Example of a Belgian Member : what is their work in the context of IUCN and/or what prompted them to join IUCN?

Antwerp Zoo Society and the Centre for Research and Conservation

G - B I K E

Presenter: Peter Galbusera

IUCN Belgium Members Day l May 8 2023

Slides : Peter Galbusera, Linda Laikre, Sean Hoban, Zjef Pereboom

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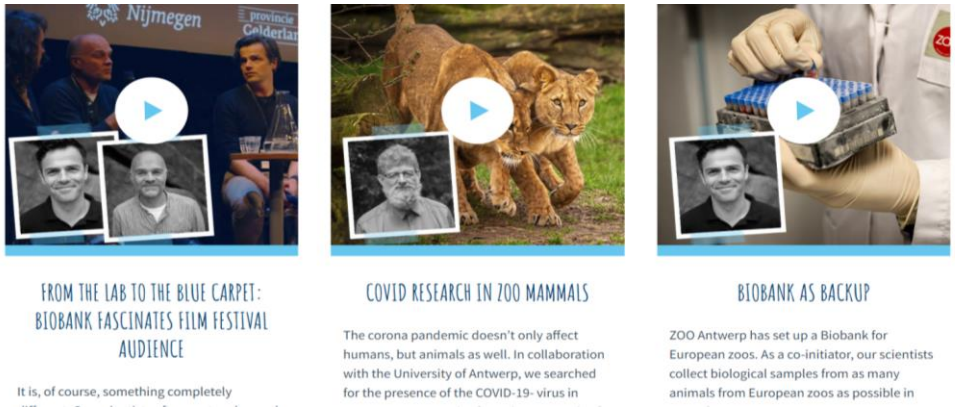
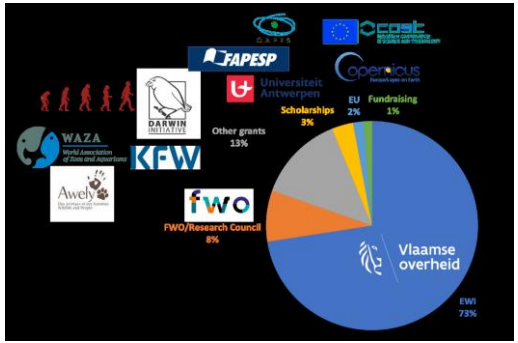
ZOO SCIENCE

ANTWERP ZOO CENTRE FOR RESEARCH AND CONSERVATION



DEPARTMENT OF ECONOMY SCIENCE & INNOVATION



www.zooscience.be

FRIS research portal

How Zoo Populations can Contribute to Conservation

- Education/exhibit opportunities:
  Raising awareness / Conservation Education
- Fundraising opportunities:
  Conservation Support
- Research collections:
  Species biology and husbandry
- In Situ Conservation
  Species protection in the field and if required Reintroductions
- Ex-situ Conservation
  Demographic and genetic backup for wild populations

THIS REQUIRES SUSTAINABLE POPULATIONS

ZOO SCIENCE

WHICH SPECIES?: Regional Collection Planning (RCP)

Taxon Advisory Groups (TAGs) decide which species are recommended to be managed under an EAZA Ex situ Programme (EEP) and what the direct, and/or indirect, and/or non-conservation roles of each EEP will be.

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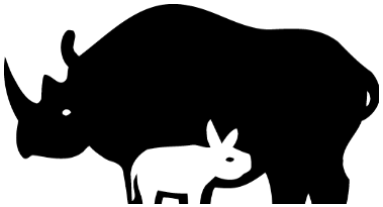
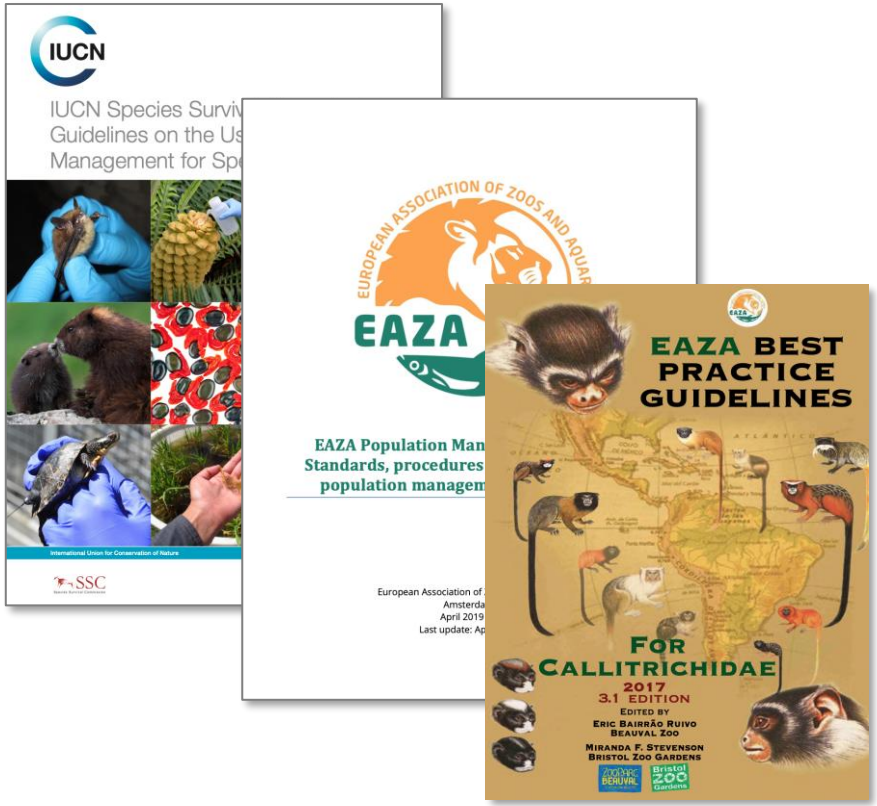
Changing the Future for Wildlife

ZOO SCIENCE

Ex-situ Breeding Programmes



EAZA Ex-situ Programmes (EEP)



ZOO SCIENCE

Role of the black vulture EEP*

- Function as a demographically stable, genetically healthy and behaviorally competent **insurance population**
- Function as **source for reintroduction projects**, mainly to re-establish breeding colonies at strategic geographical regions as described in the species' action plan

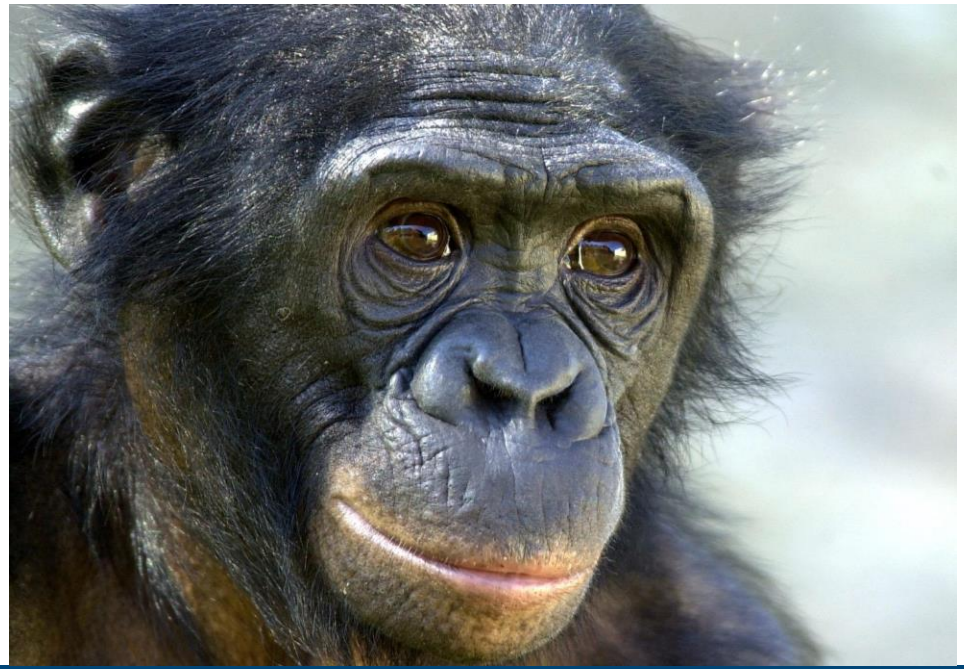
VCF VULTURE CONSERVATION FOUNDATION

*Long-term Management Plan for the European black vulture EEP (2019)

ZOO SCIENCE

Genetic and Demographic Objectives*

Role: a demographically stable and genetically healthy zoo population. *No reintroductions planned*.



