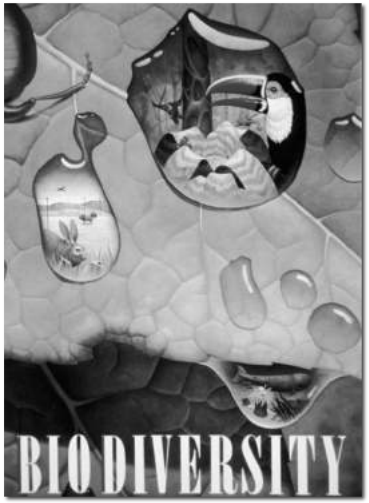
Endangered and Threatened Species of the Great Lakes Region

1

1. The value of Biodiversity
2. The Endangered Species Act
3. Endangered Wisconsin flora
4. How do species become endangered?

2



- The term "BioDiversity" was born during the National Forum on BioDiversity, held in Washington D.C. in September 1986.
- **Biodiversity** = variation at all levels
  - the genes within a single local population or species
  - the **species** composing all or part of a local community,
  - communities composing the ecosystems of the world.
- By the summer of 1992, biodiversity had moved to center stage as one of the central issues of scientific and political concern world-wide.

3

What is the value of the biological diversity of the planet?

Since life began on Earth, countless creatures have come and gone, rendered extinct by naturally changing physical and biological conditions.

Since extinction is part of the natural order, and if many other species remain, some people ask: "Why save endangered species? Why should we spend money and effort to conserve them? How do we benefit?"

Congress answered these questions in the preamble to the Endangered Species Act of 1973, recognizing that endangered and threatened species of wildlife and plants "are of aesthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people."

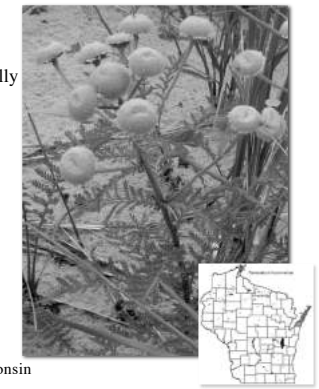
4

What is the value of the biological diversity of the planet?

View 1: The answer we give to this is often anthropocentric – we ask "*What has biological diversity done for me lately?*" — economic value

- This kind of argumentation for the value of biodiversity, although necessary, fundamentally breaks down to economics.
- Two issues with this approach:

1. We have to acknowledge that we will never be able to demonstrate an immediate, utilitarian reason for preserving every species on Earth. But who will tell us which species are unimportant?



Lake Huron Tansy
Endangered in Wisconsin

5

What is the value of the biological diversity of the planet?

View 1: The answer we give to this is often anthropocentric – we ask "*What has biological diversity done for me lately?*" — economic value

- This kind of argumentation for the value of biodiversity, although necessary, fundamentally breaks down to economics.
- Two issues with this approach:

2. If you want to protect a critical area of shoreline or a nearly old growth forest, be prepared to talk about the economic value of lakefront property, income from logging, and cost-benefit analysis.

Lake Michigan beach scene
with Lake Huron Tansy

6

What is the value of the biological diversity of the planet?

View 2: Ecological value

- One of the key tasks facing both scientists and governments is to identify and protect the species whose ecological functions are especially important to their ecosystems or to human societies - keystone species.

Kirtland's Warbler

Pinus banksiana - jack pine [keystone species]

7

What is the value of the biological diversity of the planet?

View 2: Ecological value

- We know little about ecological impacts of the removal of even dominant species.
- Not clear what significant repercussions in the eastern North American forests with the near extinction of one of its most dominant trees almost 100 years ago

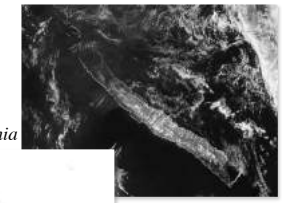
Castanea dentata
American chestnut

8

What is the value of the biological diversity of the planet?

View 3: Evolutionary value

- Isolated phylogenetic lineages or clades are inherently worthy of protection – they have more value
- Biodiversity hotspots to be protected should be assessed not only on species diversity



New Caledonia

Lobelia
Hawaiian Islands

9

What is the value of the biological diversity of the planet?

View 3: Evolutionary value

- The Hawaiian lobelioids are closely interconnected with their Honeycreeper pollinators – coevolution.
- Extinction of Honeycreeper species profoundly impact on the livelihood of these plants.

