

Course Requirements (details follow):

- (i) Attendance/Participation (10%)
50% on attendance; 50% on participation...
- (ii) Mid term test (30%)
- (iii) Essay Requirement (20%)
- (iv) Final exam (40%)

December 21st Saturday 2:00 PM SOCIOLOG 2220A 570 LH101 - 3 HOURS..

First portion:

50 multiple choice tests covering:

All assigned readings, greater weight attached to readings since mid term

Second portion:

You will be given 4 essay questions (you must answer all of them).

They will be somewhat general, so here is where you can show me what you learned!!!

The essay questions are directly based on lectures, but you should supplement it on the basis of what you read (& class videos/clips)

Ch 11: Wolves



My emphasis will be on: Impact of Human Activities on “Biodiversity”..

“the variety of life in the world or in a particular habitat or ecosystem”

More wolves in Canada than in any other Nation..



Country	Wolf population
Canada	52,000–60,000
Kazakhstan	30,000
Russia	25,000–30,000
Mongolia	10,000–20,000
China	12,500
United States	9,000
Kyrgyzstan	4,000
Tajikistan	3,000
Belarus	2,000–2,500
Spain	2,000
Ukraine	2,000
Uzbekistan	2,000

Source: Data from Mech and Boitani (2003).



In Canada, most are the grey or timber wolf..

The wolf was completely eradicated the wolf through the United States and Southern Canada (in the populated areas) “Wolf bounties”, primarily because they attacked cattle/livestock..

1978: Endangered Species Act in the U.S applied all sorts of protections, and subsequently a bit of a comeback..

In Canada in most jurisdictions, there is some hunting of wolves, but it tends to be heavily regulated (“special permits” required) Exception: Eastern Wolf (Northern Ontario) is being protected,.. “Species of special concern legislation” and protected under “Species at Risk Act” (long list of mammals, birds, reptiles, etc. that are theoretically protected on Federal lands).



Newfoundland Wolf, extinct 1911

Subspecies of grey wolf on the island of
Newfoundland

(*Canis lupus beothucus*)

Extinct over 100 years ago primarily due to excessive hunting & also habitat change and a decline in Newfoundland's caribou population

Largely hunted for its pelt, but a bounty was placed on this mammal.

Size of pre-contact population unknown, but clearly in the 1000's ..



Newfoundland Moose: approximately 120,000 moose on the island –
the most concentrated population of moose in North America