IUCN SSC PRIMATE Specialist Group

*Great Ape TAG Regional Collection Plan (2019)

ZOO SCIENCE

GOSG

GIRAFFE & OKAPI SPECIALIST GROUP

ZOOLOGY SCIENCE

GHLT Insurance Population

- The EAZA Ex situ Population functions as a long-term **insurance population** that holds potential for future reintroductions, should this be required.

Ex situ breeding populations

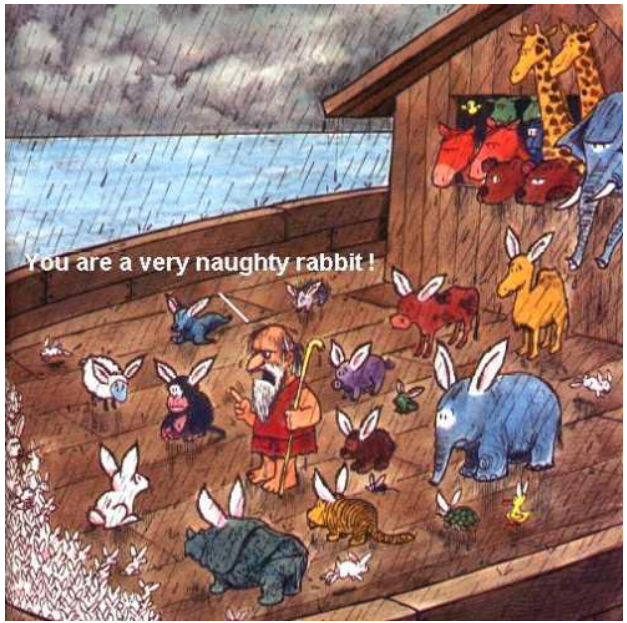
- Are always small populations: *drift & inbreeding*
- *No gene flow* without human intervention
- Live in unnatural circumstances: *genetic adaptation*
  - Absence of natural selection pressures
  - Presence of unnatural selection pressures

This makes conservation breeding populations extra vulnerable for loss of Genetic Diversity

WHO to breed……?

PMx pairing tab: Mean Kinship (based on pedigree)

- *Low MK* = few relatives = **Highest breeding priority**
- *High MK* = many relatives= **LESS priority (or DO NOT BREED)**



Population goals include **demographic and genetic goals**

ZOO SCIENCE

Incomplete pedigree > DNA-analyses

Animal Conservation

ZSL

Animal Conservation. Print ISSN 1367-9430

Molecular paternity determination in captive bonobos and the impact of inbreeding on infant mortality

S. Van Coillie[1,2], P. Galbusera[2], A. D. Roeder[3], W. Schempp[4], J. M. G. Stevens[2], K. Leus[2], G. Reinartz[5] & Z. Pereboom[2]

1 Department of Biology, University of Antwerp, Antwerpen (Wilrijk), Belgium
2 Centre for Research and Conservation (CRC), Royal Zoological Society of Antwerp, Antwerp, Belgium
3 Cardiff School of Biosciences, Cardiff University, Cardiff, UK
4 Institute of Human Genetics, University of Freiburg, Freiburg, Germany
5 Zoological Society of Milwaukee, Milwaukee, WI, USA

Keywords
Pan paniscus; microsatellite DNA; inbreeding depression; infant mortality; captive-breeding programme; hair samples.

Correspondence
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Received 17 January 2008; accepted 9 May 2008

doi:10.1111/j.1469-1795.2008.00186.x

Abstract

Inbreeding and the loss of genetic diversity may lower fitness and reduce the potential for a population to adapt to changing environments. In small populations, for example in captive populations or populations of endangered species, this can have considerable consequences for their survival. We investigated the effects of inbreeding on infant mortality in the world captive population of bonobos Pan paniscus. Using a combination of studbook data and high-quality pedigree data from genotyped individuals, inbreeding information was available for 142 captive-born individuals. For the determination of paternities that were unresolved in the studbook, nuclear microsatellite DNA was amplified from hair and blood samples using the Great Ape Kit and PowerPlex[5] 16 System. In total, 54 bonobos (17 offspring and their putative parents) were genotyped at eight tetranucleotide repeat microsatellite loci. Inbreeding coefficients were calculated for each individual for whom paternity was confirmed by either studbook data or DNA analysis. We found significantly higher infant mortality in inbred offspring compared with non-inbred offspring, suggesting that inbreeding reduces infant

Plancken dael

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How Zoo Populations can Contribute to Conservation

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- Ex-situ Conservation
  Demographic and genetic backup for wild populations

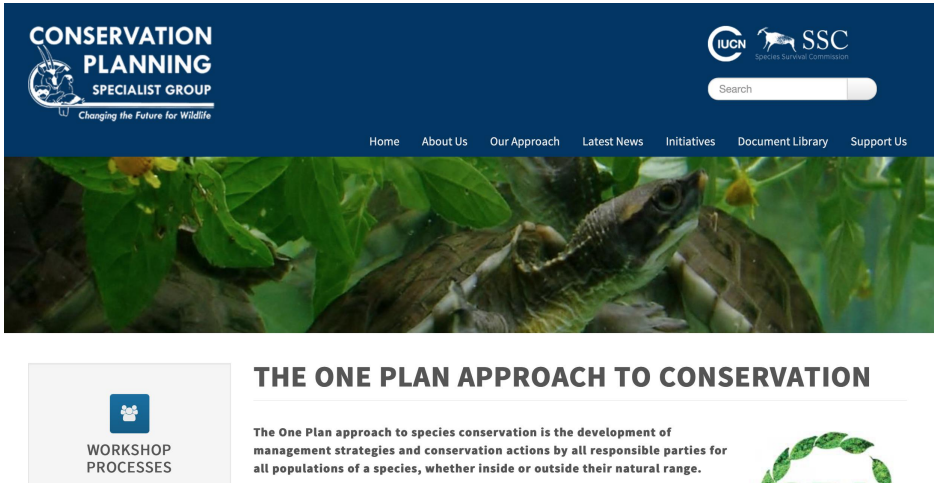
… with IUCN guidelines, data, support

… also for SPECIES CONSERVATION PLANNING

ZOO SCIENCE

Species conservation planning in a holistic approach

- Integrating in-situ and ex-situ efforts in a OPA (One Plan Approach)



