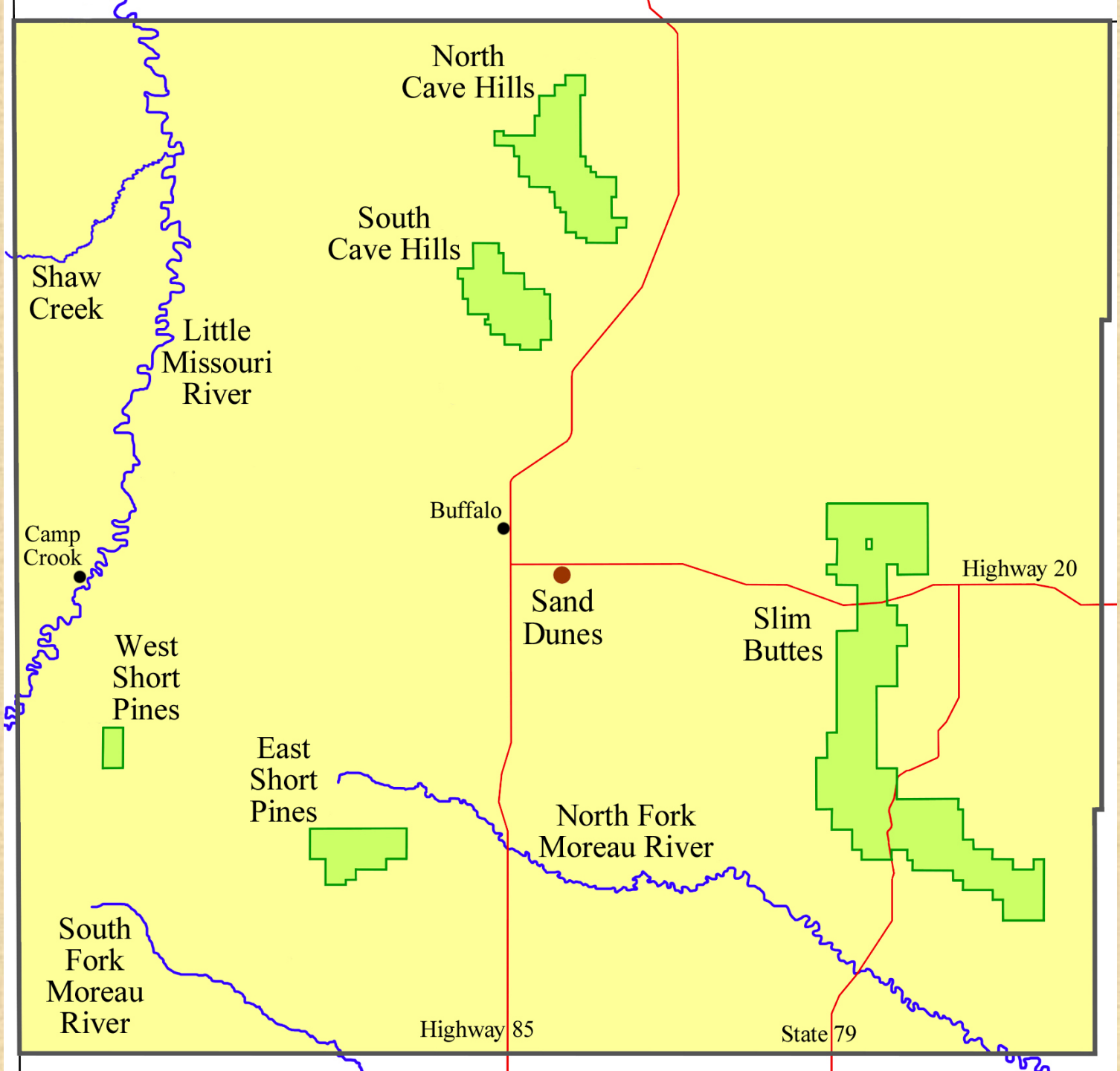
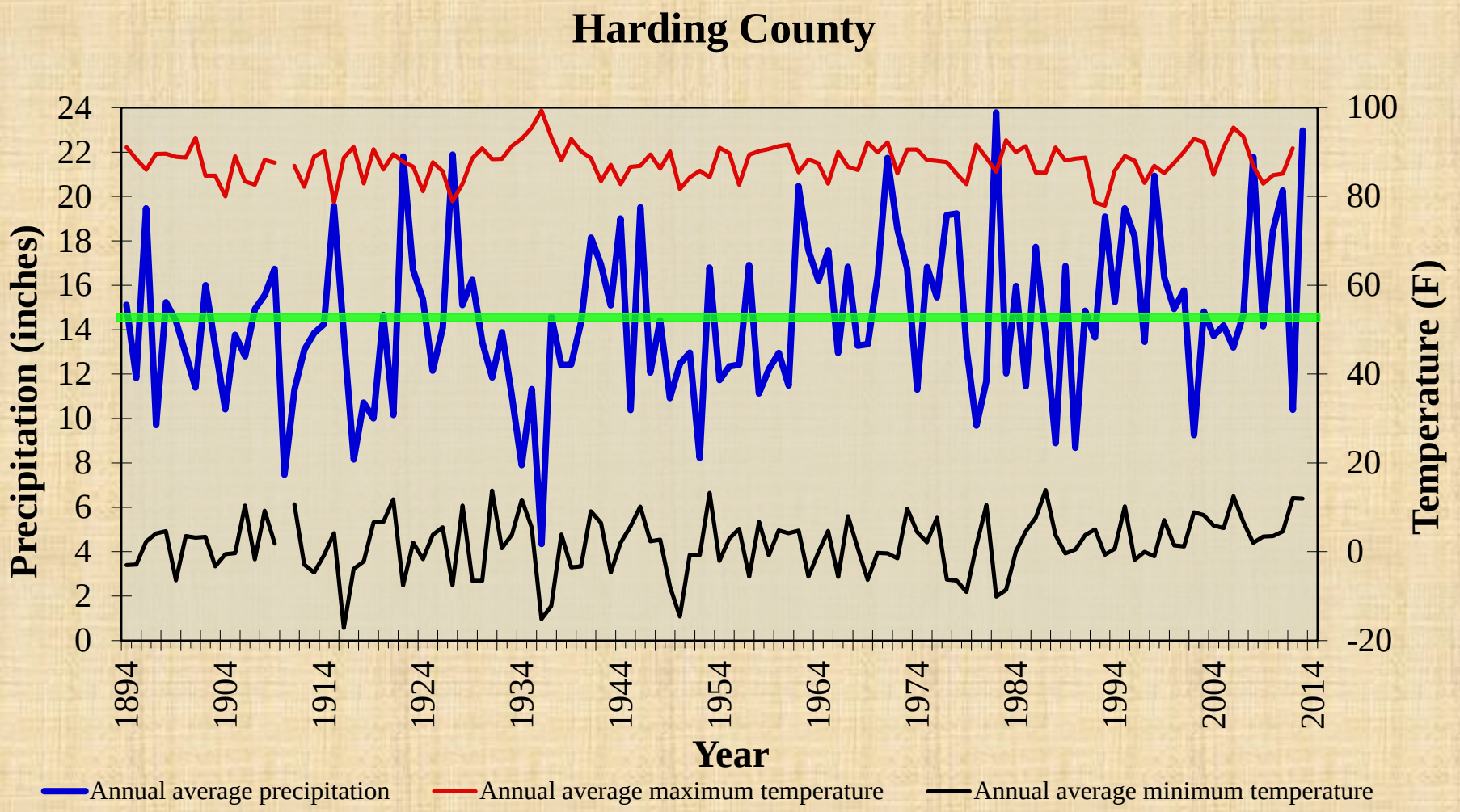
HARDING COUNTY: A CENTURY OF BOTANY IN SOUTH DAKOTA

M. Gabel, B.E. Nelson, D.E. Mergen,
K. Hansen and G. Kostel

Study Area


North
Cave Hills
South
Cave Hills
Shaw
Creek
Little
Missouri
River
Buffalo
Camp
Crook
Sand
Dunes
Highway 20
Slim
Buttes
West
Short
Pines
East
Short
Pines
North Fork
Moreau River
South
Fork
Moreau
River
Highway 85
State 79


Harding County
Precipitation (inches)
Temperature (F)
Year
24
22
20
18
16
14
12
10
8
6
4
2
0
100
80
60
40
20
0
-20
1894
1904
1914
1924
1934
1944
1954
1964
1974
1984
1994
2004
2014
Annual average precipitation
Annual average maximum temperature
Annual average minimum temperature

SOUTH DAKOTA

GEOLOGICAL SURVEY

BULLETIN NUMBER SIX

1914

A Preliminary Report on the Biology of Harding County Northwestern South Dakota

By STEPHEN S. VISHER

Report of State Geologist

STATE PUBLISHING CO.
PIERRE, S. D.

