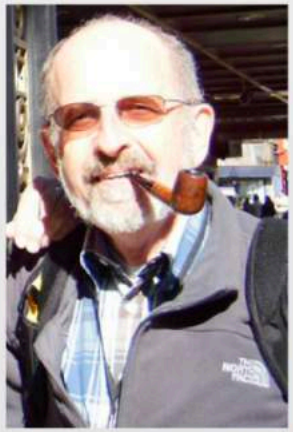
Biological invasions in the Antarctic: extent, impacts and implications

Yves Frenot[1]*, Steven L. Chown[2], Jennie Whinam[3], Patricia M. Selkirk[4], Peter Convey[5], Mary Skotnicki[6] and Dana M. Bergstrom[7]

[1] *UMR 6553 CNRS-Université de Rennes and French Polar Institute (IPEV), Station Biologique, F-35380 Paimpont, France*
[2] *2 DST Centre of Excellence fur Invasion Biology, Department of Botany and Zoology, University of Stellenbosch, Private Bag X1, Matieland 7602, South Africa*


Aliens in Antarctica
International Polar Year

A multi-national effort



Aliens in Antarctica

Propagules

Entrainment

Pathways
Vectors
Number

Origin
Composition
Can they survive?

Transport & drop-off

Travel tolerant
Establishment potential

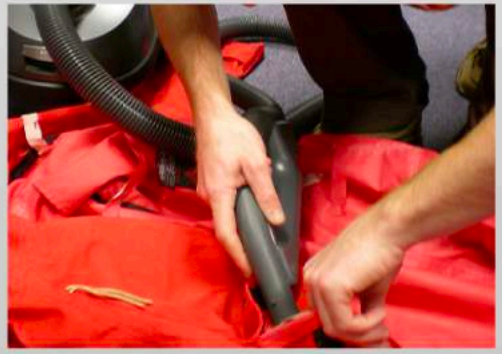
Risk assessment

Mitigation strategy

High risk areas

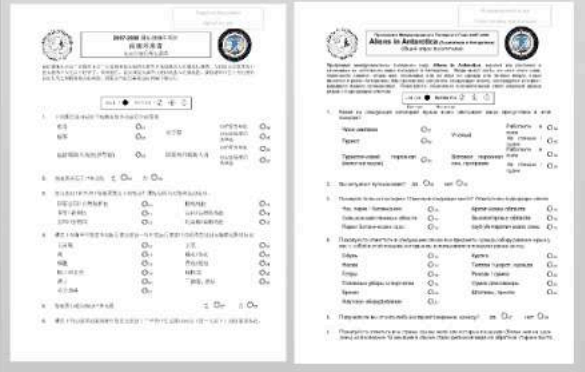
Mitigation
Prediction and management

The Study

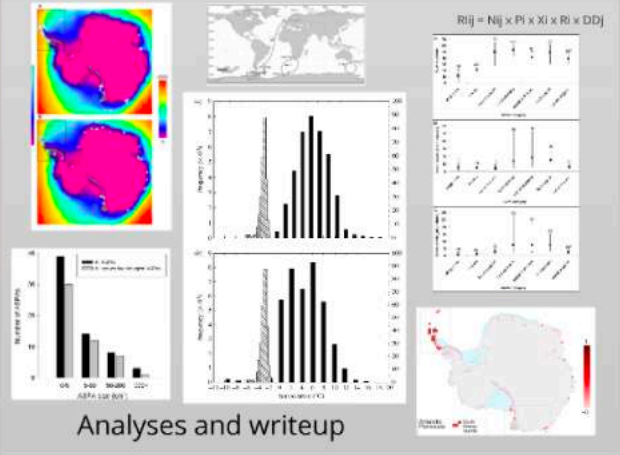


Over 850 visitors vacuumed
and propagules collected

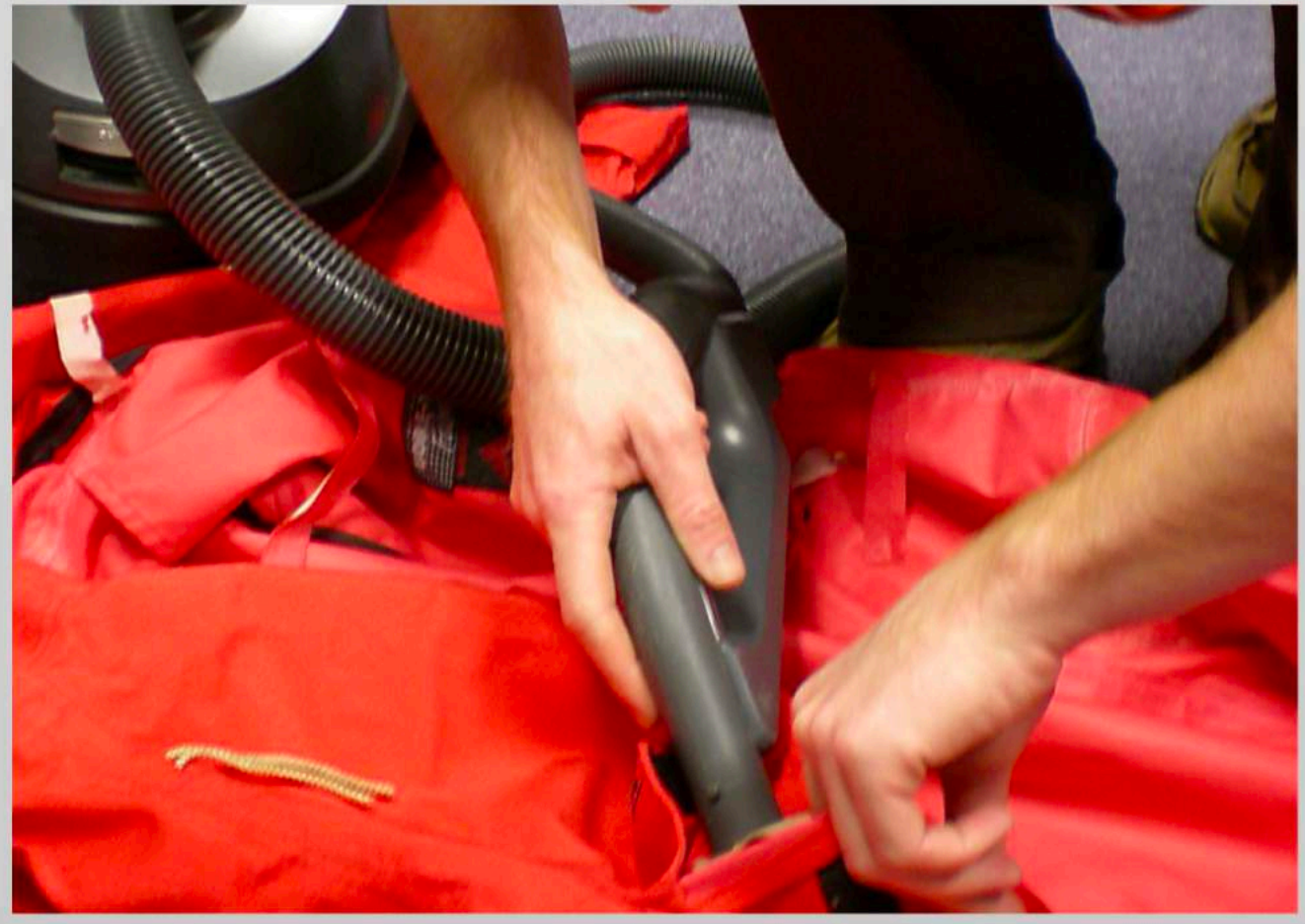
2686 seeds collected,
>80% identified to family



20 000 questionnaires, 9 languages



Analyses and writeup



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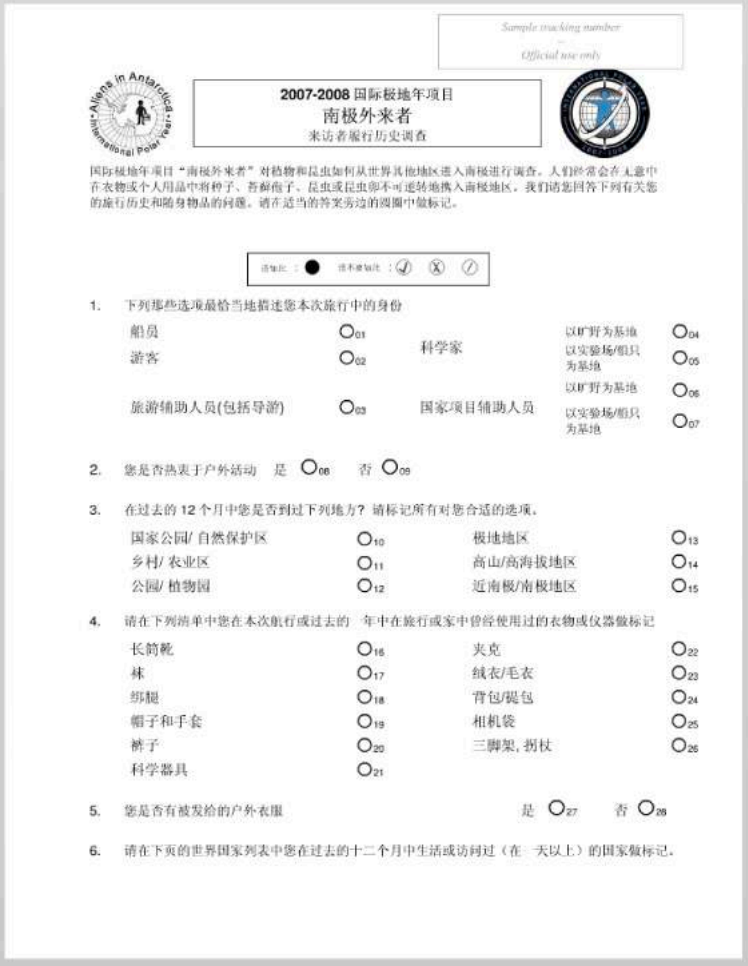


Sample tracking number
Official use only

2007-2008 国际极地年项目
南极外来者
来访者旅行历史调查

国际极地年项目“南极外来者”对植物和昆虫如何从世界其他地区进入南极进行调查。人们经常会在无意中在衣物或个人用品中将种子、苔藓孢子、昆虫或昆虫卵不可逆转地携入南极地区。我们请您回答下列有关您的旅行历史和随身物品的问题。请在适当的答案旁边的圆圈中做标记。

1. 下列哪些选项最恰当地描述您本次旅行中的身份

船员	O01	科学家	以旷野为基地	O04
游客	O02		以实验场/船只为基地	O05
			以旷野为基地	O06
旅游辅助人员(包括导游)	O03	国家项目辅助人员	以实验场/船只为基地	O07