10

What is the value of the biological diversity of the planet?

View 4: Species have intrinsic value – ethical role

- "*It is inconceivable to me that an ethical relation to land can exist without love, respect, and admiration for land, and a high regard for its value. By value, I of course mean something far broader than mere economic value; I mean value in the philosophical sense.*" Aldo Leopold, 1949

- The Judeo-Christian Stewardship Environmental Ethic argues we are accountable to God for conserving biodiversity:

"*Diversity is God's property, and we, who bear the relationship to it of strangers and sojourners, have no right to destroy it.*" D.W. Ehrenfeld, 1988

11

What is the value of the biological diversity of the planet?

View 4: Species have intrinsic value – ethical role

- human health considerations
- value to humans of preserving wild nature and a diverse and varied landscape
- moral consideration of non-human species

Silent Spring (1962) dedicated to Albert Schweitzer

'Schweitzerian ethic that embraces decent consideration for all living creatures—a true reverence for life'

12

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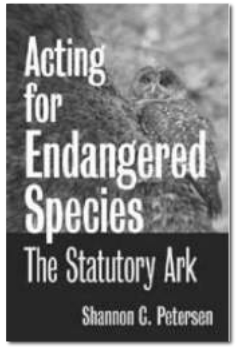
▪ The **Endangered Species Act**, Public Law 93-205, became effective on December 28, 1973, and is the most far-reaching wildlife statute ever adopted by any nation

13

Endangered Species Act

▪ The stated purpose of the ESA is to "**provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, and to provide a program for the conservation of such endangered species and threatened species**".

▪ The ESA is literally "The Statutory Ark"



14

Endangered Species Act

▪ A species is considered to be **endangered** if it is "in danger of extinction throughout all or a significant portion of its range"

▪ A **threatened** species is one that "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range"

Kirtland's warbler
[Federally endangered until Nov 2019]

Pitcher's thistle
[Federally threatened]

▪ Importantly, both of these terms recognize, by Federal law, that the *species is the functional unit of concern*, and that *extinction is the threat to be avoided*

15

Endangered Species Act

▪ However, species protection carries with it a degree of legislated habitat protection

▪ Destroying the habitat of an endangered species is legally equivalent to destroying the species itself

Kirtland's warbler

16

Endangered Species Act

- The ESA includes provisions to conserve "the ecosystems upon which endangered species and threatened species depend" by designating and listing **critical habitat** when a species is listed.

- Critical habitat is defined as specific areas within the species' range with physical or biological features either (1) essential to conservation of the species, or (2) which may require special management considerations or protection.

Kirtland's warbler

17

Endangered Species Act

Jack pine ecosystem in north central Michigan, endangered Kirtland's warbler, and the parasitic cow bird

- The ESA thus is ecosystem-orientated in its motivation, but the particular ecosystems protected are determined by which species are deemed to be in danger of extinction. That, in turn, depends in part on how "**species**" is legally defined.

18

Endangered Species Act

Biological Species Definitions

Species represent groups of populations reproductively & potentially reproductively isolated from other such groups

- The ESA has largely followed the Biological Species Concept despite protest

Phylogenetic Species Definitions

Species represent monophyletic clades of populations distinguished from other such clades by shared derived features

- According to the ESA, "species" is defined to include "any *subspecies* of fish or wildlife or plants, and any *distinct population segment* of any species of vertebrate fish or wildlife which interbreeds when mature".

19

Endangered Species Act

- Thus, the Federally endangered *Aconitum 'noveboracense'* - northern monk's hood - from the Driftless Region of SW Wisconsin and NE Iowa is protected whether or not it is considered a separate species or a subspecies of the far more widespread western monk's hood - *A. columbianum:* now = *Aconitum columbianum* var. *columbianum*

Western monk's-hood

Northern monk's-hood

Wisconsin Dells

20

Endangered Species Act

- A complex set of status codes have been proposed for submission to the "list" and removal from the "list"