CALIFORNIA

ELLWOOD CHAPPELL PERISHO, State Geologist
1914

Visher 1914

- About 430 plant species listed as occurring in Harding County
- Most plants identified by Aven Nelson
- Included specimens/information from Over, Rowley and Fromme

Specimens vs. Species listed

- Over – nearly all specimens from 1920-1930
- Rowley – no specimens seen
- Fromme – specimens of 183 species
- Visher – specimens of 365 species

METHODS

- Translation to modern species names – about 43% unchanged

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- Other literature sources
  - Hansen and Hoffman 1987
  - Heidel and Dueholm 1995
  - Gabel and Simonson 2008

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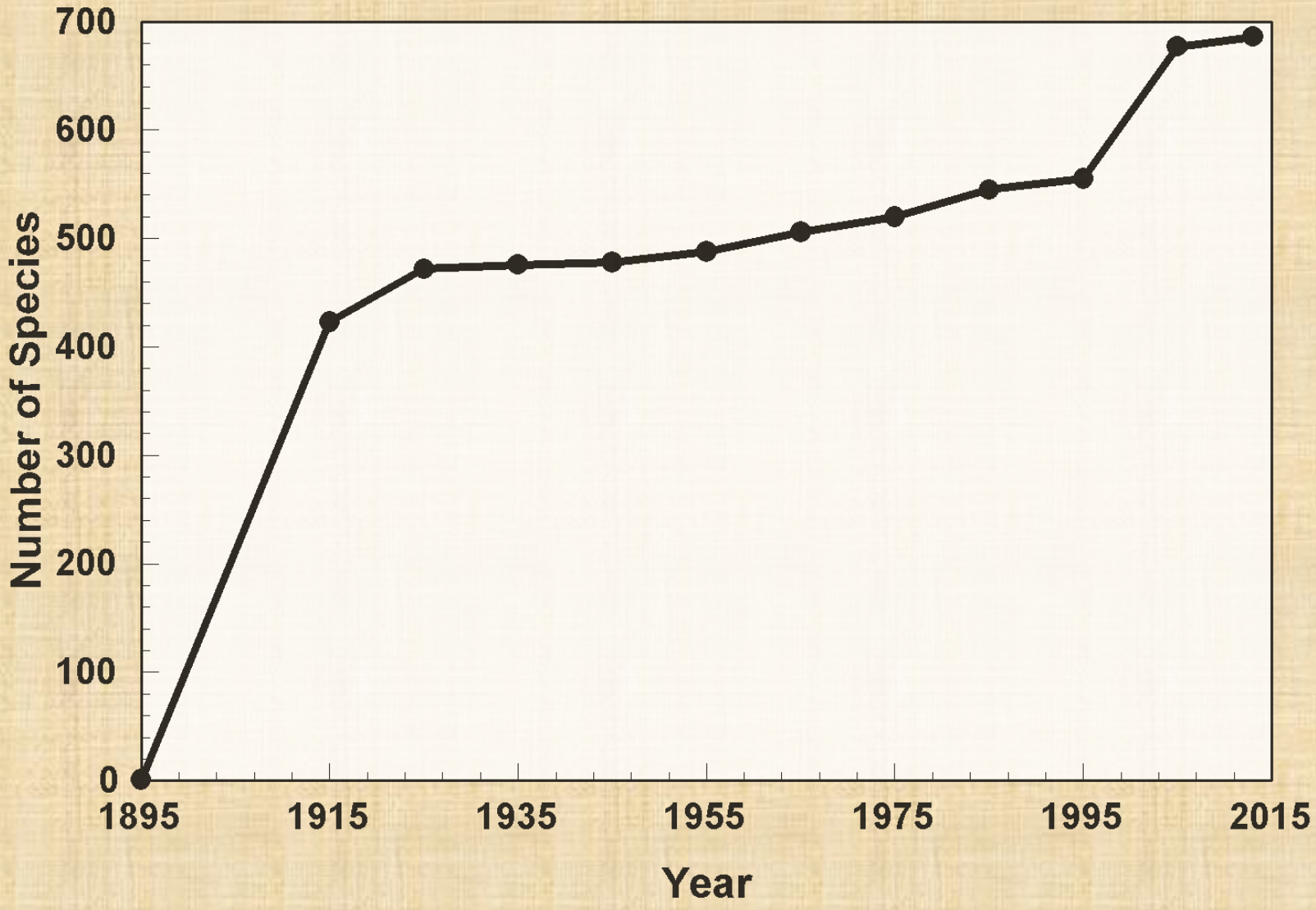
- Other literature sources
  - Hansen and Hoffman 1987
  - Heidel and Dueholm 1995
  - Gabel and Simonson 2008
- Collections
  - Forest Service collections
  - Black Hills State - 2002-2013
  - University of Wyoming - 2009-2010

