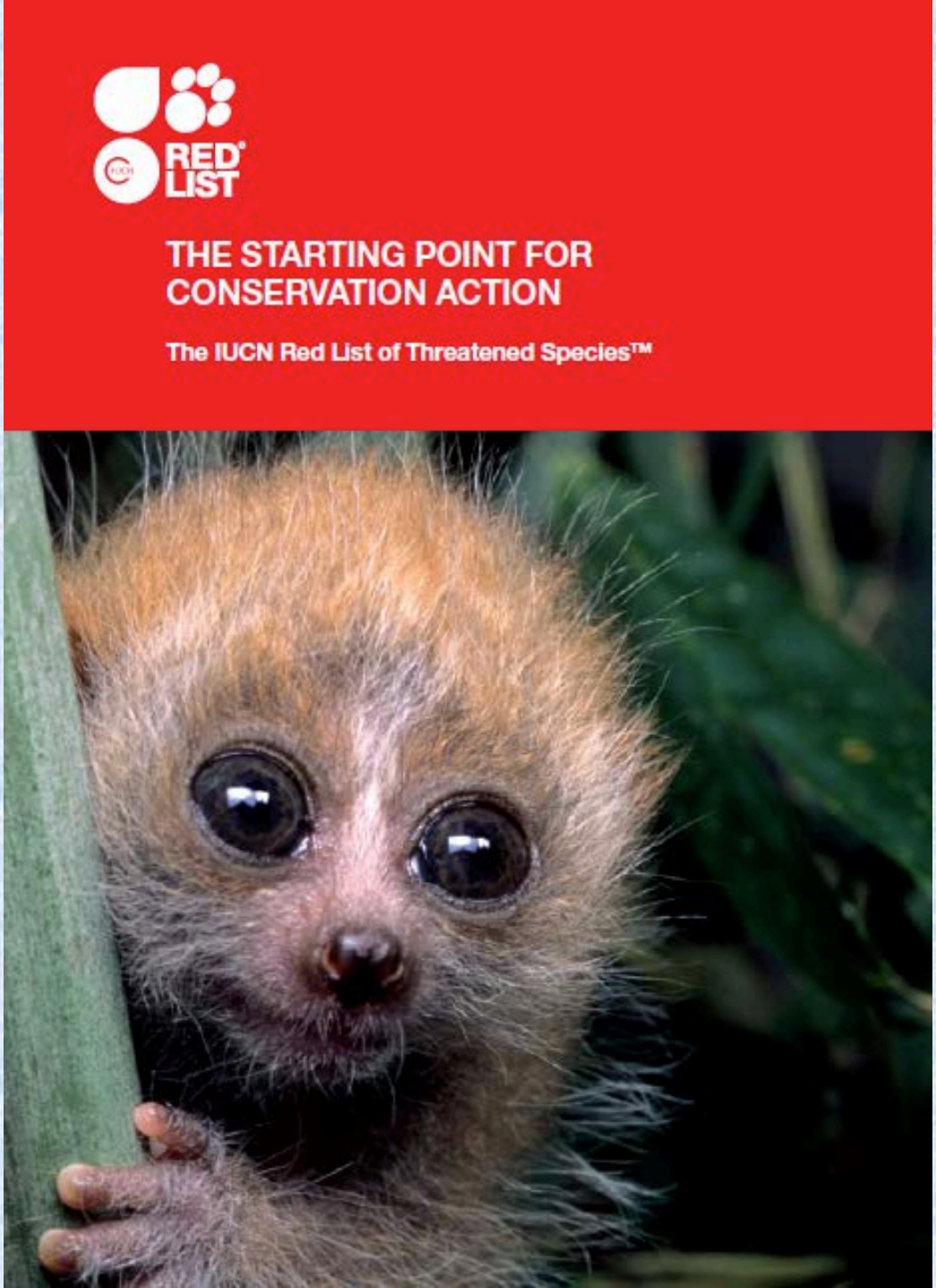



# IUCN Red List Process

Cormack Gates
Keith Aune

**The IUCN Red List Categories and Criteria have several specific aims**

•to provide a system that can be applied consistently by different people;

•to improve objectivity by providing users with clear guidance on how to evaluate different factors which affect the risk of extinction;

•to provide a system which will facilitate comparisons across widely different taxa;

•to give people using threatened species lists a better understanding of how individual species were classified.

# The Red List Process

From Raw Data to Red List

## Red List Authority (RLA)

(SGs, Partner organizations, other institutions)

**Pre-Assessment** (see step 1.1)

RLA members review data sources and compile data appropriate for Red List assessments.

**Assessment** (see step 2.1)

Carried out by one RLA member working alone; or a small group of members working together; or a large group of members in a workshop; or contributions from the whole membership through a workshop or email/internet forum.

Assessments submitted directly to RLA

Assessment rejected by Reviewers

**Review** (see step 3.1)

RLA coordinator arranges review by at least one appropriate expert in Red List Assessments

RLA comments returned to Red List Unit

Reviewed assessment accepted by RLA

## Global Species Programme & Partner Projects

(Includes Global Biodiversity Assessments and Regional Assessments; often involves RLAs & Partner organizations)

**Pre-Assessment** (see step 1.2)

Data source review and data compilation done by project staff, expert consultants, and project participants.

**Assessment** (see step 2.2)

Assessments prepared through workshops, review, consistency checks, etc.

Post workshop review and consistency checks carried out.

Assessment rejected by RLA

**Review** (see step 3.2)

Project coordinators contact appropriate RLAs to arrange assessment review.

