CANADA FOUNDATION FOR INNOVATION

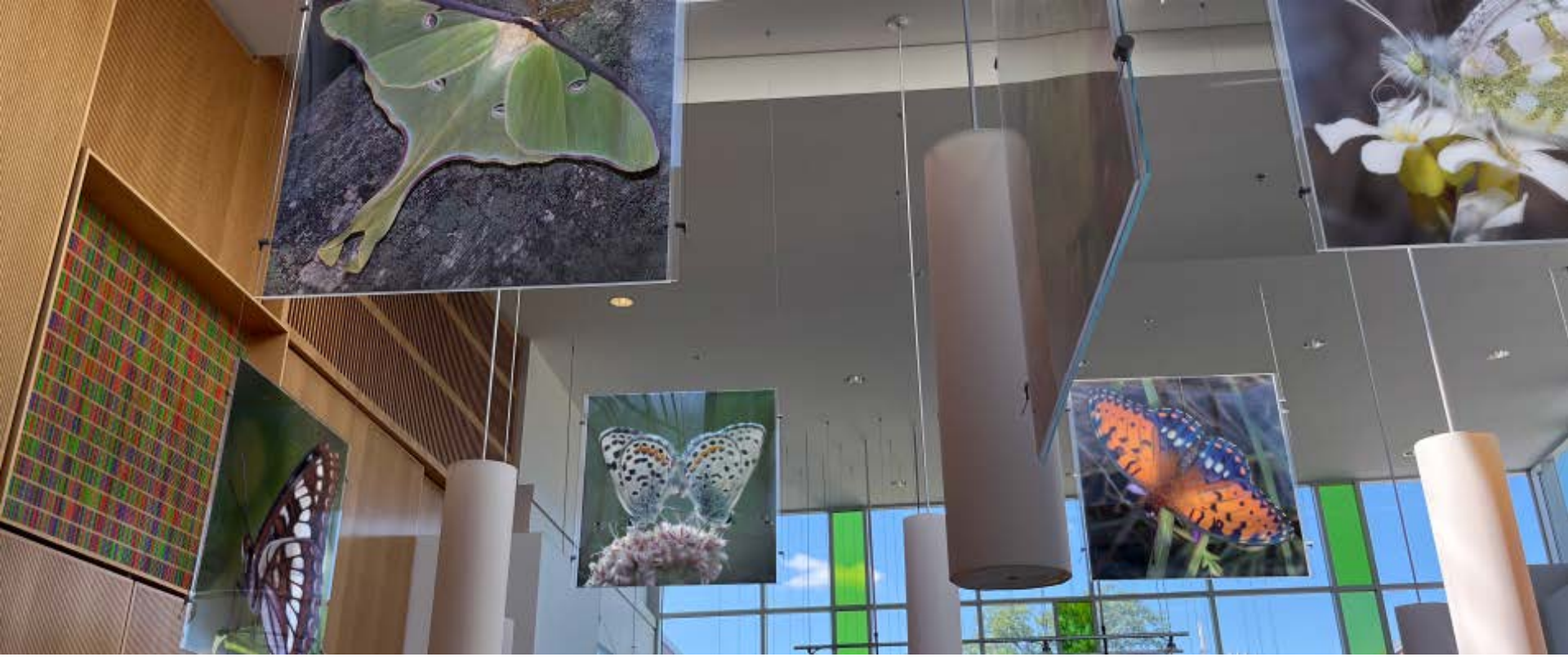
MSIF Workshop Panel 1

Diversifying and expanding facility user bases to optimize benefits for Canada / Diversifier et augmenter le nombre d'utilisateurs et utilisatrices des installations afin d'optimizer les retombées pour le Canada

Moderator: Volker Gerdts, Director & CEO, VIDO
Monique Albert, Chief Operating Officer, CBG
Jodi Cooley, Executive Director, SNOLAB
Alexandre Forest, Executive Director & COO, Amundsen Science

November 2, 2023

INNOVATION
Canada Foundation for Innovation
Fondation canadienne pour l'innovation



UNIVERSITY of GUELPH

IMPROVE LIFE.

Centre for Biodiversity Genomics

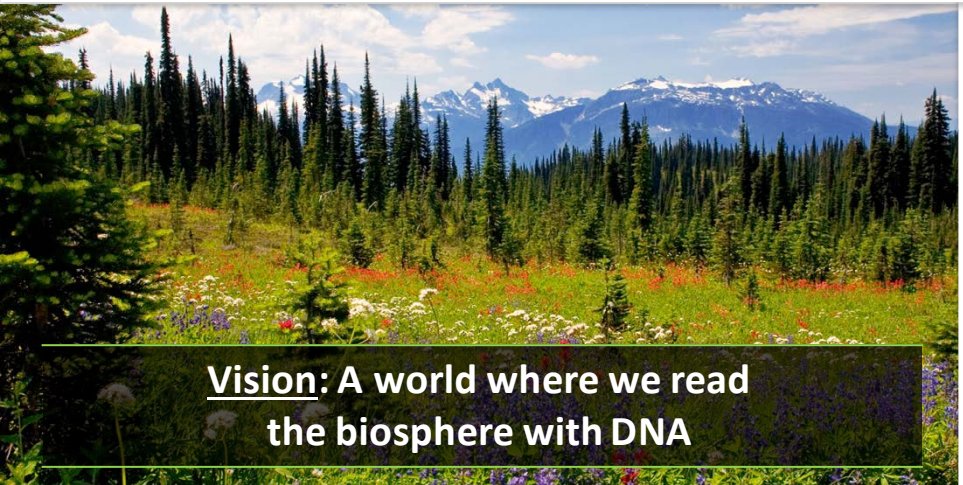
2023 MSIF Workshop

Monique Albert, COO

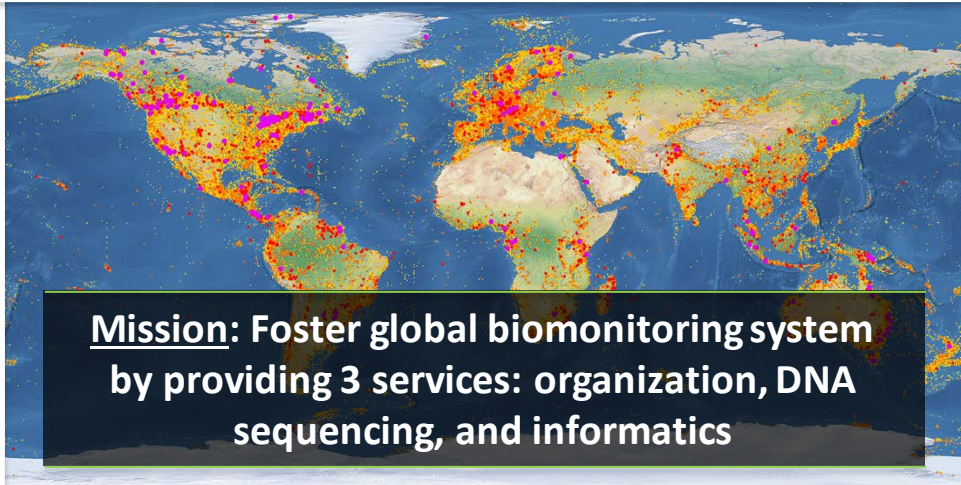
Introduction: Centre for Biodiversity Genomics

2005: Established as founding unit in the Biodiversity Institute of Ontario

2022: Transitioned to a separate University Research Centre



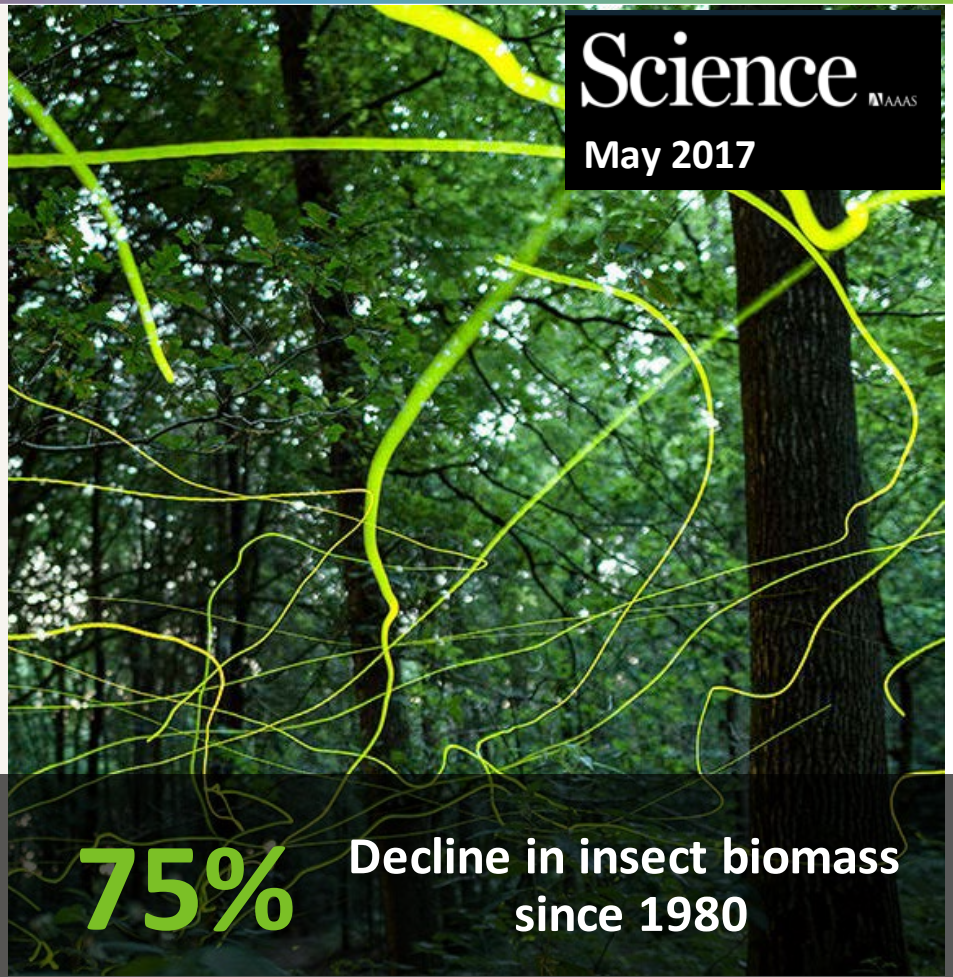
Vision: A world where we read the biosphere with DNA



Mission: Foster global biomonitoring system by providing 3 services: organization, DNA sequencing, and informatics