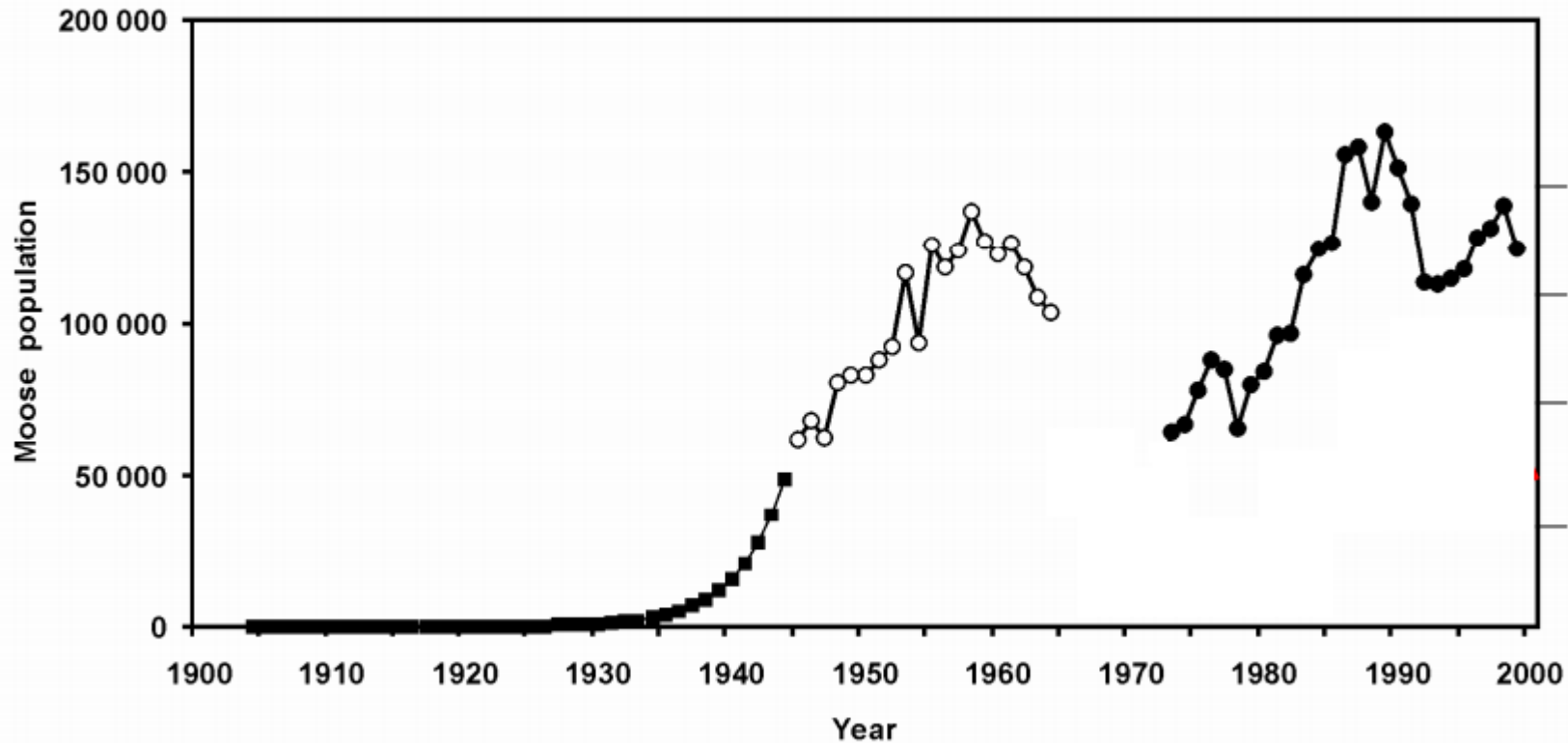
About a half dozen introduced in 1904

The extinction of the wolf on Newfoundland (apex predator)
& the introduction of the moose in the early 1900s (major competitor for many species) has had a major impact..

Changes at the top of the “food chain” (apex predator) has had “cascading” impact on all other species on the island.,
including both other carnivores, herbivores as well as all sorts of various plant life/forest type/ etc.,

Well known ecological “maxim”: “everything in an ecosystem is connected or interrelated”...

Moose trends in Newfoundland



Note: over this same period the number of Caribou (native) on the island increased substantially, but most recently there numbers have declined quite noticeably..

Productivity = 15 calves/100 cows

National Parks Services
& their wildlife biologists:

- Moose density (animals/km²) ranges from 3-20 times the density found in other boreal forest systems.
- Moose have exceeded ecological carrying capacity



In its natural state, if a “disturbance” occurs (e.g. forest fire, wind storm, disease), eventually a forest recovers through forest succession..

Northern forests at an early stage of succession is an important part of the Moose diet..



Moose
diet



Yellow Birch



balsam fir

The presence of over 100,000 moose are alternating/hindering natural forest succession,
& in fact having a major impact on the types of forests characterizing
the island..



Disruption of the entire process of forest rejuvenation through
the natural process of succession..

Nature's balance has been
disrupted with a growing
abundance of trees that
are not part of the Moose's
diet



spruce



Tamarack Larch



forest songbirds dependent on hardwood and balsam
fir trees have gone into major decline, as have certain
types of forest lichen..

Boreal felt lichen (endangered)



Lincoln's Sparrow



Common Yellow Throat



The impact of browsing pressure has been documented by “Parks Canada” biologists..

Outside fenced exclosures...



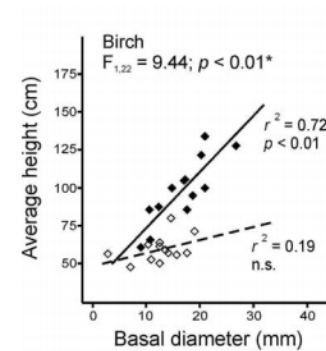
Inside exclosures...