Reviewed assessment accepted by RLA

**Consistency Check** (see step 4.2)

Project coordinators check criteria use, supporting documentation, consistency, proofreading and formatting before submission to the RLU

## Red List Unit

Unreviewed assessment referred to RLA (see step 3.1)

Problem detected

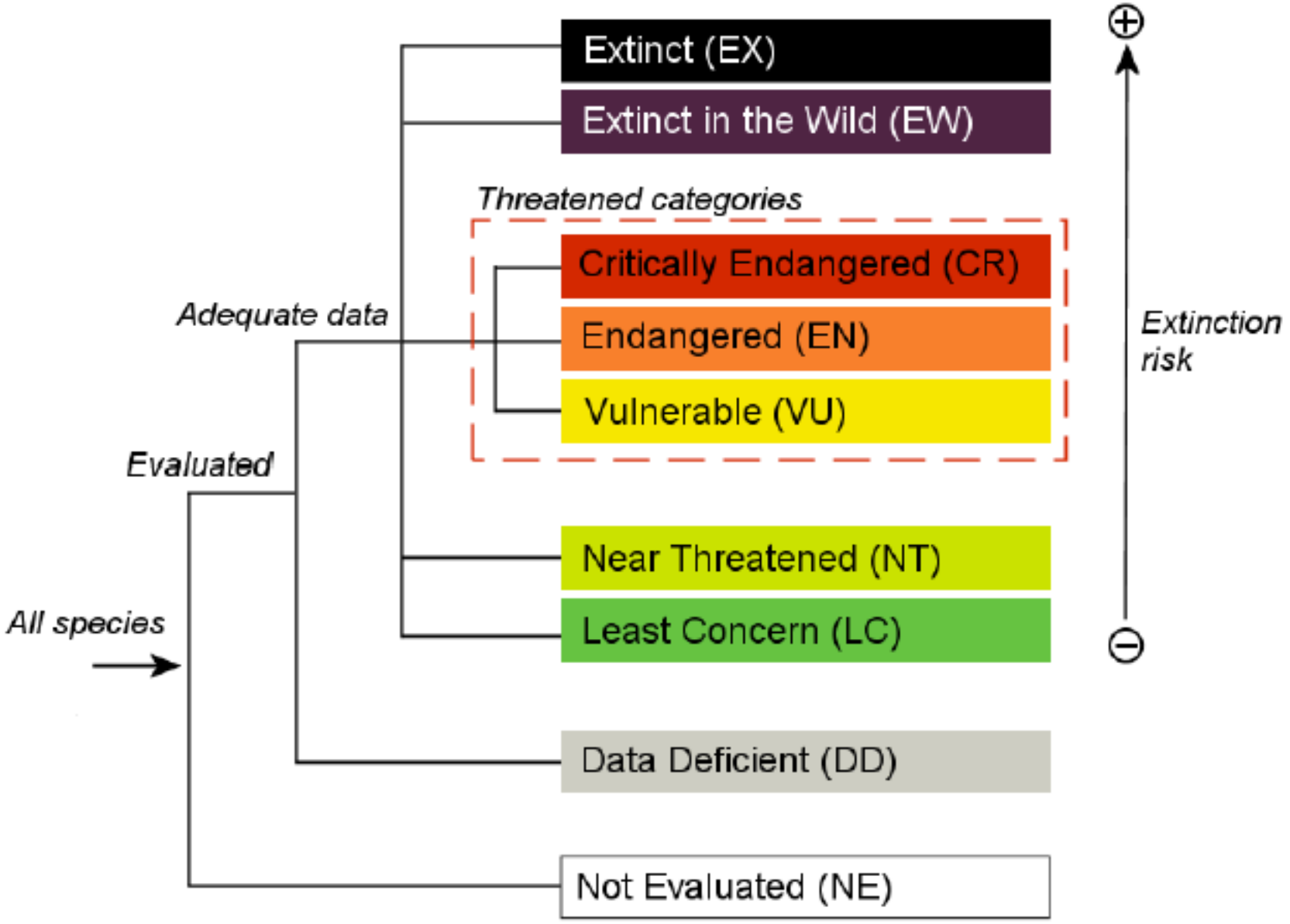
Problem detected

**Submission** (see steps 4.1, 4.2, 4.3)

Red List Unit scans assessments submitted from above projects for obvious errors and checks consistency between projects.

Red List Unit checks criteria use, supporting documentation, consistency, proofreading and formatting for:

- Reviewed assessments from RLA.
- Unreviewed assessments from outside IUCN SSC network.


Extinct (EX)
Extinct in the Wild (EW)
Threatened categories
Critically Endangered (CR)
Endangered (EN)
Vulnerable (VU)
Near Threatened (NT)
Least Concern (LC)
Data Deficient (DD)
Not Evaluated (NE)
Adequate data
Evaluated
All species
Extinction risk

# Assessment Criteria

There are five quantitative criteria which are used to determine whether a taxon is threatened or not, and if threatened, which category of threat it belongs in.

A. Declining population (past, present and/or projected)
B. Geographic range size, and fragmentation, decline or fluctuations
C. Small population size and fragmentation, decline, or fluctuations
D. Very small population or very restricted distribution
E. Quantitative analysis of extinction risk

# SUMMARY OF THE FIVE CRITERIA (A-E) USED TO EVALUATE IF A TAXON BELONGS IN AN IUCN RED LIST THREATENED CATEGORY (CRITICALLY ENDANGERED, ENDANGERED OR VULNERABLE).[1]

**A. Population size reduction.** Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

| | Critically Endangered | Endangered | Vulnerable |
|---|---|---|---|
| A1 | ≥ 90% | ≥ 70% | ≥ 50% |
| A2, A3 & A4 | ≥ 80% | ≥ 50% | ≥ 30% |

- **A1** Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased.
- **A2** Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.
- **A3** Population reduction projected, inferred or suspected to be met in the future (up to a maximum of 100 years) *[(a) cannot be used for A3]*.
- **A4** An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