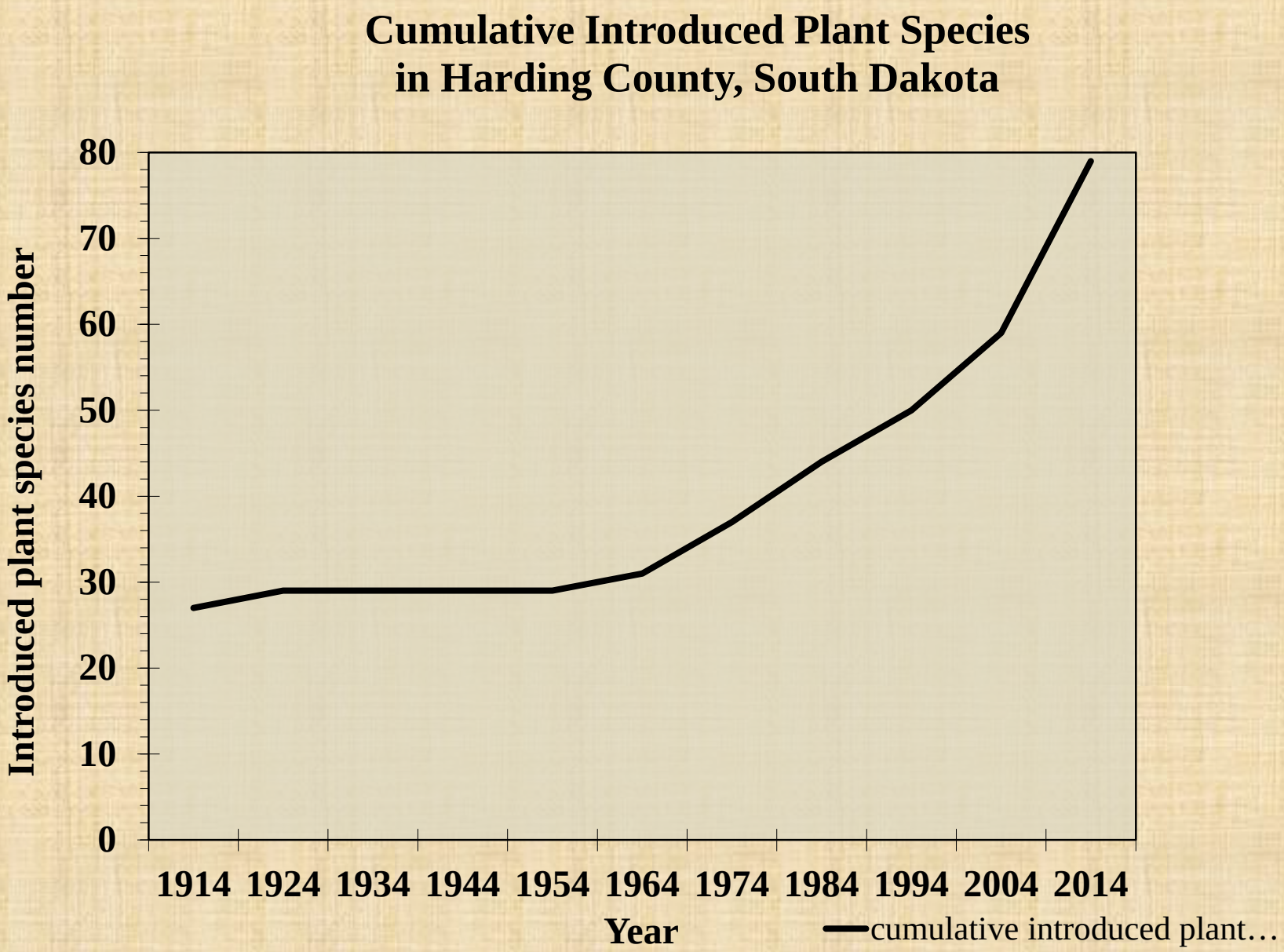
METHODS

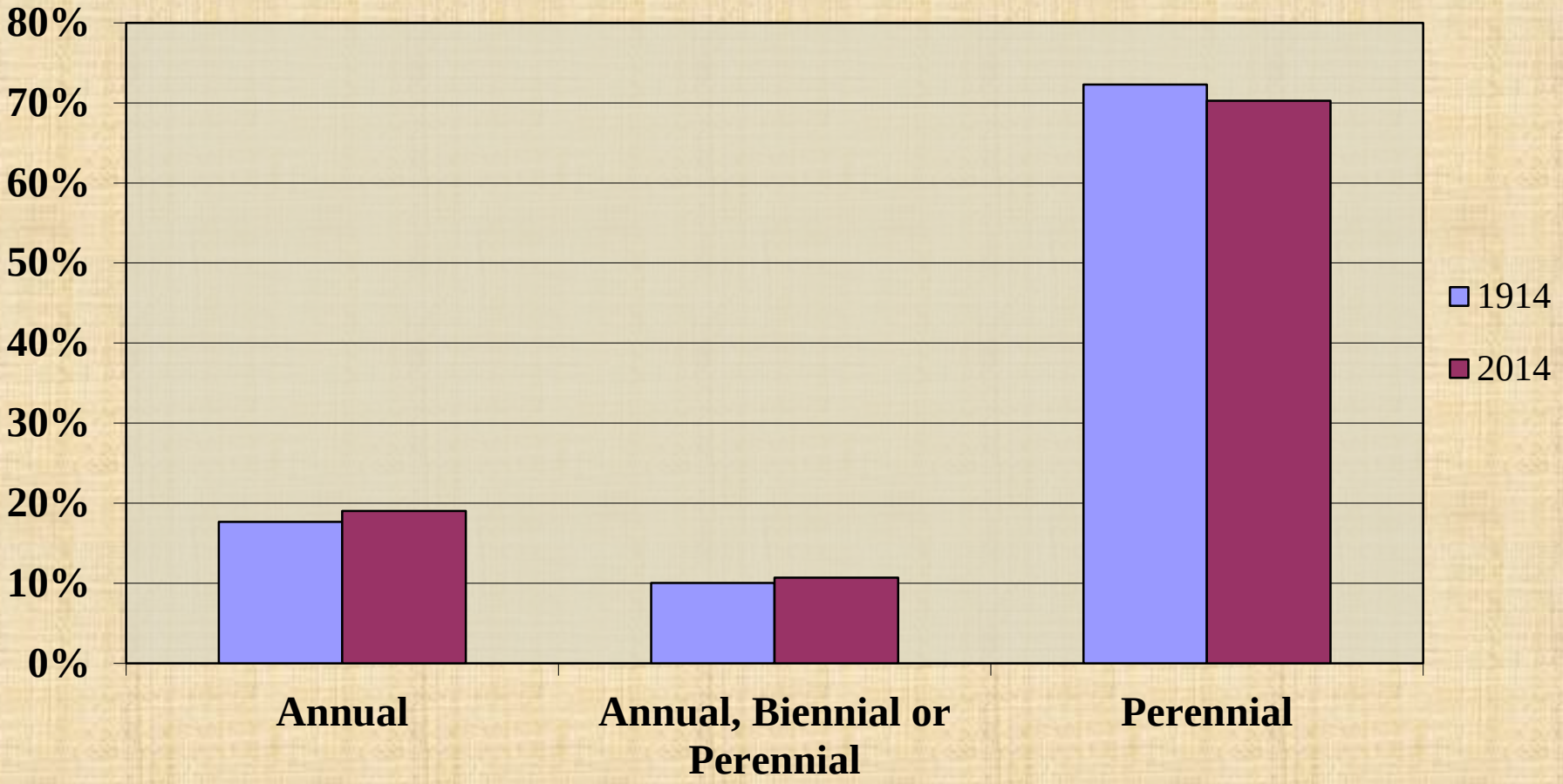
- Use of databases
  - Specimen citations not included
    - USDA Plants
    - Biota of North America
  - Specimen citations
    - Rocky Mountain Herbarium
    - Black Hills State University Herbarium
      - composite of data from 26 herbaria