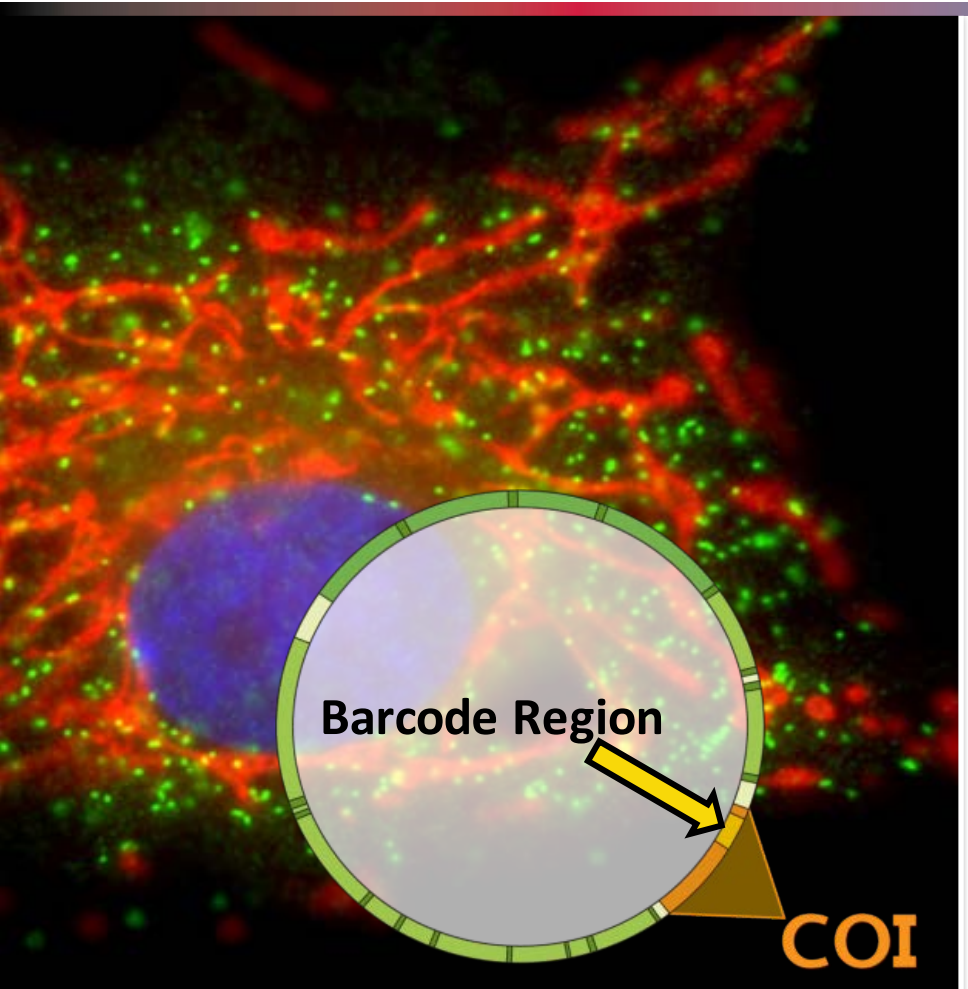
Introduction: The Motivation

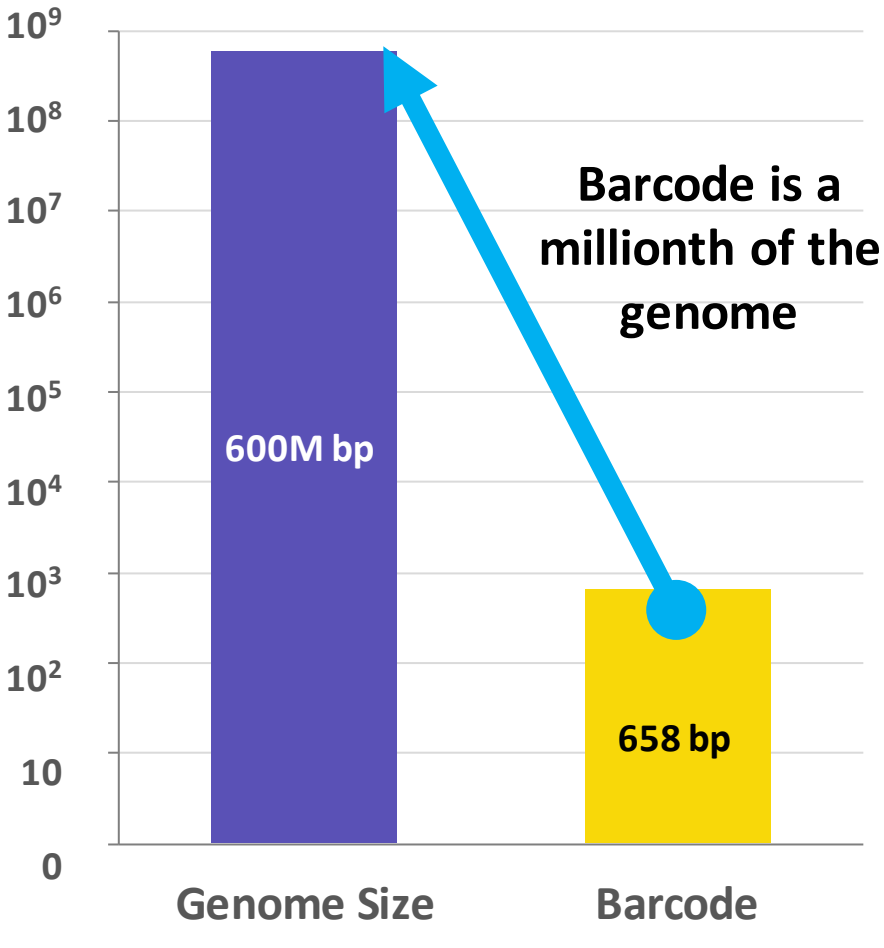
60% Decline in 3000 vertebrate species since 1970



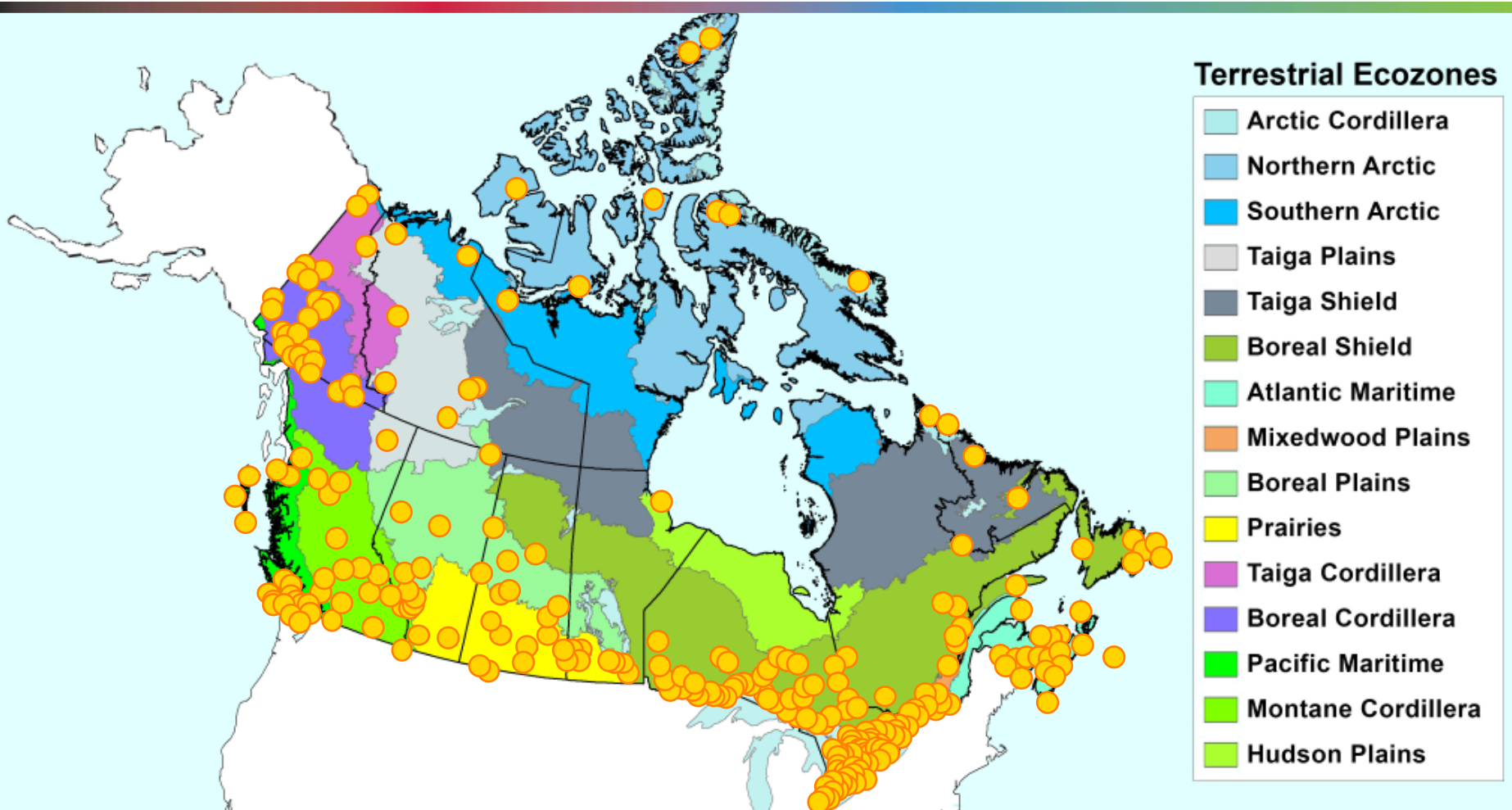
75% Decline in insect biomass since 1980