2. 您是否热衷于户外活动 是 O08 否 O09

3. 在过去的 12 个月中您是否到过下列地方？请标记所有对您合适的选项。

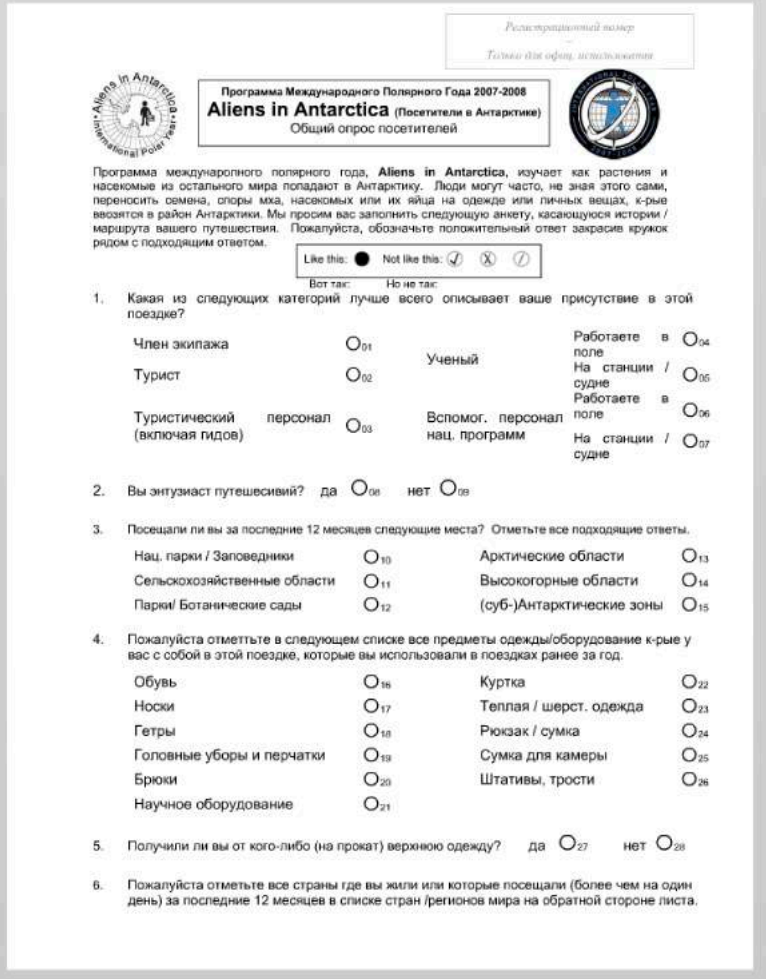
国家公园/ 自然保护区	O10	极地地区	O13
乡村/ 农业区	O11	高山/高海拔地区	O14
公园/ 植物园	O12	近南极/南极地区	O15

4. 请在下列清单中您在本次航行或过去的 一年中在旅行或家中曾经使用过的衣物或仪器做标记

长筒靴	O16	夹克	O22
袜	O17	绒衣/毛衣	O23
绑腿	O18	背包/提包	O24
帽子和手套	O19	相机袋	O25
裤子	O20	三脚架, 拐杖	O26
科学器具	O21		

5. 您是否有被发给的户外衣服 是 O27 否 O28

6. 请在下页的世界国家列表中您在过去的十二个月中生活或访问过（在一天以上）的国家做标记。



Регистрационный номер
Только для офиц. использования

Программа Международного Полярного Года 2007-2008
Aliens in Antarctica (Посетители в Антарктике)
Общий опрос посетителей

Программа международного полярного года, **Aliens in Antarctica**, изучает как растения и насекомые из остального мира попадают в Антарктику. Люди могут часто, не зная этого сами, переносить семена, споры мха, насекомых или их яйца на одежде или личных вещах, к-рые ввозятся в район Антарктики. Мы просим вас заполнить следующую анкету, касающуюся истории / маршрута вашего путешествия. Пожалуйста, обозначьте положительный ответ закрасив кружок рядом с подходящим ответом.

Like this: ● Not like this: ✓ ✗ /
Вот так: Но не так:

1. Какая из следующих категорий лучше всего описывает ваше присутствие в этой поездке?

Член экипажа	O01	Ученый	Работаете в поле	O04
Турист	O02		На станции / судне	O05
Туристический персонал (включая гидов)	O03	Вспомог. персонал нац. программ	Работаете в поле	O06
			На станции / судне	O07

2. Вы энтузиаст путешесивий? да O08 нет O09

3. Посещали ли вы за последние 12 месяцев следующие места? Отметьте все подходящие ответы.

Нац. парки / Заповедники	O10	Арктические области	O13
Сельскохозяйственные области	O11	Высокогорные области	O14
Парки/ Ботанические сады	O12	(суб-)Антарктические зоны	O15

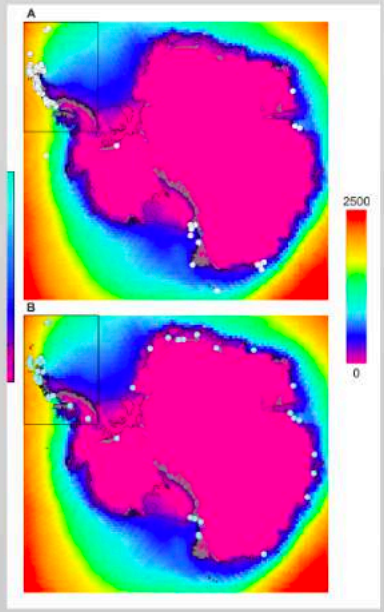
4. Пожалуйста отметьте в следующем списке все предметы одежды/оборудование к-рые у вас с собой в этой поездке, которые вы использовали в поездках ранее за год.

Обувь	O16	Куртка	O22
Носки	O17	Теплая / шерст. одежда	O23
Гетры	O18	Рюкзак / сумка	O24
Головные уборы и перчатки	O19	Сумка для камеры	O25
Брюки	O20	Штативы, трости	O26
Научное оборудование	O21		

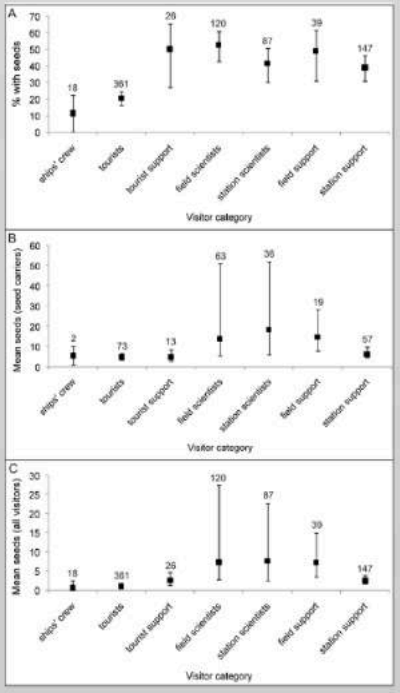
5. Получили ли вы от кого-либо (на прокат) верхнюю одежду? да O27 нет O28

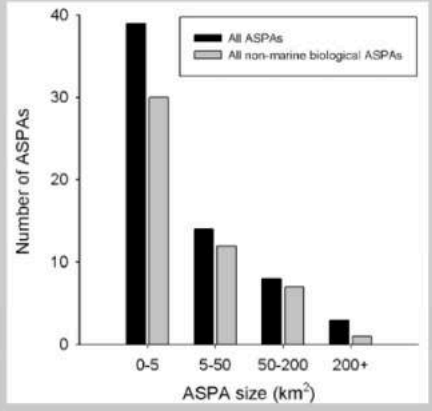
6. Пожалуйста отметьте все страны где вы жили или которые посещали (более чем на один день) за последние 12 месяцев в списке стран /регионов мира на обратной стороне листа.

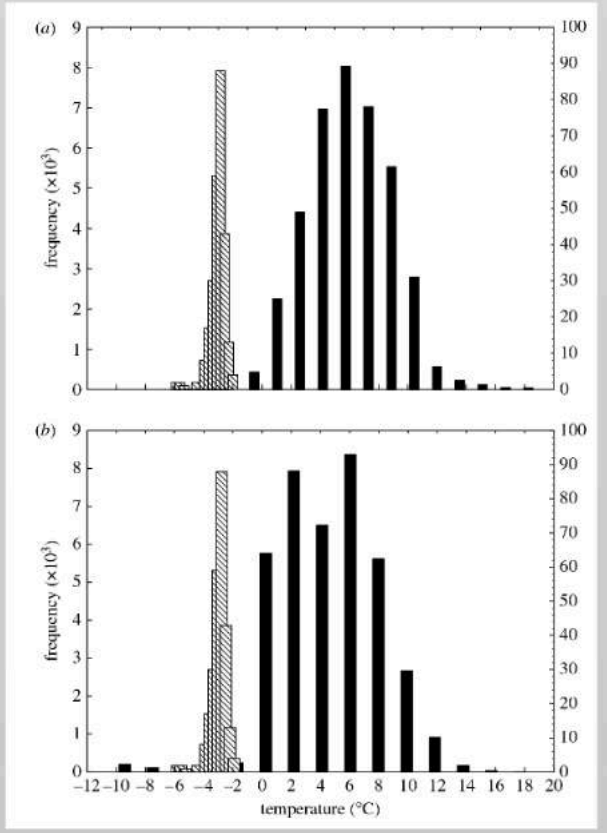
20 000 questionnaires, 9 languages

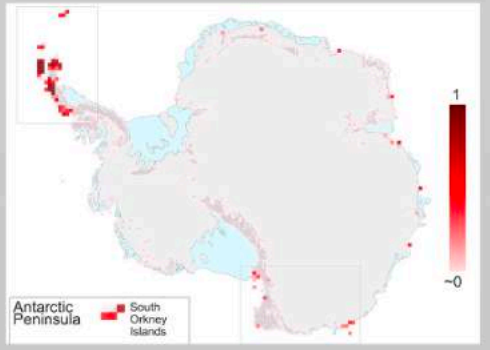


RIij = Nij x Pi x Xi x Ri x DDj

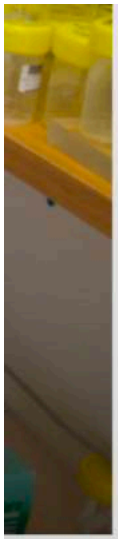




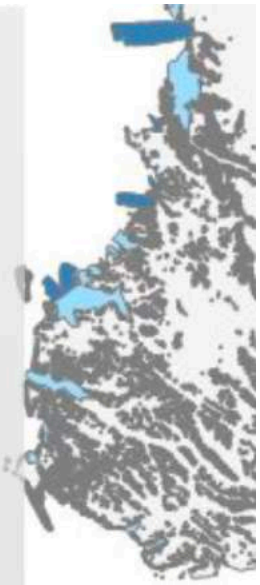




Analyses and writeup



Outcomes



Cargo

Ecological Applications, 19(7), 2009, pp. 1944–1959

Breaching the dispersal barrier to invasion: quantification and management

JENNIFER E. LEE[1] AND STEVEN L. CHOWN

Centre for Invasion Biology, Department of Botany and Zoology, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa

Antarctic Science page 1 of 9 *(2012)* © Antarctic Science Ltd 2012 doi:10.1017/S0954102012000272

Does a new transportation system increase the risk of importing non-native species to Antarctica?