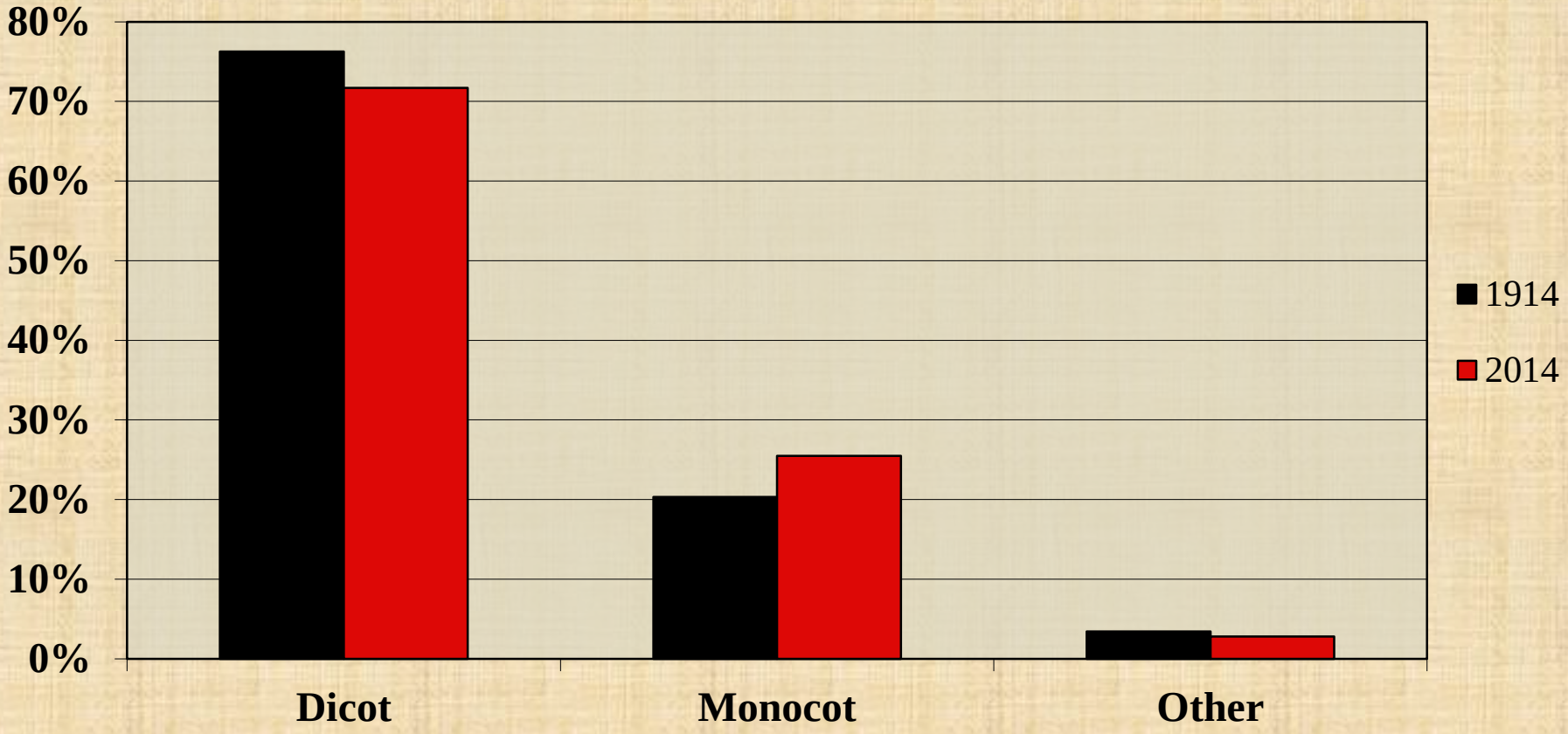
Floristic Quality Assessment

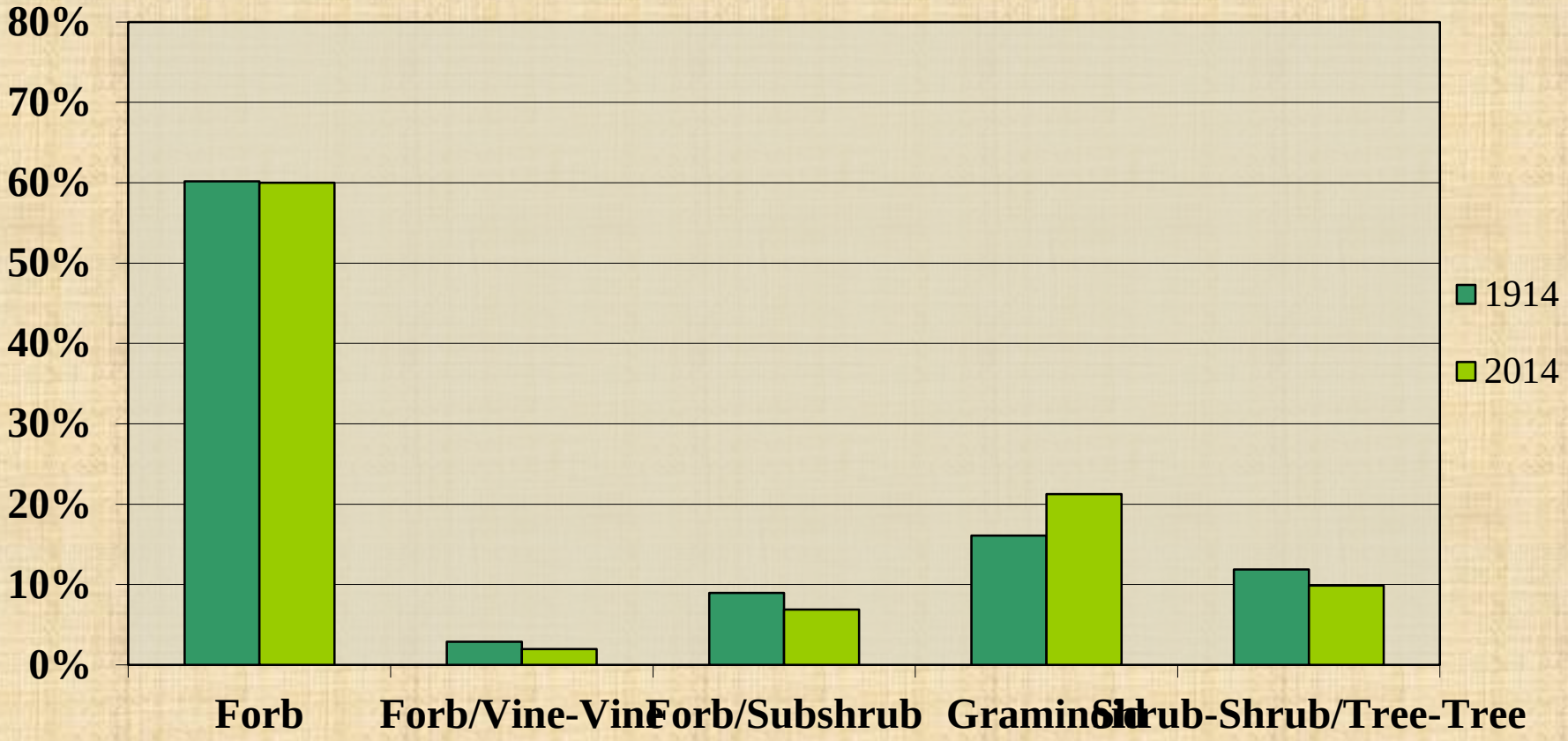
- Identify significant sites
- Compare different sites
- Long-term monitoring
- Evaluate habitat restoration


700
600
500
400
300
200
100
0
Number of Species
1895
1915
1935
1955
1975
1995
2015
Year


Cumulative Introduced Plant Species
in Harding County, South Dakota
Introduced plant species number
80
70
60
50
40
30
20
10
0
1914
1924
1934
1944
1954
1964
1974
1984
1994
2004
2014
Year
cumulative introduced plant…


80%
70%
60%
50%
40%
30%
20%
10%
0%
Annual
Annual, Biennial or Perennial
Perennial
1914
2014


80%
70%
60%
50%
40%
30%
20%
10%
0%
Dicot
Monocot
Other
1914
2014


80%
70%
60%
50%
40%
30%
20%
10%
0%
Forb
Forb/Vine-Vine
Forb/Subshrub
Graminoid
Shrub-Shrub/Tree-Tree
1914
2014

Coefficients of Conservatism

- C values determined by committee (USGS 2001), each native species assigned a value from 0-10
- Estimated probability plant will occur in unaltered habitat
- Zero (0) value found anywhere
- Ten (10) value restricted to high quality habitat