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OPA

One Plan Approach to Conservation Planning

THE ONE PLAN APPROACH TO CONSERVATION

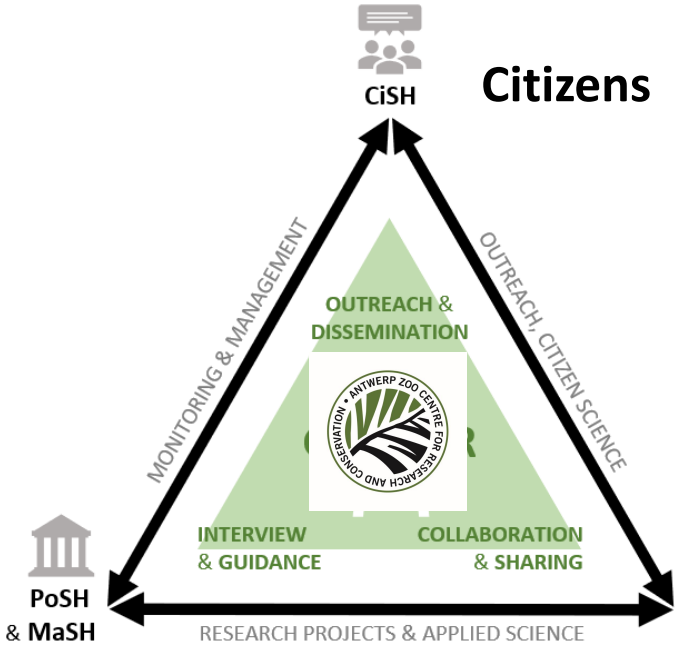
The One Plan approach to species conservation is the development of management strategies and conservation actions by all responsible parties for all populations of a species, whether inside or outside their natural range.

Species conservation in a holistic approach

- Integrating in-situ and ex-situ efforts in a OPA (One Plan Approach)

- From Conservation Biology to Conservation Science: holistic approach including genetics, socio-economics …
- Including all stakeholders: researchers, managers, policy makers, NGOs/citizens,…

Conservation: need to involve all stakeholders



Policy makers & Managemers

Researchers

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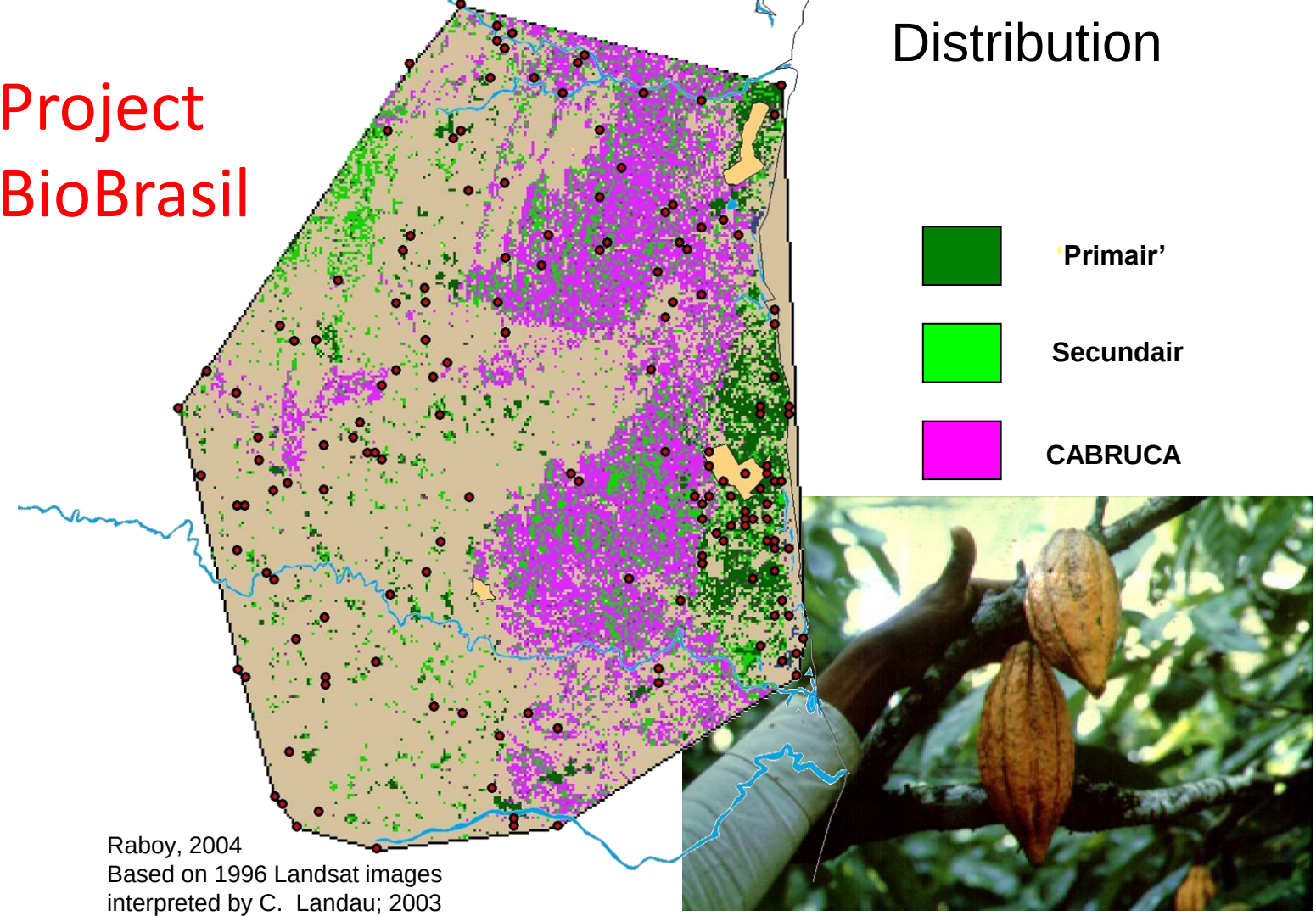
Example: Golden-headed lion tamarins: in situ

- Endemic in Bahia & Atlantic coastal forest
- Threatened by habitat loss & fragmentation
- Population estimate of about 10,000 individuals
- Only 500 individuals left in protected areas and 500 in zoos