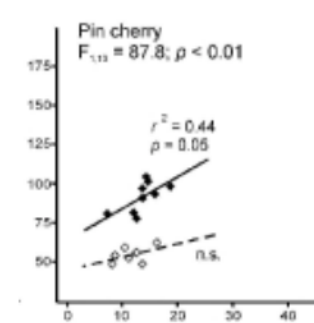
Experimental moose exclosures demonstrated that trees can recover following release from browsing pressure

Tree response following release from moose browsing

White birch



Pin cherry



Fenced

Control



This large mammal is having a significant impact on the biodiversity of the island.

- > major impact on its forests & local Flora (plant life)
- > major impact on other species (some of which are endangered)
no natural predators,...

Why is nothing being done about it?



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- no natural predators,..

Why is nothing being done about it?



Part of the way of life, in “rural Newfoundland”,..
.. Supplement your grocery bill

10,000s hunting licenses every year.. Newfoundlanders have extremely high cultural/social ties with “everything moose”..

Nobody seems to be considering it a problem, except for some “naturalists/scientists” working in our National/Provincial Parks..

Can distinguish between:

“Social Carrying Capacity”: The number of animals that can occur in an area to maximize hunting opportunities, viewing opportunities (ecotourism), etc. “the more the merrier”??

as opposed to the

“Ecological carrying capacity”.. The number of healthy animals that an area can support without damage to the area’s ecosystem... moose in Nfld are already beyond the “carrying capacity” of the Island’s ecosystems..

The ecological role of the wolf in Yellowstone (textbook)

- The **biodiversity** of ecosystems depends on biotic (biological) and abiotic (non-biological) factors
 - Biotic: competition, predation, parasitism and disease
 - Abiotic: climate, wildfires, access to water



In the northern forest, the wolf is an apex predator, and hence, an important role in maintaining the biotic balance in northern ecosystems..

In the NA context, if no wolves? Too many ungulates (moose, caribou, etc)..

If too many Ungulates, then what? Biotic imbalance, potentially with unexpected impact!!

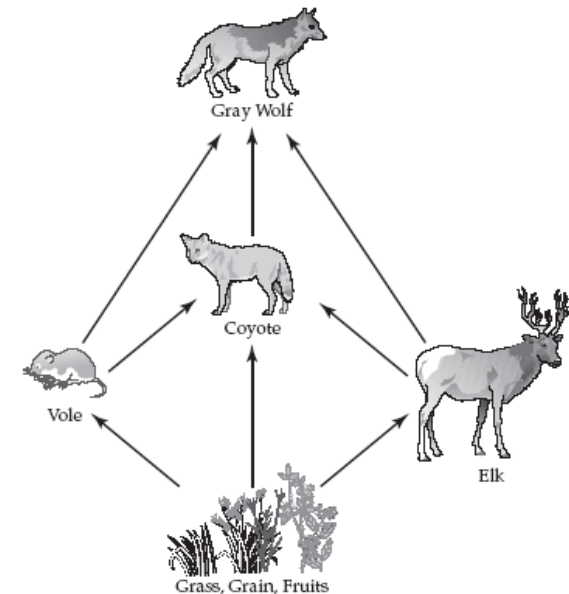
Relevant in understanding the ecological role of the wolf

- **Trophic levels** – stratifications of various species/organisms, by their level on the food chain
- Lower trophic levels are consumed by successively higher trophic levels

- **Highest level:**
- **‘apex predators’** (wolves; eagles; mountain lions, etc),
- **with no natural predators**
- **Middle levels:**
- **Primary, secondary** & sometimes **tertiary consumers**
- (mice eating plants; snakes eating mice; coyotes eating snakes, etc.)
- **Lowest level:** is plant life or **primary producers**

Part of the food web in Yellowstone National Park is shown below.