MEGUMU TSUJIMOTO[1,2] and SATOSHI IMURA[1,3]

[1]*The Graduate University for Advanced Studies (SOKENDAI), 10-3, Midori-cho, Tachikawa-shi, Tokyo 190-8518, Japan*
[2]*Research Fellow of the Japan Society for the Promotion of Science, 8, Ichibancho, Chiyoda-ku, Tokyo 102-8472, Japan*
[3]*National Institute of Polar Research, 10-3, Midori-cho, Tachikawa-shi, Tokyo 190-8518, Japan*
tsujimoto@nipr.ac.jp

Seed viability

Polar Biol (2010) 33:1125–1130
DOI 10.1007/s00300-010-0801-4

ORIGINAL PAPER

Impact of anthropogenic transportation to Antarctica on alien seed viability

K. A. Hughes · J. E. Lee · C. Ware ·
K. Kiefer · D. M. Bergstrom

Transfer

Global Environmental Change 20 (2010) 96–112

Contents lists available at ScienceDirect

Global Environmental Change

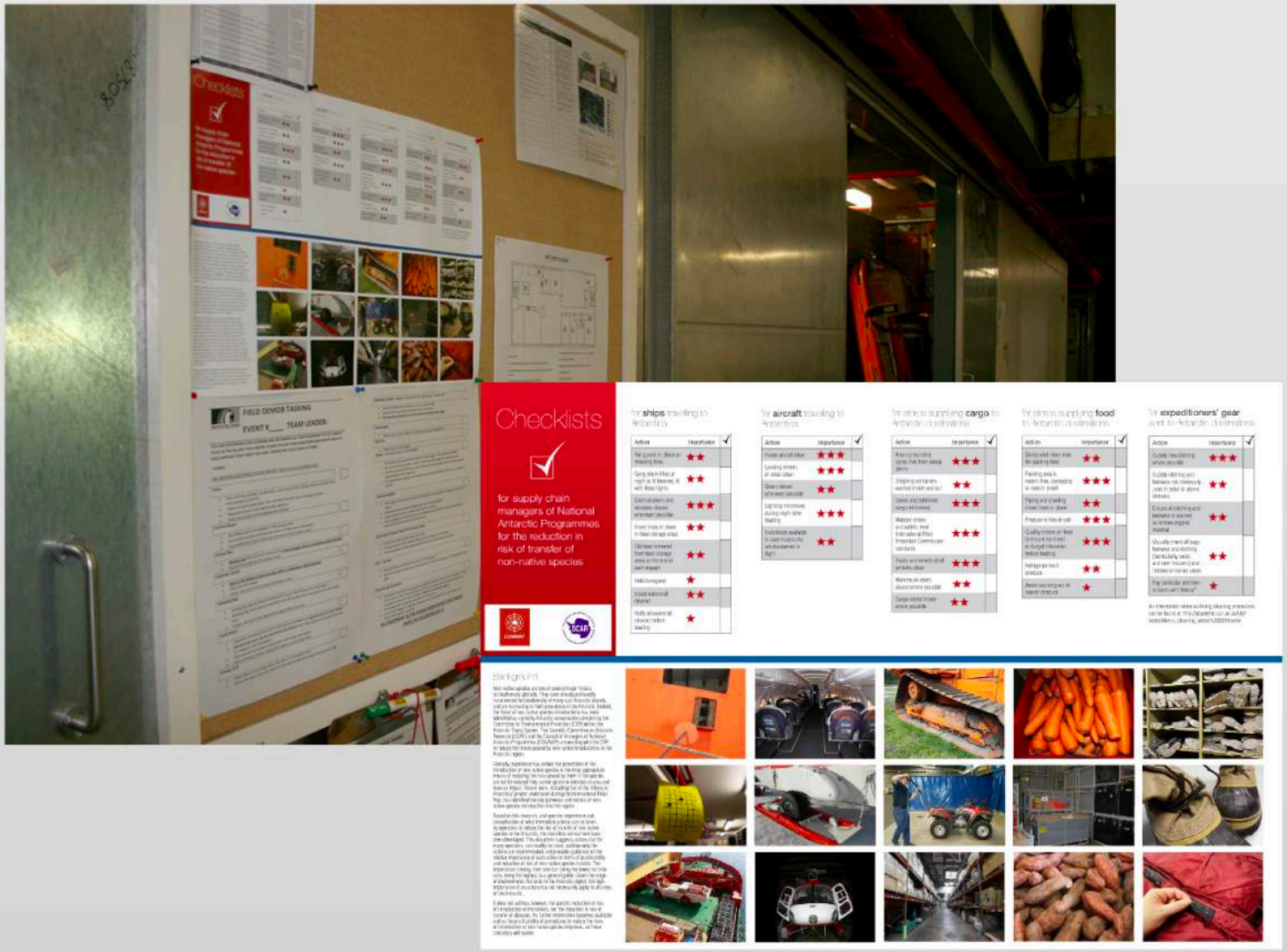
journal homepage: www.elsevier.com/locate/gloenvcha

Review

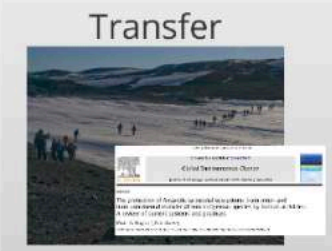
The protection of Antarctic terrestrial ecosystems from inter- and intra-continental transfer of non-indigenous species by human activities: A review of current systems and practices

Kevin A. Hughes *, Pete Convey

British Antarctic Survey, Natural Environment Research Council, High Cross, Madingley Road, Cambridge CB3 0ET, United Kingdom

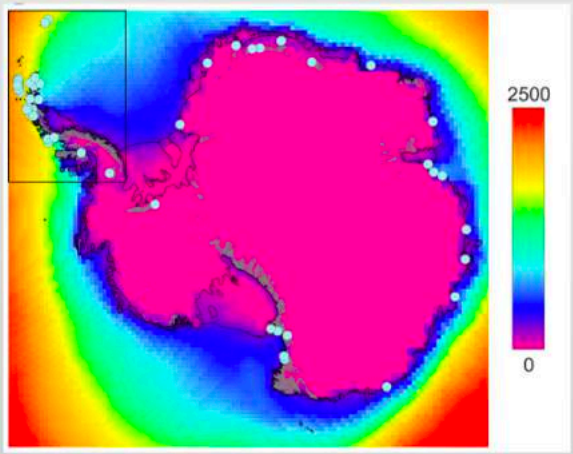

Checklists
FIELD DEMOB TASKING
EVENT #____ TEAM LEADER:
Checklists
for supply chain managers of National Antarctic Programmes for the reduction in risk of transfer of non-native species
for ships travelling to Antarctica
for aircraft travelling to Antarctica
for stations supplying cargo to Antarctic destinations
for stations supplying food to Antarctic destinations
for expeditioners' gear and to Antarctic destinations
Background


TAKE IT NEW
OR
TAKE IT
CLEAN !

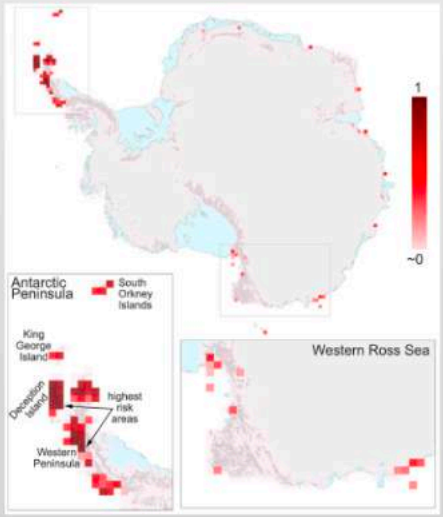


Better practices in Antarctica

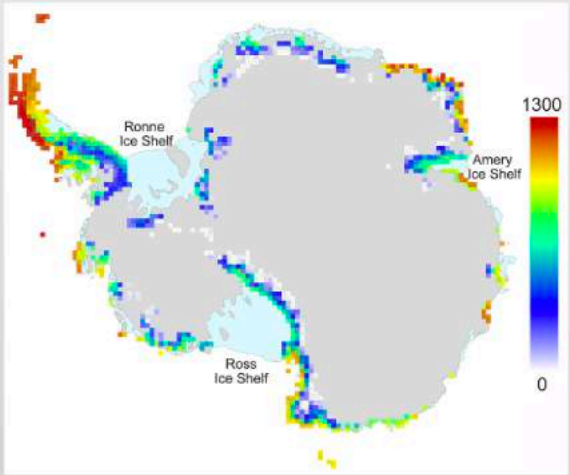
Continent-wide risk assessment



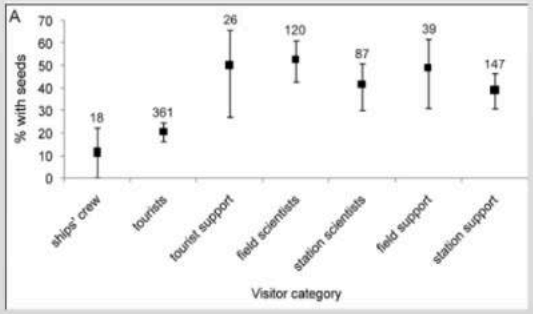
Degree days and landings



Risk Index



Predicting changes with climate



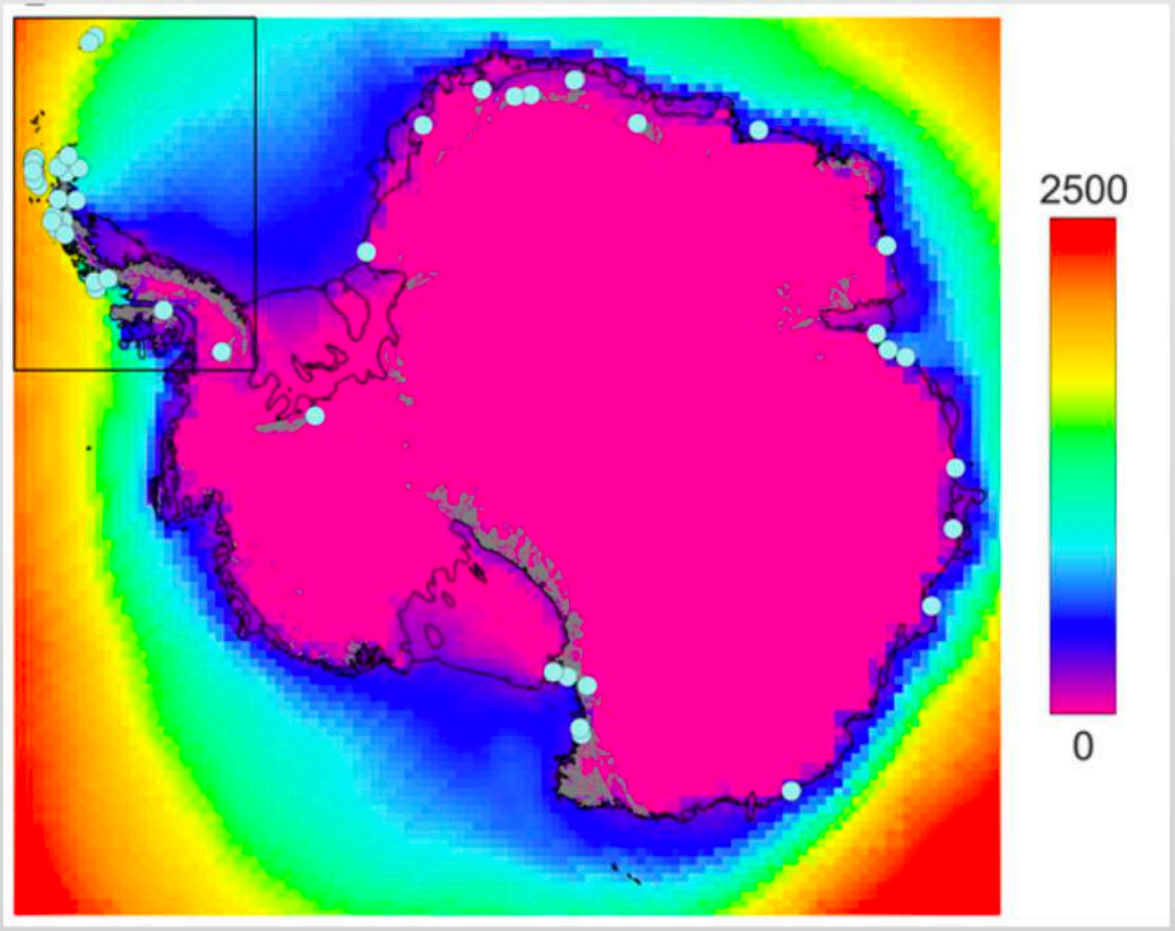
PNAS

Continent-wide risk assessment for the establishment of nonindigenous species in Antarctica