*based on any of the following:*

- **(a)** direct observation *[except A3]*
- **(b)** an index of abundance appropriate to the taxon
- **(c)** a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality
- **(d)** actual or potential levels of exploitation
- **(e)** effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

**B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)**

| | Critically Endangered | Endangered | Vulnerable |
|---|---|---|---|
| **B1.** Extent of occurrence (EOO) | < 100 km² | < 5,000 km² | < 20,000 km² |
| **B2.** Area of occupancy (AOO) | < 10 km² | < 500 km² | < 2,000 km² |
| **AND at least 2 of the following 3 conditions:** | | | |
| (a) Severely fragmented OR Number of locations | = 1 | ≤ 5 | ≤ 10 |
| (b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals | | | |
| (c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals | | | |

## C. Small population size and decline

| | Critically Endangered | Endangered | Vulnerable |
|---|---|---|---|
| **Number of mature individuals** | < 250 | < 2,500 | < 10,000 |
| **AND at least one of C1 or C2** | | | |
| **C1.** An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future): | 25% in 3 years or 1 generation (whichever is longer) | 20% in 5 years or 2 generations (whichever is longer) | 10% in 10 years or 3 generations (whichever is longer) |
| **C2.** An observed, estimated, projected or inferred continuing decline AND at least 1 of the following 3 conditions: | | | |
| **(a)** (i) Number of mature individuals in each subpopulation | ≤ 50 | ≤ 250 | ≤ 1,000 |
| (ii) % of mature individuals in one subpopulation = | 90–100% | 95–100% | 100% |
| **(b)** Extreme fluctuations in the number of mature individuals | | | |

## D. Very small or restricted population

| | Critically Endangered | Endangered | Vulnerable |
|---|---|---|---|
| **D.** Number of mature individuals | < 50 | < 250 | **D1.** < 1,000 |
| **D2.** *Only applies to the VU category* Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time. | - | - | **D2.** typically: AOO < 20 km² or number of locations ≤ 5 |

## E. Quantitative Analysis

| | Critically Endangered | Endangered | Vulnerable |
|---|---|---|---|
| **Indicating the probability of extinction in the wild to be:** | ≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.) | ≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.) | ≥ 10% in 100 years |

1 Use of this summary sheet requires full understanding of the *IUCN Red List Categories and Criteria* and *Guidelines for Using the IUCN Red List Categories and Criteria*. Please refer to both documents for explanations of terms and concepts used here.

**Recent IUCN BSG and RLA tasks:**

•Published Bison Status Report and Management Guidelines 2010

•Established principles of ecological bison restoration-ABS 2013

•Form Red List Team 2014

•Initial Red List Assessment of bison- Published 2015 Near Threatened

• Established Criteria and Categories matrix on for assessing if a population is functioning as a 'wild population' 2015

•Compile data on populations to be assessed 2015

•PVA Workshop May 2015

•Preparing Red List assessments following IUCN's Red List Categories and Criteria and guidelines May-July 2016

•External/Internal Review of Assessment July-August 2016

•Prepare the assessment and submit to IUCN. September 2016

# What is a wild bison population?

*A key question for assessing status*

*IUCN American Bison Specialist Group Workshop*
*Big Sky Resort, Montana*
*16 September 2013*

Cormack Gates
Faculty of Environmental Design
University of Calgary

# Definitions: Wild Population

IUCN 2012. Red List Guidelines for application of IUCN Red List criteria at regional and national levels. *Version 4.0*.

"22. Wild population
A population within its natural range in which the individuals are the result of natural reproduction (i.e. not the result of human-mediated release or translocation); if a population is the result of a benign introduction that is now or has previously been successful (i.e. self-sustaining), the population is considered wild."

"The categorization process should be applied only to wild populations inside their natural range and to populations resulting from benign introductions (IUCN 1998, 2001, 2012)."

What about re-introduced and augmented populations?

IUCN Guidelines for Using the IUCN Red List Categories and Criteria
Version 10 (February 2013)

In addition to taxa within their natural range and subpopulations resulting from benign introductions (outside the taxon's natural range), **the criteria should also be applied to self-sustaining translocated or re-introduced subpopulations (within the taxon's natural range)**, regardless of the original goal of such translocations or re-introductions. In such cases, the listing should indicate whether all or part of the assessed population has been introduced.

IUCN Red List Guidelines 2013

“Assessments of the following taxa may NOT be included on the IUCN Red List

***Domesticated taxa (in the case where a taxon comprises both domesticated and wild individuals, only the wild population may be assessed and included; feral animals derived from a domesticated source should not be included)”***

# Classification of Input from IUCN BSG Members

**Structures and patterns**

- genetic structure: cattle genes; diversity
- Population demography (structure and size)
- Geographic location re: original range

**Ecological processes**

- Bison shape their environment
- Effects on biotic and abiotic elements
- Scale and freedom of movements
- Opportunity to engage in inter-specific behaviours
- Full range of interactions with other species
- Natural selection/evolution

**Management systems and ownership**

- natural mortality vs. selective culling
- Land area/ scale and freedom of movements
- Public vs. private ownership

**Legal and political**

- Legal status as wildlife
- Risk of a population gaining or losing statutory status as wildlife
- Implications of listing: e.g. threatened vs. conservation dependent

# Missions for Bison Population Management

**Personal interest**

- Hobby; interest in learning about the species

**Education and display**

- Public education
- Research
- Institutional promotion and financing

**Production and commerce**

- Marketable products (meat, breeding stock, eco-tourism)
- Profitability or economic sustainability of a business or institution

**Ecosystem services**

- Species representation
- Ecological processes providers
- Effects on ecosystem structure
- Recreation and hunting / problem wildlife, stray animals
- Stock for translocations