Endangered Species Act Status Codes
E -- Endangered
T -- Threatened
EmE -- Emergency Listing, Endangered
EmT -- Emergency Listing Threatened
SAE, E(S/A) -- Similarity of Appearance to an Endangered Taxon
SAT, T(S/A) -- Similarity of Appearance to a Threatened Taxon
PE -- Proposed Endangered
PT -- Proposed Threatened
C -- Candidate Taxon, Ready for Proposal
D3A -- Delisted Taxon, Evidently Extinct
D3B -- Delisted Taxon, Invalid Name in Current Scientific Opinion
D3C -- Delisted Taxon, Recovered
DA -- Delisted Taxon, Amendment of the Act
DM -- Delisted Taxon, Recovered, Being Monitored First Five Years
DO -- Delisted Taxon, Original Commercial Data Erroneous
DP -- Delisted Taxon, Discovered Previously Unknown Additional Populations and/or Habitat
DR -- Delisted Taxon, Taxonomic Revision (Improved Understanding)
AD -- Proposed Delisting
AE -- Proposed Reclassification to Endangered
AT -- Proposed Reclassification to Threatened

21

Endangered Species Act

Summary of Listed Species – February 10, 2018
U.S. Fish & Wildlife website

	U.S. Endangered	Foreign Endangered	**U.S. Threatened**	Foreign Threatened
Animals	**500**	594	**218**	89
Plants	**772**	1	**171**	2
Total	**1279**	595	**382**	91

- 1168 approved "Recovery Plans"
- The success of the ESA is indicated by "Delisting" of a number of the original "Listed" species – *Kirtlands warbler, peregrine falcon, bald eagle, American alligator, brown pelican, *grizzly bear, *gray wolf, *humpback whale*; although some have been delisted because they went extinct – *eastern puma, blue pike, dusky seaside sparrow, southern pennyroyal*

22

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~2,450 species of vascular plants known from Wisconsin

7 Federally Threatened, **72** State Endangered, **58** State Threatened, and ~**200** Special Concern taxa

http://dnr.wi.gov/topic/NHI/WList.html

23

Endangered Wisconsin Flora

7 species Federally listed as 'Threatened'

Some are State listed as 'Endangered', some as 'Threatened' (one as 'Extirpated' is no longer on state list)

Wisconsin's Federally Listed Species

Plants

Scientific Name	Common Name	Global Rank	State Rank	USESA STATUS	WI STATUS
Cirsium pitcheri	dune thistle	G3	S2	LT	THR
Lespedeza leptostachya	prairie bush-clover	G3	S2	LT	END
Oxytropis campestris var *chartacea*	Fassett's locoweed	G5T1	**S1S2**	LT	END
Aconitum noveboracense	northern wild monkshood	G3	S2	LT	THR
Iris lacustris	dwarf lake iris	G3	S3	LT	THR
Platanthera leucophaea	prairie white-fringed orchid	G2	S3	LT	END
Asclepias meadii	Mead's milkweed	G3	EXT	LT	EXT

24

Endangered Wisconsin Flora

Platanthera leucophaea
Prairie fringed orchid

State endangered,
Federally threatened

25

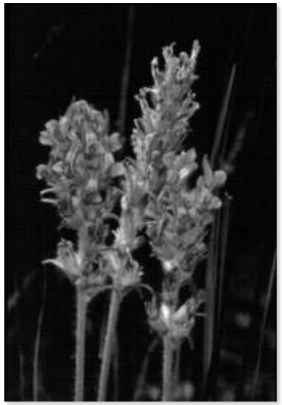
Endangered Wisconsin Flora

State endangered,
Federally threatened

Lespedeza leptostachya
prairie bush-clover

26

Endangered Wisconsin Flora



Oxytropis campestris var. *chartacea*

Cold Mountain crazyweed, Fassett's locoweed,
northern yellow locoweed

State endangered,
Federally threatened

27

Endangered Wisconsin Flora

State threatened,
Federally threatened

Aconitum 'noveboracense' - monks' hood
Aconitum columbianum Nutt. subsp. *columbianum*

28

Endangered Wisconsin Flora

State threatened,
Federally threatened

Cirsium pitcheri
Dune thistle

29

Endangered Wisconsin Flora

State threatened,
Federally threatened

Iris lacustris
Dwarf lake iris

30

Endangered Wisconsin Flora

State extirpated,
Federally threatened

Asclepias meadii
Mead's milkweed

31

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32

How Species Become Endangered

Rarity can be simply a way of life for some species with specialized habitats or restricted biogeographic distributions.

Rhododendron lapponicum - lapland rosebay
Endangered in Wisconsin

Circumboreal species found in Great Lakes region only in the Driftless Area and on cliffs along the Wisconsin and Kickapoo River gorges

33

How Species Become Endangered

Rarity can be simply a way of life for some species with specialized habitats or restricted biogeographic distributions.

