

Icelandic Museum of Natural History

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Biodiversity – meaning and importance Vision of Icelandic Museum of Natural History

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Föstudagsfyrirlestur – Hólar University Zoom meeting – December 11th 2020



The roots

- IMNH founded in 2007 offspring of Icel.Soc.Nat.Hist. (1889)
- Central Museum, 1 of 3 (Act of IMNH 35/2007 + Museums Act 141/2011)
- Main role: Information sharing/dissemination:
 - "shed light on nature in Iceland, natural history, nature conservation and use of natural resources by exhibitons, publication and other means of information sharing, in oeder to ensure sustainable use, public access and presveration of the natural heritage in Iceland."
- Main tasks/activity:
 - collection, documentation, preservation, research, dissemination





Benedikt Gröndal writer & nat. hist. (1826–1907), Stefán Stefánsson botanist (1863–1921) and Björn Bjarnarson attorney (1853-1918)

Gröndalshús, Reykjavík - first home to Nat.Hist. Museum.

Perlan



WATER in Icelandic Nature VATNIÐ í Náttúru Íslands

Exhibtion by the Icelandic Museum of Natural History Opened December 1st 2018 Visitors 2019: 188.191 (~ 500.000 in the Pearl), RedDot designer awards 2019



Perlan: WATER in Icelandic Nature

Mixture of interactive multimedia, "conventional" exhibits and activite participitation Ecological approach – connectivity, processes, evolution, dynamic nature

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Concept definition of UN Convention of Biological Diversity (CBD 1992):

"Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." (https://www.cbd.int/)

Concept strength:

- Refers to diversity/variability among and within species and ecosystems.
 Applies to "all levels" of the living world genes, species communities, ecosystems....
 Applies to all interactions among functional units.
- □ Captures both patterns and processes of BD that generate and maintain BD ecological and evolutionary processes.

□ It's the **difference** that matters (something is otherwise than something else!).

Weakness (in execution):

- Overemphasis on (large) species numbers.
- <u>Decoupling from physical environment/habitat geologial diversity.</u>
- Poor dissemination/info sharing (difficult, abstract and complex concept).



- CBD (1992) took effect in Iceland in 1994 (196 nations in 2020).
- Approval of policy on BD in 2008 Report: Stefnumörkun Íslands um framkvæmd Samningsins um líffræðilega fjölbreytni. 28 p.
- Action plan for BD approved in 2010 (Minister for the Environment). Report: Stefnumörkun Íslands um líffræðilega fjölbreytni – framkvæmdaáætlun. 19 p. -Following the 20 Aichi Biodiversity Targets set in 2010 by UN CBD for next 10 years. In short: to slow down reduction in BD before year 2010 Targets not met in 2020 (Report: IBBS 2019 Global Biodiversity Assessment).
- Work underway to renew the Icelandic policy in the light of post 2020 UN CBD Biodiversity Targets (postponed due to COVID-19 from Oct. 2020 to June–Oct. 2021). Ready in late 2021?

..."væntingar að það geti orðið **alþjóðleg tímamót svipað og Parísarsamkomulagið** var með loftslagsmálin þar sem verði dregið betur fram hvaða aðferðafræði og nálganir **ríki heims** ætla að koma sér saman um til þess að tryggja vernd og sjálfbæra nýtingu líffræðilegrar fjölbreytni til frambúðar," Jón Geir Pétursson expert at the Environmental Ministry.



Biodiversity – threats/pressures

Targets not met in 2020 (Report: IBBS 2019 Global Biodiversity Assessment)

Key messages:

"A. Nature and its vital contributions to people, which together embody biodiversity and ecosystem functions and services, are deteriorating worldwide.

B. Direct and indirect drivers of change have accelerated during the past 50 years.

C. Goals for conserving and sustainably using nature and achieving sustainability cannot be met by current trajectories, and goals for 2030 and beyond may only be achieved through transformative changes across economic, social, political and technological factors.

D. Nature can be conserved, restored and used sustainably while other global societal goals are simultaneously met through urgent and concerted efforts fostering transformative change."

Primary threats/pressures:

- Climate change
- Habitat fragmentation, shrinkage
- Pollution, nutrient overload



Biodiversity in Iceland

Nature characteristics:

- Geographically young, volcanic activity, plate tectonics (E meets W), isolated island
- Large natural areas, wilderness, sparesly populated
- Basaltic lava bedrock + andosoles peculiar habitat
- Diversity in freshwater systems
 Springfed, Glacial & Geothermal + direct runoff + wetlands
- Warm + cold water masses Gulf stream & E-Greenland an E-Iceland stream



Iceland's springs and spring areas are among the largest in the world.

Árni Hjartarson 2018. ÍSOR/NMSÍ



Biodiversity in Iceland

Nature characteristics:

- Few species neither reptilia nor amphibia
- Flora and fauna young (< 10.000 BP, except 2 sp. of subsurface amphipods!)
- Those present (birds, fish + marine mammals) often in large populations.
 Iceland important globally for migratory marine mammals + migratory and trans-migratory birds
- Intraspecific diversity important?
 Variability in phenotypic and genetic traits well known among freshwater fish





Nature characteristics: Intraspecific variability/diversity



ÍSLANDS



Biodiversity in Iceland

The same applies to Iceland as the rest of the world!

Climate warming



Air T (°C) in Iceland in past 170 years (untill 2015), measured at 15 stations. Deviations from 20. century averages. Data: Icel. Met. Office

Warming by 0.8 °C pr. century from middle 19. century – in line with global warming.

Halldór Björnsson et al. 2018. Loftslagsbreytingar og áhrif þeirra á Íslandi – Skýrsla vísindanefndar um loftslagsbreytingar 2018. Veðurstofa Íslands. 236 p.