Cypipedium parviflorum
CC=10

Monarda fistulosa CC=5

Non-native species WEEDS CC=*

Coefficients of Conservatism

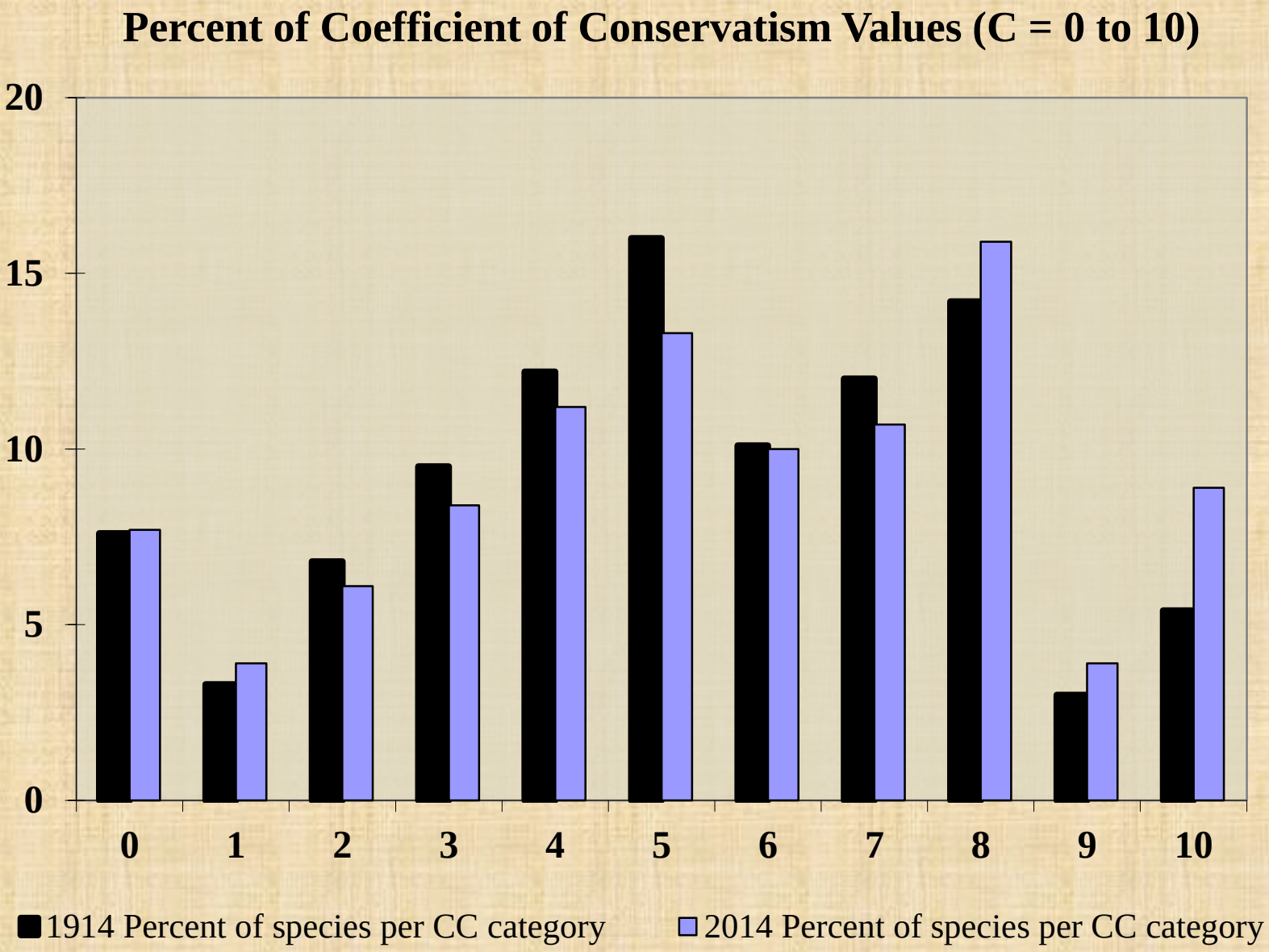
- C values determined by committee (USGS 2001), each native species assigned a value from 0-10
- Mean C values = $\bar{C} = \frac{\sum C}{N}$
- (of 714 species, 44 native species have not been assigned values)
- C value for Visher species $\bar{C}$ = 5.3 (1914)
- C value for all native species $\bar{C}$ = 5.4 (2014)

Actual numbers by categories per century. means (standard error)

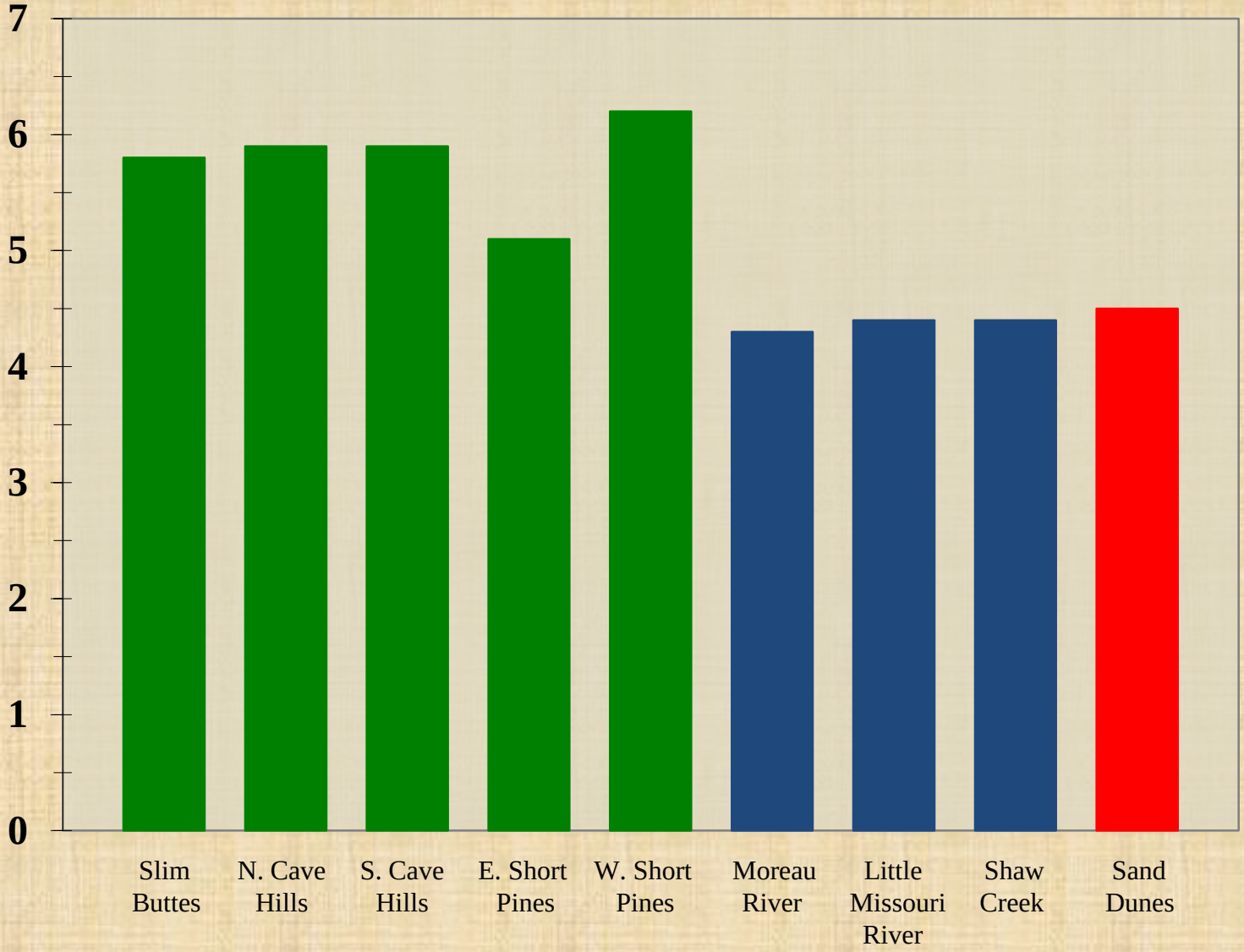
CATEGORY	N	1914	N	2014
Life forms		$\overline{C}$		$\overline{C}$
Forbs	201	4.8 (0.2)	337	5.2 (0.2)
Graminoids	55	5.1 (0.4)	120	5.2 (0.3)
Forbs/shrubs mostly subshrub species	34	6.5 (0.5)	44	6.7 (0.4)
Shrubs	27	6.1 (0.4)	35	6.0 (0.3)
Shrubs or sometimes trees	11	5.3 (0.6)	19	5.4 (0.4)
Trees	7	4.7 (0.8)	11	4.1 (0.7)
Forbs/Vines	4	6.0 (1.1)	6	5.3 (1.3)
Vines	5	4.0 (0.9)	5	4.0 (0.9)

Coefficients of Conservatism (% of all values)

C of C	E. WA	W. WA	CO	IL	MI	OH	1914 Visher	2014 Modern
0-3	16	18	8	17	15	11	28	26
4-6	56	58	46	34	36	48	36	35
7-10	28	24	46	49	49	41	37	40