Introduction: Barcode Region for Animal Kingdom

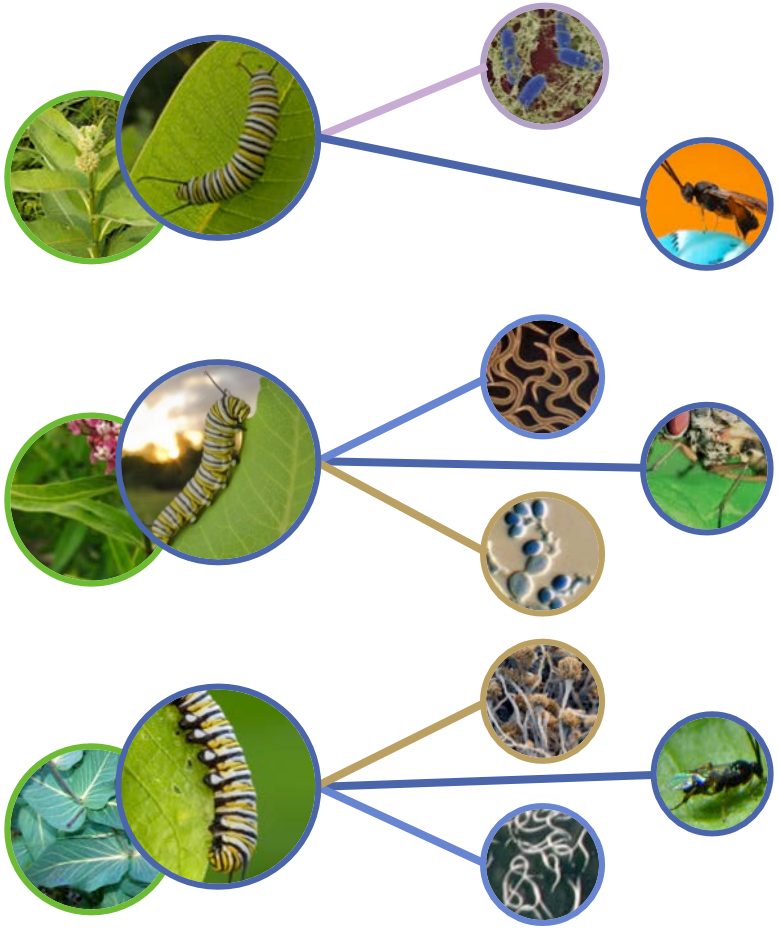


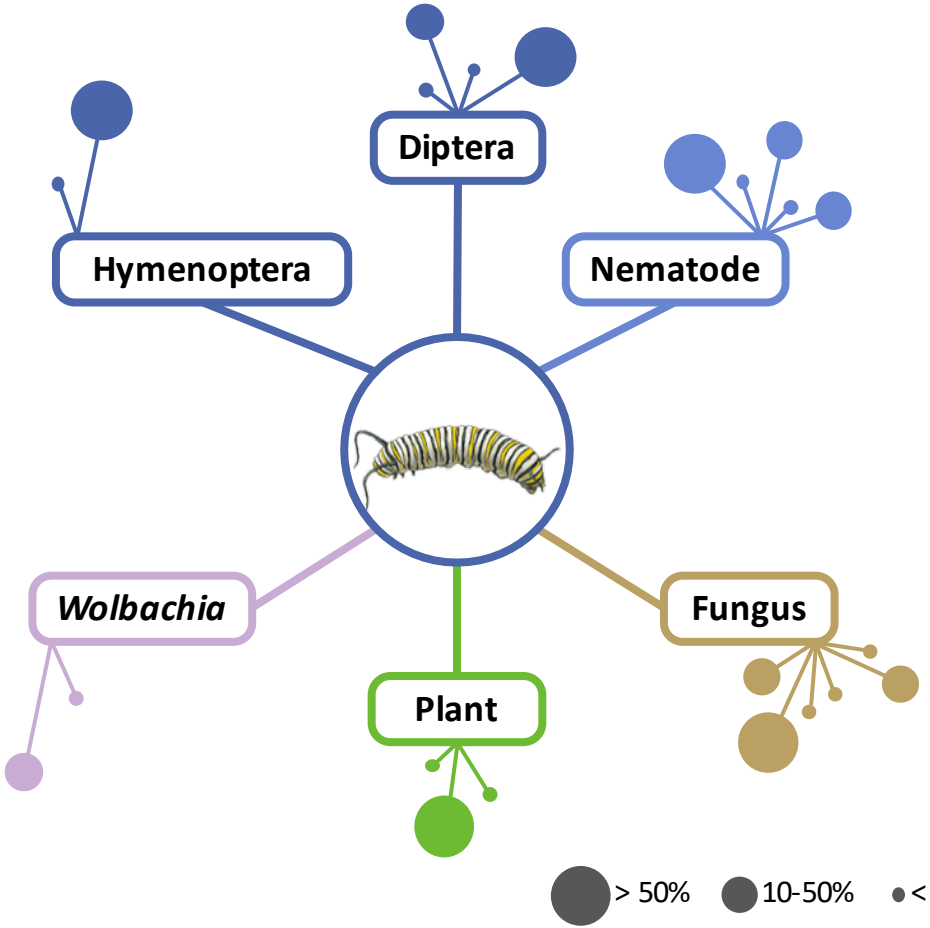


Introduction: Species Discovery & Ecozone Validation



Introduction: Species Interactions





Introduction: Biodiversity Genomics Services

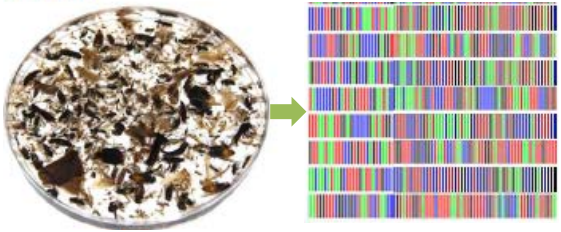
SPECIMENS: >10M

IMAGE LIBRARY: >8M

DNA EXTRACTS: >12M

Biorepositories

DNA BARCODING
CAPACITY: 3M SPECIMENS PER YEAR



METABARCODING
CAPACITY: 20K BULK SAMPLES PER YEAR

Sequencing

14M+ DNA BARCODES
1M+ SPECIES

Informatics

Introduction: Strong Usership in 2022-23

3M specimens + DNA extracts added

8K specimens + DNA extracts loaned

Biorepositories

2.1M individual specimens sequenced

5K bulk samples sequenced

300 external users from 30 nations

Sequencing

1.9M unique IP visits

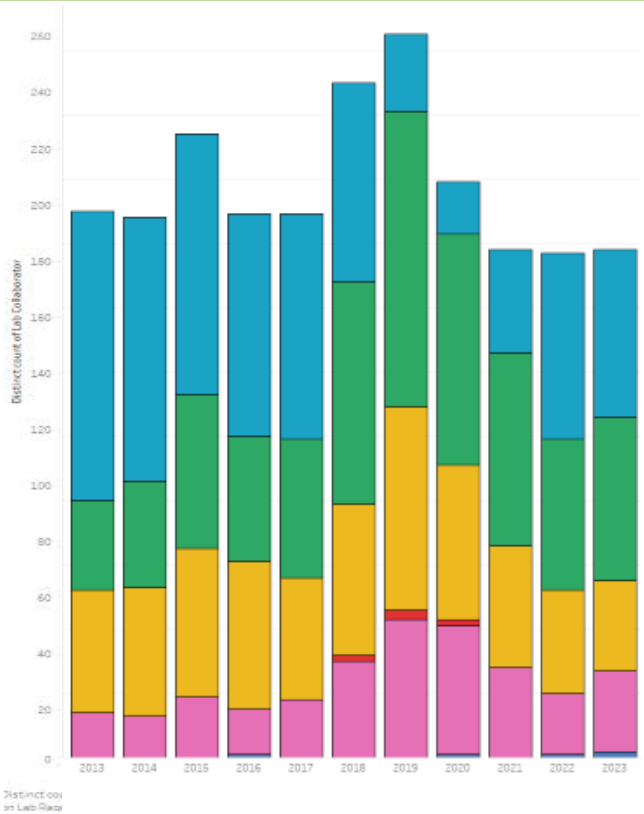
7.2M ID requests fulfilled

94M records analysed

30 TB data accessed

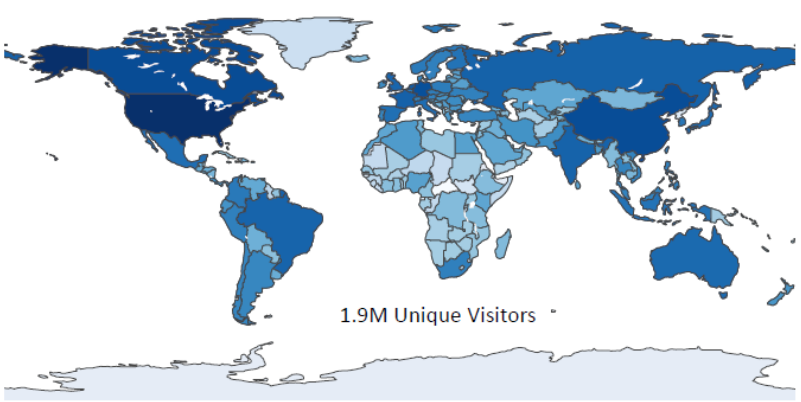
Informatics

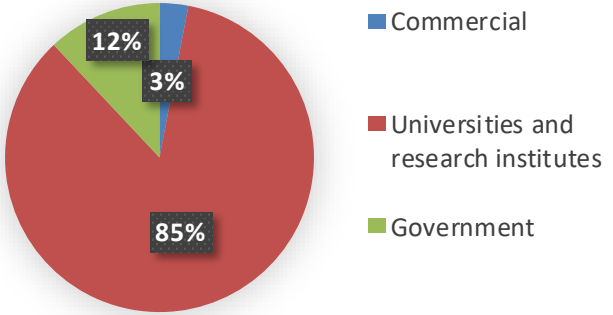
User Diversity: Demographics



Other

Users of sequencing services

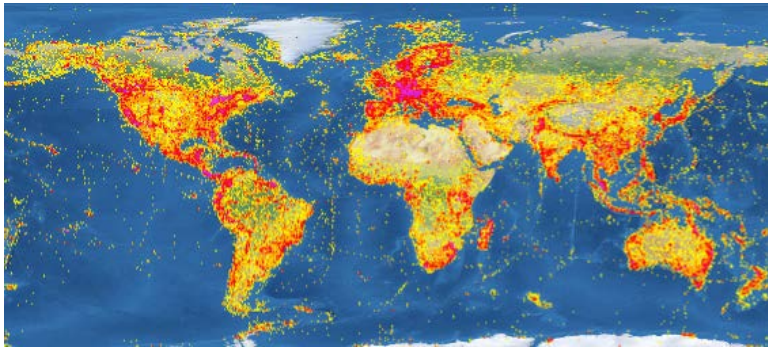




Users of Informatics services

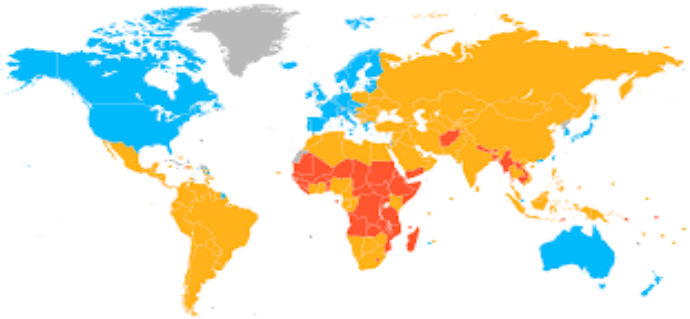
User Diversity: Categories

SECTOR



LOCATION

CITIZENS and COMMUNITIES



DEVELOPING NATION STATUS

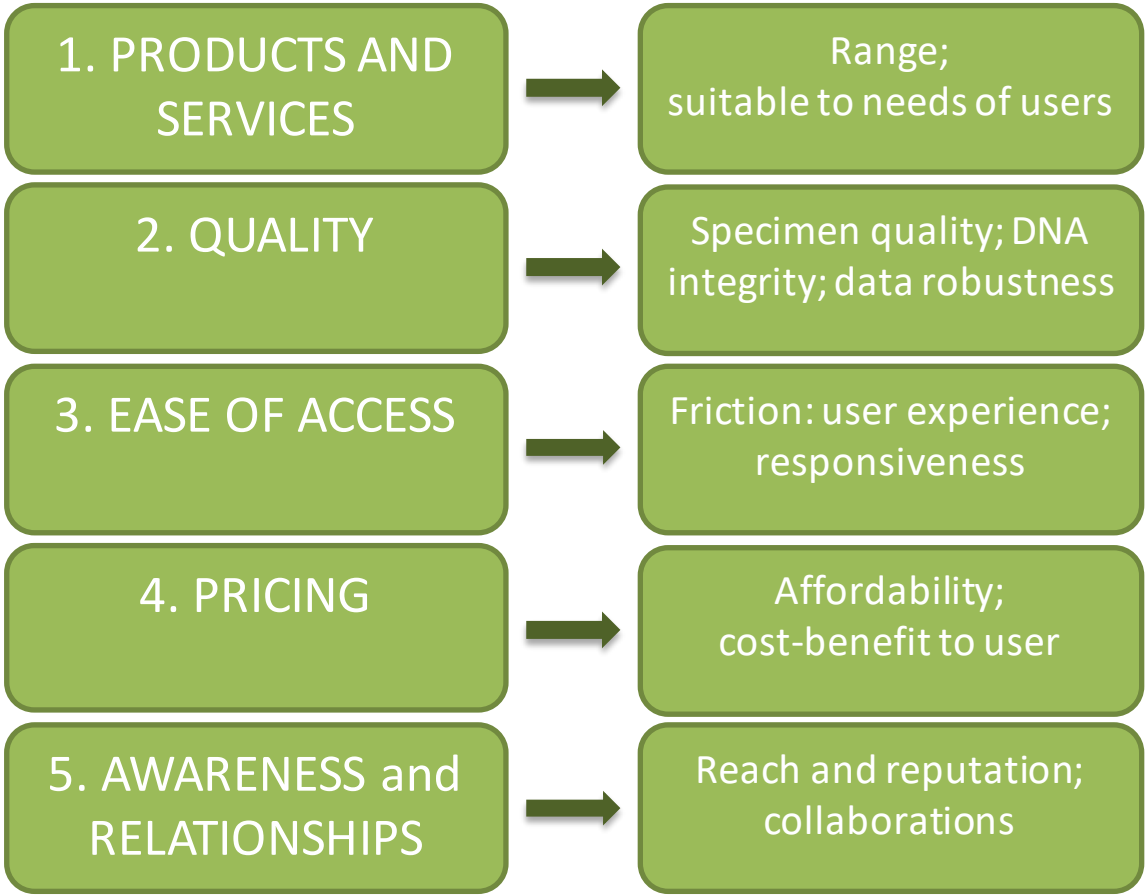
User Diversity: Categories

RELATIONSHIP

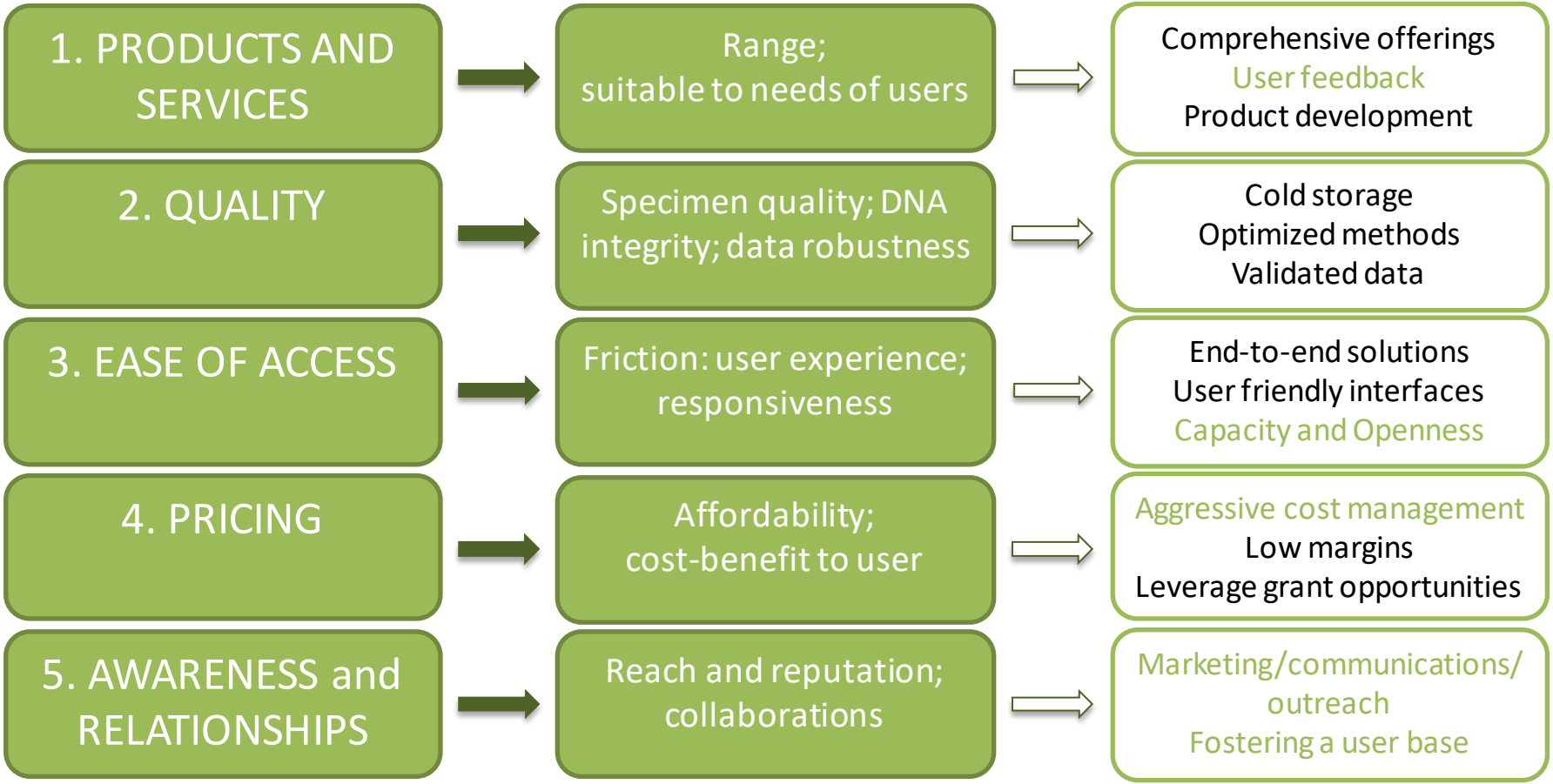
TYPE OF REQUEST

IMPACT

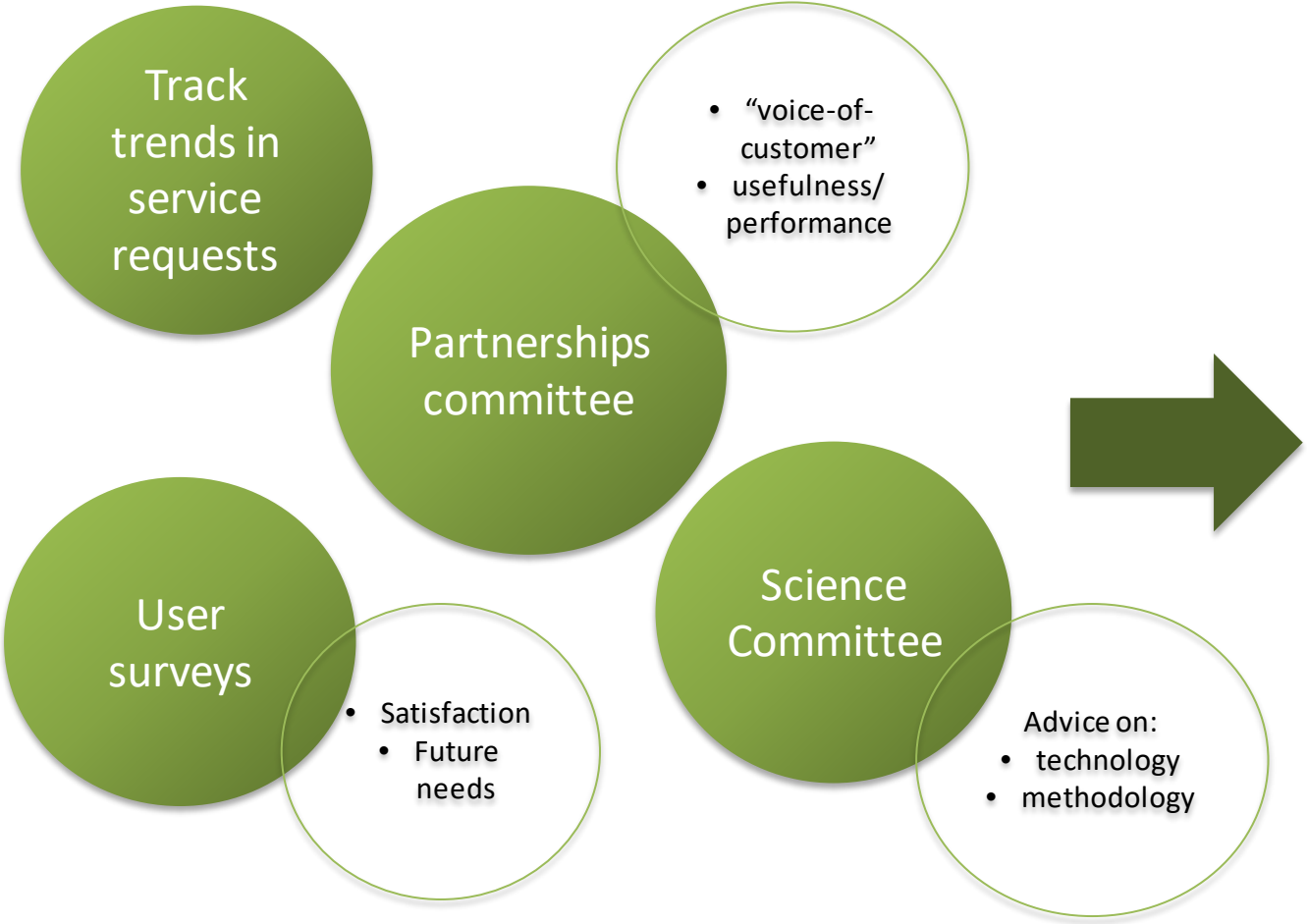
Expanding User Base: Influencing Factors