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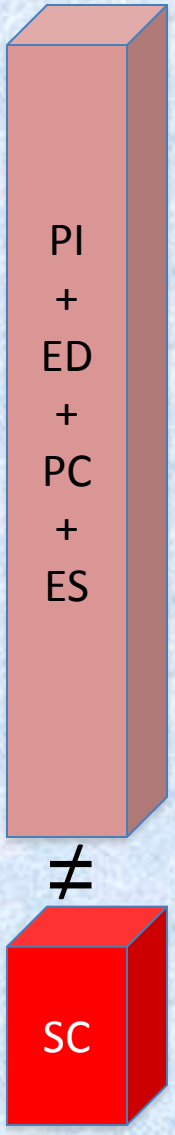
**Perpetuation of bison as populations of wild animals (species conservation)**

- Conservation of species patterns (genetic, geographic, demographic)
- Environments that provide resources and risks
- Maintenance of species formational processes



# Species-Level Biodiversity Conservation

*Biodiversity conservation defined*:
The protection, maintenance, and rehabilitation of genetic diversity, species, and ecosystems to sustain biodiversity and the continuance of evolution and other natural processes (adapted from Department of Fisheries and Oceans Canada, DFO 2009)

*Biodiversity conservation at the species level*:
The challenge is protecting both 'pattern' and 'process'.

***Pattern*** can be equated to genetic diversity including local adaptations and geographic variations, and its conservation can be accomplished by the identification and protection of groups of populations, at least over the short-term.

In contrast, protecting ***processes*** requires maintaining the "context" for natural selection to operate, namely viable populations, habitat integrity and connectedness, infra- and interspecies interactions, and other environmental factors.

# Some Concepts

***Natural selection*** allows the constituent diversity of a population to express itself and to be acted upon, with the result that local adaptation is maintained as a process.

Natural selection is expressed in terms of ***fitness***, a relative term referring to differences between individuals in their production of offspring that survive to reproduce.

***Local adaptations*** are seen as geographic variation in morphological, behavioral, physiological or life history characteristics that may be associated with individual fitness.

Even small ***fitness effects*** can leave a strong pattern on an evolutionary time scale.

The preservation of local adaptations as patterns and adaptation as process are both important objectives of species conservation.

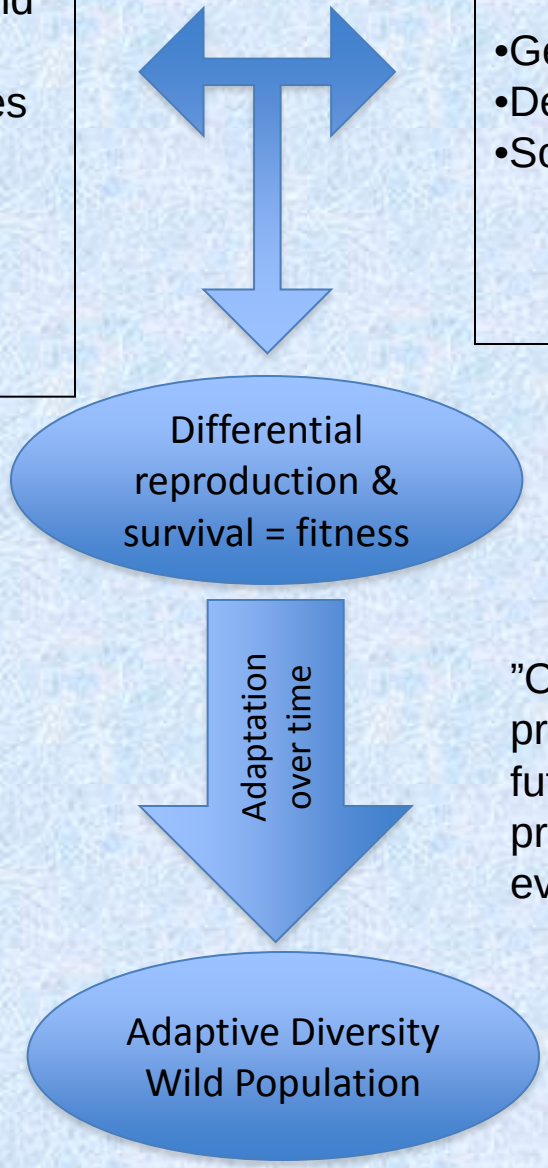
**Principle:**
Conservation actions should aim to preserve both adaptive diversity and evolutionary (formational) processes across the geographic range of a species.

**Extrinsic Factors**

- Resource gradients – time and space
- Interactions with other species
  - Resource competition
  - Predators
  - Pathogens
- Climate and weather
- Other natural perturbations

**Intrinsic Factors**

- Genetic makeup
- Demographic structure
- Sociobiology
  - Competition for mates
  - Competition for resources
  - Risk aversion behavior




# Evolutionary Ecology

”Current biodiversity is the product of past evolution, just as future biodiversity will be a product of contemporary evolution” (Hendry et al. 2010).

# Proposed definition of a wild bison population

*An evolutionary ecology perspective*

A wild bison population represents patterns of adaptation and geographic variation arising from species formational processes and occurs in locations where ecological and socio-ecological conditions support natural selection and continued evolution of the species in the long term (hundreds of years).

**Mission:**
**Perpetuation of bison as populations of wild animals (species conservation)**

- •Conservation of species patterns (genetic, geographic, demographic)
- •Environments that provide resources and risks
- •Maintenance of species formational processes

The central questions for assessing if a bison population is **functionally** 'wild by nature' involve

- •the degree to which natural selection has been and continues to be the primary formational process; and by corollary
- •the extent to which humans control breeding and movements.