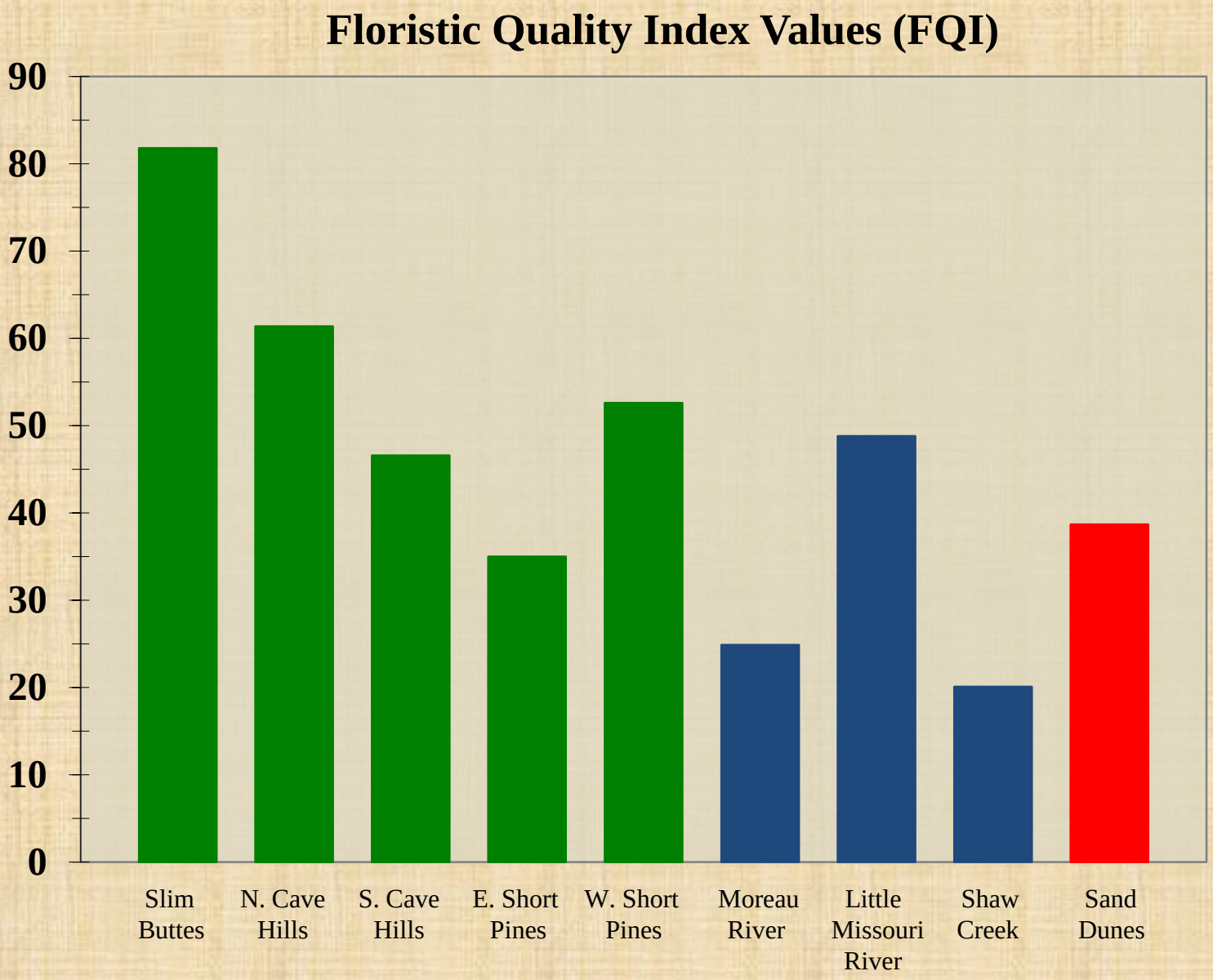

Percent of Coefficient of Conservatism Values (C = 0 to 10)
20
15
10
5
0
0
1
2
3
4
5
6
7
8
9
10
1914 Percent of species per CC category
2014 Percent of species per CC category

Mean Coefficient of Conservatism Values ($\overline{C}$)