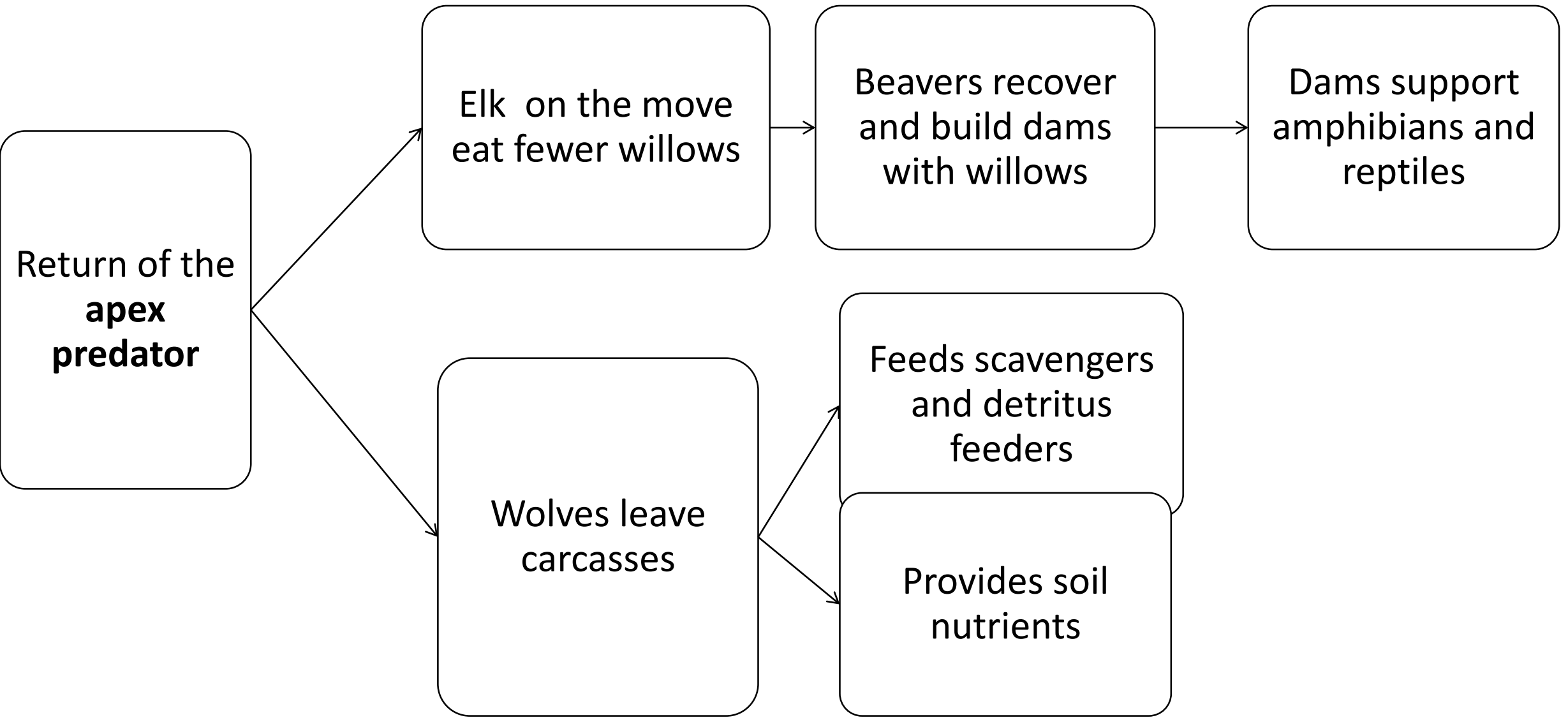
YELLOWSTONE NATIONAL PARK FOOD WEB



The ecological role of the wolf: trophic processes

- **Trophic cascades** occur when changes in one trophic level cause changes in another
 - Can start from the top down:
 - Loss of a carnivore (such as an **apex predator**) may allow herbivores to proliferate, which may reduce the vegetation.
 - Eradication of the wolf in Yellowstone National Park -> more elk -> less willows
 - Can start from the bottom up:
 - Loss of a particular plant may affect populations of herbivores that depend on that plant for food, which will affect populations of carnivores that depend on that herbivore for food.
 - **Less willows -> fewer beavers**
 - Can cascade up and down through an ecosystem:
 - Eradication of the wolf -> more elk -> less willows -> fewer beavers -> fewer amphibians/reptiles -> fewer eagles/hawks, etc.. Less biodiversity overall!! (Yellowstone)

The ecological role of the wolf: Reintroduction in Yellowstone





- Trophic cascades therefore affect **biodiversity**
- At any point in the food web, species may fill a crucial **niche**
 - Reintroduction of a niche species can result eventually in “greater” biodiversity
 - Among wildlife ecologists:
 - This insight has led to the promotion of the so called “re-wilding” movement..
 - Important to reintroduce apex predators in maintaining or promoting or even re-establishing ecosystem health and sustainability.
- With a goal of environmental sustainability, the **rewilding** movement uses:
 - An **ecocentric** approach
 - **Conservation orientation..**

Problem here:

Invasive species:

introduced species (also called "non-indigenous" or "non-native") that adversely affect the [habitats](#) or regions they invade

Can dramatically alter the biodiversity of a region..