**Categories for inclusion or exclusion of populations for Red List assessment**

- **Functioning** as a wild population – *assess*
- **Functioning** as a wild population **with limitations** – *assess*
- **Not functioning** as a wild population – *do not assess*

| | Criteria | Yes or No | Comments |
|---|---|---|---|
| **1** | **Physical environment (range resources)** | | |
| 1.1 | Range area and resources can sustain an minimum viable population (MVP) or larger population ***without supplementation*** | If No then not wild | See definitions below (range, range area, MVP, large population, sustainable population) |
| 1.2 | Bison have unresrticted access to resources within the entire range area | If No then not wild | Fencing or other artificial structures or herding are not used to constrain daily or seasonal resource selection within the range area. This criteria does not apply to population distribution limits imposed for management purposes outside the range area. |
| **2** | **Species patterns** | | |
| 2.1 | Sustainable population normally exceeds 1000 > 1 yr old | If No then must be Yes in next box | Large populations exceed 1000. See definition of sustainable population below. |
| 2.2 | *Sustainable population normally exceeds, or has the potential to equal or exceed 400 > 1 year old, but is less than 1000 | If Yes then functions as wild with limitation | MVP: Populations >400 but < 1000 function as a wild population with limitation. Range area must have the potential to sustain 400 or more bison > 1year. |
| 2.3 | Adult sex ratio: mature male: female ratio $\geq$ 20:100 | If No then not wild | Mature males are 6 years and older. Mature females - 2 years and older. See explanations below. |
| 2.4 | Sufficient infraspecific genetic variation exists for natural selection to operate on | If No then not wild | Requires using multiple tests for heterozygosity and allelic richness employing current molecular technologies |
| 2.5 | Very low or low level of historic cattle gene introgression | If No then not wild | Requires tests based on current molecular technology. Very low means < 1% cattle gene markers. Low means < 2%. |
| **3** | **Reproductive and natural selection processes** | | |
| 3.1 | Reproductive selection: No artificial selection of mates, either male or female | If Yes then not wild | Mate selection is achieved through competion among males, and female choice, NOT by importation, bull rotation, or other artificial means. |
| 3.2 | Natural selection: spatial and temporal variation in resource abundance and quality are important factors influencing reproduction and survival | If No then not wild (see exception) | No supplemental forage is provided to sustain the population. Minerals or water are not intentionally provided to sustain the bison population. Baiting with forage for capture is not considered supplementation. |
| 3.3 | *Large carnivores are present in the range | If No then functions as wild with limitation | A bison population without large carnivores present may function as a wild population with limitation |


Yukon/Minto Flats
Farewell Lake
Delta Jctn
Copper River
Chitina
Aishihik
Nahanni
Mackenzie
Nordquist
Slave River
Hay-Zama
Wood Buffalo N.P.
Pink Mtn
Caribou Mtns-Peace
Etthithun Lake
Cold Lake
Chitek Lake
Prince Albert N.P.
Yellowstone N.P.
G.T.N.P. Nat'l Elk Refuge
Ute-Ouray
Book Cliffs
Henry Mountains
House Rock State Wildlife Area
Janos-Hidalgo Herd
Free-ranging Bison Herds
Plains Bison
Wood Bison
Recent
Reintroduction
Historical Range

# Status of Conservation Bison N. A.

| | | | |
|---|---|---|---|
| Total Wood Bison | 10103 | | |
| Total Plains Bison | 21946 | | |
| | | | |
| Wild Function N=8 herds | 15677 | 9118 Wood Bison | 6559 Plains Bison |
| Wild but small population N=13 | 4388 | | |
| Free Range Wild type N=21 | 20065 | 10103 Wood Bison | 9962 Plains Bison |
| Wild Range Limited N=17 | 9334 | | |
| | | | |
| All Wild type N=38 | 29399 | | |
| Not Functioning as Wild N=30 | 2650 | | |
| Total All bison N=68 | 32049 | | |


Model Input Values: Reproductive data
• Polygynous (mates reshuffled each year)
• Age of first reproduction: 3 yrs (females, at birth)
• Age of first reproduction: 5 yrs (males, at birth)
• Age-specific fecundity (both sexes)
• Reproductive senescence (both sexes)
• Dominance not specifically modeled
• Single calf only, with 50:50 sex ratio at birth
• No density-dependent reproduction

| Herd | Initial N | Initial kinships | Managed herd size | Cull / removal strategy | Anthrax risk (major) | Anthrax risk (minor) | Risk of herd extermination | Repro rates | Mort rates |
|---|---|---|---|---|---|---|---|---|---|
| **PLAINS** | | | | | | | | | |
| Yellowstone | 3000 | 0 | 3000 | All age/sex classes | 0.1% risk/yr<br>40% survival | 0.1% risk/yr<br>90% survival | No risk | a | A |
| Grand Teton/Nat Elk | 825 | 0.1024 | 500 | Cows (3-12yrs) | 0.1% risk/yr<br>40% survival | 0.1% risk/yr<br>90% survival | No risk | b | B |
| Pink Mountain | 1302 | 0.1744 | 1300 | All age/sex classes | No risk | No risk | No risk | b | B |
| **WOOD** | | | | | | | | | |
| Greater Wood Buffalo | 4000 | 0 | 4000 | All age/sex classes | 1% risk/yr<br>44% survival<br>33% of normal repro in next yr | 20% risk/yr<br>90% survival<br>(lower for old males) | 0.01% if diseased | c | B |
| Hay-Zama | 501 | 0.0399 | 500 | All age/sex classes | No risk | No risk | 100% if get TB or Brucellosis | c | B |
| Mackenzie | 700 | 0.1304 | 2000 | Cows, older bulls (8+yr) | 1% risk/yr<br>44% survival<br>33% of normal repro in next yr | 20% risk/yr<br>90% survival<br>(lower for old males) | 50% if get TB or Brucellosis | c | B |
| Nahanni | 431 | 0.0399 | 500 | Cows, older bulls (8+yr) | No risk | No risk | No risk | c | B |
| Aishihik | 1230 | 0.0399 | 1000 | Cows, older bulls (8+yr) | No risk | No risk | No risk | c | B |