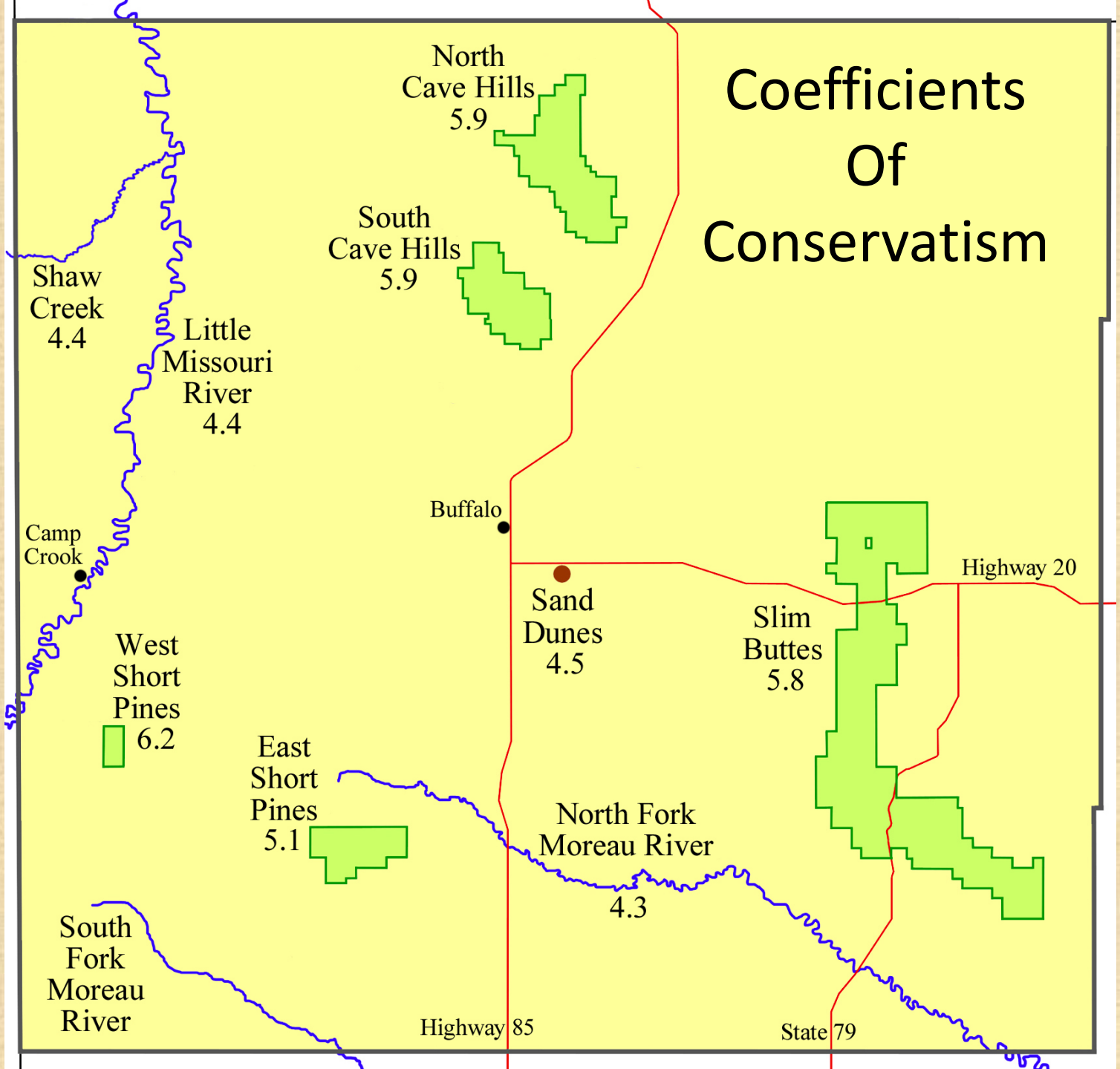


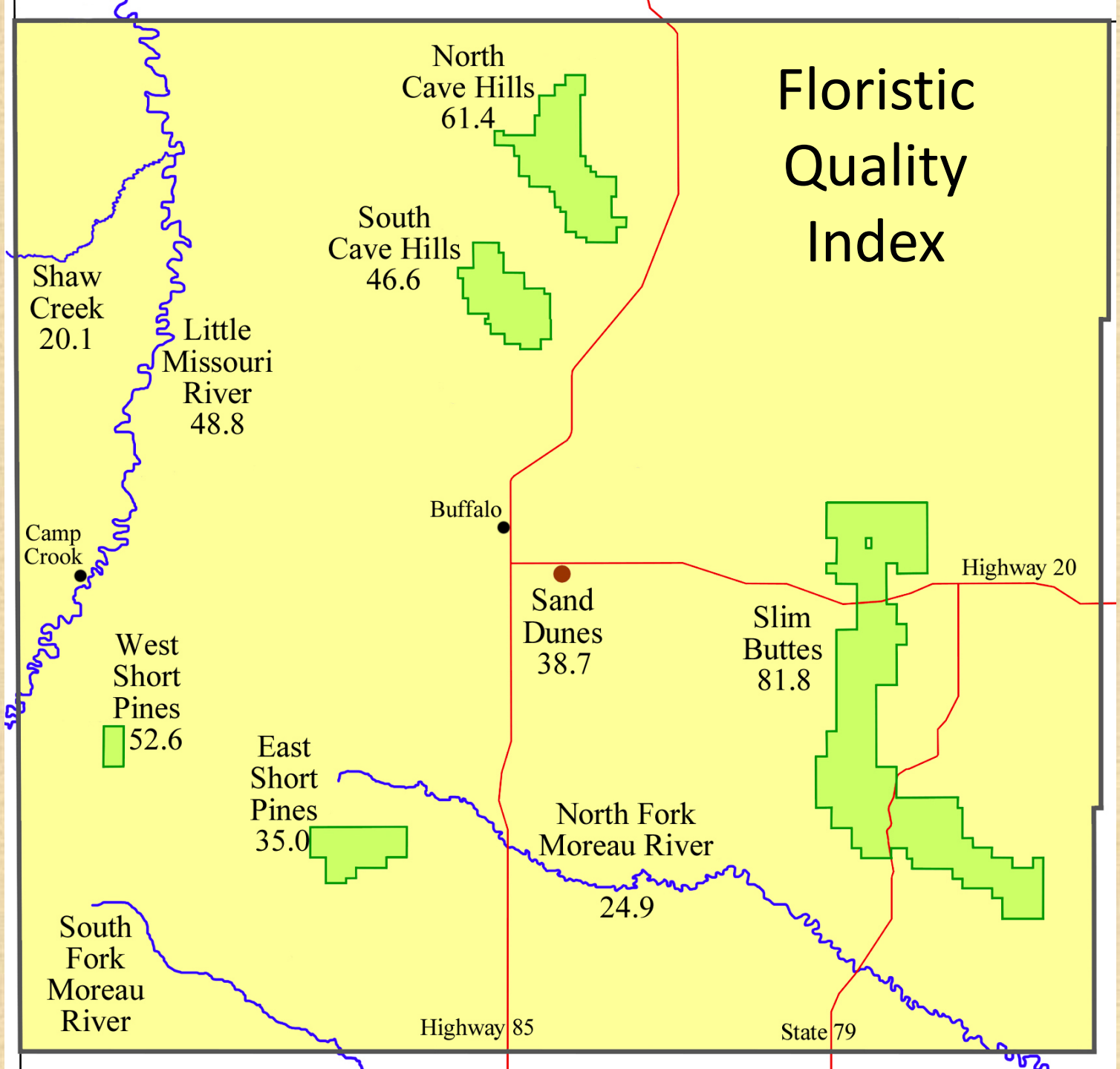
Floristic Quality Index

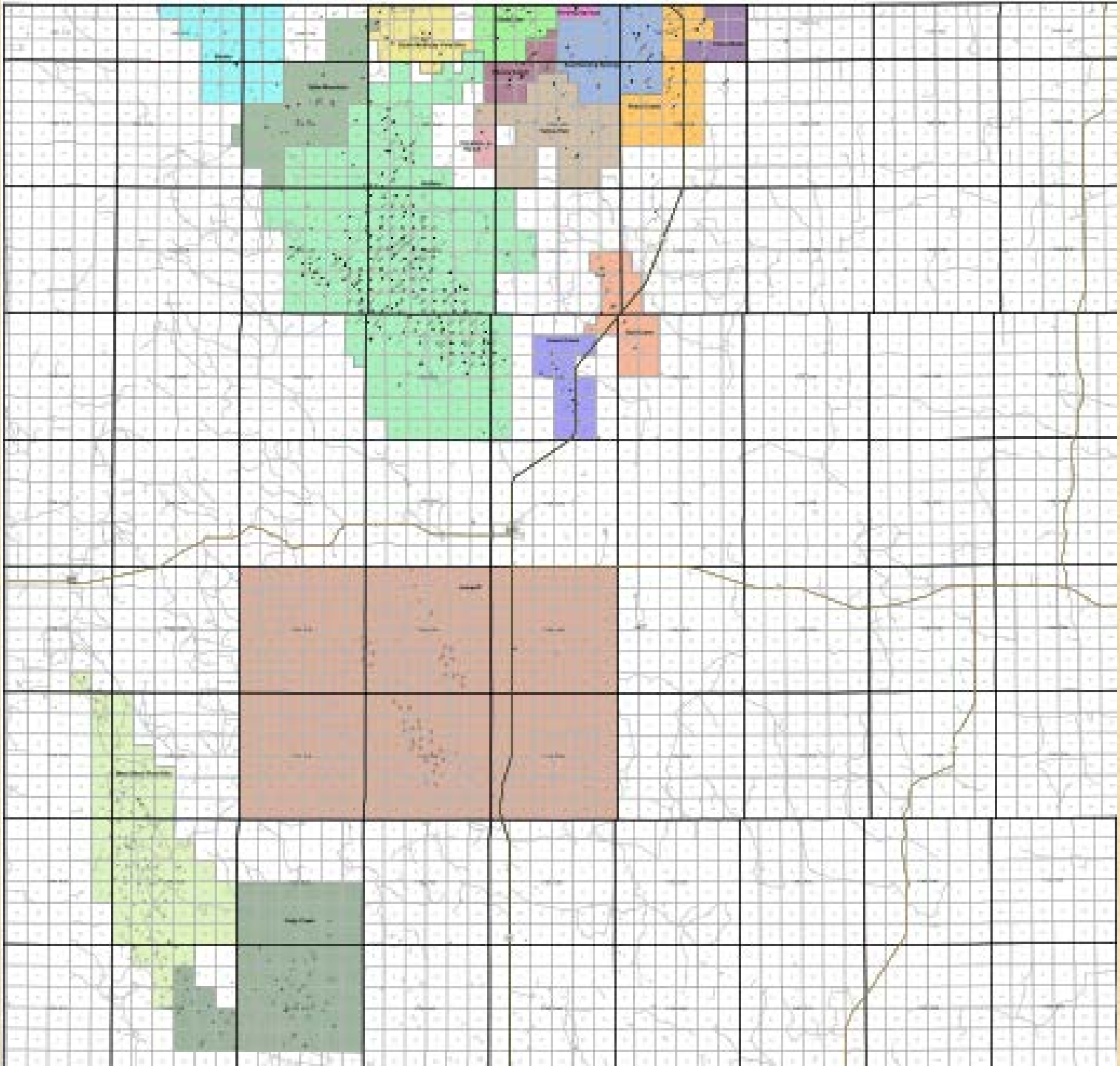
- FQI = $\overline{C} * \sqrt{n}$


Floristic Quality Index Values (FQI)
90
80
70
60
50
40
30
20
10
0
Slim Buttes
N. Cave Hills
S. Cave Hills
E. Short Pines
W. Short Pines
Moreau River
Little Missouri River
Shaw Creek
Sand Dunes