Peacelove Lovebirds - One first adult violet-necked parent feeding a fledgling - Photo Taken in Maui, Hawaii



World wide: 1000's of examples like this, i.e. of invasive species having a large ecological impact

This can be particularly problematic when an ecosystem doesn't have native "predators" that might contain the #'s involved...

Various "invasive" species have either been "non-intentionally" or "intentionally" introduced into parts of the world with devastating impact..

**PROBLEM: INVASIVE SPECIES CAN HAVE A
MAJOR IMPACT ON THE BIODIVERSITY
OF LOCAL ECOSYSTEMS**

-> MAJOR POPULATION DECLINE AND EVEN EXTINCTION OF COMPETITORS

European Rabbit



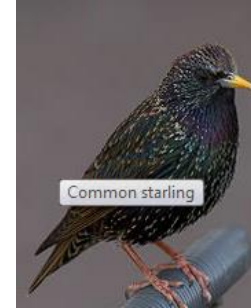
Invasive to Australia

Emerald ash borer



Invasive to N.A.

Native to Europe



Starling

Common rat



Invasive practically everywhere.

Feral Cat



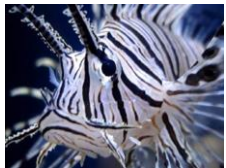
Invasive practically everywhere.

Asian Long-horned beetle



Invasive to N.A.

Lion Fish



Invasive to Caribbean



Zebra Mussel



Grey squirrel

Invasive in Europe

Common Malaria Mosquito



Spread throughout the tropics

Canadian geese



Invasive in Europe

Asian Carp



<https://www.youtube.com/watch?v=k3N5t70aJ2A>

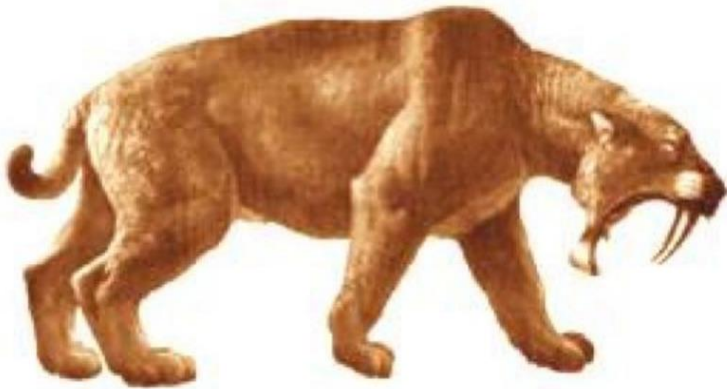
**I've heard the argument:
Might we think of human beings, as an "invasive" species???**

Human activities have always had a major impact on other species, including some of the better known "extinctions" that are frequently associated with humans.

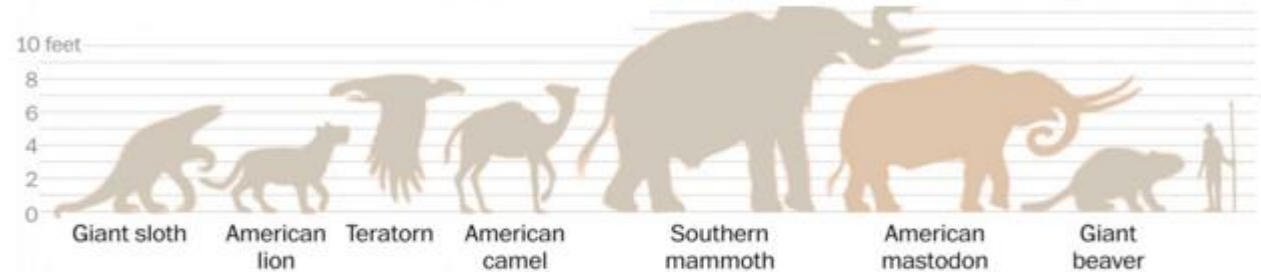
E.G. Many speculate that the movement of humans into North America 1000s of years ago had a major impact upon the numbers of other "megafauna" (large mammals and birds) that have since become extinct..