Isle Royale, Michigan

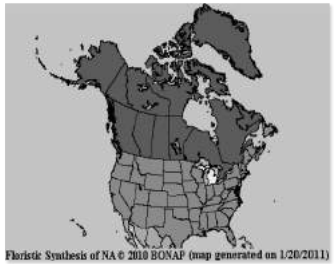
A large group of the threatened and endangered plants of the Great Lakes Region are only found in Isle Royale

34

How Species Become Endangered

Rarity can be simply a way of life for some species with specialized habitats or restricted biogeographic distributions.

Isle Royale, Michigan • Members of arctic or boreal lineages



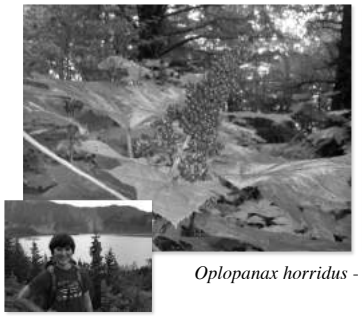
Saxifraga tricuspidata - prickly saxifrage

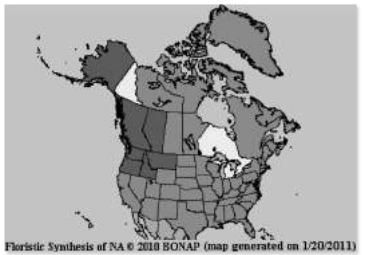
35

How Species Become Endangered

Rarity can be simply a way of life for some species with specialized habitats or restricted biogeographic distributions.

Isle Royale, Michigan • Members of western montane lineages





Oplopanax horridus - devil's club

36

How Species Become Endangered

- In the Great Lakes region, the single most important reason for endangered species is the drastic and rapid change of pre-settlement community types.

Pre-settlement forest types based on 19th century surveyors' records

37

How Species Become Endangered

- Deforestation and oak savanna/prairie use for agriculture have largely made many ecosystems simply experiments in "island biogeography".

38

How Species Become Endangered

- The endangered Karner Blue is restricted to disappearing oak savanna habitat in the Great Lakes region with its larval stages dependent on a single species of plant - *Lupinus perennis*

39

How Species Become Endangered

- As predicted by the theory of island biogeography, prairie patches inventoried in southern Wisconsin in 1950 and again in 2000 showed significant loss of species diversity during the 50 year interval (Leach and Givnish, 2001)
- As expected, moth-pollinated species such as the prairie fringed orchid were one of the first to disappear

Platanthera leucophaea
Prairie-fringed orchid

40

How Species Become Endangered

Three of our greatest plant threats in the Great Lakes region are now actively spreading and decimating our forests and wetlands

Invasion of the aliens

Alliaria petiolata
Garlic mustard

Rhamnus cathartica
European buckthorn

Lythrum salicaria
Purple loosestrife

41

How Species Become Endangered

- Cumulative effect is degradation of genetic diversity or severe genetic bottlenecks

Agalinus skinneriana
Purple false foxglove

Threatened (4 states) in Great Lakes region - restricted to south facing dry prairies

42

How Species Become Endangered

- Cumulative effect is degradation of genetic diversity or severe genetic bottlenecks

- Variation in floral coloration and pattern exists and is correlated with geographical location.

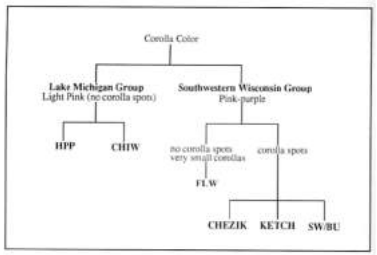


Figure 4. Diagram showing possible relationships between six *Agalinis skinneriana* populations in Wisconsin and northeastern Illinois based on floral morphological data gathered in the field in 1996.

43

How Species Become Endangered

- Cumulative effect is degradation of genetic diversity or severe genetic bottlenecks

- DNA fingerprinting, however, reveals practically no genetic variation.

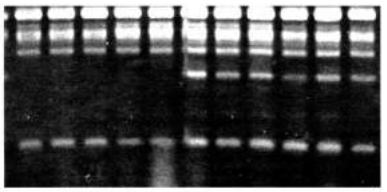


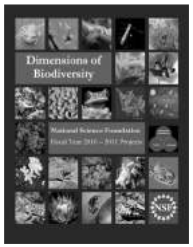
Figure 1. Photo showing the polymorphism at 550 bp produced in the FLW population of *Agalinis skinneriana* using primer AB-20. Lanes 1–5 represent FLW individuals; Lanes 6–10 are individuals from CHEZIK; and Lane 11 is an individual from HPP.