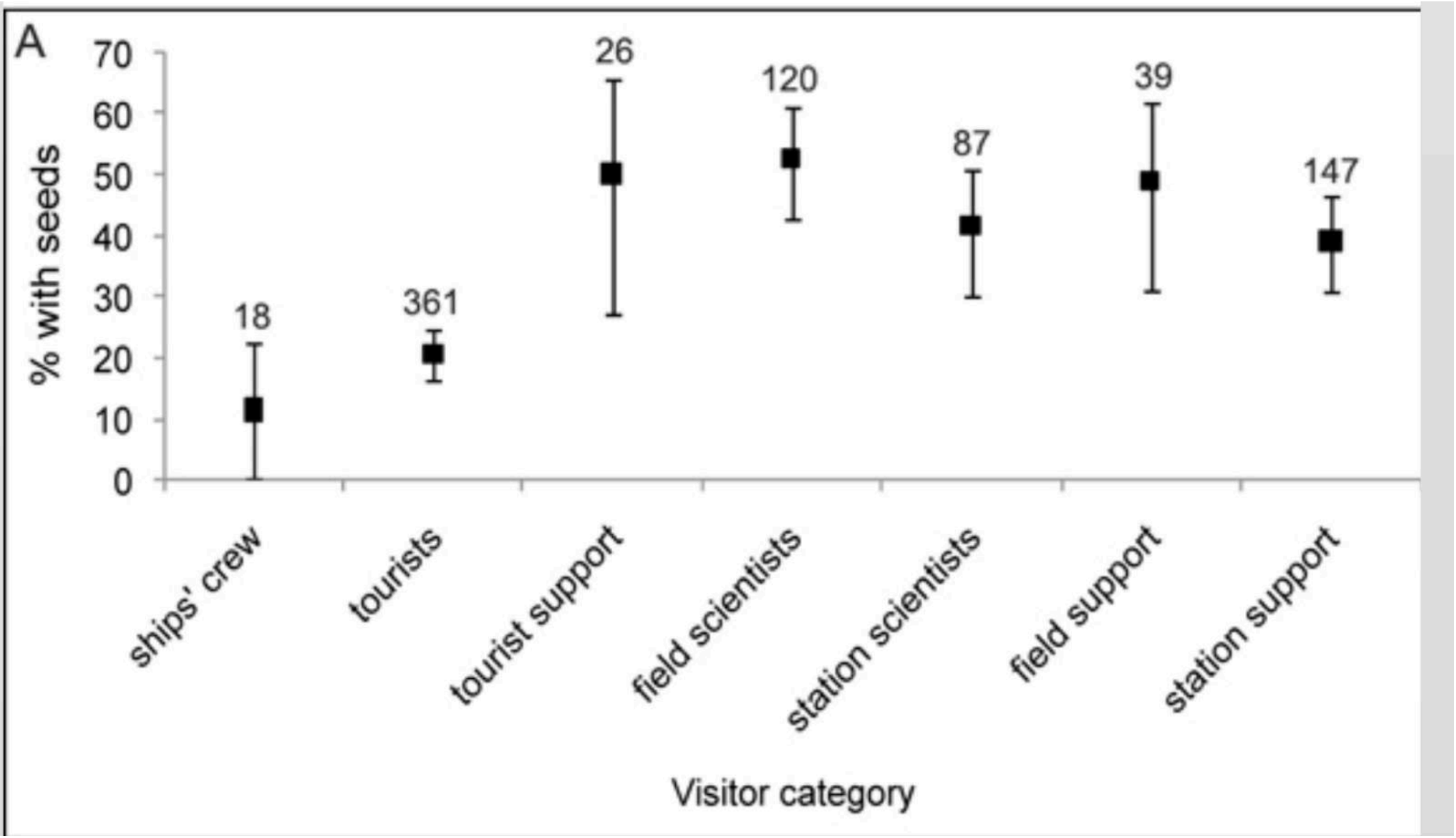
Steven L. Chown[a,1], Ad H. L. Huiskes[b], Niek J. M. Gremmen[b], Jennifer E. Lee[a], Aleks Terauds[a,c], Kim Crosbie[d], Yves Frenot[e], Kevin A. Hughes[f], Satoshi Imura[g], Kate Kiefer[c], Marc Lebouvier[h], Ben Raymond[c], Megumu Tsujimoto[i,j], Chris Ware[c], Bart Van de Vijver[k], and Dana Michelle Bergstrom[c]

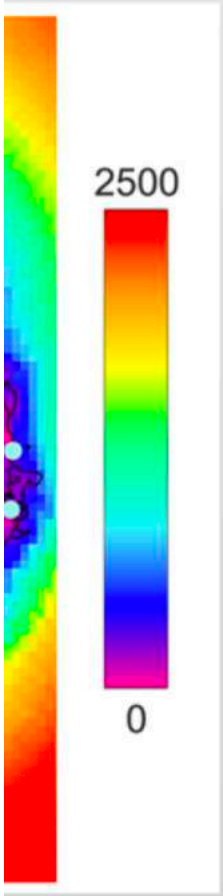
[a]Centre for Invasion Biology, Department of Botany and Zoology, Stellenbosch University, Matieland 7602, South Africa; [b]Netherlands Institute of Ecology, 4400 AC, Yerseke, The Netherlands; [c]Australian Antarctic Division, Department of Sustainability, Environment, Water, Population and Communities, Kingston 7050, Australia; [d]International Association of Antarctica Tour Operators, Providence, RI 02906; [e]French Polar Institute Paul Emile Victor, 29280 Plouzané, France; [f]British Antarctic Survey, Natural Environment Research Council, High Cross, Cambridge CB3 0ET, United Kingdom; [g]National Institute of Polar Research, Tokyo 190-8518, Japan; [h]Station Biologique, Unité Mixte de Recherche Ecobio Centre National de la Recherche Scientifique–Université de Rennes 1, 35380 Paimpont, France; [i]Graduate University for Advanced Studies, Tachikawa, Tokyo 190-8518, Japan; [j]Japan Society for the Promotion of Science, Tokyo 102-8472, Japan; and [k]National Botanic Garden of Belgium, Domein van Bouchout, B-1860 Meise, Belgium

Edited by Peter M. Vitousek, Stanford University, Stanford, CA, and approved January 30, 2012 (received for review December 1, 2011)

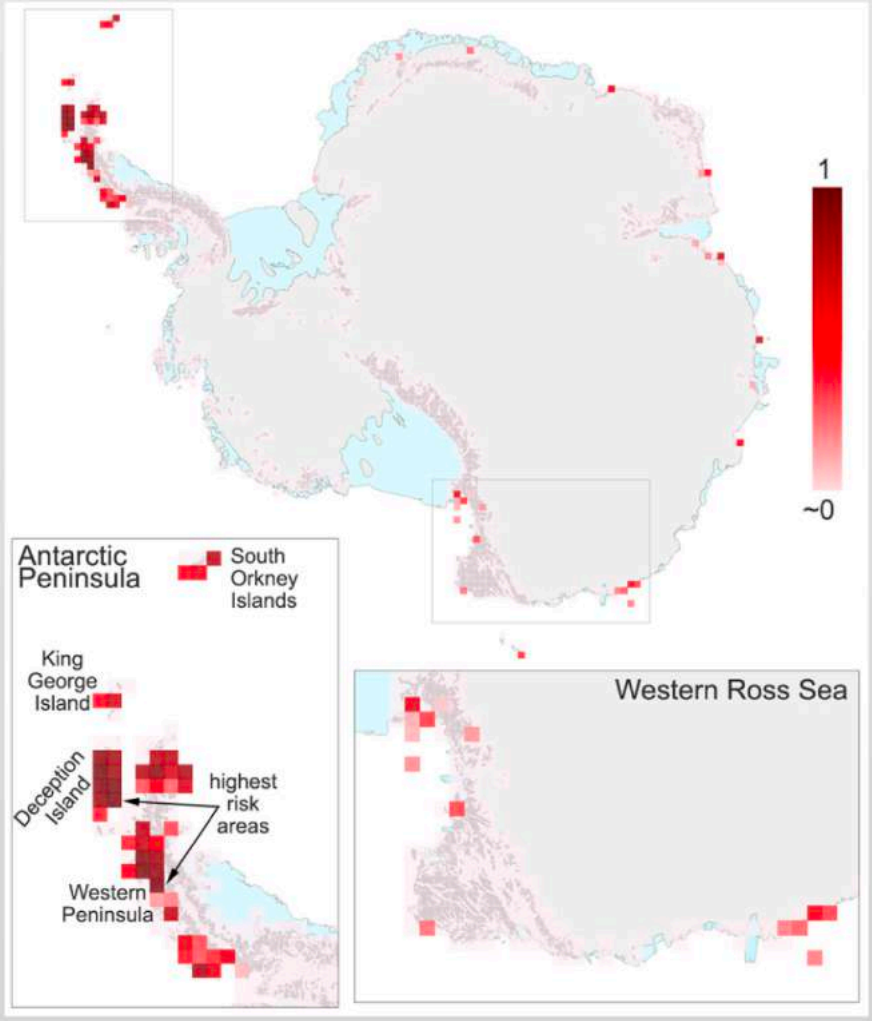


Degree days and landings

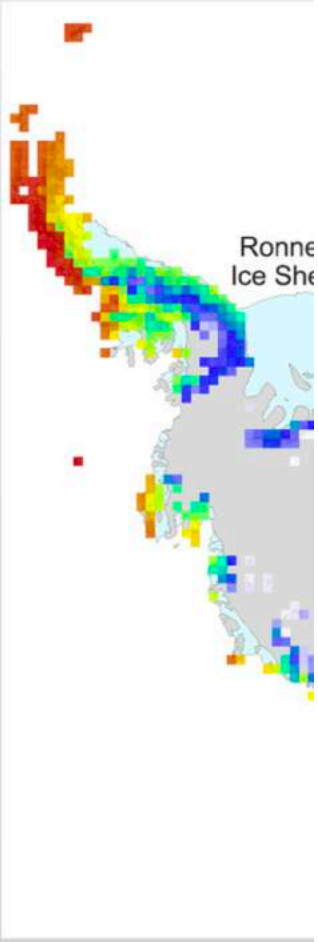

A
% with seeds
70
60
50
40
30
20
10
0
18
361
26
120
87
39
147
ships' crew
tourists
tourist support
field scientists
station scientists
field support
station support
Visitor category