Or was it something else?



Where have all the megafauna gone?



SOURCE: Science

PATTERSON CLARK/THE WASHINGTON POST

Human activities have had a major impact on “populations” of other large mammals,..

Including “APEX predators”..

-> this in turn has had a much greater impact beyond the decline of their populations..

Both globally, and in Canada we have been observing a decline in “biodiversity”..

so much so, that some speak of a “extinction” crisis.. forcing unprecedented #'s of species into extinction..

- **In Canada, protection of biodiversity is a “mixed jurisdiction”
Federal/Provincial..**
- **Species at Risk Act (SARA) - Federal**

Federal Legislation - **Species at Risk Act** :

CATEGORY / STATUS	EXTINCT	EXTIRPATED	ENDANGERED	THREATENED	SPECIAL CONCERN	TOTALS
Mammals	2	4	15	13	25	59
Birds	3	2	20	6	23	54
Reptiles		2	5	6	8	21
Amphibians			4	3	9	16
Fishes	6	2	10	18	40	76
Lepidopterans		3	3	2	2	10
Molluscs	1	1	7	1	1	11
Vascular Plants		2	49	33	44	128
Mosses			1			1
Lichens			1		3	4
TOTALS	12	16	115	82	155	380



Eastern Wolverine



Southern Grey Wolf











Canada Lynx



Blue Whale

Also provincial jurisdiction: Ontario “species at risk act”.. Currently protecting about 180 species “at risk”..

Ontario				
	Insects	Aweme Borer Moth	Papaipema aweme	endangered
	Birds	Bald Eagle	Haliaeetus leucocephalus	special concern
	Birds	Bank swallow	Riparia riparia	threatened
	Birds	Barn Owl	Tyto alba	endangered
	Birds	Barn Swallow	Hirundo rustica	threatened
	Mammals	Beluga	Delphinapterus leucas	special concern
	Plants and Lichens	Bent Spike-rush	Eleocharis geniculata	endangered
	Plants and Lichens	Bird's-foot Violet	Viola pedata	endangered

In theory:

When a species is listed on the SARO list, the species and its habitat are protected under the Act, which prohibits the “killing, harming, harassing, possessing, buying, selling, trading, leasing or transporting species listed as threatened or endangered”. The Act also provides habitat protection by prohibiting “damaging or destroying habitat of endangered and threatened species”.

Critique:

Hard to get some animals and plants on the list (e.g. Atlantic Salmon, Peary Caribou)

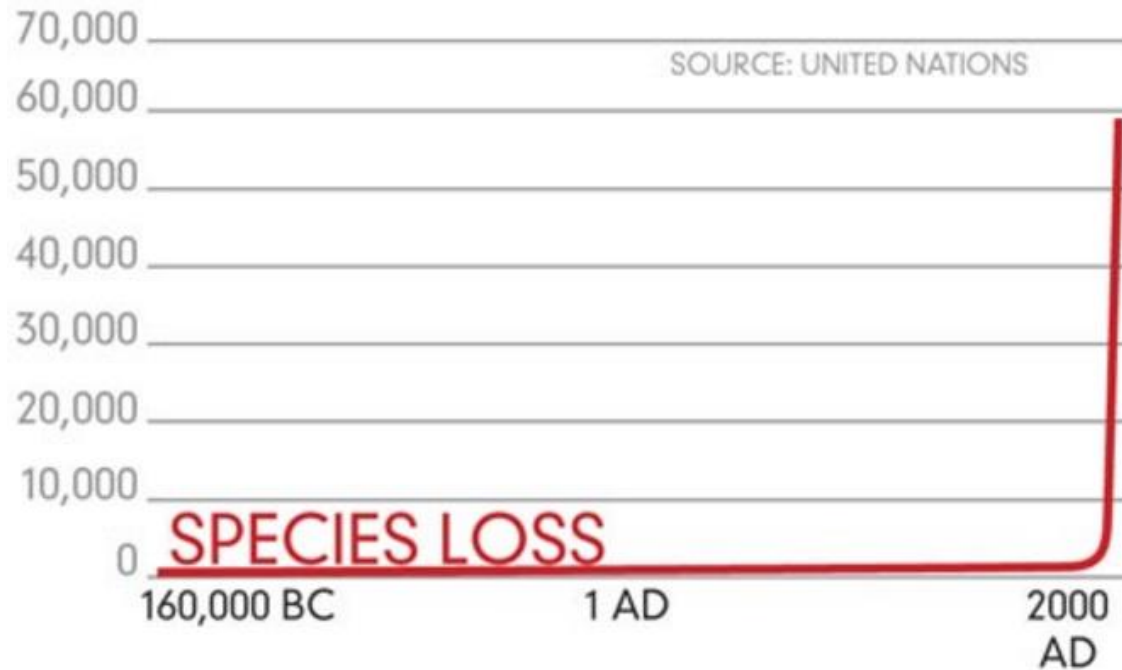
The government has chronically failed to identify and protect the habitat for the longer term survival of these species