## *Example of one iteration for Yellowstone herd*

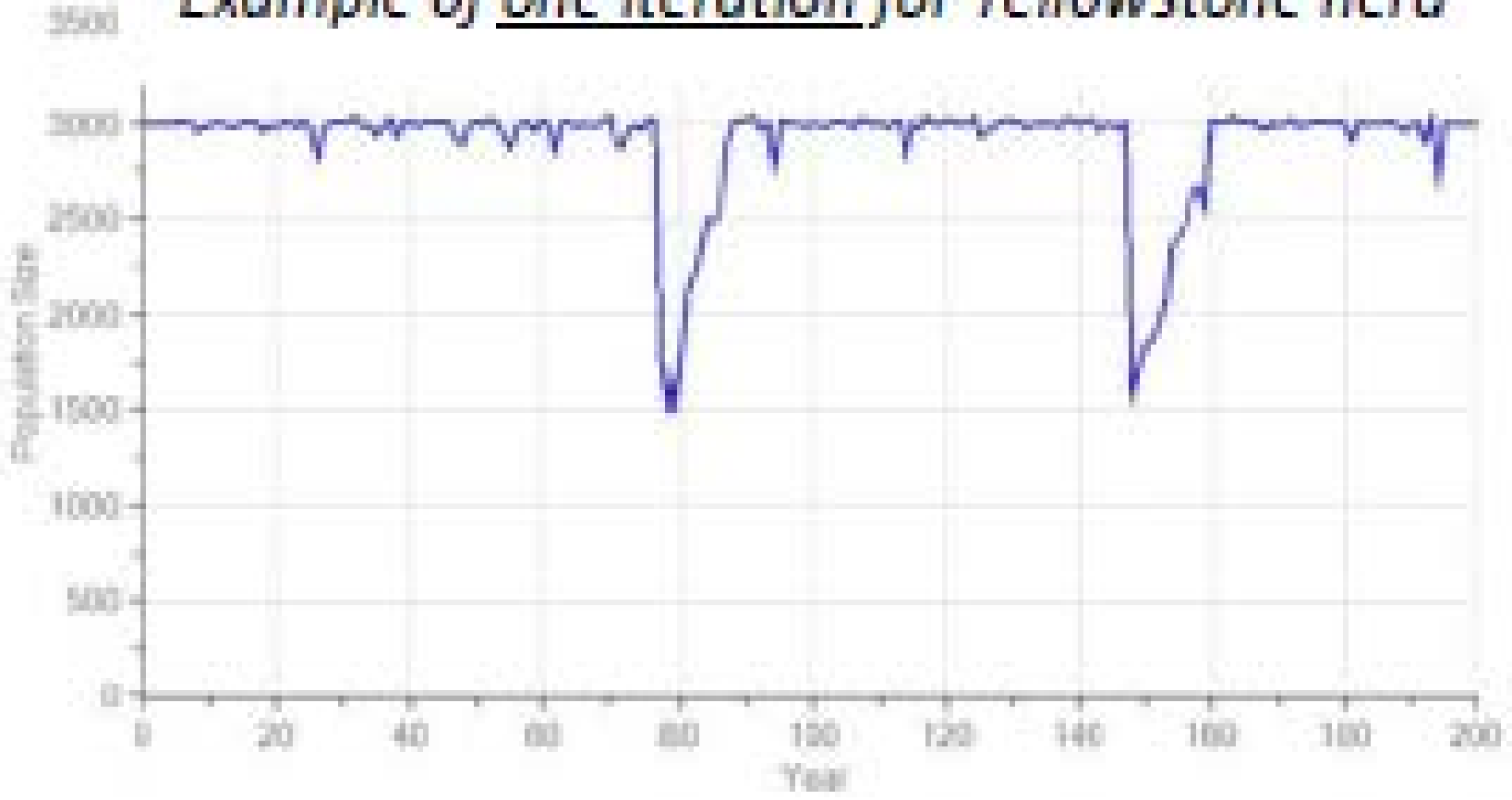


Table 4. Herd-specific model results for plains bison.

| | | | Model Results | | | | |
|---|---|---|---|---|---|---|---|
| Herd (plains) | Size (K) | Initial Het | Stoch r | % K | $PE_{200}$ | $Het_{200}$ | $F_{200}$ |
| Yellowstone | 3000 | 1 | 0.057 | 94 | 0 | 0.990 | 0.009 |
| Grand Teton | 500 | 0.898 | 0.009 | 77 | 0.008 | 0.834 | 0.159 |
| Pink Mountain | 1300 | 0.826 | 0.018 | 80 | 0.004 | 0.803 | 0.195 |
| **Metapopulation** | **4800** | | **0.046** | **89** | **0** | | |