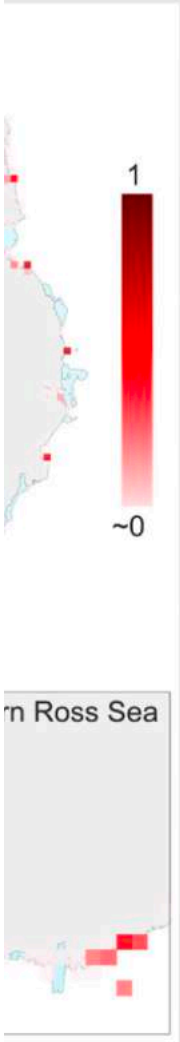
ngs

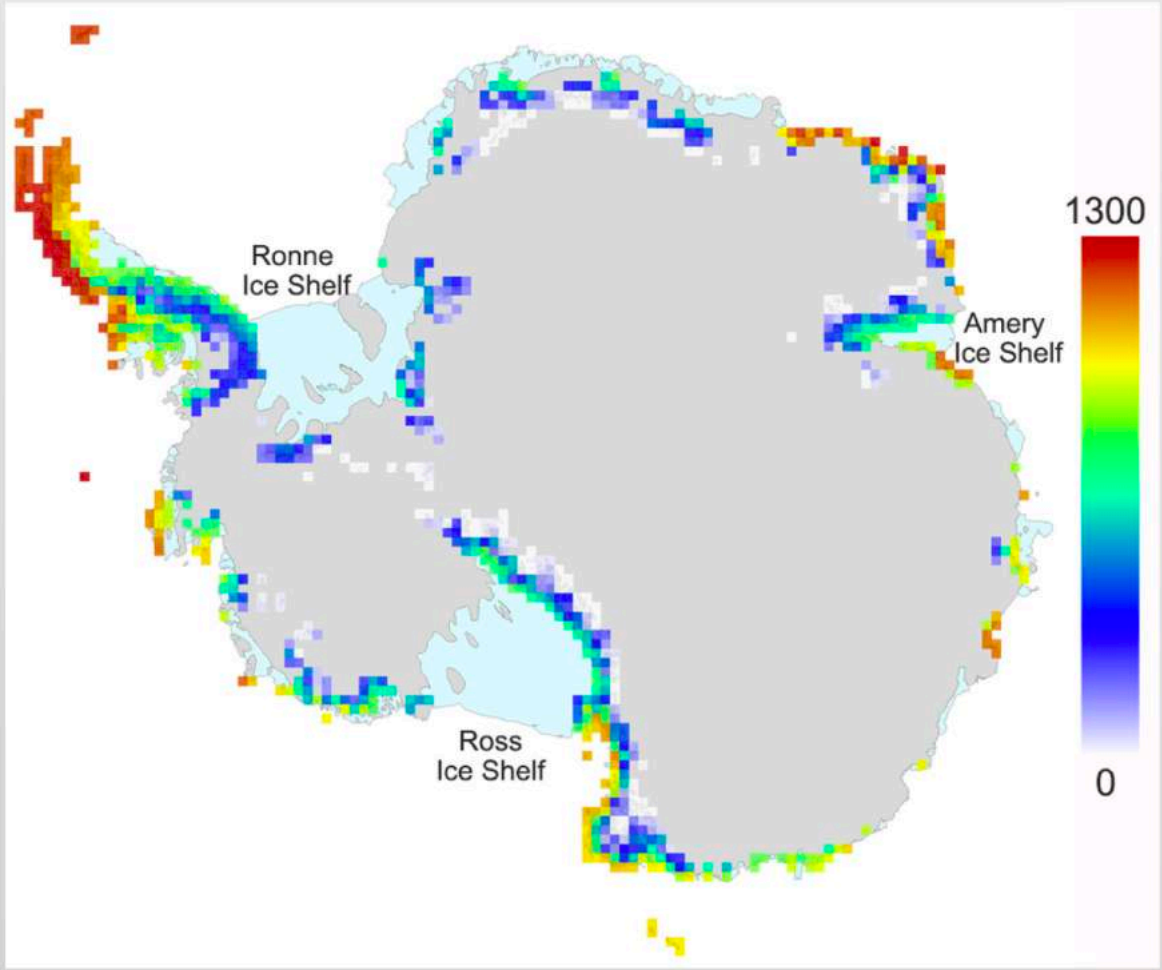


Risk Index



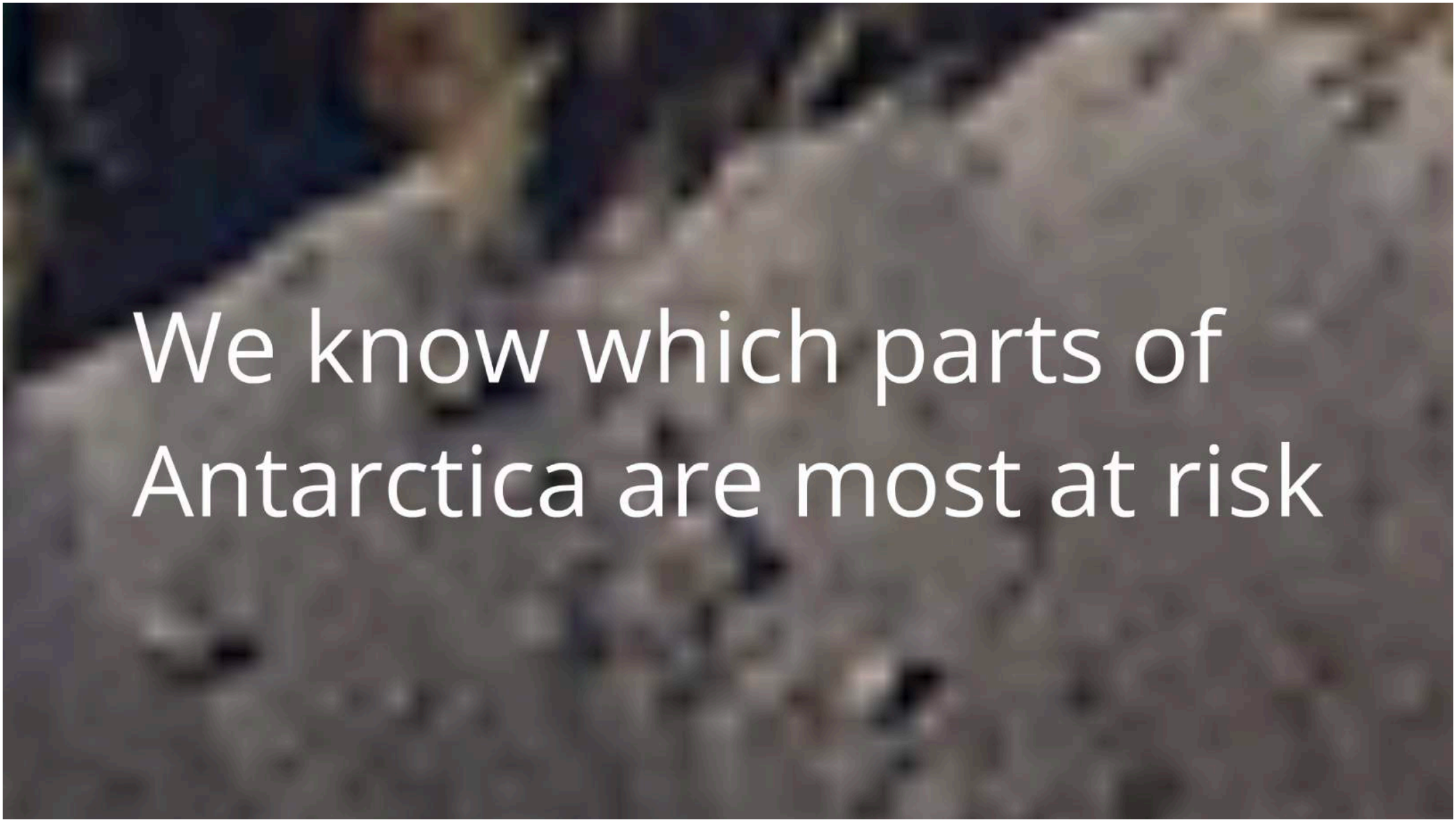
Predictin



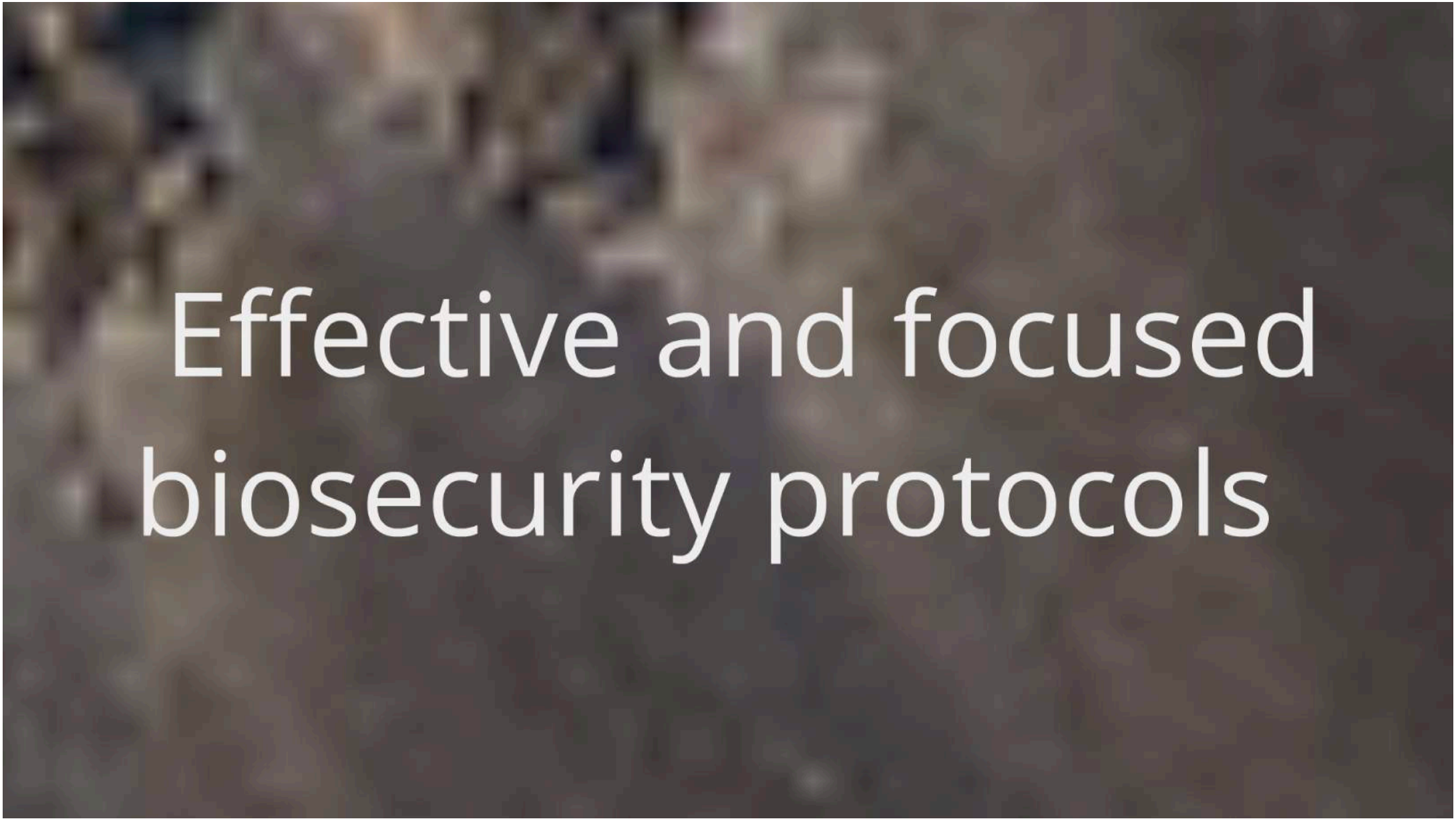


Predicting changes with climate

Implications

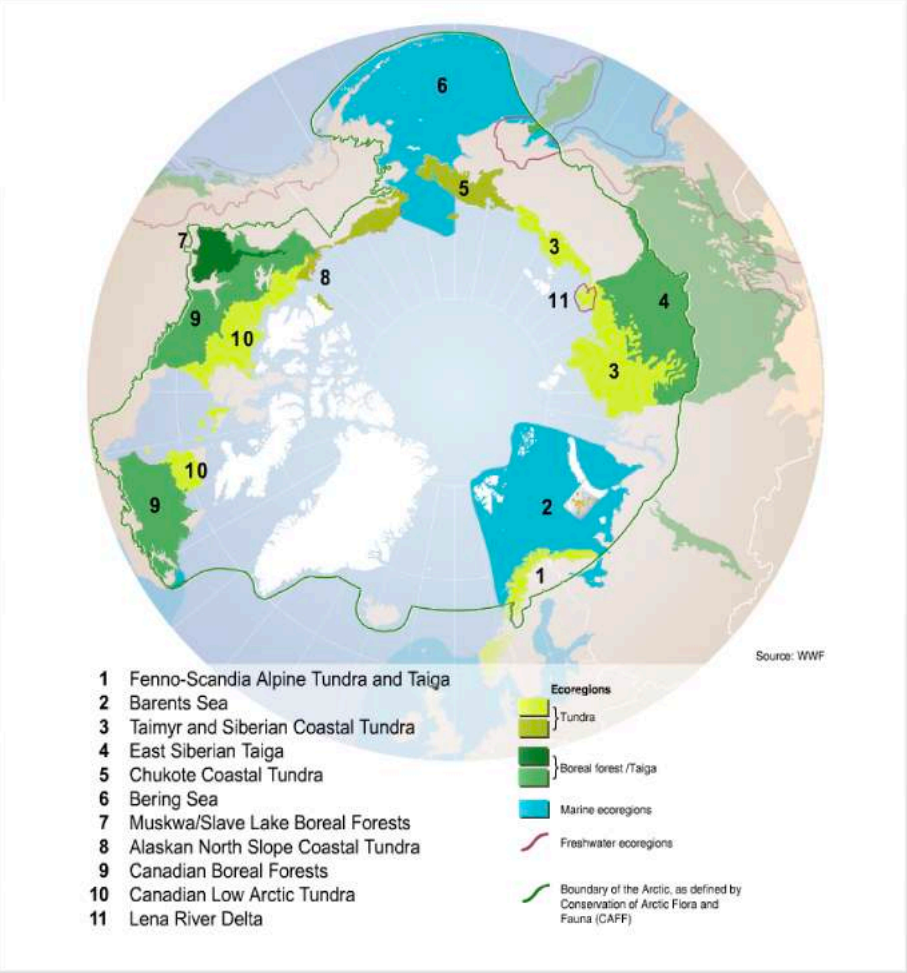

We know which parts of
Antarctica are most at risk

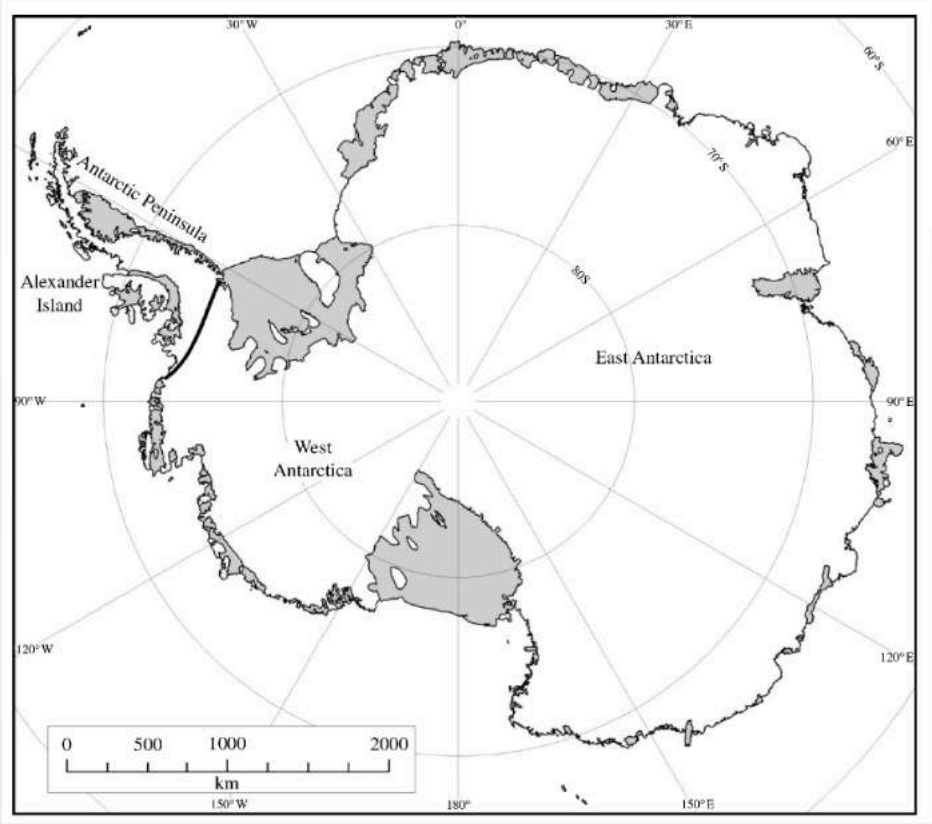

We have a better understanding
of the pathways of risk

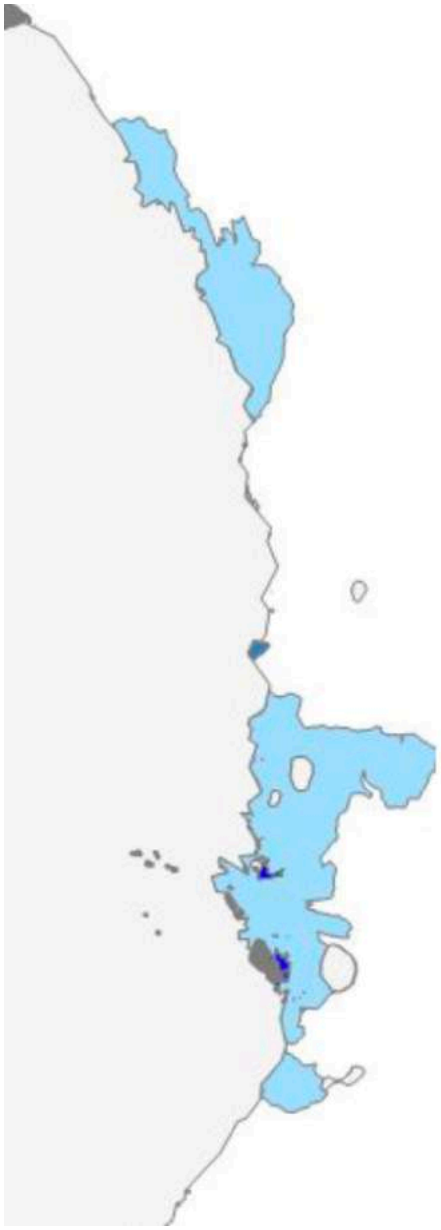

Effective and focused
biosecurity protocols

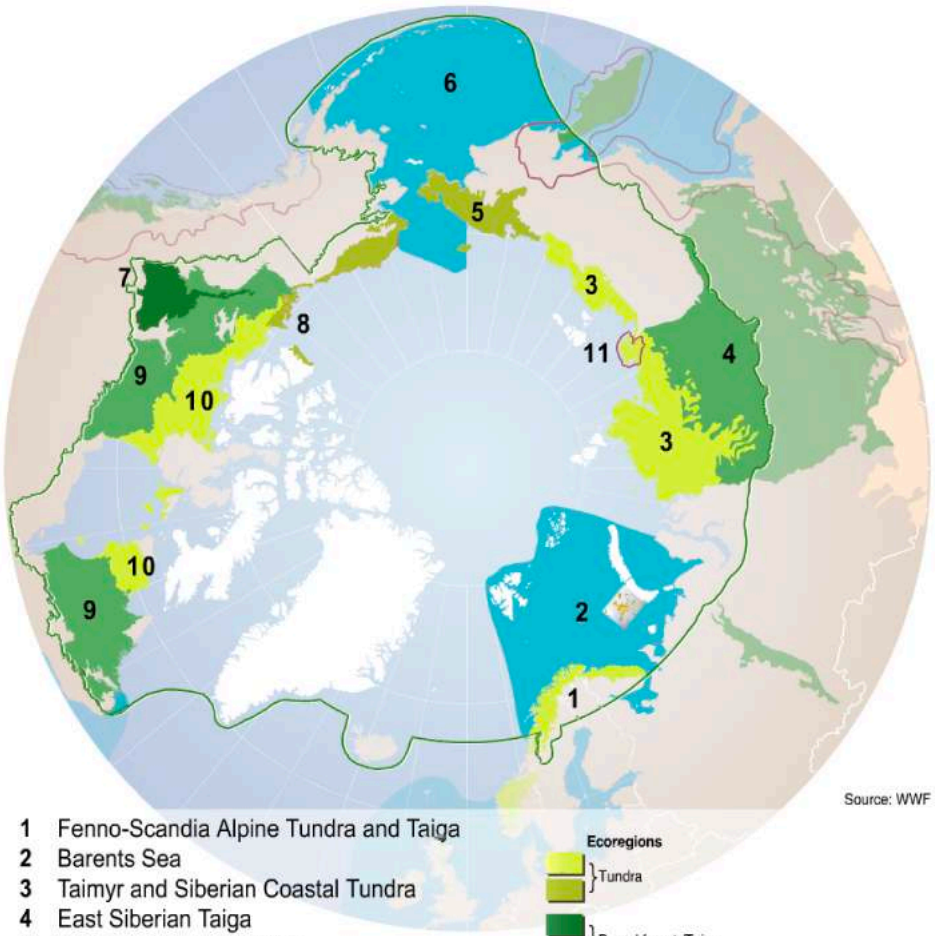

As climate changes, the risk of
establishment will increase

Bioregions


6
5
7
8
3
11
4
9
10
3
10
9
2
1
Source: WWF
1 Fenno-Scandia Alpine Tundra and Taiga
2 Barents Sea
3 Taimyr and Siberian Coastal Tundra
4 East Siberian Taiga
5 Chukote Coastal Tundra
6 Bering Sea
7 Muskwa/Slave Lake Boreal Forests
8 Alaskan North Slope Coastal Tundra
9 Canadian Boreal Forests
10 Canadian Low Arctic Tundra
11 Lena River Delta
Ecoregions
Tundra
Boreal forest /Taiga
Marine ecoregions
Freshwater ecoregions
Boundary of the Arctic, as defined by Conservation of Arctic Flora and Fauna (CAFF)


30° W
0°
30° E
60° S
60° E
70° S
80S
Antarctic Peninsula
Alexander Island
East Antarctica
90° W
90° E
West Antarctica
120° W
120° E
0
500
1000
2000
km
150° W
180°
150° E