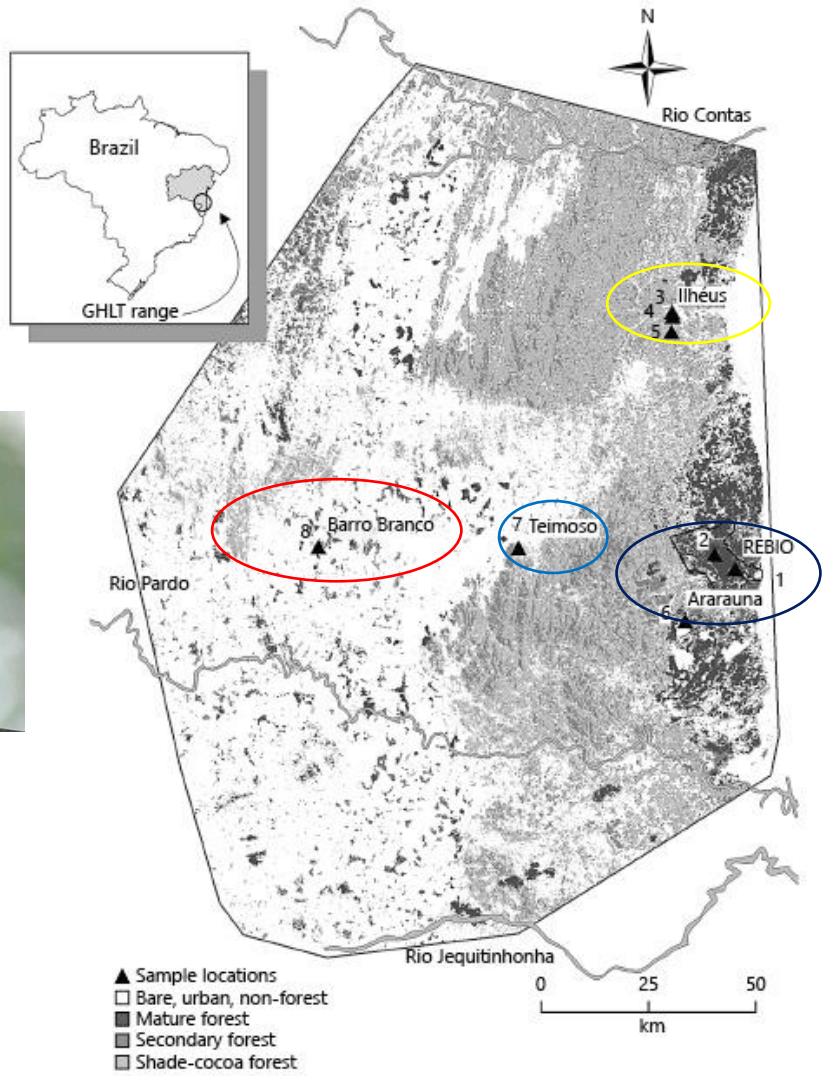
Project BioBrasil

Distribution

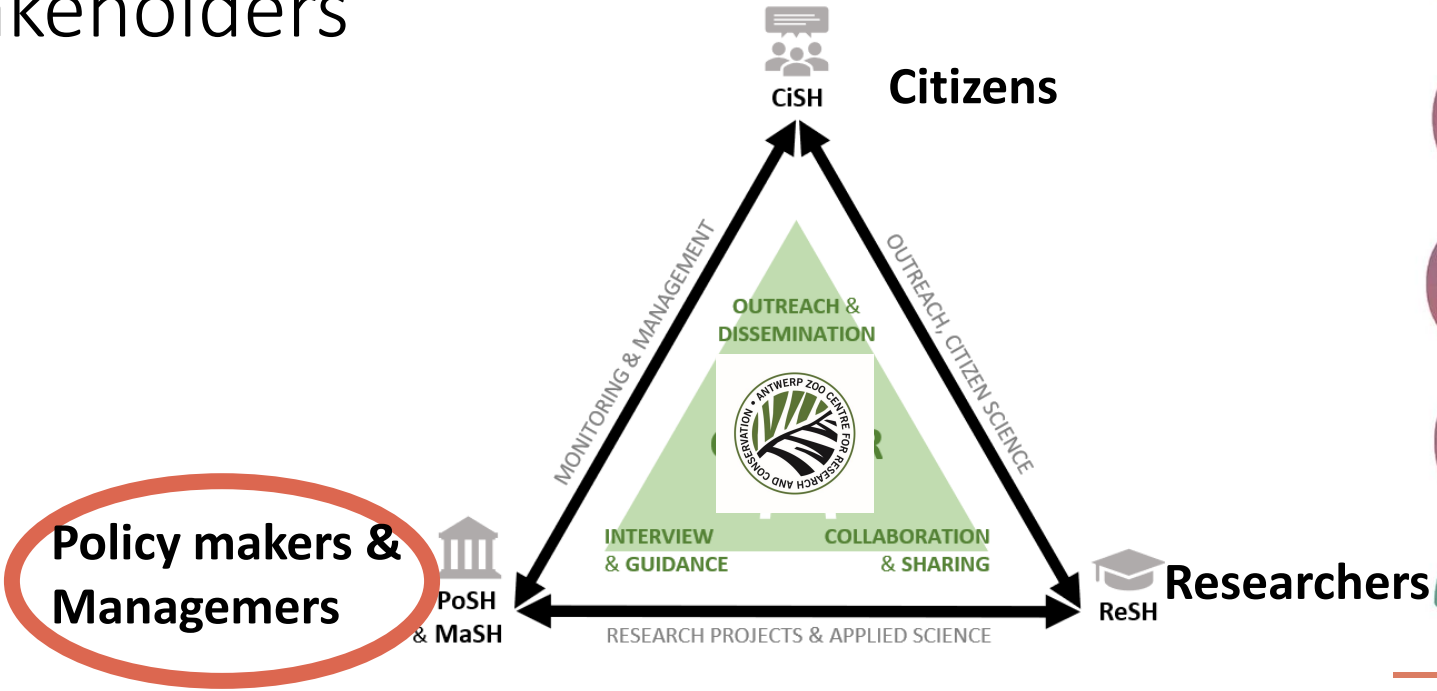


Raboy, 2004
Based on 1996 Landsat images interpreted by C. Landau; 2003

Genetic Diversity



Conservation: need to involve all stakeholders



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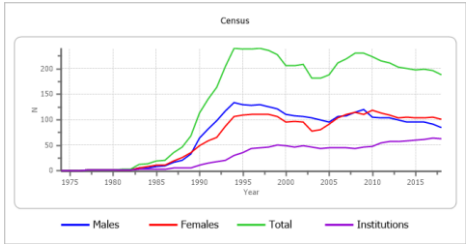
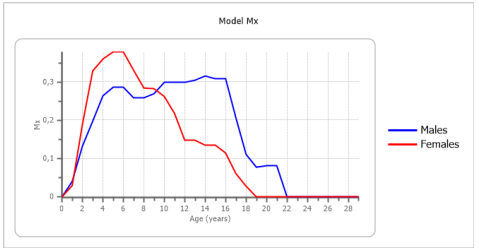
Management, incl. assessments and planning

- Ex-situ: GHLT EEP, ISB… (with EAZA, …)





- In-situ: BaLTCI/ICMLB = Bahian Lion Tamarin Conservation Initiative

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ICMLB

How Zoo Populations can Contribute to Conservation

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  Demographic and genetic backup for wild populations

… SPECIES CONSERVATION PLANNING

… POLICY SUPPORT: from local to GLOBAL!

ZOO SCIENCE

Policy - Conserving Genetic (Bio)Diversity

Received: 25 October 2022 | Revised: 25 January 2023 | Accepted: 19 March 2023

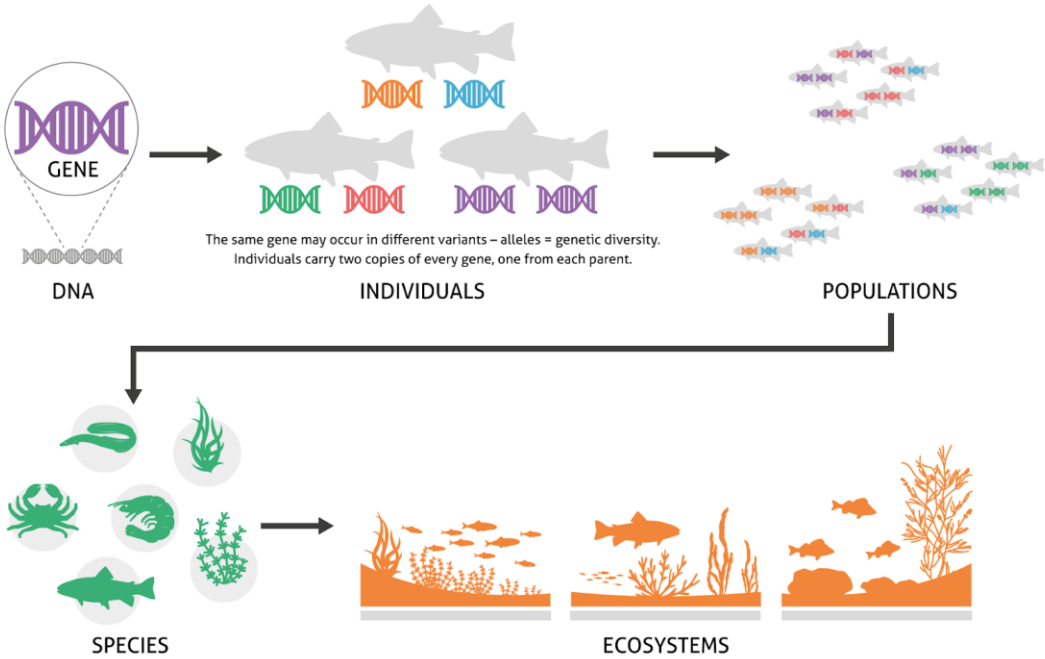
DOI: 10.1111/csp2.12929

PERSPECTIVE

Conservation Science and Practice
A Journal of the Society for Conservation Biology
Open Access
WILEY