Note: at least 30,000 species overall in Ontario..

A large motivator for both the conservation & “rewilding movement”

- **Extinction crises** – major losses of biodiversity, as compared to the **background extinction rate**, or the historical average rate of biodiversity loss

This table shows estimates of cumulative species loss over the last 160,000 years..



Note: This is only known or documented extinctions..

ESTIMATES SUGGEST THAT THE TRUE NUMBERS ARE MUCH HIGHER...

Why? Many species are “unknown”..

Are we currently experiencing what some scientists call “an extinction crisis” or what others have popularized as the “sixth extinction”??

Past **extinction crises** were caused by non-human factors, but the current one is anthropogenic..
why?

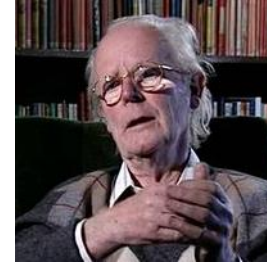
- The Sixth Great Extinction: Joint British/Spanish film..
- Natural historians/biologists/geologists/evolutionary biologists/social scientist
- <https://www.youtube.com/watch?v=rVwRnRYdiJ0>

The Sixth Great Extinction: Joint British/Spanish film..
Natural historians/biologists/geologists/evolutionary biologists/social scientist

Richard Alan Fortey is a British palaeontologist and natural historian. He has previously served as President of the Geological Society of London.



John Maynard was a British theoretical evolutionary biologist and geneticist. Elected a Fellow of the Royal Society in Britain, and past recipient of the Darwin Medal.



Lester Russel Brown is a United States environmental analyst, founder of the Worldwatch Institute, and founder and president of the Earth Policy Institute. Written over 50 books on environmental issues.



Andrew Herbert Knoll is the Fisher Professor of Natural History and a Professor of Earth and Planetary Sciences at Harvard University