Ministry of Environment and Natural Resources 2020. Aðgerðaáætlun í loftslagsmálum. Aðgerðir íslenskra stjórnvalda til að stuðla að samdrætti í losun gróðurhúsalofttegunda til 2030. 169 p.



Biodiversity – threats & consequences Iceland

- Warming (terrestrial, oceanic, freshwater, defrosting)
- Ocean acidification
- Habitat fragmentation (roads, land filling, damming e.t.c.)
- Soil erosion

Some species go (capelin), others come (mackerel), still others stay (cod)

Halldór Björnsson et al. 2018.



Acidity (pH) in warm (red) and cold (blue) surface layers in Icelandic waters during winter. Halldór Björnsson et al. 2018.





Biodiversity – threats & consequences

Warming of Þingvallavatn and ecosystem change



Yearly mean water T in Þingvallavatn (blue) and yearly mean air T in the catchment area (red) 1962–2016. Ca. 0.2° C/decade, highest in June–August, rise on average 1.3–1.6 °C.

- Increase in nutrient load NO₃
- Increase in primary production
- Reduction in big diatomes Aulacoseira islandica, A. italica and Asterionella Formosa
- Changes in fish species composition???



Hilmar J. Malmquist et. al 2020

Biodiversity – threats & consequences

Warming of Elliðavatn and ecosystem change



Hilmar J. Malmquist et al. 2009, Jeppesen et al. 2012

Shallow lake Elliðavatn has been warming for the last decades. At same time, the Arctic charr, cold water species, has collapsed. However, brown trout, more het tolerant species, is OK.

Lately, T of 15-20°C has been recorded for days and weeks during summer. That is too much for Arctic charr, both direct and indirect effects.

Arctic charr populations are declining in many lakes and rivers in Iceland.

SLANDS



Gaps and weakness (Iceland):

Overemphasis on species numbers (large animals) Missing info on small organisms, processes (events over time) and interactions Regarding climate change:

Less research and monitoring on nature than in 2018 than 2008.

Monitoring plan of key factors in nature are missing, especially CC related.

Halldór Björnsson et al. 2018. Icel. Met. Office., p. 17.

Poor communication, information sharing, dissemination

Failure by the scientific community. IBBS 2019 Global Biodiversity Assessment

How to enhance knowledge and understanding of BD?

What is IMNH doing?

Research (basic and prerequisite to all activity by IMNH) – part of IMNH policy. Relate to biological (and geological) diversity, with focus on climate change:

Arctic tadpole shrimp (*Lepidurus arcticus*) – distribution, biology. IMNH, Nat.Hist.Kóp., RORUM Lake monitoring (e.g. Þingvallavatn, Blávatn) – biology, water quality, T, Ice. IMNH, Nat.Hist.Kop., UI "Biodiversity – origin and nature". Hólar University, IMNH, UI, IINH, CAFF, LUFF et al.

3 research projects:

Ecology and evolution of freshwater fishes (eco, evo, devo).

Nature and Value of Biodiversity. Philosophical and biological approach.

Biodversity in Iceland - information sharing, educational data, data portals



How to enhance knowledge and understanding of BD?

What is IMNH doing?

Application – Icelandic Climate Fund (MENR/RANNÍS):

"The interaction of climate change and biodiversity: communication between science and society" Skúli Skúlason, Bjarni K. Kristjánsson, Camille A Leblanc og Hilmar J. Malmquist

Overall objective:

Formulate and present existing scientific knowledge of BD and effects of CC in a way that can be understood by the public, politicians, educators and experts, in order for society to be better equipped to manage and treat nature in a sustainable, meaningful way, especially regarding measures and response to current threats of CC and land use on BD in Iceland.

- 1) The nature and value of BD. Collect available data and info. Prepair for diverse stakeholders.
- Knowledge and data on BD in Iceland and relations to CC.
 Focus on selected vertebrates and freshwater systems.
 Prepair for society, diverse stakeholders.
- 3) Information sharing. Present 1) and 2) to society at large: public open-web-site, educational texts, podcasts, short films guidelines for policy making, EXHIBITONS



How to enhance knowledge and understanding of BD?

What is IMNH doing?

COLABORATION - work/projects in the pipes Group of biologists preparing a **memento** on **"biodiversity conservation research in Iceland**" Statement/challenge to authorities to improve and facilitate MFRI, UI, IFBR&D, Hólar University, IMNH, IINH + more

Inspired by:



Intergovernmental laboratory for life science research. Founded 1974, 27 member states including Iceland. 6 laboratories in 5 countries, 1800 employees. Leading expertise in molecular biology and techniques.



Planetary Biology

How organism interact and respond to environmental changes At molecular, cellular, organismal and population level. Microbes, algae, plants, animals.

Collaboration between scientists in member states.

Planetary health



EMBL's call "From molecules to ecosystems"

What is out

there? Assessing **biodiversity** using different tools e.g. eDNA, taxonomic cues etc.

Iceland: decades of sample collection and monitoring...

EMBL: experience with Tara Ocean Foundation, sequencing core facilities, computational infrastructure and data analysis expertise

How do different environmental factors affect species and whole ecosystems?

Studies of **processes** (ecological,

evolutionary etc) Iceland: unique ecosystems, decades of research, extensive long term research and in some cases good understanding of some major processes

EMBL: Extensive knowledge of development, physiology, immunology which can help with the understanding of these processes

What are the mechanisms behind these

changes?

Studies of the genetic, epigenetic and molecular **mechanisms** behind the

processes **Iceland**: facilities to run experiments to investigate some of these mechanisms **EMBL:** Extensive knowledge of development, physiology, metabolism, immunology, sequencing core facilities, computational infrastructure and data analysis expertise, advanced molecular techniques .

Kalina Kapralova UI