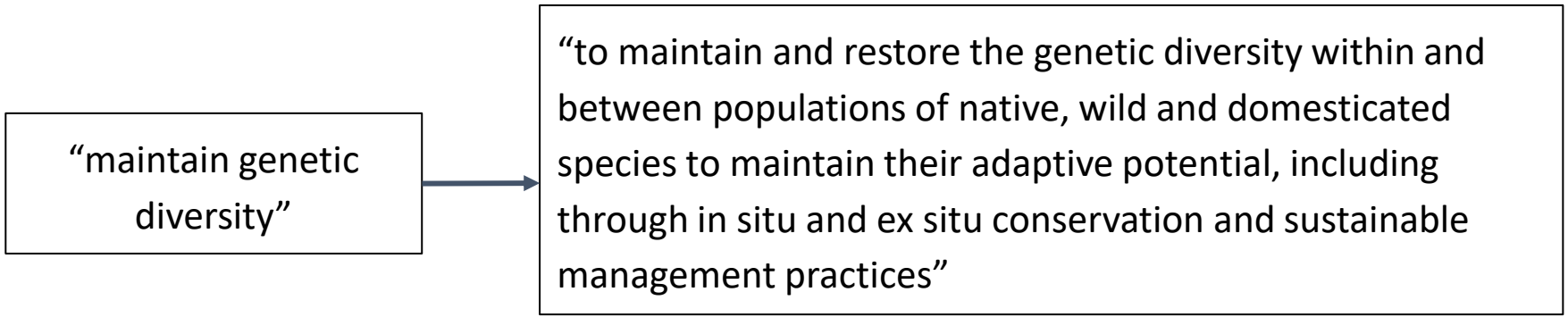
Conserving species' evolutionary potential and history: Opportunities under the Kunming–Montreal Global Biodiversity Framework

Marine Robuchon[1] | Jessica da Silva[2,3] | Grégoire Dubois[1] | Rikki Gumbs[4,5] | Sean Hoban[6,7] | Linda Laikre[8] | Nisha R. Owen[5,9] | Andrea Perino[10]



What were the outcomes of COP15?

Goal protecting species, their populations and their genetic diversity



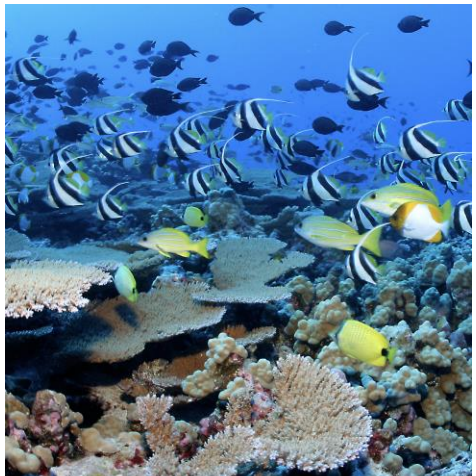
Indicators that we developed:

- Proportion of populations large enough to maintain genetic diversity
- Proportion of historic populations maintained

Proportion of distinct populations maintained (A.8.1)

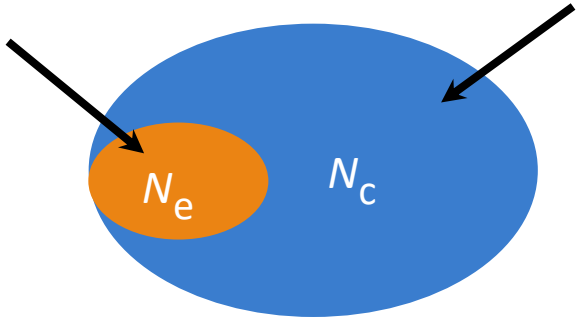
Relevant: Maintain genetic adaptations

Understandable: People can see adaptations to different habitats



Genetic effective population size (N_e)
shows how the population ”behaves” genetically

Census size
number of mature individuals (N_c)



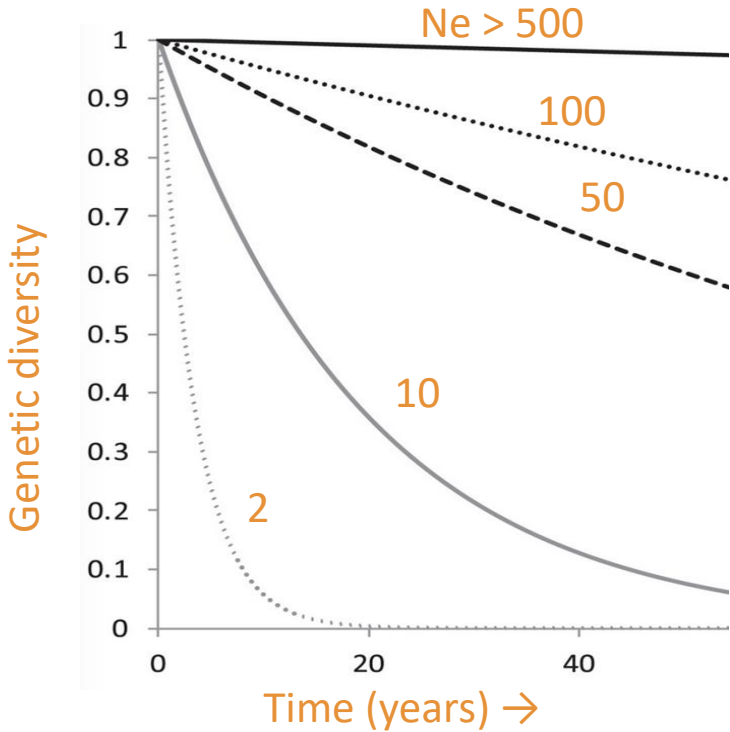
1 / 10 = 0.1

The effective population size (N_e) determines the rate of loss of genetic diversity and is much smaller than the census size (~10% on average)

Frankham et al. 2022, Frankham 1995, Palstra & Ruzzante 2008, Charlier et al. 2011

The proportion of populations [or breeds] with an effective population size (Ne) above 500 (A.5)

Relevant: “Sufficiently large” to prevent genetic erosion/ inbreeding, and maintain adaptive capacity