## *Example of <u>one iteration</u> for Mackenzie herd*

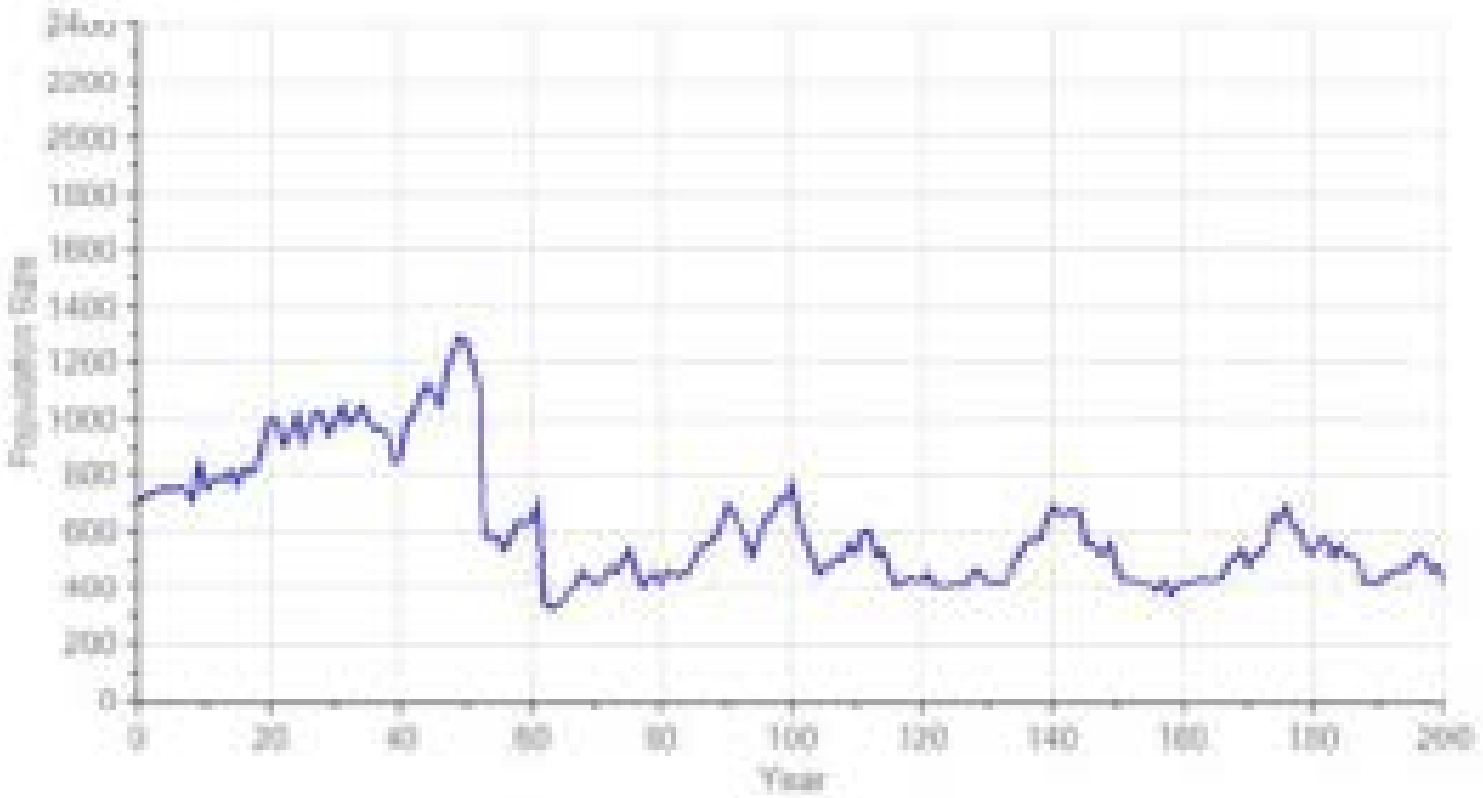
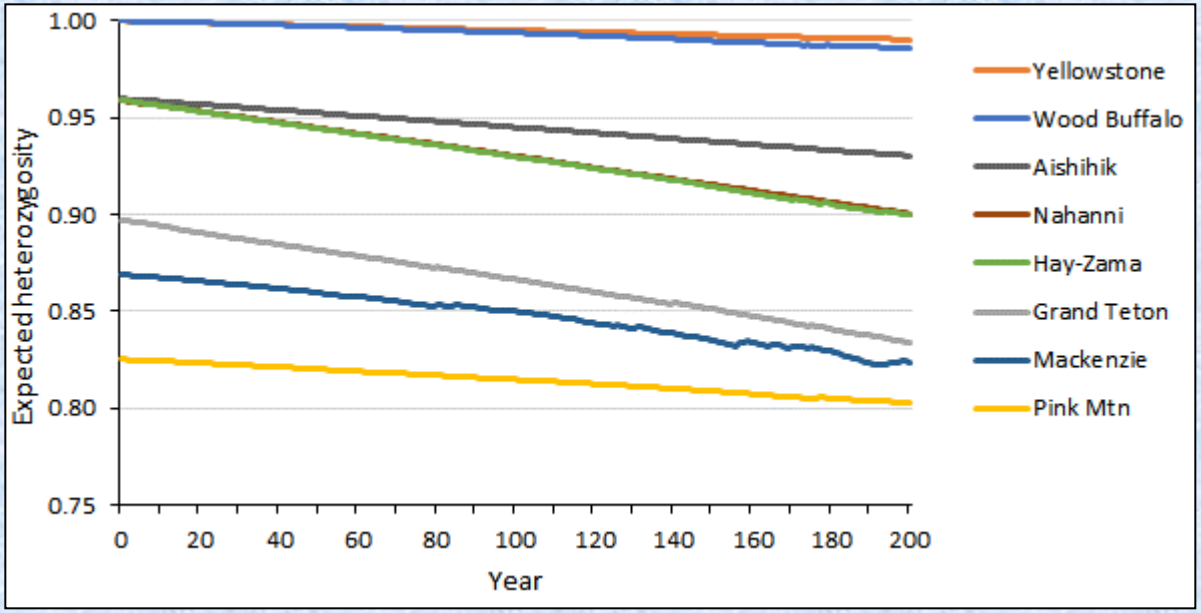
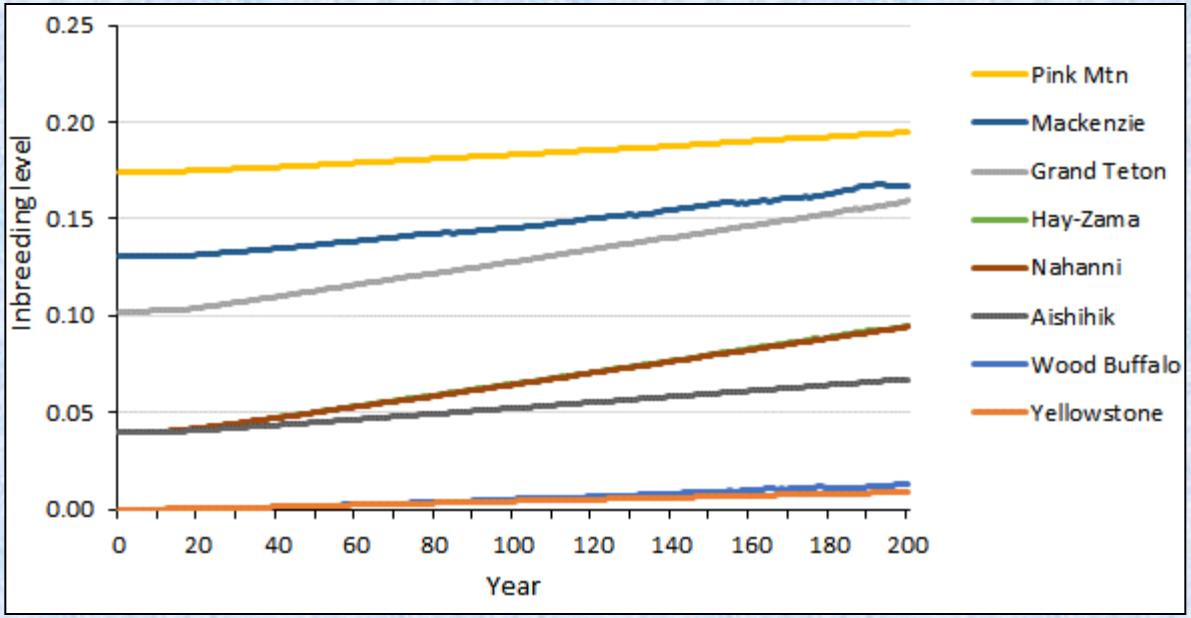