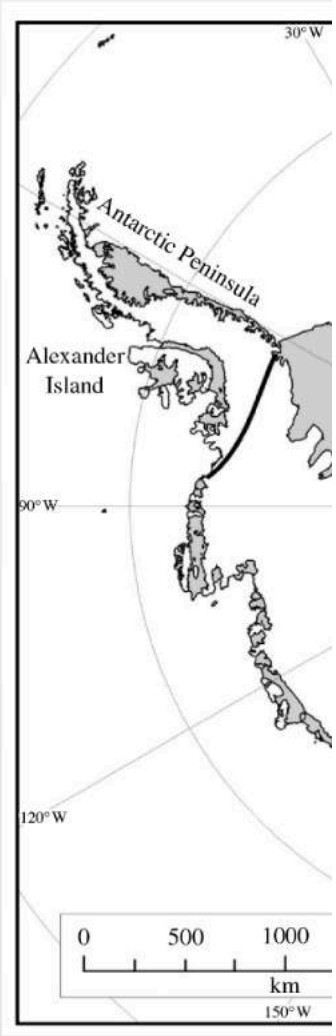


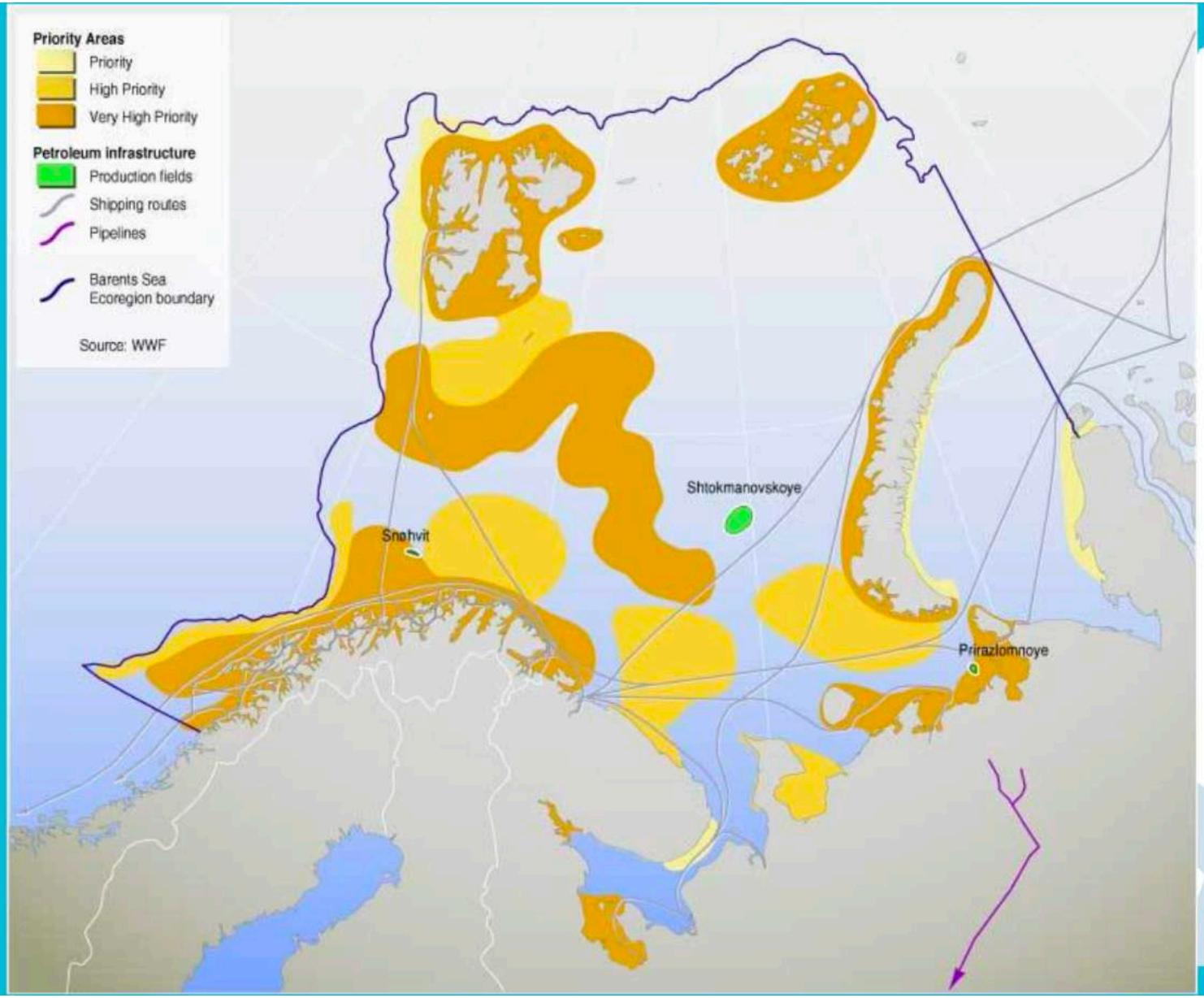


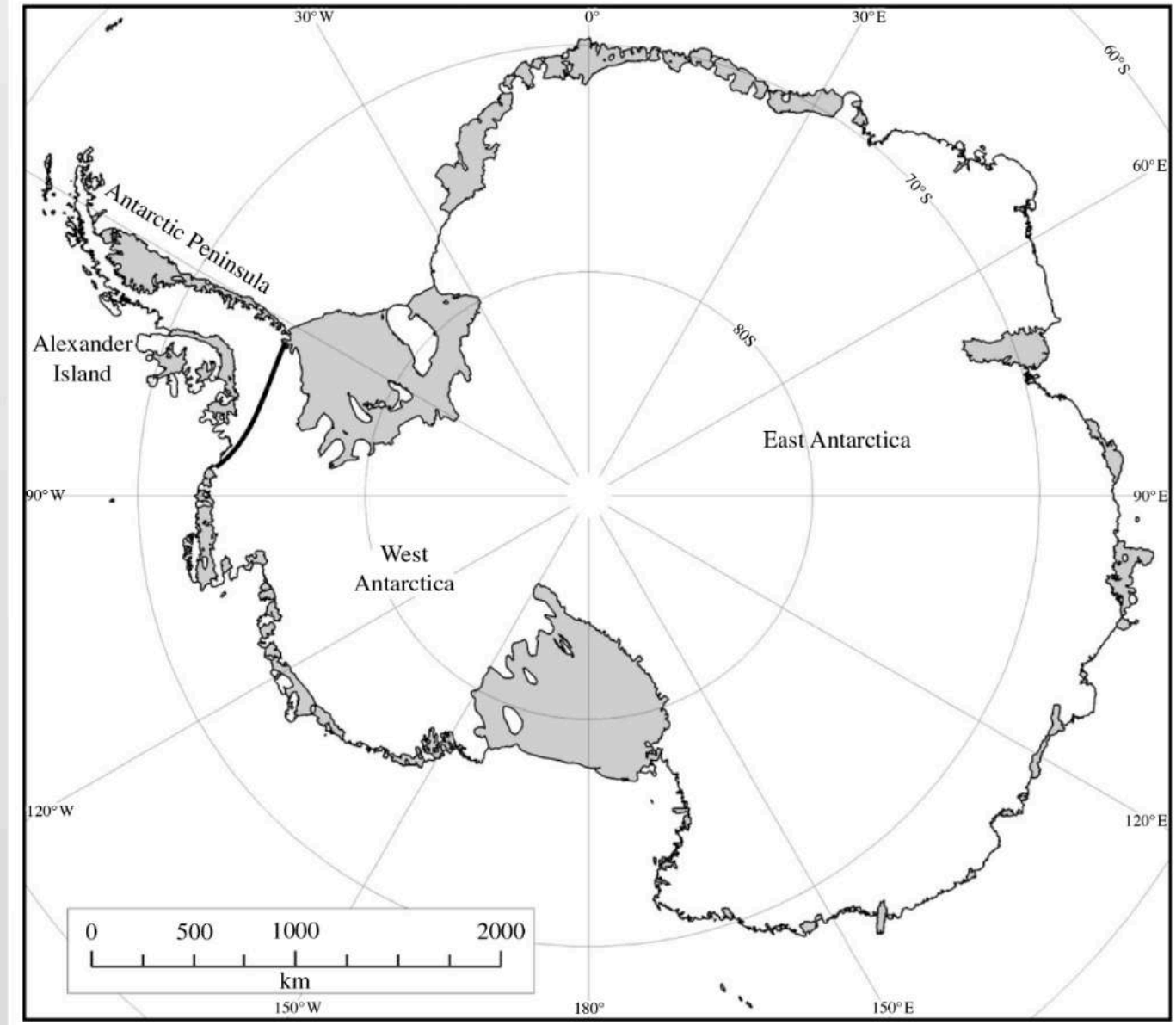
1 Fenno-Scandia Alpine Tundra and Taiga
2 Barents Sea
3 Taimyr and Siberian Coastal Tundra
4 East Siberian Taiga
5 Chukote Coastal Tundra
6 Bering Sea
7 Muskwa/Slave Lake Boreal Forests
8 Alaskan North Slope Coastal Tundra
9 Canadian Boreal Forests
10 Canadian Low Arctic Tundra
11 Lena River Delta

Source: WWF

Ecoregions
Tundra
Boreal forest /Taiga
Marine ecoregions
Freshwater ecoregions
Boundary of the Arctic, as defined by Conservation of Arctic Flora and Fauna (CAFF)




Priority Areas
Priority
High Priority
Very High Priority
Petroleum infrastructure
Production fields
Shipping routes
Pipelines
Barents Sea Ecoregion boundary
Source: WWF
Shtokmanovskoye
Snøhvit
Prirazlomnoye


30° W
0°
30° E
60° S
60° E
70° S
80S
Antarctic Peninsula
Alexander Island
East Antarctica
90° W
90° E
West Antarctica
120° W
120° E
0
500
1000
2000
km
150° W
180°
150° E

e: WWF

BIODIVERSITY RESEARCH

Conservation biogeography of the Antarctic

Aleks Terauds[1,2]*, Steven L. Chown[1,†], Fraser Morgan[3], Helen J. Peat[4], David J. Watts[2,‡], Harry Keys[5], Peter Convey[4] and Dana M. Bergstrom[2]

Diversity and Distributions

A Journal of Conservation Biogeography

Conservation biogeography of the Antarctic

Aim

To present a synthesis of past biogeographic analyses and a new approach based on spatially explicit biodiversity information for the Antarctic region to identify biologically distinct areas in need of representation in a protected area network.

Location

Antarctica and the sub-Antarctic.

Methods

We reviewed and summarized published biogeographic studies of the Antarctic. We then developed a biogeographic classification for terrestrial conservation planning in Antarctica by combining the most comprehensive source of Antarctic biodiversity data available with three spatial frameworks: (1) a 200-km grid, (2) a set of areas based on physical parameters known as the environmental domains of Antarctica and (3) expert-defined bioregions. We used these frameworks, or combinations thereof, together with multivariate techniques to identify biologically distinct areas.