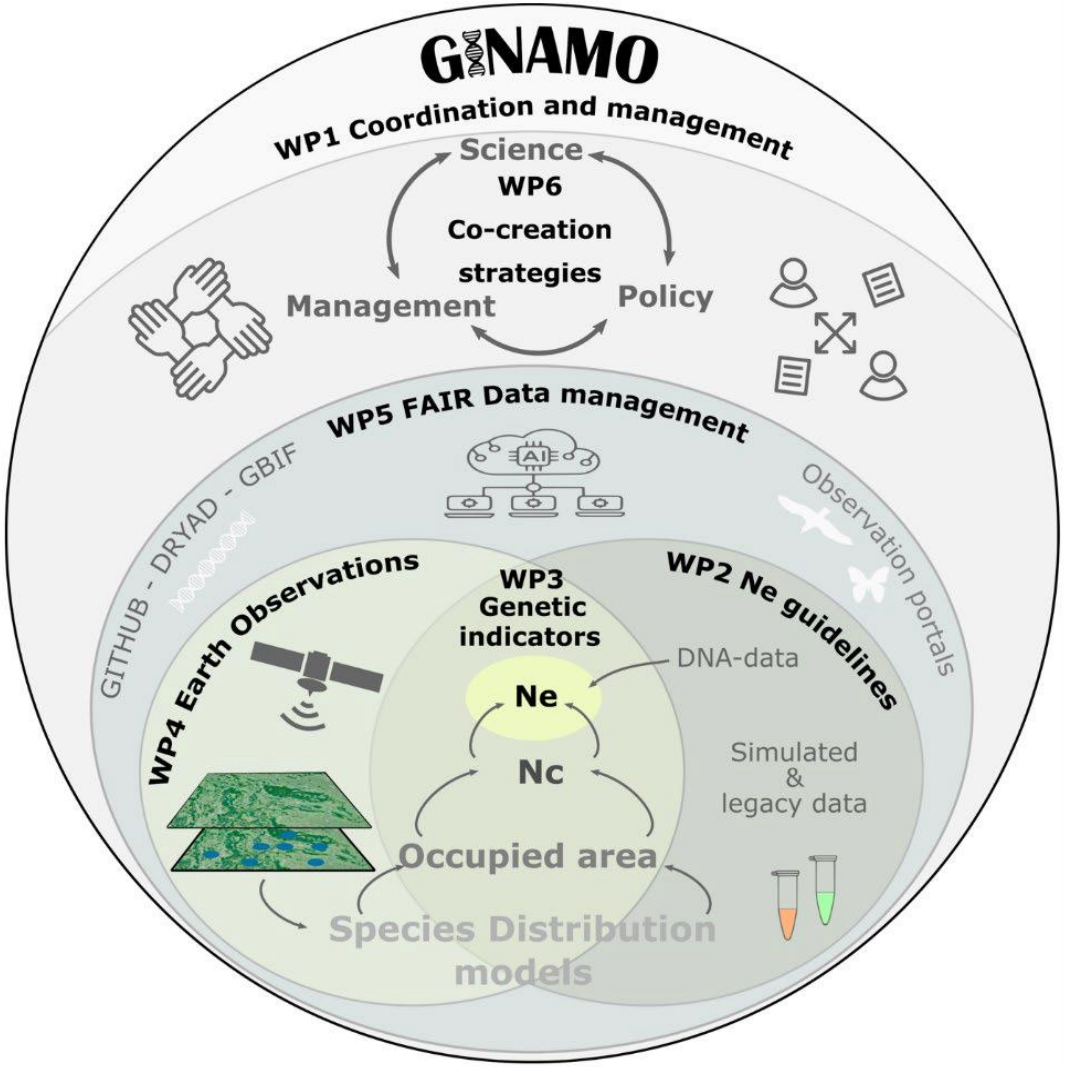
Indicators of genetic diversity

Previously no indicators for wild species

- DNA data is expensive, technical, slow
- Need affordable, understandable metrics

We have “good enough” non-DNA data

(from herbaria, citizen scientists, government reports, flora, local knowledge holders)


GNAMO
WP1 Coordination and management
Science
WP6
Co-creation
strategies
Management
Policy
WP5 FAIR Data management
AI
GITHUB - DRYAD - GBIF
Observation portals
WP4 Earth Observations
WP3
Genetic
indicators
WP2 Ne guidelines
DNA-data
Ne
Nc
Simulated
&
legacy data
Occupied area
Species Distribution
models

Putting into practice

- 9 countries, ~100 species per country: Australia, Belgium, Colombia, France, Japan, Mexico, South Africa, Sweden, USA

- **Includes biodiversity agencies of the countries**

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South African National Biodiversity Institute

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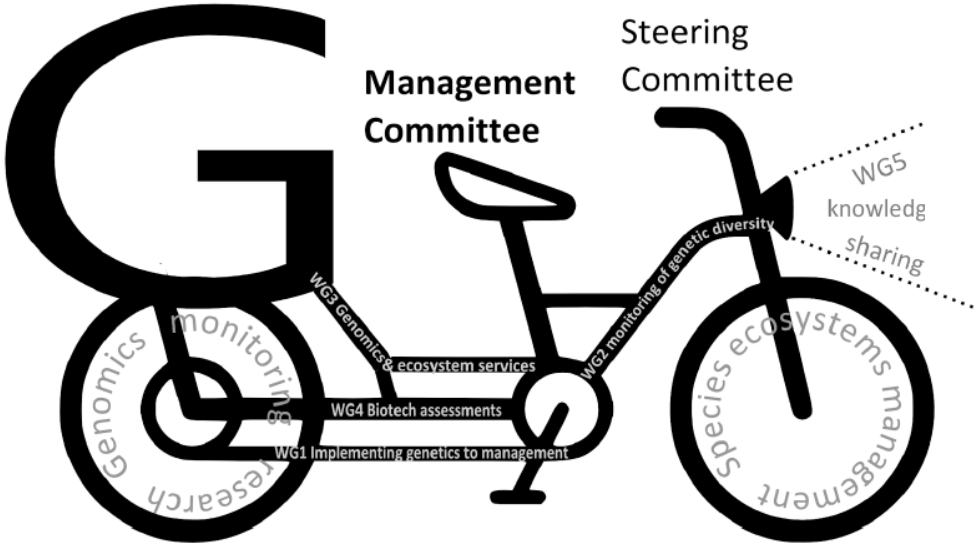
Genomic BIodiversity Knowledge for Resilient Ecosystems



Genomic Biodiversity Knowledge for resilient Ecosystems

Genetic Variation - key to adapting to environmental change

Main Findings

Humans depend on ecosystems. We need to act and stand guard against the loss of biodiversity caused by human activities and climate change, also for our own sake.

- **Genetic diversity** is variation at the DNA level. Genetic diversity is the basis of biological differences, both between species and among individuals of the same species.
- Because of genetic diversity, some individuals are better suited to survive and reproduce in certain conditions, and will be favoured by **natural selection.**
- Genetic diversity increases the probability of species survival, especially during environmental change. **Genetic diversity is therefore crucial to the resilience of ecosystems** and the production of ecosystem services.
- Populations that are small and isolated rapidly lose genetic diversity. Therefore, management should focus on **enlarging and connecting populations** above critical thresholds, to retain the capacity to adapt genetically to change.
- **Measuring and monitoring** genetic diversity enables us to better evaluate species health, genetic variation and the exchange of genetic variation across different populations (gene flow) to improve the management of biodiversity and natural resources.

Key Recommendations

Preventing more extinctions and safeguarding ecosystems requires immediate and comprehensive action.

- Conserve and restore genetic diversity to sustain the viability of species and ecosystems and increase their resilience to climate change.
- Implement genetic methods for analysing and monitoring genetic variation in species of special concern for ecosystem services or conservation. These important conservation tools provide science-based information to managers and policy makers.
- Improve species conservation programmes so they safeguard and strengthen genetic diversity. Plants and animals have adapted to their environments for several hundreds of years, and their genetic adaptations make it more likely that they will survive environmental changes.
- Modify guidelines for national reporting on the EU Habitats Directive, Birds Directive, Marine Strategy Framework Directive and Water Framework Directive to explicitly recommend that genetic diversity and gene flow in species are assessed and monitored wherever it is relevant.

Photo: Adaptive colour variation among European pool frogs (*Pelophylax lessonae*). Dark individuals (outermost individuals, from northern Europe) heat up more easily than light-coloured individuals (central, from Southern Europe), which is advantageous in cold regions. (photo: Per Sjögren-Gulve).