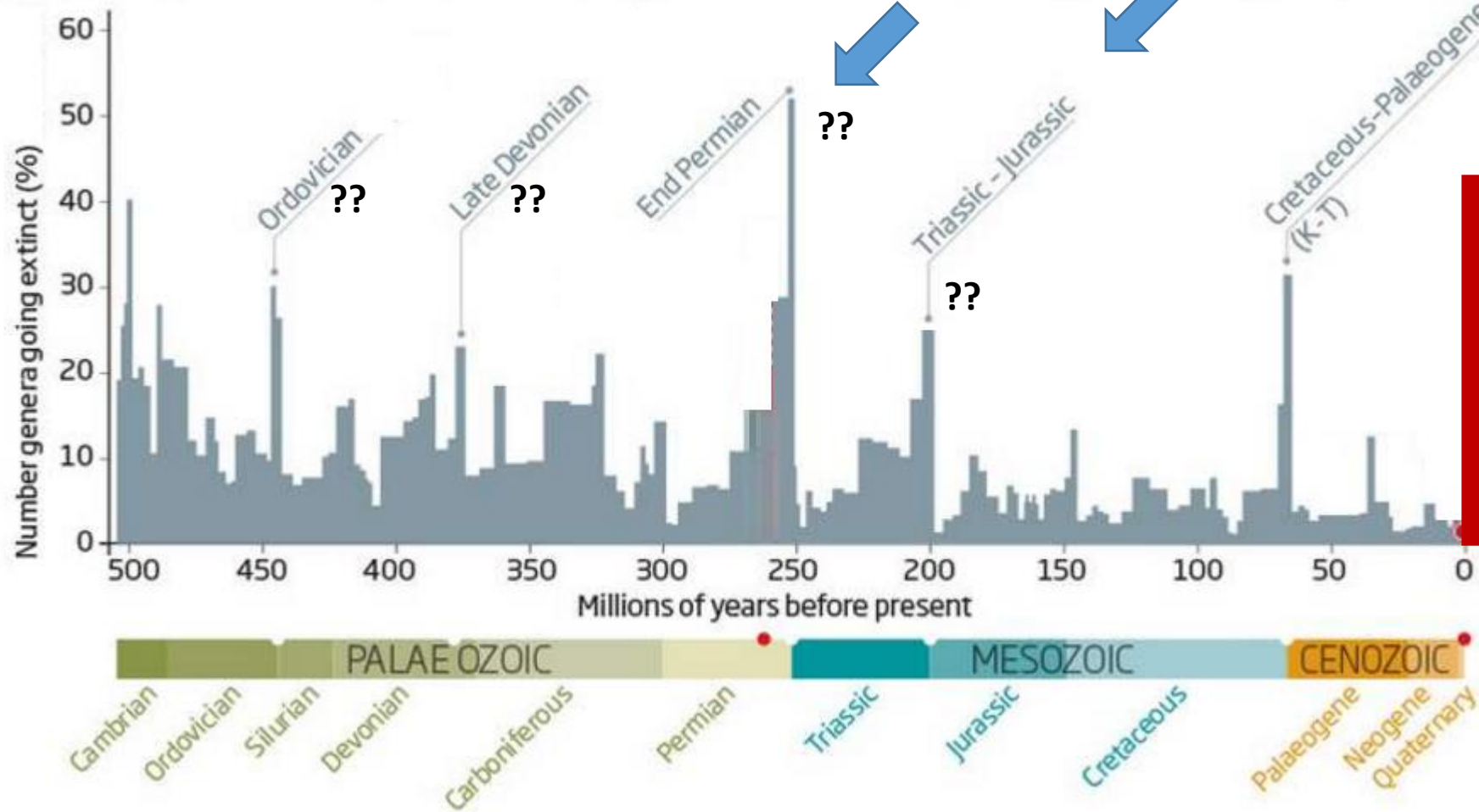
Paul Felix Hoffman, OC is a Canadian geologist and Sturgis Hooper Professor Emeritus of Geology at Harvard University.



Massive volcanic events that modified the planet's climate?

Massive meteorite

Could five big extinctions become six ?



Will there be a Sixth great extinction?

INDUSTRIAL
REVOLUTION (last 250
years)

Note: Red here is mere speculation.. "unknown future".. Will this occur?

Based on recent U.S. Research (Brown and Duke Universities), it has been estimated that: 12 per cent of birds, 23 per cent of mammals and 32 per cent of amphibians are currently threatened..

It has also been estimated that the average pre-human extinction rate was [0.1 extinction per million species per year](#). The current extinction rate is approximately 100 extinctions per million species per year, or 1,000 times higher than natural background rates. They also predict that future rates may be as much as 10,000 times higher.

Past **extinction crises** were caused by non-human factors, but the current one is anthropogenic

Causes include:

habitat fragmentation & the corresponding loss of ecological processes

e.g. consider deforestation: roughly half of all known species are in our forests

exotic species invasion

Imbalance in natural food chains/ecosystems..

pollution, and climate change (the world's corral reefs are in fact dying; 25% of known aquatic species) IS CLIMATE CHANGE OUR GREATEST CHALLENGE?

- Why be concerned about high extinction rates for:
- Insects/Micro-organisms/Reptiles/Snakes/ etc..
- High extinction rates are problematic because:
- These species provide all sorts of "ecosystem services" (e.g. insects & pollination)
- Provide materials such as food, fuels and fibres (for human & non-human uses)
- Regulating climate, disease outbreaks, wastes and pollination
- Supporting processes such as nutrient cycling and water purification; etc.