Expanding User Base: Influencing Factors



Expanding User Base: User and Expert Feedback



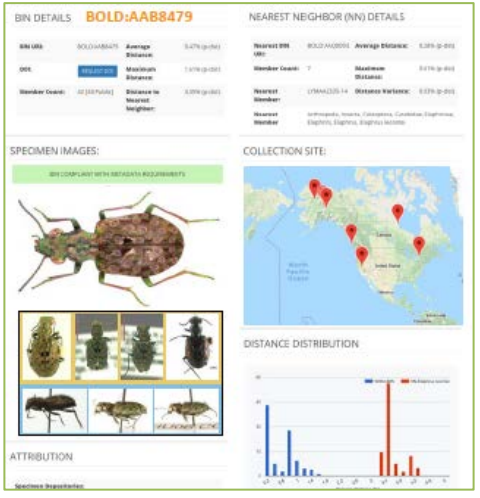
1. **Address gaps to match user needs/demand**
2. **Develop technologies to advance capabilities**

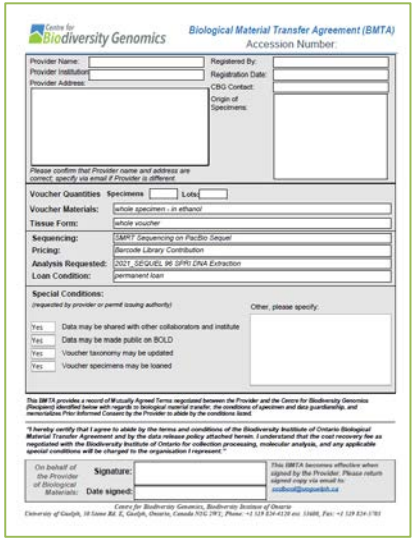
Expanding User Base: Aid Access

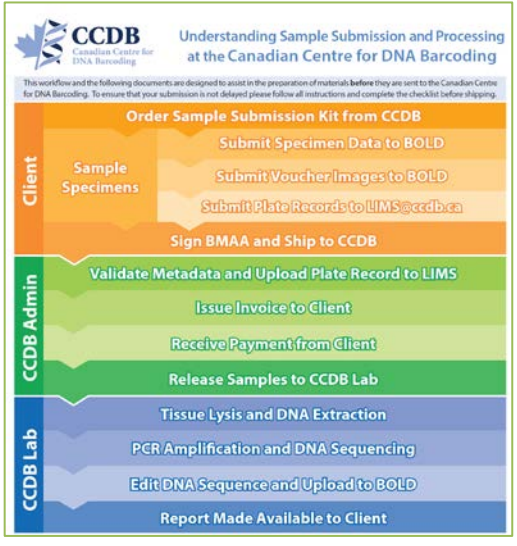
BOLD SYSTEMS

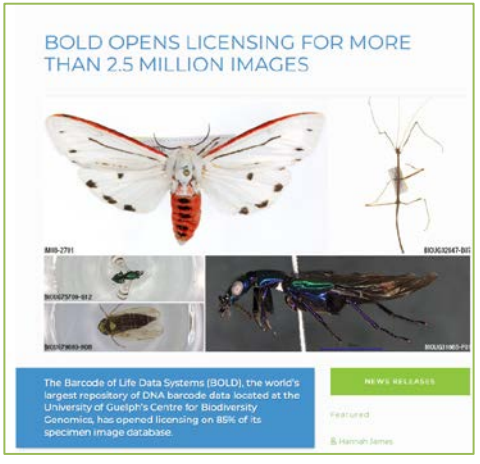
Barcode of Life Data Systems Handbook

A web-based bioinformatics platform supporting the DNA barcoding of animal, plant, and fungal species.

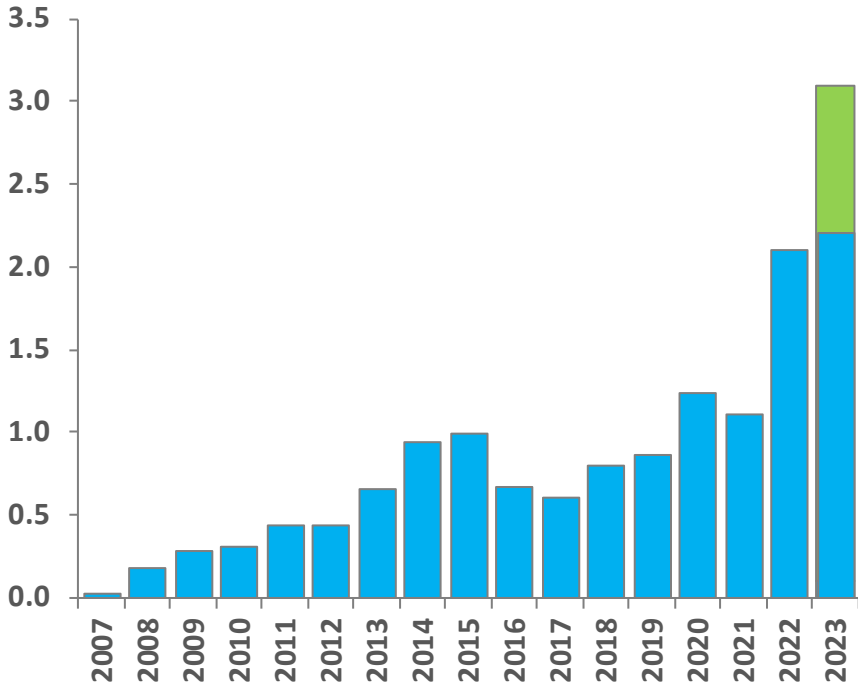








Expanding User Base: Raise Capacity



3 fold increase in capacity over 3 years
(from 1M to 3M)

Specimen Processing and DNA Barcoding

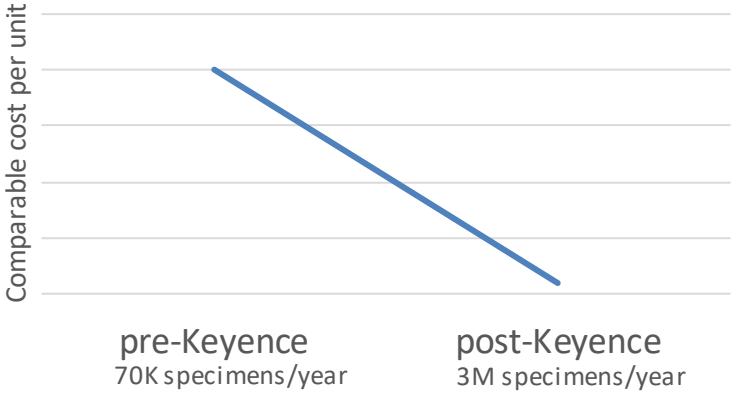
BOLD 4 (2015): supports up to **10M** records
BOLD 5 (2024): support up to **100M** records