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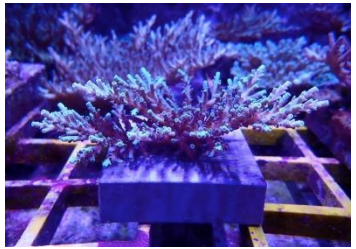

IUCN Belgium Day May 8 2023

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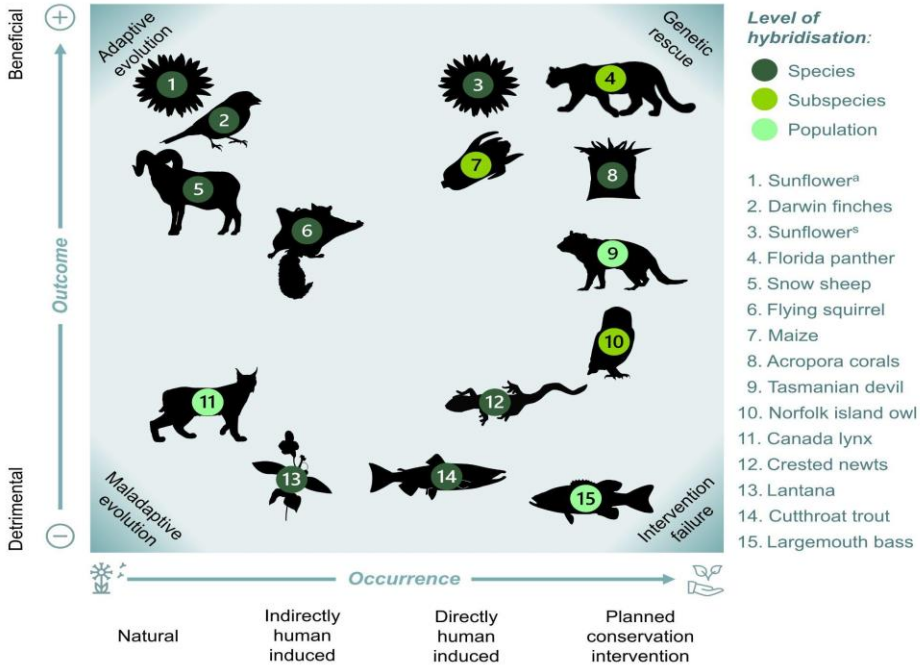
Hybrids – worth the consideration for conservation