Table 5. Herd-specific model results for wood bison.

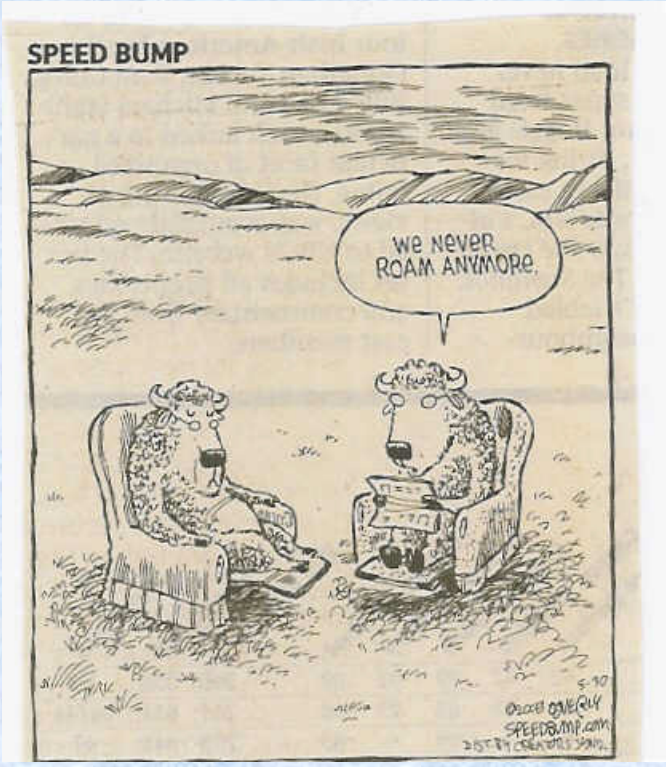
| | | | Model Results | | | | |
|---|---|---|---|---|---|---|---|
| Herd (wood) | Size (K) | Initial Het | Stoch r | % K | $PE_{200}$ | $Het_{200}$ | $F_{200}$ |
| Wood Buffalo | 4000 | 1 | 0.016 | 66 | 0.008 | 0.985 | 0.013 |
| Hay-Zama | 500 | 0.960 | 0.031 | 84 | 0.024 | 0.901 | 0.094 |
| Mackenzie | 2000 | 0.870 | 0.001 | 42 | 0.096 | 0.824 | 0.168 |
| Nahanni | 500 | 0.960 | 0.021 | 85 | 0 | 0.901 | 0.094 |
| Aishihik | 1000 | 0.960 | 0.024 | 88 | 0 | 0.930 | 0.067 |
| **Metapopulation** | **8000** | | **0.019** | **48** | **0** | | |


Expected heterozygosity
1.00
0.95
0.90
0.85
0.80
0.75
0
20
40
60
80
100
120
140
160
180
200
Year
Yellowstone
Wood Buffalo
Aishihik
Nahanni
Hay-Zama
Grand Teton
Mackenzie
Pink Mtn


Inbreeding level
0.25
0.20
0.15
0.10
0.05
0.00
0
20
40
60
80
100
120
140
160
180
200
Year
Pink Mtn
Mackenzie
Grand Teton
Hay-Zama
Nahanni
Aishihik
Wood Buffalo
Yellowstone

# Next Steps

- Final Red List Assessment Report
- IUCN Bison Specialist Group Meeting September 26, 2016
- Do we Need a Bison Conservation Action Plan?
  - Promote International Collaboration
  - Transcend Jurisdictional Constraints
  - Ensure Demographic Viability of Individual Herds and Meta-populations
  - Protect Genetic Integrity of the Species
  - Coordinate Monitoring and Management across Herds
    - Ecological Principles and Practices
    - Culling Practices
    - Health Plan
    - Herd and Genetic Management
    - Legal and Policy Constraints
    - Maintain Evolutionary Capacity




UNITED STATES OF AMERICA
BISON
NATIONAL MAMMAL