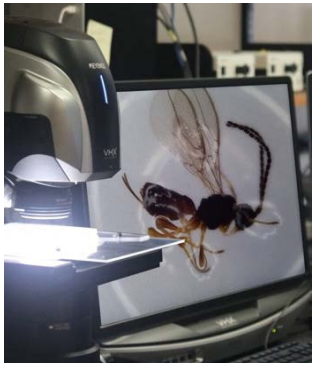
10 fold increase in capacity

Data Systems

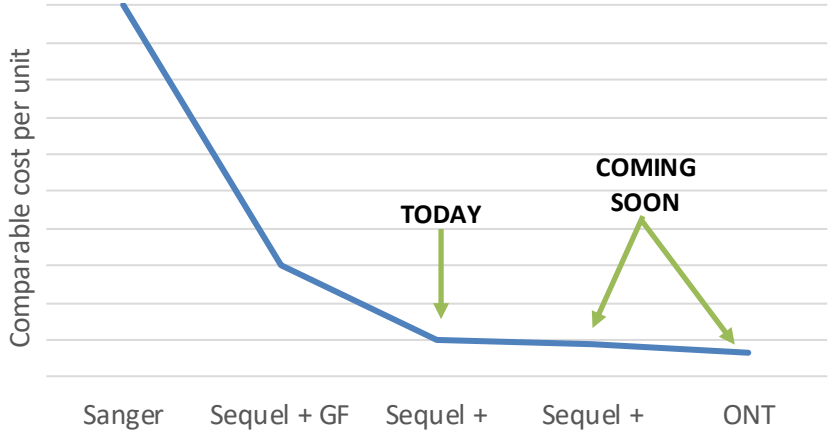
Expanding User Base: Reduce Costs

Digital imaging costs per specimen

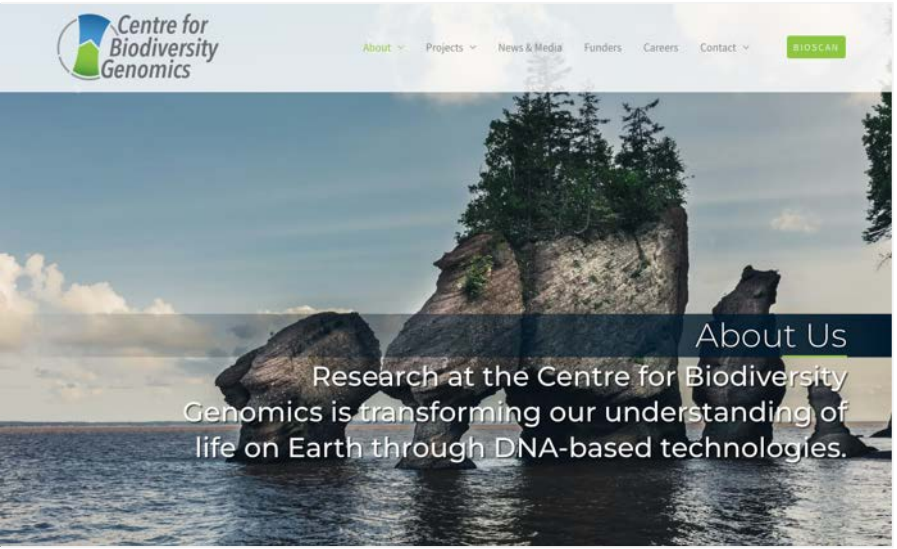


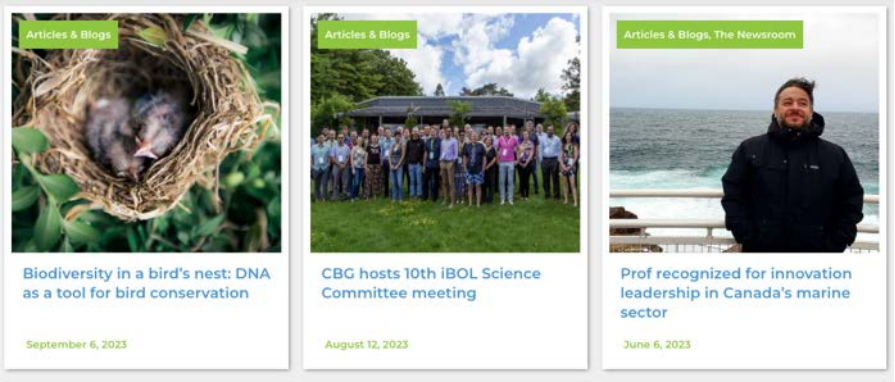


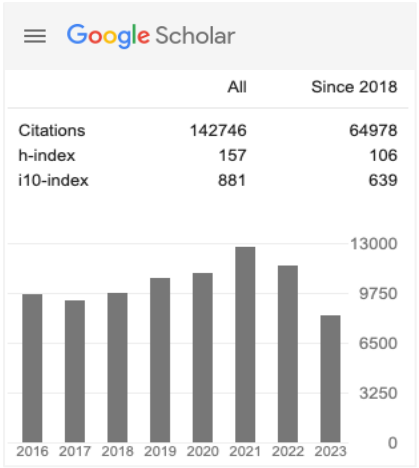
Extraction and sequencing costs

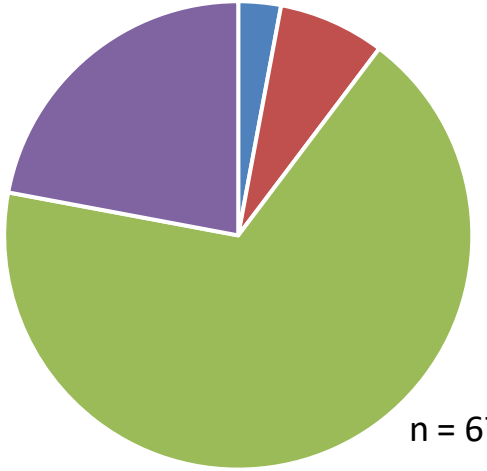


Expanding User Base: Marketing and Outreach





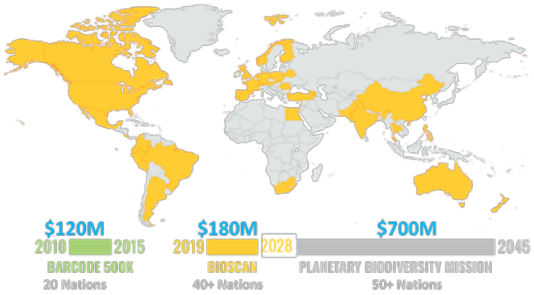




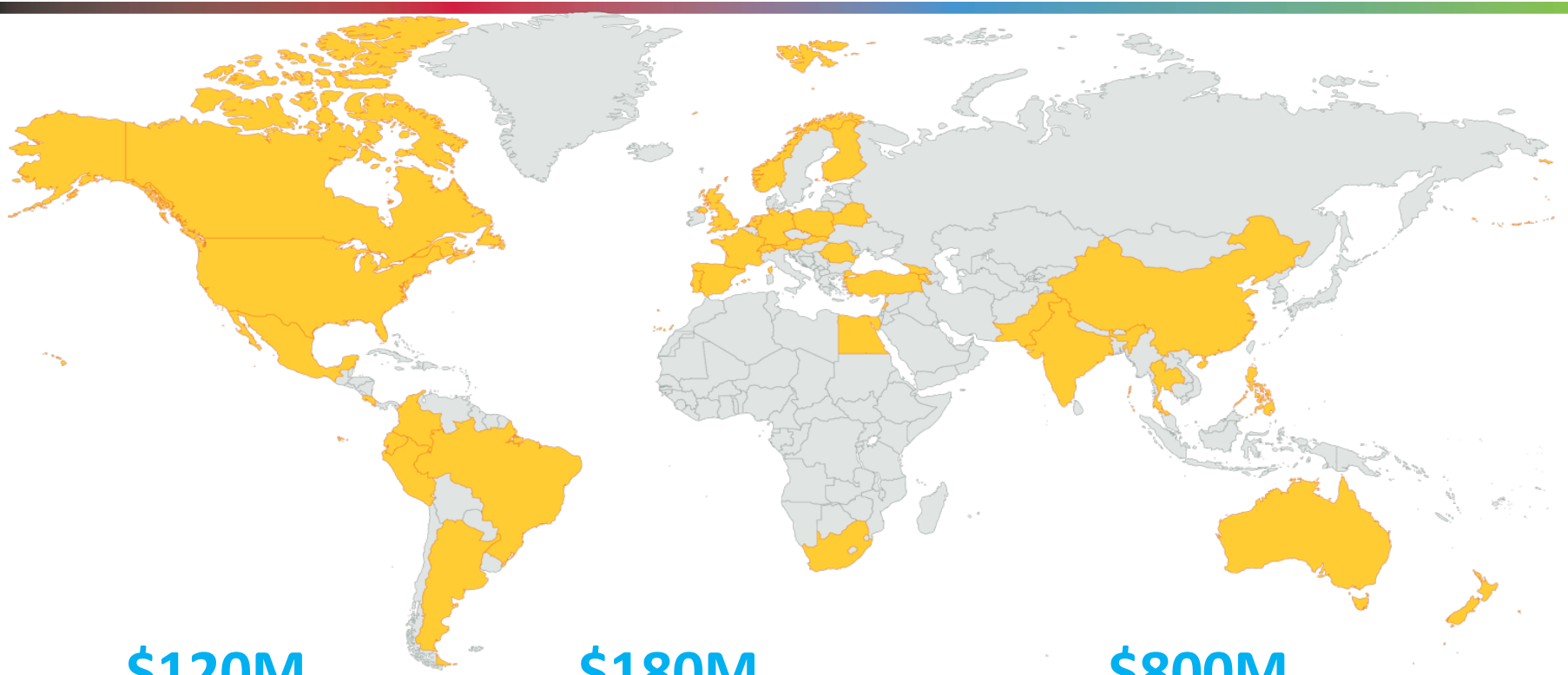
- Courses, workshops, training sessions
- Public events (hosted): symposia, conferences, open houses, group tours
- Media relations: interviews, press releases, broadcasts, podcasts
- Stakeholder events: presentations, booths at trade shows, conferences

Expanding User Base: Expand iBOL Consortium

international BARCODE OF LIFE



Expanding User Base: Lead Global Research Programs



$120M

2010 — 2015

BARCODE 500K

20 Nations

$180M

2019 — ЖДЖМ

BIOSCAN

40+ Nations

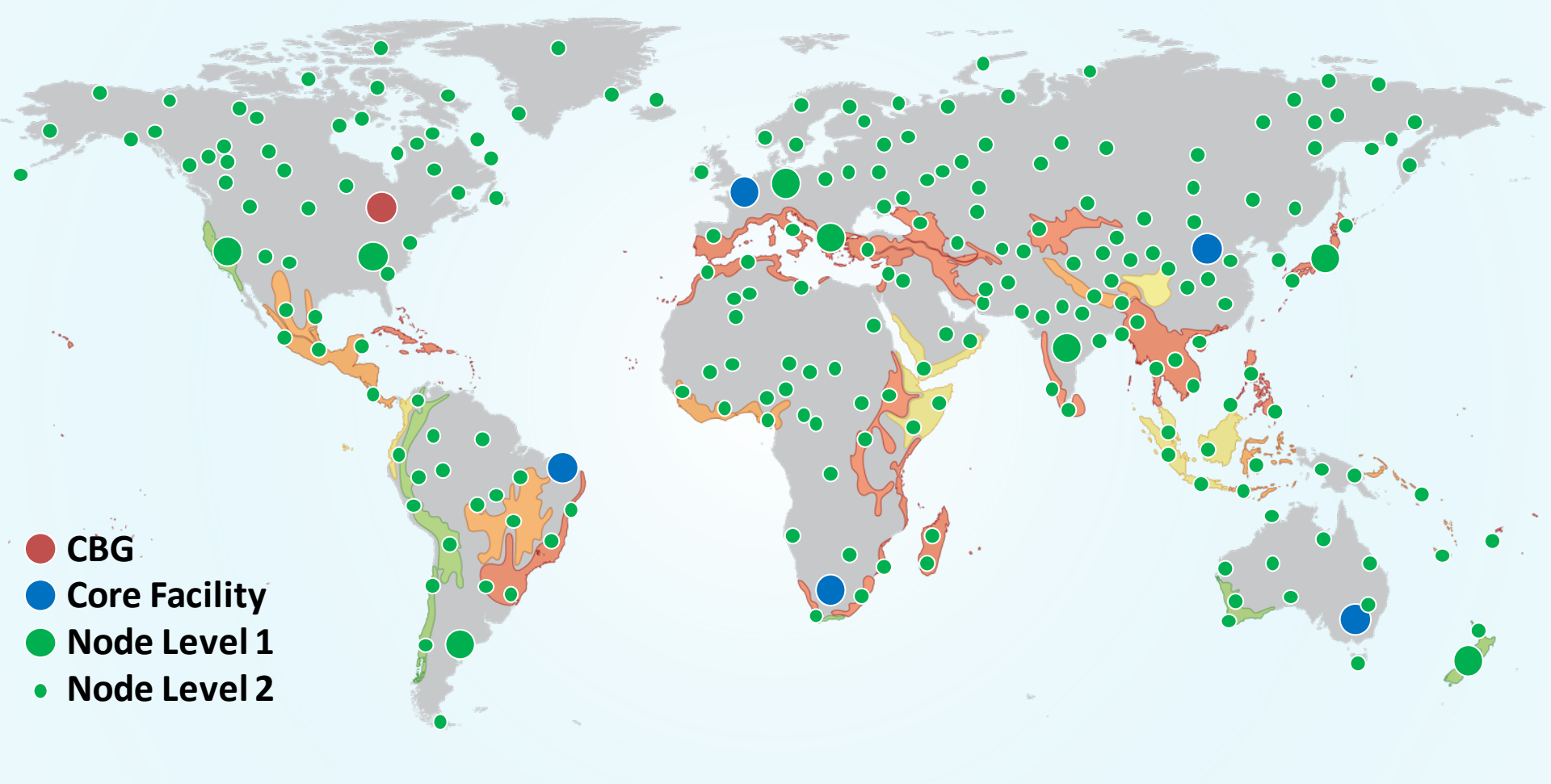
$800M

ЖДЖМ — 2045

PLANETARY BIODIVERSITY MISSION

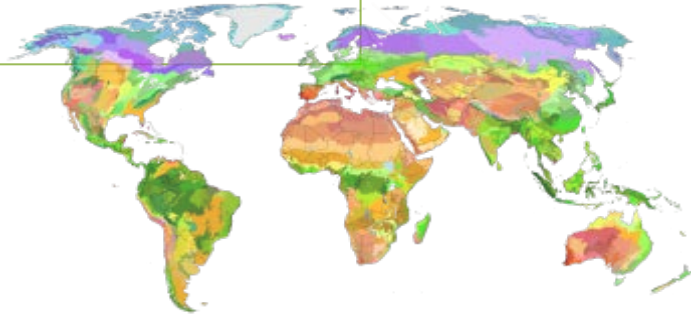
50+ Nations

Expanding User Base: Support Distributed Facilities



Challenges: Broaden the User Base

Generate data for half of the world's 867 ecoregions



T'SOU-KE FIRST NATION

Seek synergy with users

Adjust proportion of data users from high-impact sectors

Knowledge to manage biodiversity for:

- Policymakers
- Government
- Communities
- Conservation agencies
- Environmental assessment consultants

Thank you

CANADA FIRST RESEARCH EXCELLENCE FUND

INNOVATION.CA
CANADA FOUNDATION FOR INNOVATION | FONDATION CANADIENNE POUR L'INNOVATION

GenomeCanada

Ontario Genomics

WALDER FOUNDATION

New Frontiers in Research Fund
Fonds Nouvelles frontières en recherche

Ontario
Ministry of Colleges and Universities

Philanthropy

NSERC CRSNG

Polar Knowledge Canada

GORDON AND BETTY MOORE FOUNDATION

UNIVERSITY of GUELPH

Diversifying and expanding the facility user base to optimize benefits for Canada

Alexandre Forest, Amundsen Science

MSIF Workshop 2023

Saskatoon, 2 November 2023

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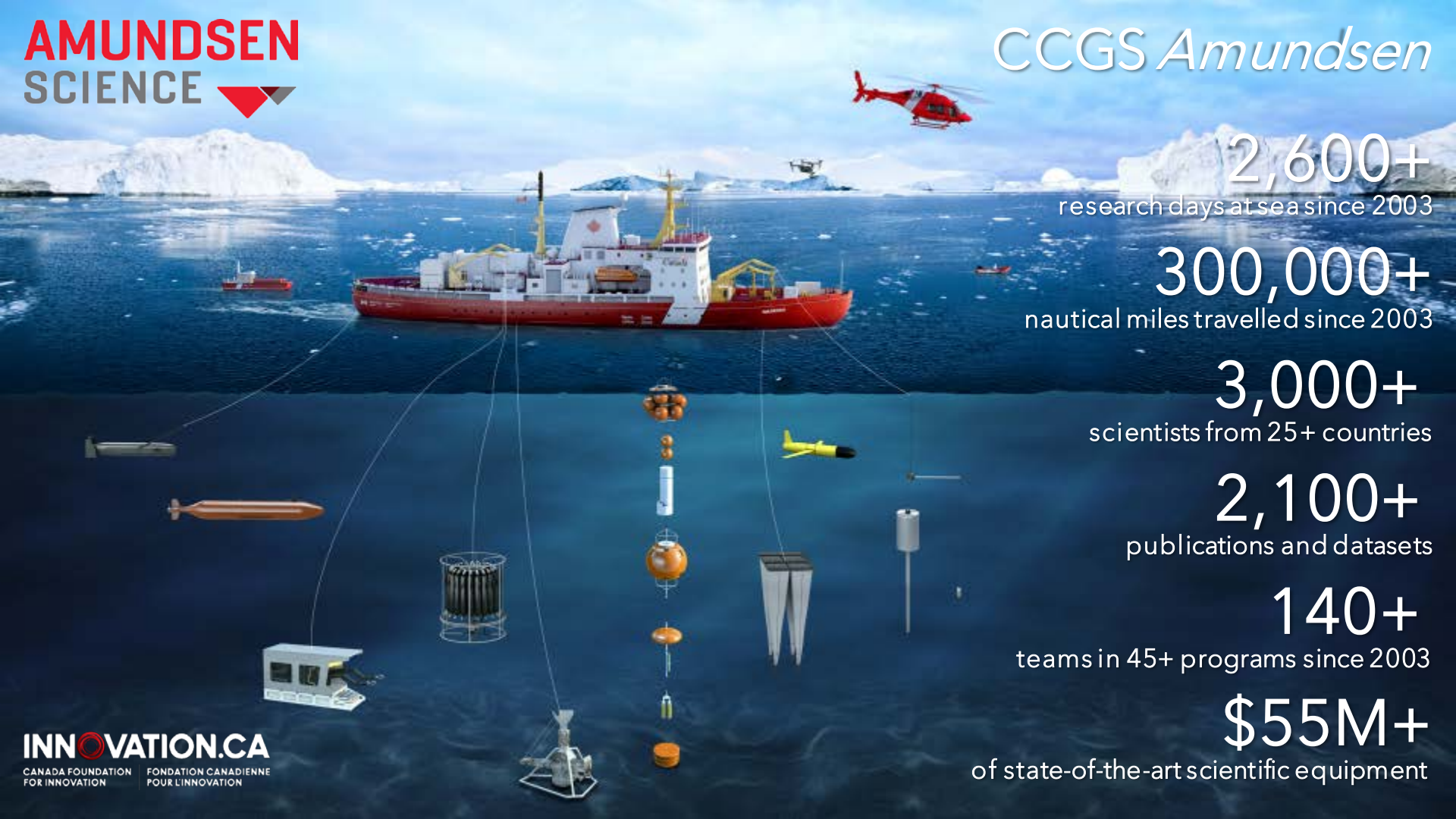
AMUNDSEN SCIENCE