IUCN Position Statement

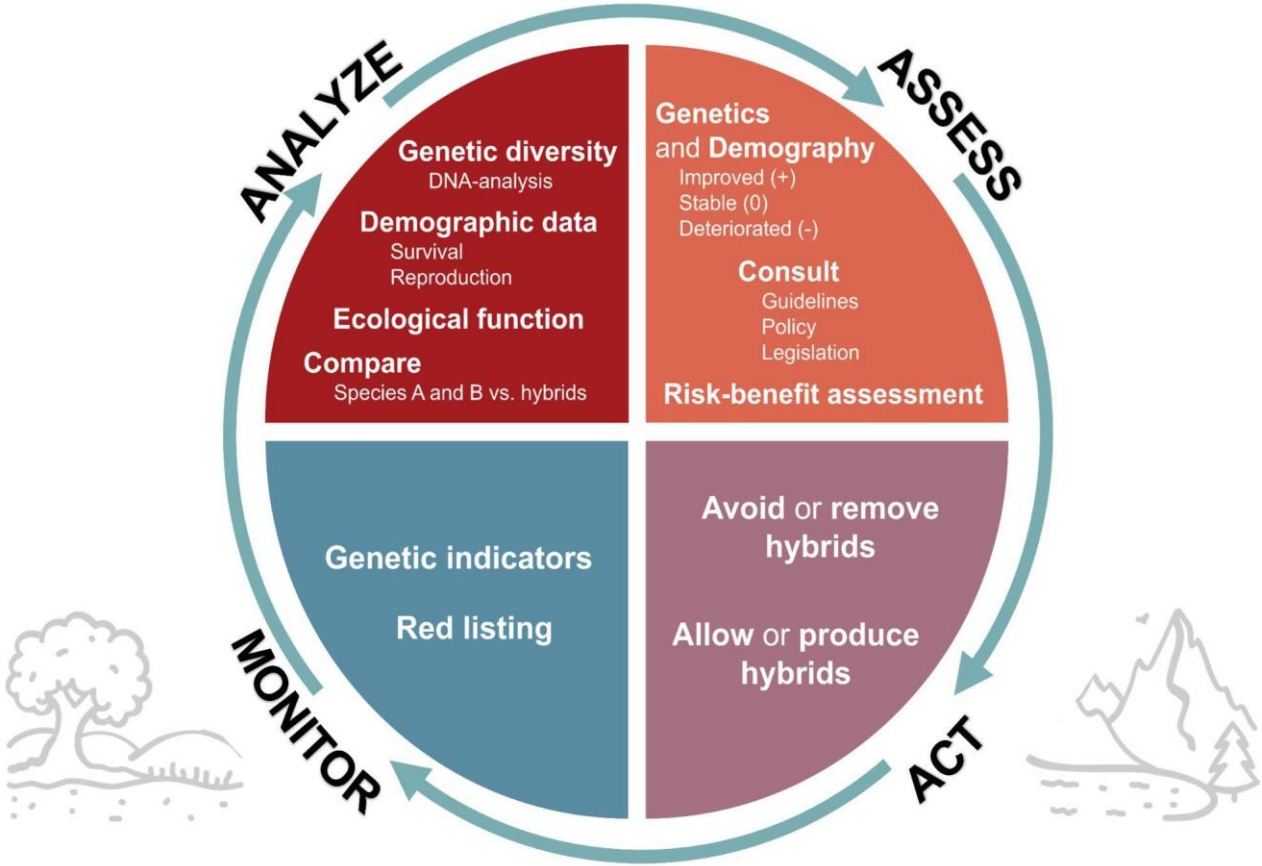


Hybrids: new developments, opportunities and needs

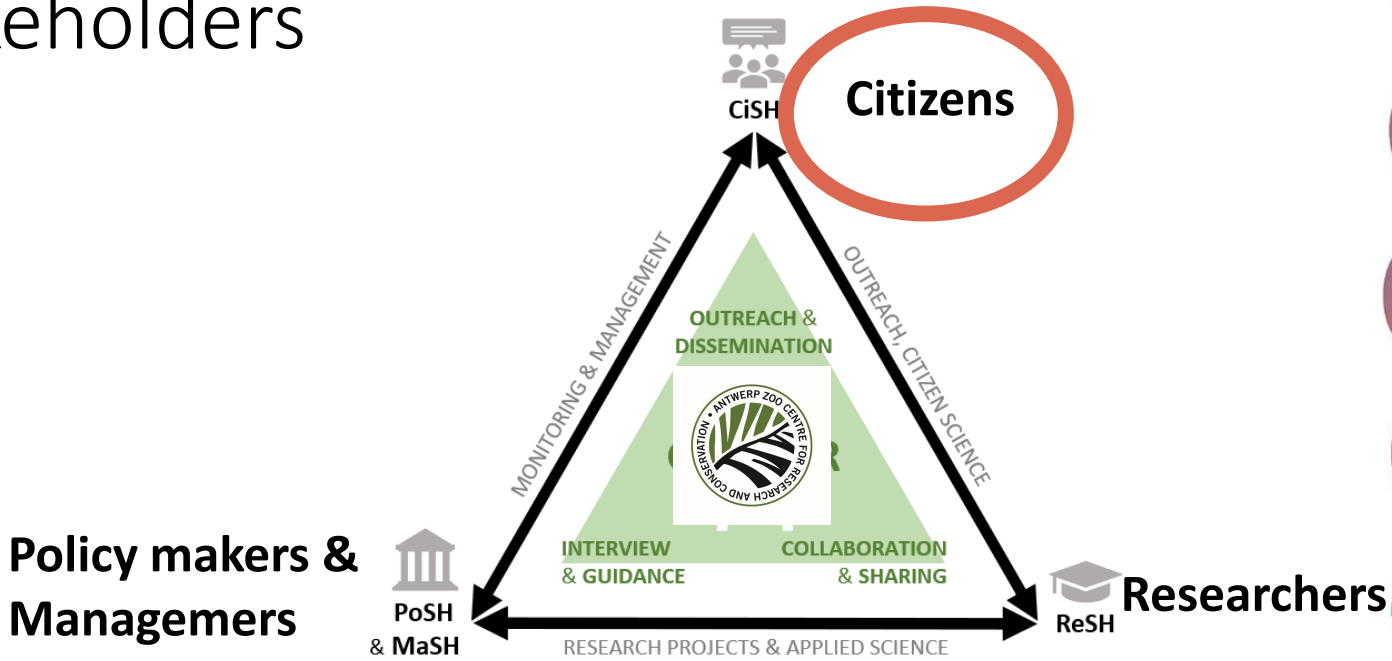
- Increased challenges in biodiversity conservation
- Technological developments
- Increased recognition of the importance of genetic variation (Global Biodiversity Framework) > gene-centered instead of species-centered

- Need and opportunity to assess the potential of hybrids for the conservation of biodiversity at all three levels (genetic, species and ecosystems)
- Focus on effects of hybrids/hybridisation, case-by-case approach

Hybrids


ANALYZE
Genetic diversity
DNA-analysis
Demographic data
Survival
Reproduction
Ecological function
Compare
Species A and B vs. hybrids
ASSESS
Genetics
and Demography
Improved (+)
Stable (0)
Deteriorated (-)
Consult
Guidelines
Policy
Legislation
Risk-benefit assessment
MONITOR
Genetic indicators
Red listing
ACT
Avoid or remove hybrids
Allow or produce hybrids

Conservation: need to involve all stakeholders



Policy makers & Managemers

Researchers

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Citizen outreach

- Zoo visitor education
- EAZA : social media, Newsletter
- video games, floor game

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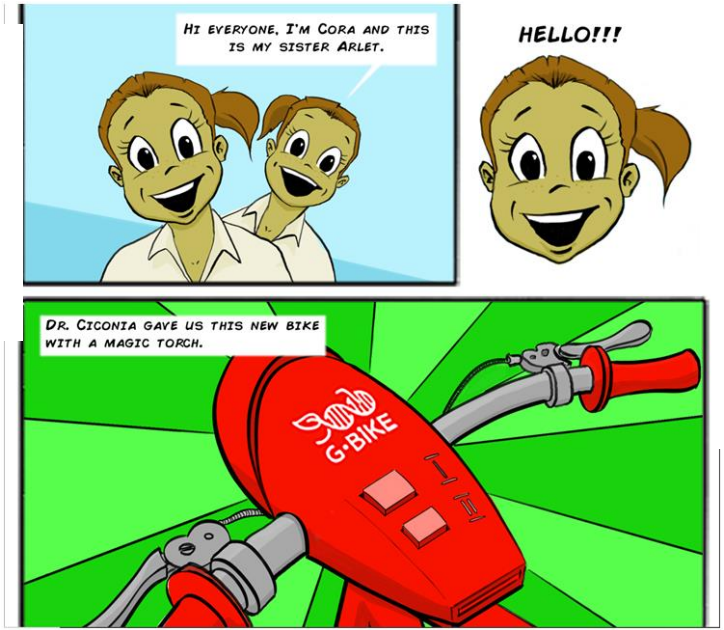
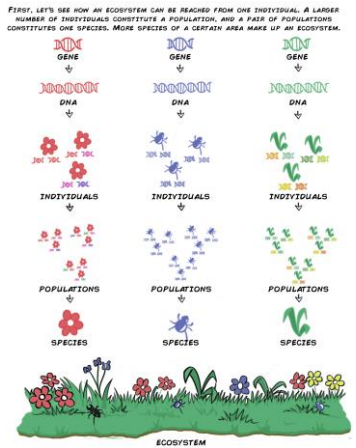
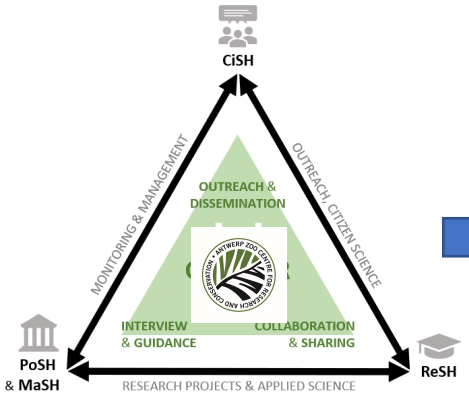
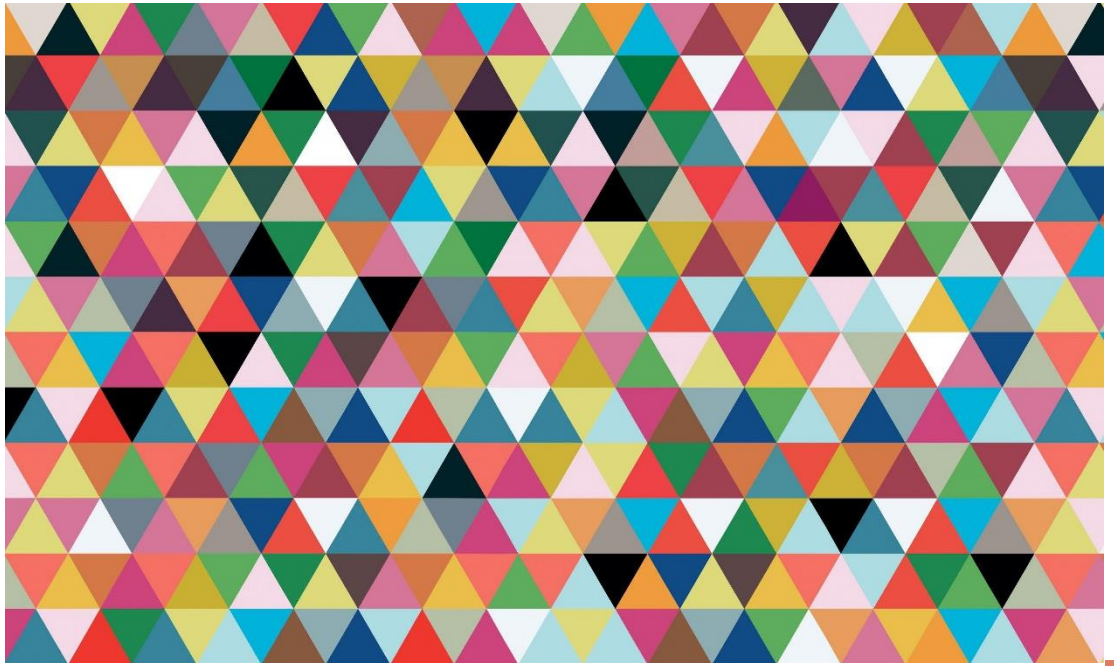
GBiKE digital educational comics: “Genes on Wheels”





IUCN : “I, YOU, for the conservation of nature”





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