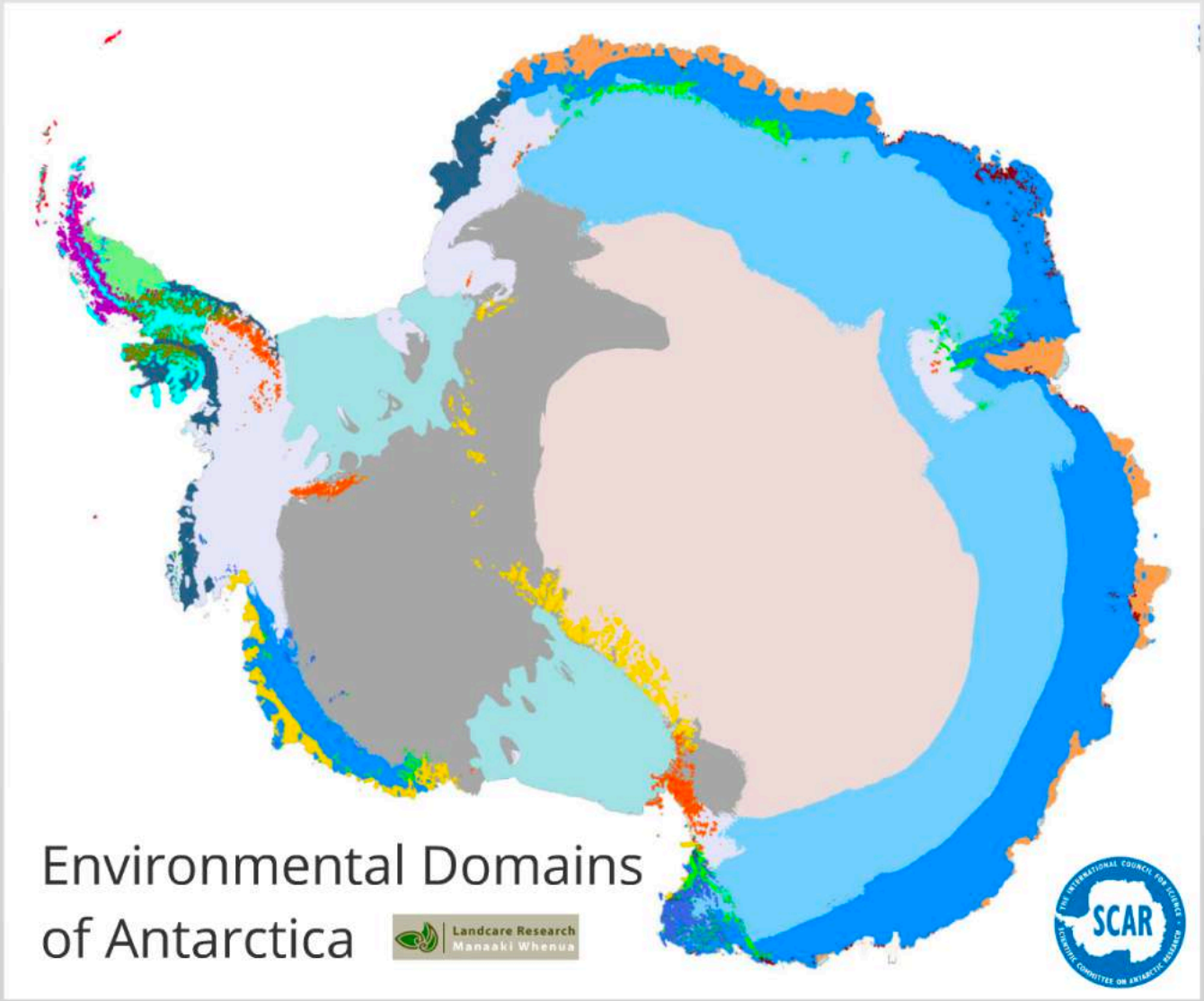
Results

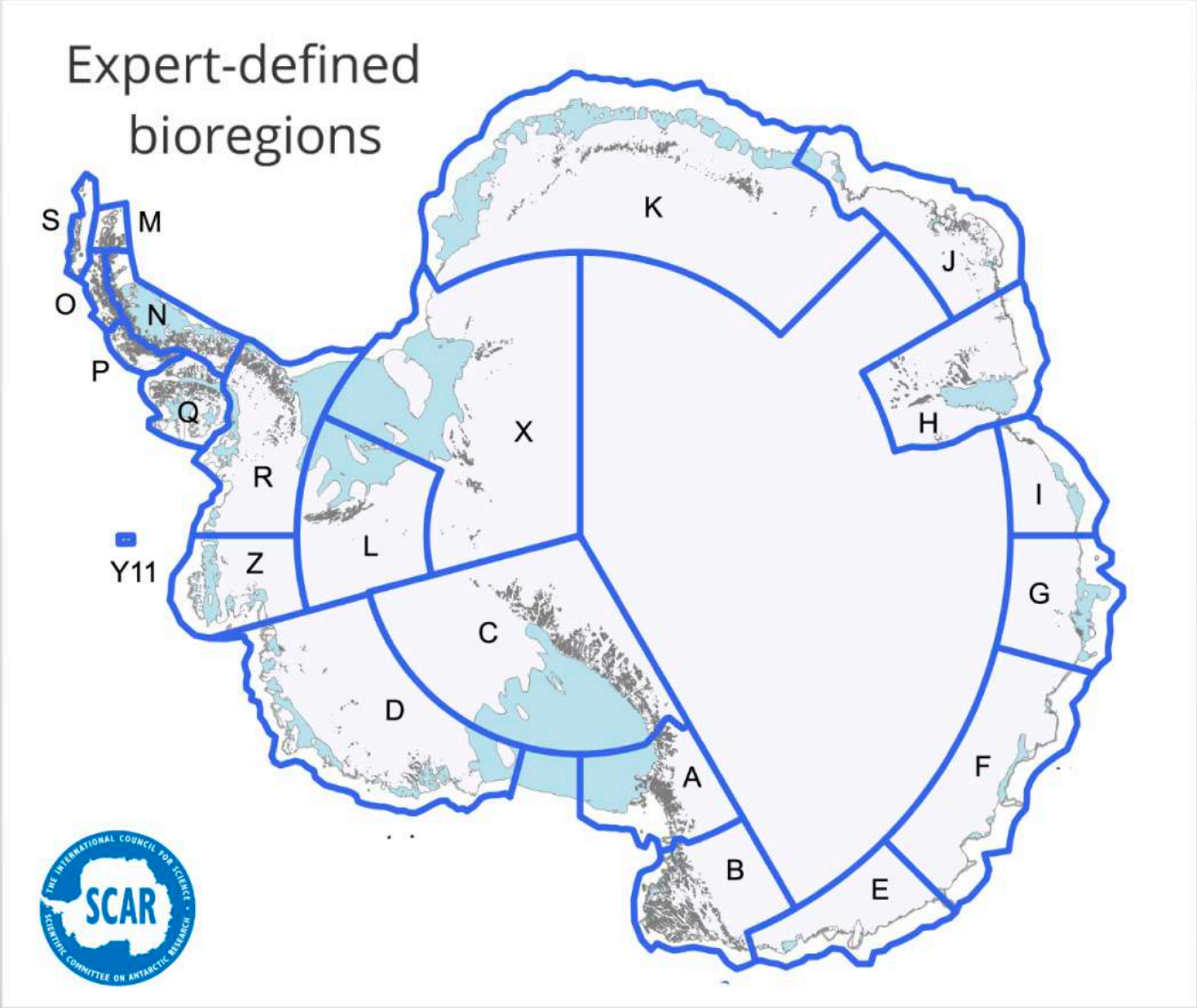
Early studies of continental Antarctica typically described broad bioregions, with the Antarctic Peninsula usually identified as biologically distinct from continental Antarctica; later studies suggested a more complex biogeography. Increasing complexity also characterizes the sub-Antarctic and marine realms, with differences among studies often attributable to the focal taxa. Using the most comprehensive terrestrial data available and by combining the groups formed by the environmental domains and expert-defined bioregions, we were able to identify 15 biologically distinct, ice-free, Antarctic Conservation Biogeographic Regions (ACBRs), encompassing the continent and close lying islands.

Main conclusions

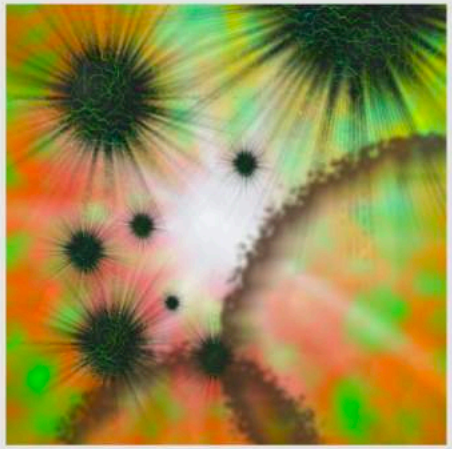
Ice-free terrestrial Antarctica comprises several distinct bioregions that are not fully represented in the current Antarctic Specially Protected Area network. Biosecurity measures between these ACBRs should also be developed to prevent biotic homogenization in the region.

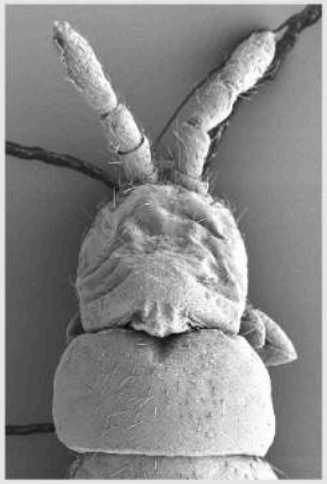
One of the co-authors of this paper, Aleks Terauds, will be presenting the SCAR lecture on June 13th as part of the 35th Antarctic Treaty Consultative Meeting. The title of the talk will be, 'Aliens in Antarctica'

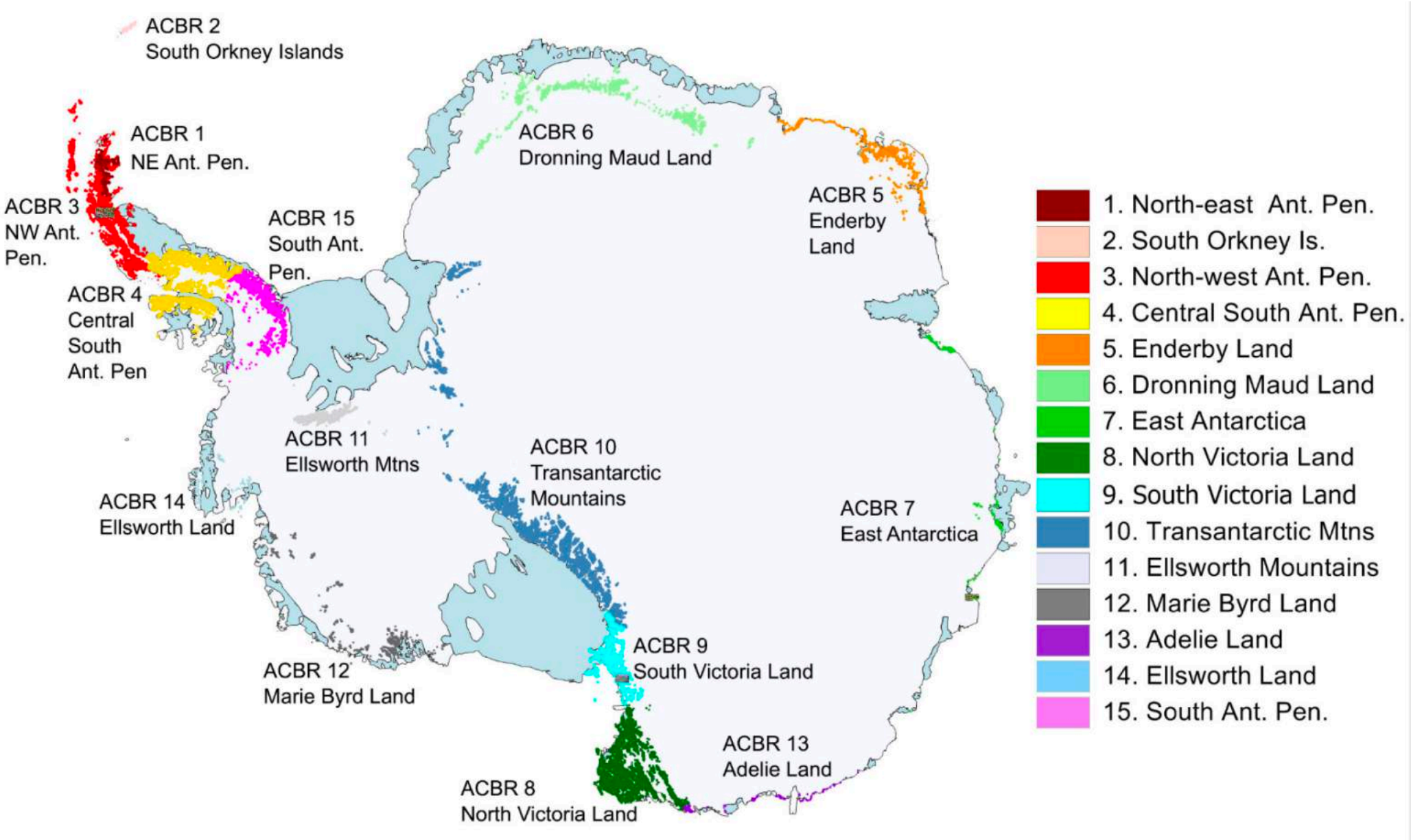

Environmental Domains
of Antarctica
Landcare Research
Manaaki Whenua
SCAR


Expert-defined bioregions
S
M
O
N
P
Q
R
Y11
Z
L
X
K
J
H
I
G
C
D
A
B
E
F
SCAR
THE INTERNATIONAL COUNCIL FOR SCIENCE
SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH

+biodiversity






ACBR 2
South Orkney Islands
ACBR 1
NE Ant. Pen.
ACBR 3
NW Ant.
Pen.
ACBR 4
Central
South
Ant. Pen
ACBR 15
South Ant.
Pen.
ACBR 6
Dronning Maud Land
ACBR 5
Enderby
Land
ACBR 11
Ellsworth Mtns
ACBR 10
Transantarctic
Mountains
ACBR 14
Ellsworth Land
ACBR 7
East Antarctica
ACBR 9
South Victoria Land
ACBR 12
Marie Byrd Land
ACBR 13
Adelie Land
ACBR 8
North Victoria Land
1. North-east Ant. Pen.
2. South Orkney Is.
3. North-west Ant. Pen.
4. Central South Ant. Pen.
5. Enderby Land
6. Dronning Maud Land
7. East Antarctica
8. North Victoria Land
9. South Victoria Land
10. Transantarctic Mtns
11. Ellsworth Mountains
12. Marie Byrd Land
13. Adelie Land
14. Ellsworth Land
15. South Ant. Pen.


Pete Convey/B

The Future

Aliens in Antarctica

Biodiversity

Visitors

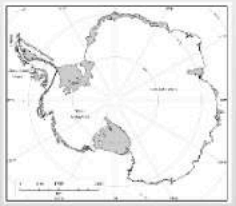
Threats

Research

Outcomes

The Future

Bioregions



Implications

THE INTERNATIONAL COUNCIL FOR SCIENCE
SCAR
SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH

COMNAP
Council of Managers of National Antarctic Programs