UNIVERSITÉ LAVAL


AMUNDSEN
SCIENCE
CCGS Amundsen
2,600+
research days at sea since 2003
300,000+
nautical miles travelled since 2003
3,000+
scientists from 25+ countries
2,100+
publications and datasets
140+
teams in 45+ programs since 2003
$55M+
of state-of-the-art scientific equipment
INNOVATION.CA
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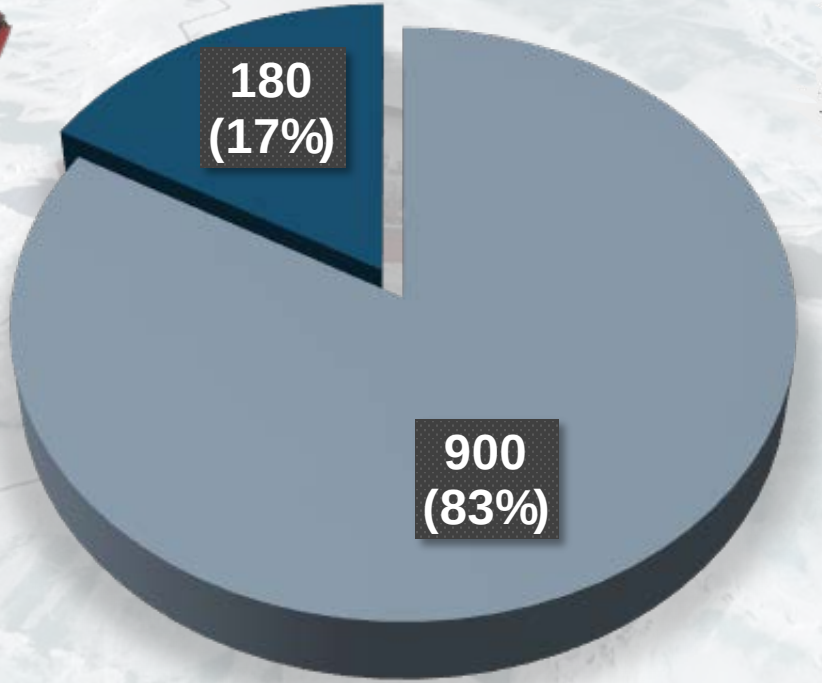
FONDATION CANADIENNE POUR L'INNOVATION

CCGS Amundsen user base ≈ 1100 / year

1 out of 6 users board the ship



Primary on-board users

- 85% Canadians
- 60% universities
- 80% HQPs
- 35% students (PhD, MSc, post-docs)
- 50-50% men/women
- 50% below 30 years

Second-level users (data users)

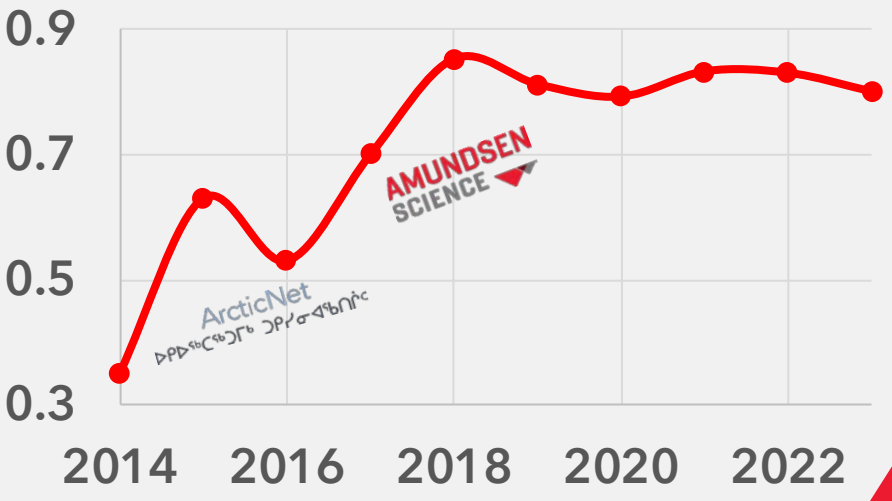
- 65% Canadians
- 75% universities
- 65% HQPs
- 30% students (PhD, MSc, post-docs)

No data users without primary users

On-board users: both a scientific and human experience

Often “life-transformative”…

What diversity mean:
Diversity at the program level



Simpson's Diversity Index increased since the creation of Amundsen Science, but reaches a plateau

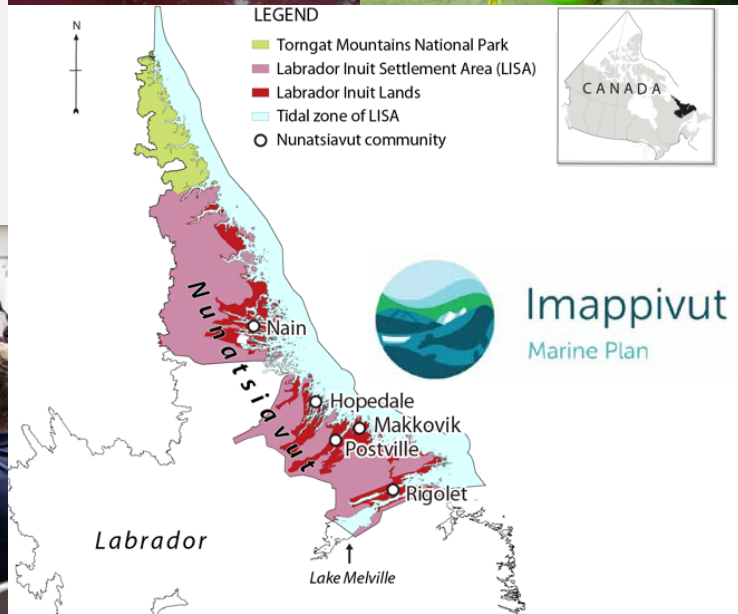
NUNATSIAVUT
Qanuirlipitaa? 2017
ISICLE
atlas
ArcticNet
ITTAQ HERITAGE & RESEARCH CENTRE
Dark Edge
ISECOLD
Canadian Arctic Shelf Exchange Study
Sentinel North
NETCARE
KEBABB
INUVIALUIT
BaySys
Imappivut Marine Plan
GREEN EDGE
Malina Sun goddess of Inuit
CFL CIRCUMPOLAR FLAW LEAD SYSTEM STUDY INTERNATIONAL POLAR YEAR 2007-2008
PeCaBeau 2021
GEOTRACES
RÉSEAU QUÉBEC MARITIME

AMUNDSEN SCIENCE

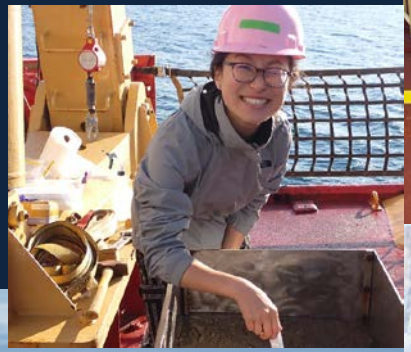
Example: Imappivut 2023

First primary program led by an Inuit organization

- Nunatsiavut leading in collaboration with key academic and federal partners
  - MUN / Marine Institute, U of C, NRCan & DFO, AS
- Holistic view of research, onboard training
- First Inuit Chief Scientist
- Research & cultural exchange day in Nain



Diversity at the individual level



Our committment to Equity, Diversity and Inclusion

Amundsen Science is committed to develop and adopt comprehensive EDI practices. Some actions taken recently to broaden the scope of our user's community and help people feel safe on board:

- Form a committee to identify strategies to improve EDI practices;
- Adopt an Equity, Diversity and Inclusion Action Plan;
- Create a Code of Conduct for Expedition Participants.
- Identify safe contact persons onboard and onshore.
- Facilitating Inuit participation and supporting Indigenous-led research

Strengthening user engagement and diversifying our user community will contribute to the sustainability and growth of the facility.

AMUNDSEN SCIENCE

Strategies for diversifying and expanding the user base

Reach out, reach out, reach out!

- In-person & virtual visits to universities, departments, and communities
- Organization of workshops and participation to relevant conferences
- Increase public awareness: newsletter, website, social media, outreach, etc.

Key communication and outreach activities

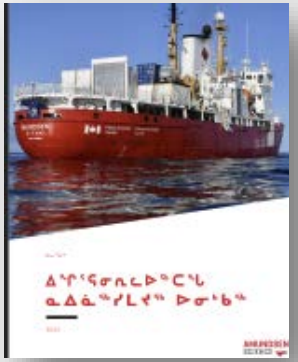
Social media

Newsletter

Annual Amundsen Science Planning Workshop

Website

https://amundsenscience.com/



Expedition summaries & reports

Upcoming conferences

- ArcticNet Science Meeting, Iqaluit, December 2023
- Arctic Science Summit Week, Scotland, March 2024
- Canadian Polar Data Workshop V, Halifax, May 2024

AMUNDSEN SCIENCE

Users become ambassadors since our most important success criterion is their satisfaction and the achievement of their scientific objectives

1- Drive the science program of the *Amundsen*

2- Drive the development of the central equipment pool

4- Their funding is leveraged by AS for the operation of the ship and new equipment

3- Are consulted regularly through the Annual Planning Workshop and other venues

Challenges to diversifying and expanding the user base and mitigation approaches

Challenge 1

- Increasingly high ship-time costs that prevent access to users who may have no or limited access to ship-time funding

Challenge 2

- Costly and complex logistics associated with the mobilization and access to the ship that new users may find discouraging

Challenge 3

- Lack of awareness from users who may still believe that the *Amundsen* is always fully booked only used by a few large programs

Challenges to diversifying and expanding the user base and mitigation approaches

Mitigation approach 1

- Use of a larger share of the MSI funding to support innovative projects from atypical new users

Mitigation approach 2

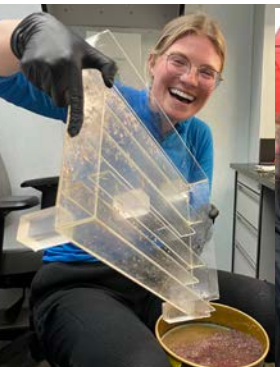
- Increased support from Amundsen Science to aid in the mobilization and implementation of under-represented projects

Mitigation approach 3

- Continuously reaching out to the national and international community and to Inuit Nunangat organizations

Thank you!

Join us!



2023/11/02

SNOLAB Overview

Jodi Cooley
Executive Director | SNOLAB
Professor of Physics | Queen’s University
Adjunct Research Professor | SMU

Introducing SNOLAB

- SNOLAB hosts rare event searches and measurements. It's located 2 km underground in the active Vale Creighton nickel mine near Sudbury, Ontario, Canada.

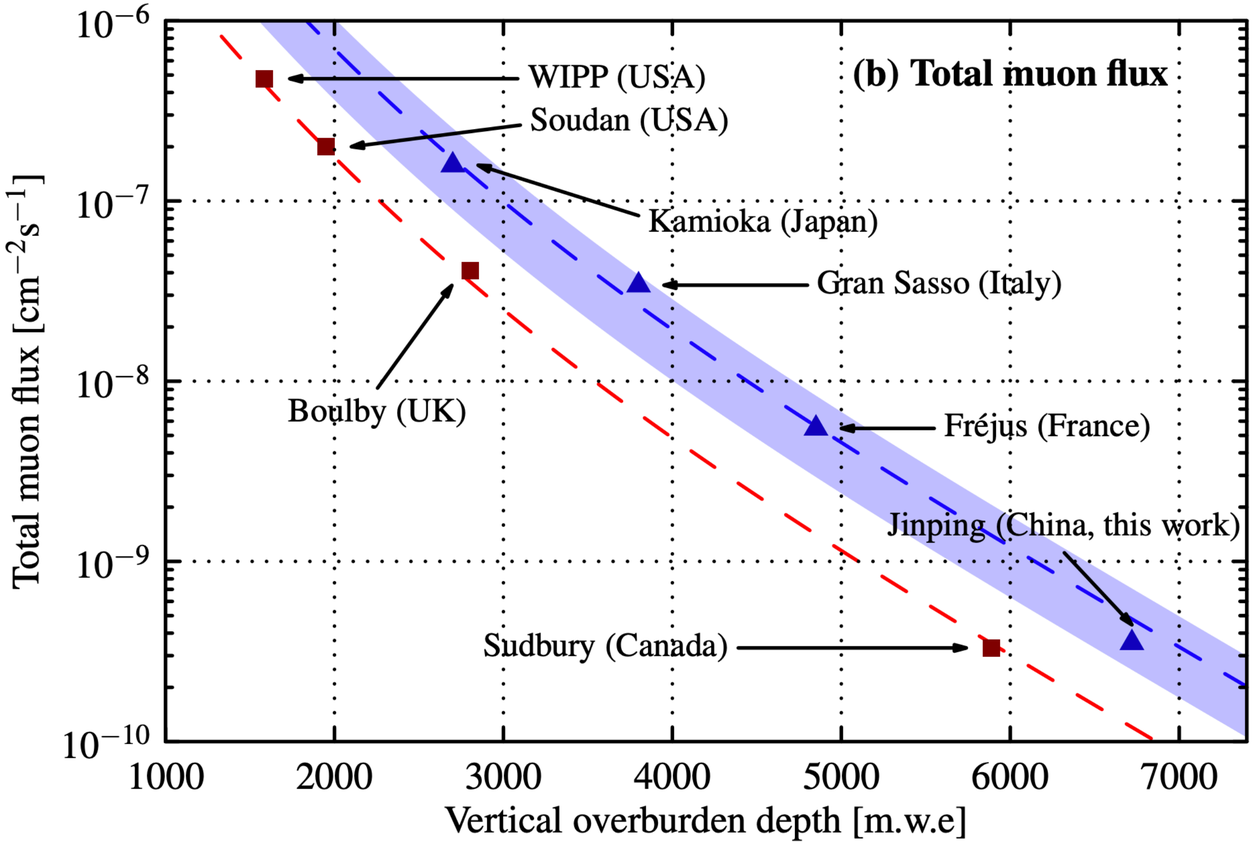
- SNOLAB is operated jointly by University of Alberta, Carleton University, Laurentian University, University of Montreal, and Queen's University.