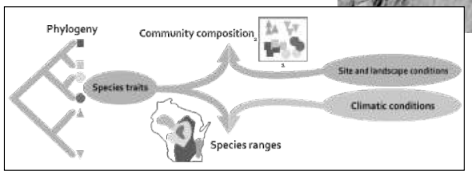
Kercher & Sytsma (2000) in *Natural Areas Journal*

44

How Species Become Endangered

- Climate change – the newest threat





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How Species Become Endangered

- Climate change – the newest threat

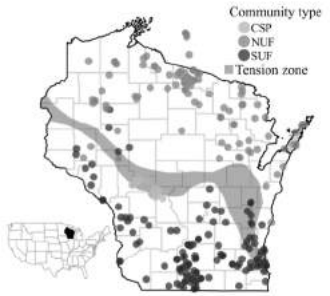
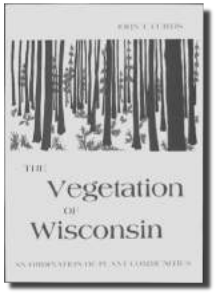


Fig. 1 Locations and community types of the 266 sites resampled across Wisconsin. Sites are colored by community types: northern upland forest (NUF), southern upland forest (SUF), and pine barrens of the central sand plains (CSP). The historical location of the tension zone designated by Curtis (1959) is shown in gray.

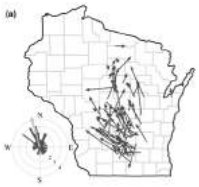


Ash et al. 2017 – Tracking lags in historical plant species' shifts in relation to regional

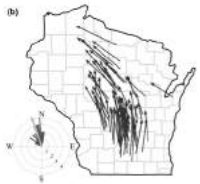
46

How Species Become Endangered

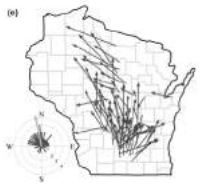
- Climate change – the newest threat



Shifts in 78 species' distributions from 1950s – 2000s



Shifts in climate envelope of 78 species from 1950s – 2000s



Lag in geographic shift relative to climate shift of 78 species

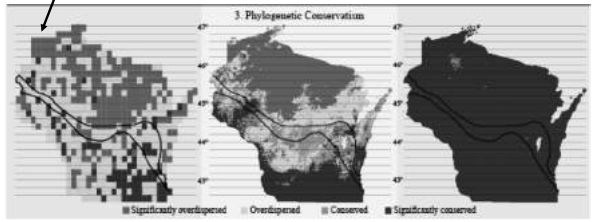
Ash et al. 2017 – Tracking lags in historical plant species' shifts in relation to regional climate change

47

How Species Become Endangered

- Climate change – the newest threat

2017 – specimen & model 2070 – model projection



48

What can or should be done?

- Wisconsin has a number of state mandated programs for protecting species and natural areas in which they occur *in association with private landowners*

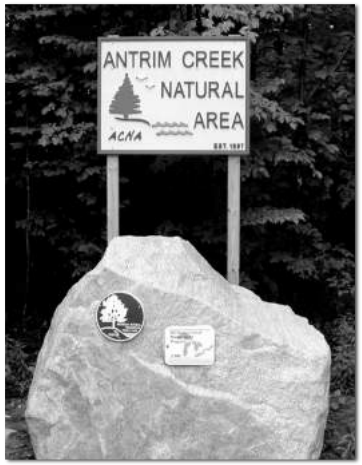
Endangered and Nongame Species: protecting and managing endangered species; working with private landowners to increase awareness and protection of endangered resources.

Natural Heritage Inventory: surveying the state for endangered resources; maintaining the Natural Heritage Inventory database; providing information to natural resource managers, land-use planners and developers.

State Natural Areas: protecting and managing state natural communities; providing educational and research opportunities; coordinating the DNR/DOT Native Plant Seed program..

49

What can or should be done?



- The Antrim Creek Natural Area is a good example where a combination of the local public, county government, conservancy groups, and basic science permitted the preservation of a 1 mile stretch of Lake Michigan shoreline valued in the millions of dollars.

50