- SNOLAB operations are funded by the Province of Ontario, and the Canada Foundation for Innovation.

Why Underground?

- A growing community of users *needs* environments that are both shielded from radiation and clean to achieve sensitivity for rare event searches.
- Astrophysical systems emit high energy radiation which create muons in Earth's atmosphere
- SNOLAB has the lowest muon fluxes available
- Clean room throughout the underground facility

Guo et al., arXiv:2007.15925v2



Science Strategy

The science at SNOLAB is focused on increasing our understanding of the particles and forces that have shaped the universe.

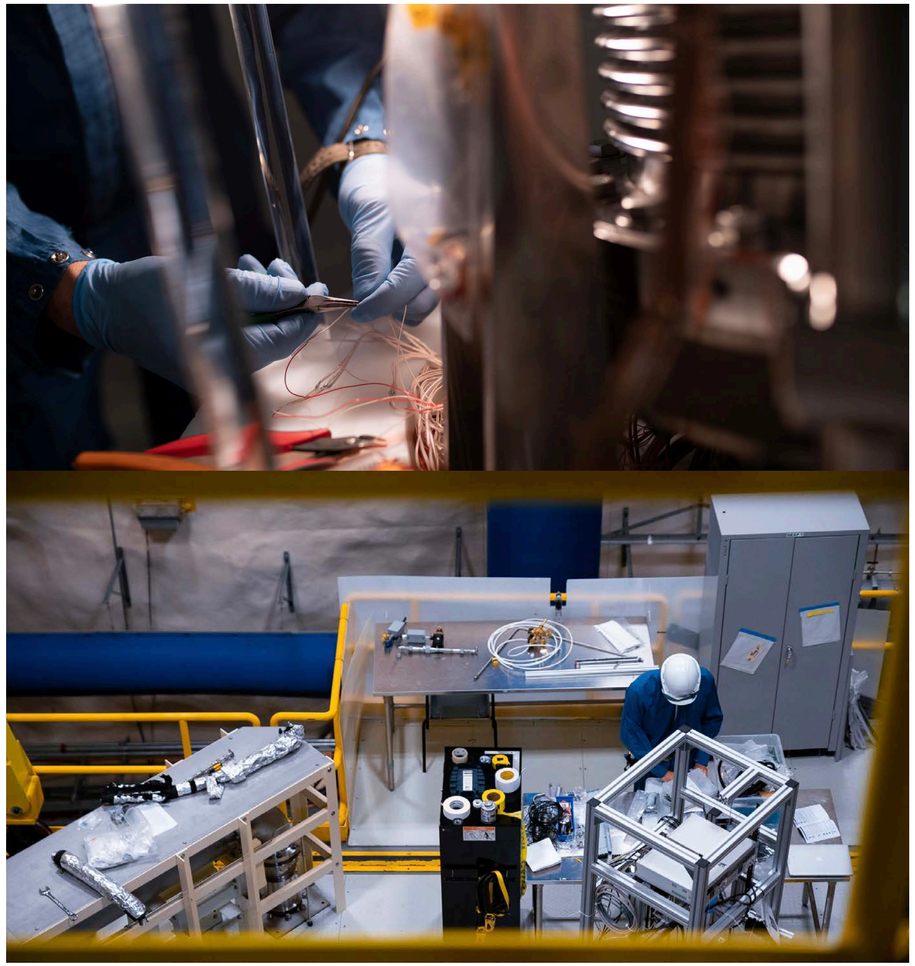
- What is the nature of dark matter?
- What is the nature of the neutrino?

SNOLAB collaborates with scientific research required deep underground facilities.

- Neutrino observatories (solar, supernovae, geo, reactor, etc.)
- Effects of radiation on biological systems
- Environmental monitoring (nuclear non-proliferation, aquifers, etc.)

SNOLAB is interested in pursuing new collaborations and opportunities in emerging areas of underground science

- Effects of radiation on quantum technologies



SNOLAB by Numbers

1000+
annual academic users/collaborators

25%
of those users/ collaborators are Canadian researchers

24
Our international collaborators come from 24 countries

164
Our international collaborators come from 164 institutions

What Does Diversity Mean to SNOLAB?

- World class science and research excellence requires contributions from diverse perspectives.
- People are the heart of SNOLAB's success:
  - Strive to achieve and maintain diversity in our staff, researchers, technicians, engineers, operations, corporate professionals and collaborators
- SNOLAB is committed to a diverse research portfolio.
  - Host experiments that represent diverse and multidisciplinary research topics.
  - Balance large-scale, mid-scale and small-scale programs.
  - Balance staging of experiments: conceptual design, technical design, installation, commissioning, operating and decommissioning.

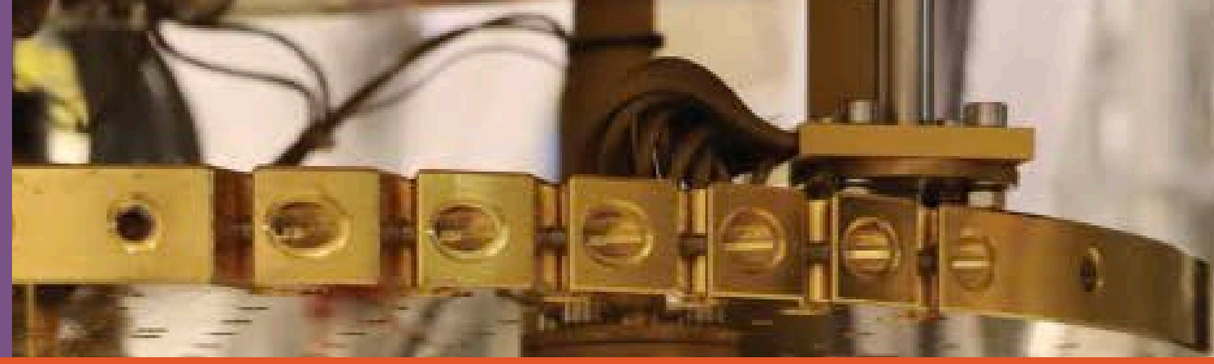
1

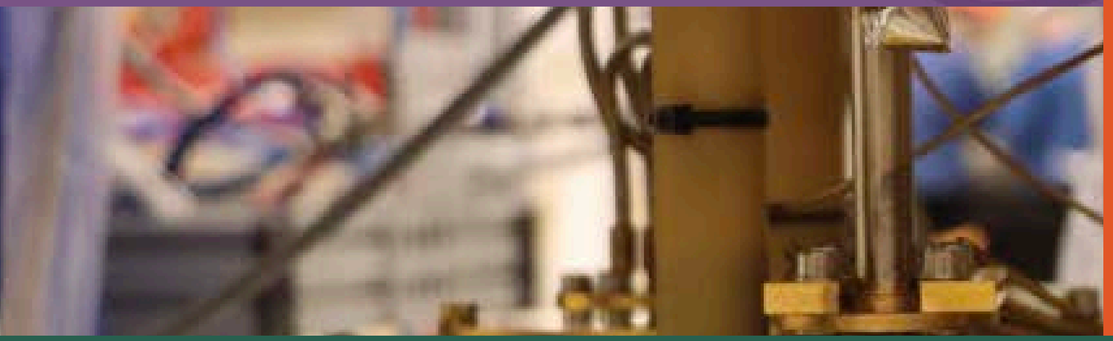
Excellent science

Drive breakthrough discoveries at the frontiers of underground science.

Expected outcomes:

- Cementing of Canada's leadership in deep underground science
- A stronger, more competitive Canada in scientific discovery
- More Canadian researchers positioned as global leaders





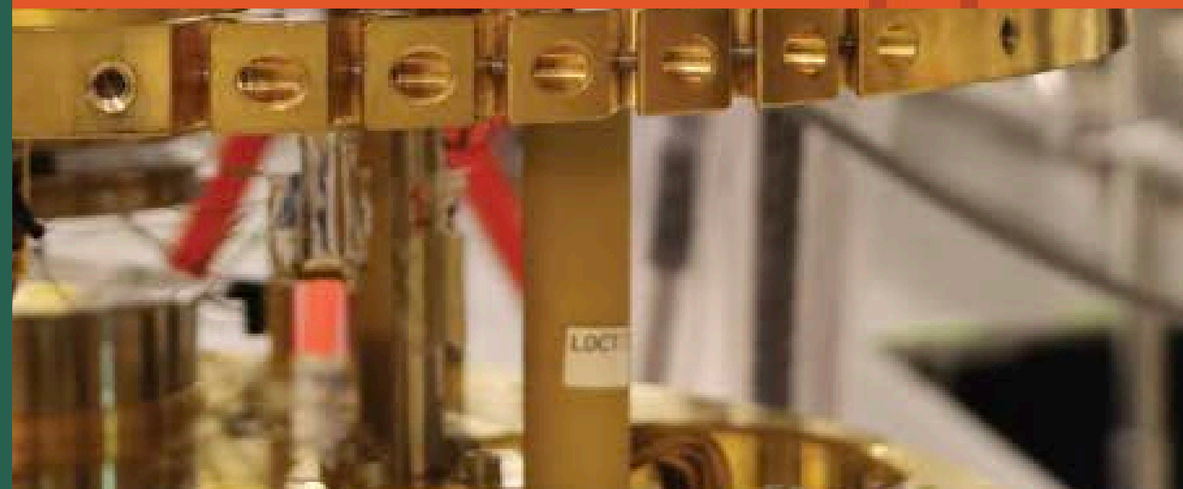
2

Cutting-edge infrastructure

Continuously improve our research infrastructure to remain state of the art.

Expected outcomes:

- Attraction of the most advanced international experiments to Canada
- Greater global impact and enhanced reputation of Canada's underground science infrastructure



3

Skilled people

Foster and develop diverse talent in an inclusive environment.

Expected outcomes:

- Canadian leadership in advancing EDI in research facilities
- A new generation of HQPs prepared to discover and innovate in a global economy
- Greater access to STEM skills and opportunities in Northern Ontario

Strategies and Barriers to Expanding and Diversity SNOLAB User Base

- Pursue a diverse science portfolio anchored by our world leading dark matter and neutrino programs, and open to new science opportunities in emerging areas of underground science.
- Host experiments at a different stages of development
- Provide state-of-the-art infrastructure
- Encourage and foster a welcoming, collaborative environment for collaborations who use the facility.

SNOLAB –
At a Glance

Current Experiments
Future Experiments
Laboratory Facilities
Experiment Areas

Cube Hall
DEAP-3600, PICO500, NEWS-G
potential for large project after 2026

Cryopit
nEXO/LEGEND

Electrical Shop

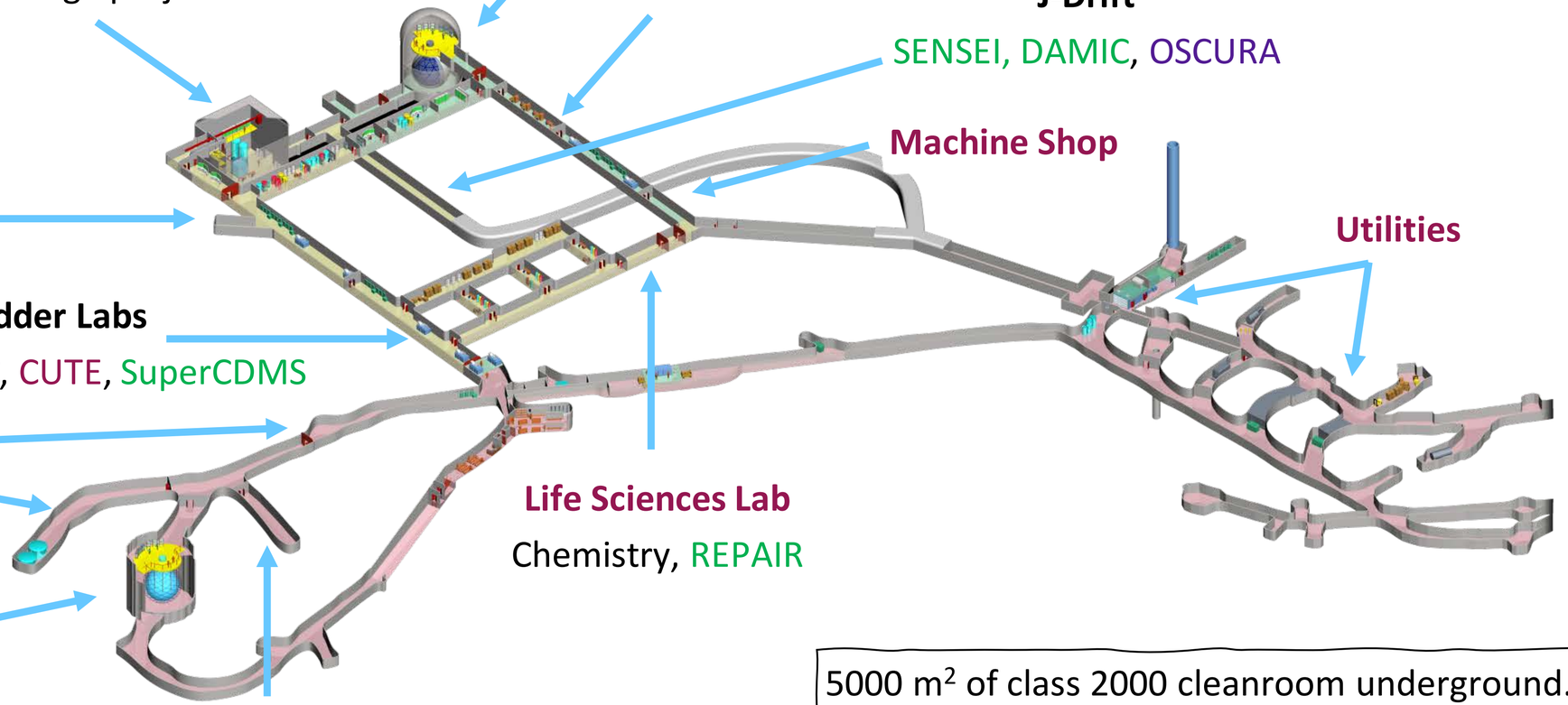
J-Drift
SENSEI, DAMIC, OSCURA

Halo Stub
HALO
potential breakthrough for future expansion

Machine Shop

Utilities

Ladder Labs
PICO40, SBC, CUTE, SuperCDMS



Plants
UPW, LN2, Scintillator, Te Diol, TeA

Life Sciences Lab
Chemistry, REPAIR

SNO Cavern
SNO+, SNO+ Te
Potential for large project after 2035

Low Background Lab
HPGe assay/screening, XRF, Radon Boards, FLAME
XIA, CTBT Dual HPGe

5000 m^2 of class 2000 cleanroom underground.
<2000 particles >0.5 µm in diameter per ft^3

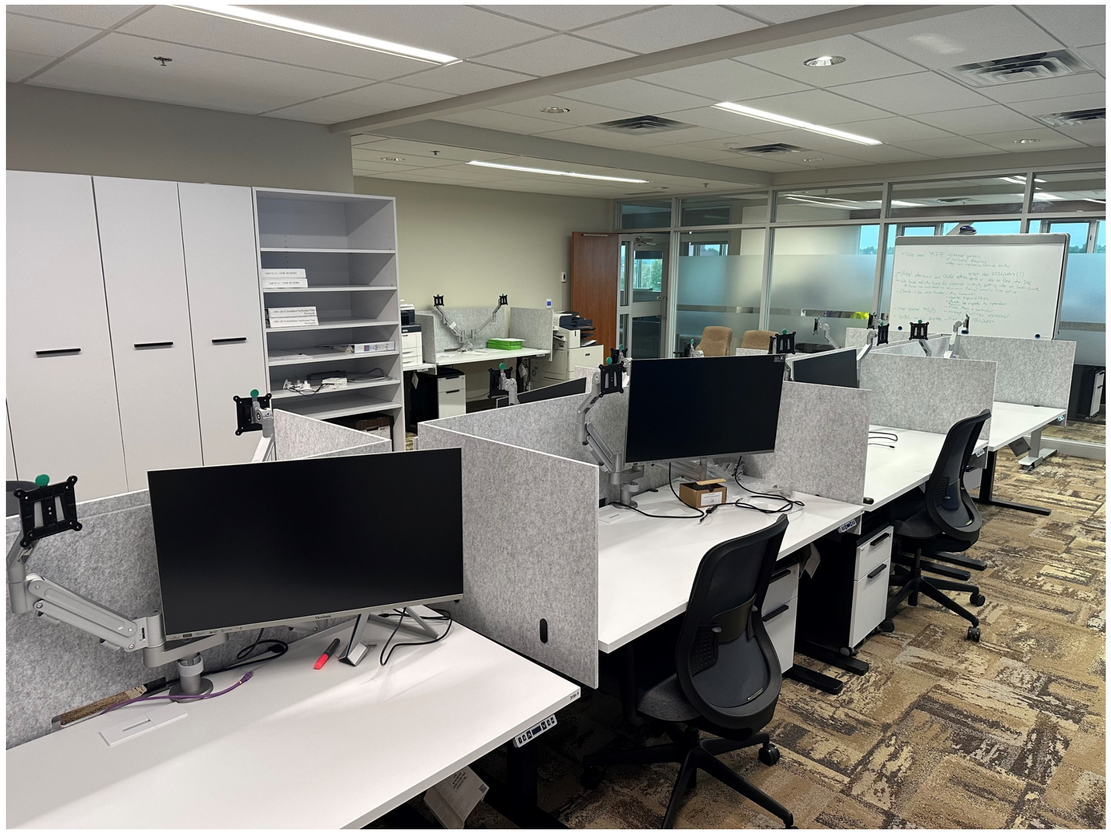
Infrastructure: Surface Spaces & Support

Become an intellectual hub that fosters collaboration and connection.

- Assign dedicated staff to assist domestic and international users in the navigation of logistical and cultural aspects of their long-term stay;
- Create a formal user support system that users can rely on;
- Provide dedicated physical space to encourage collaboration and connection;
- Promote equity, diversity, and inclusivity.

Create Welcoming Environment - SNOLAB Summer of Science

- SNOLAB will host a series of meetings and workshops in Summer 2024
- Invited senior scientists in-residence will give/lead topical and relevant lectures and discussions in weeks between.
- Challenge: Need to find funding to offset housing and travel costs for student participants.



Infrastructure: Underground Spaces

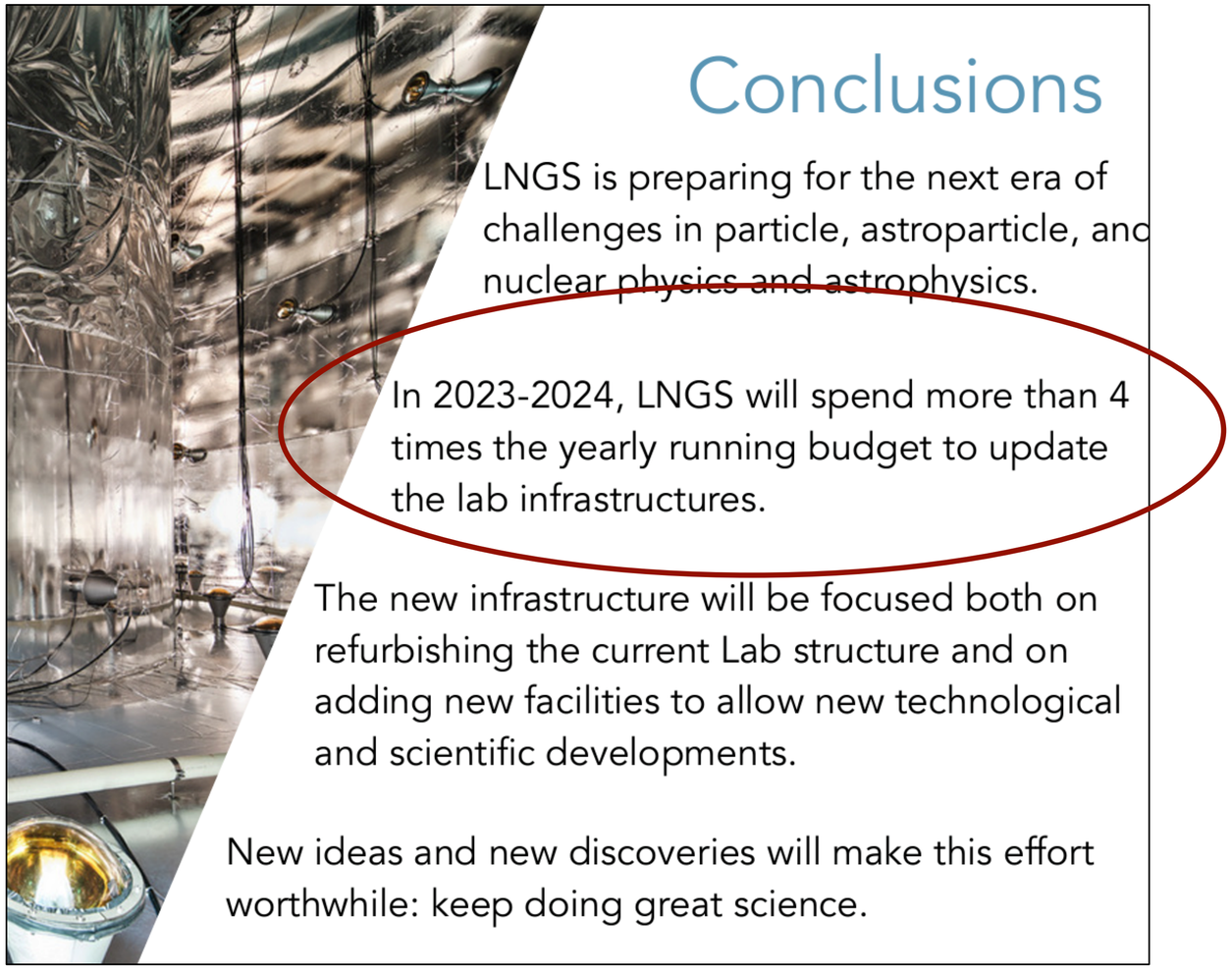
Improvements to the underground environment.

- “Drys” are in need of renovations with particular attention paid to equity for those who need more privacy.
- Plans to create wellness spaces underground.

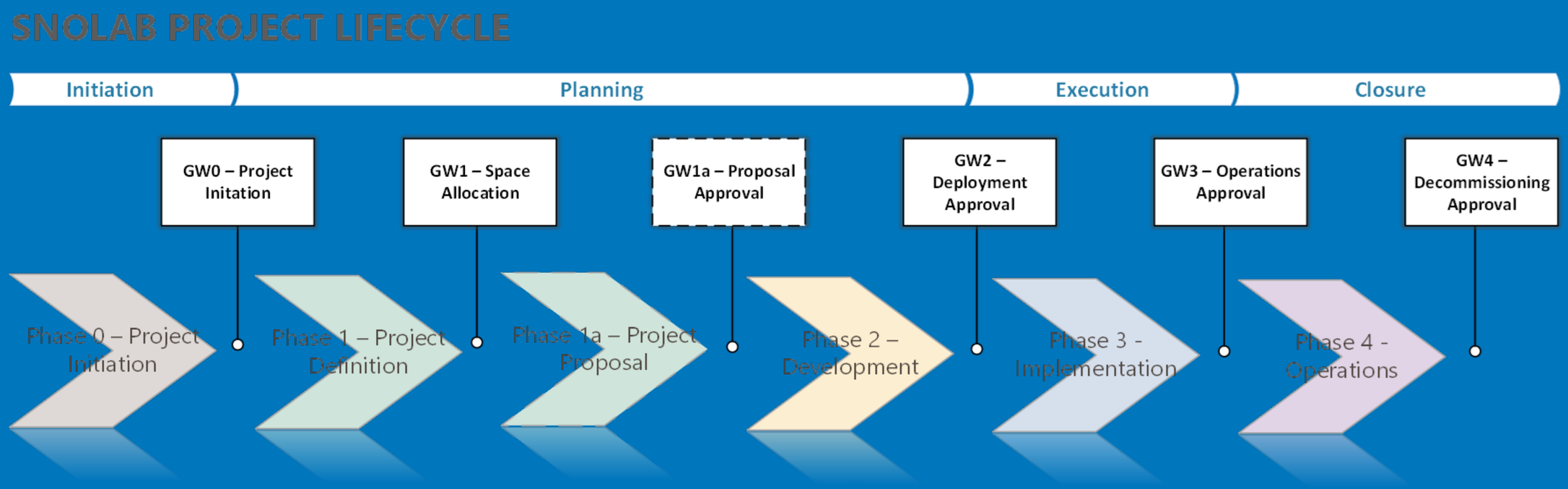
  Two-fold challenge:
  - Balancing the various demands on a strained budget.
  - Execution needs to be staged in order to keep laboratory requirements for cleanliness.

Infrastructure Challenge: Competition

- Underground laboratories around the world are making significant investments in their infrastructure.
  - Boulby Underground Facility (UK) is planning upgrade which includes doubling their staff and expanding their underground facility to include a large 25 m^3 cavern to attract a next generation dark matter experiment.
  - LGNS (Italy) will spend more than 4 times their yearly operating budget to update lab infrastructures.
  - Homestake Underground Laboratory is also expanding their underground space.



Accountability of Collaborations



- SNOLAB life cycle process whereby SNOLAB supports experiments through their life cycle at the lab.
- All collaborations who seek space allocations are required to have both an EDI plan and a code of conduct which is reviewed as part of the life cycle process for an experiment.

Conclusions

- SNOLAB is a clean, underground laboratory hosting a variety of experiments.
- To retain its global leadership, SNOLAB recognizes it is essential to weave diversity into the culture of the lab.
- Diversity is woven through the three pillars of our 2023-2029 Strategic plan: Excellent Science, Cutting-edge infrastructure, and Skilled people.
- I am very excited about the opportunities that SNOLAB provides the scientific community. I believe SNOLAB well positioned to attract world-class experiments and support major discoveries in the next decade.