Coefficients Of Conservatism

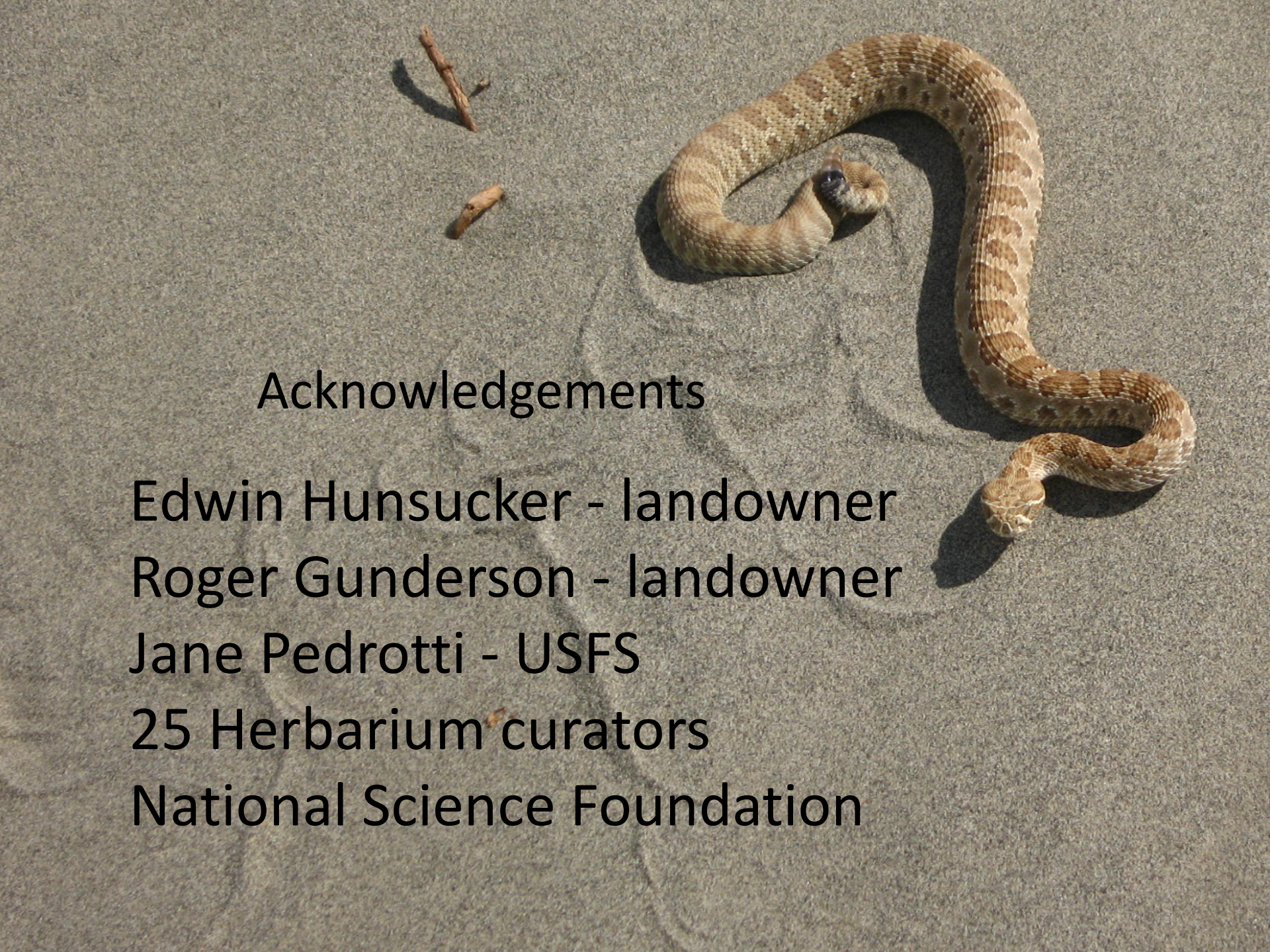



Floristic Quality Index
North Cave Hills 61.4
South Cave Hills 46.6
Shaw Creek 20.1
Little Missouri River 48.8
Buffalo
Camp Crook
Sand Dunes 38.7
Highway 20
Slim Buttes 81.8
West Short Pines 52.6
East Short Pines 35.0
North Fork Moreau River 24.9
South Fork Moreau River
Highway 85
State 79



Summary

- Increase from over 430 species to over 724
- 8% increase introduced species 1914 to 2014
- No major changes in types of plants
- Some excellent habitats still mostly intact
- Baseline knowledge critical before more development



Acknowledgements

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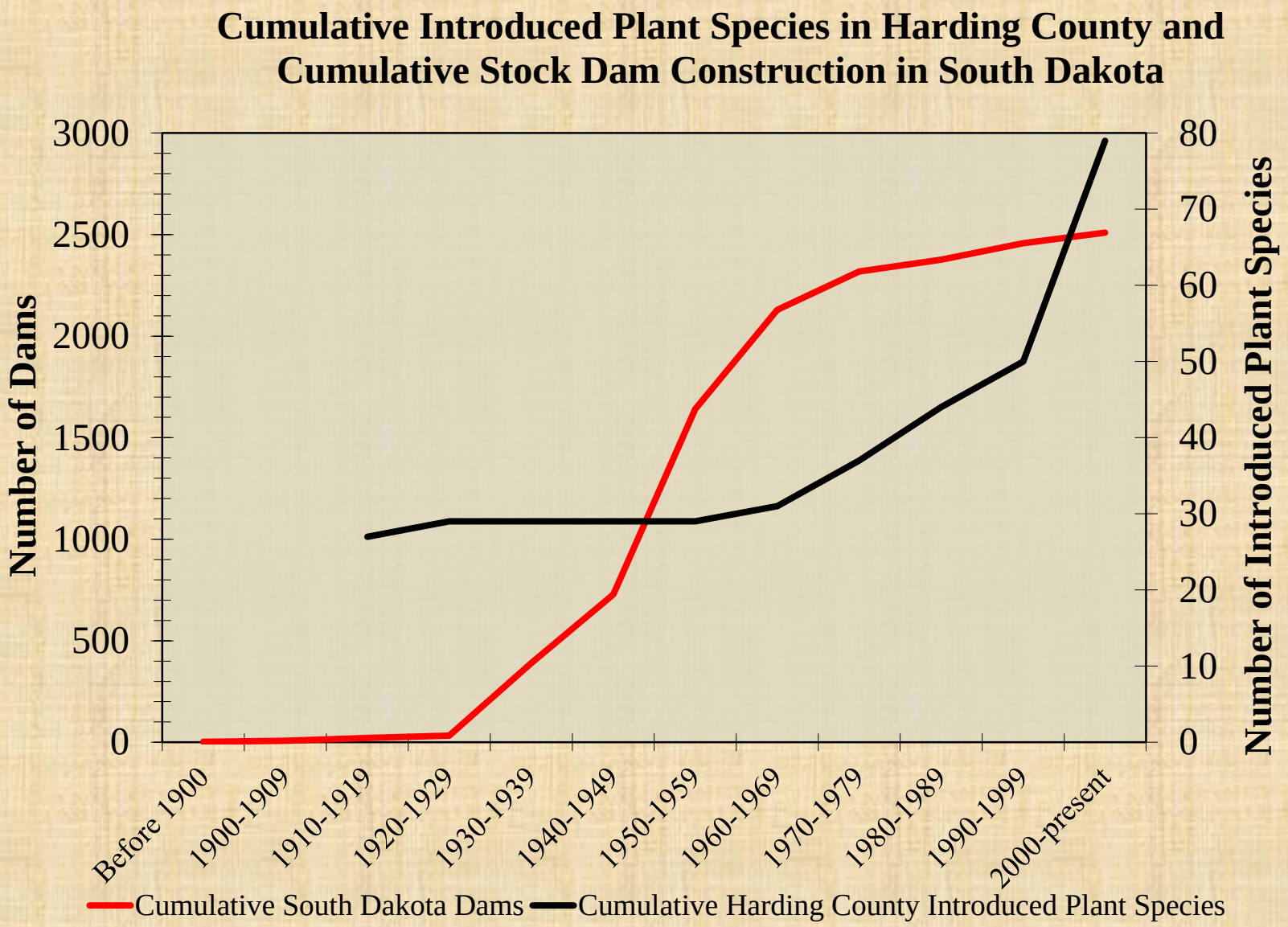
25 Herbarium curators
National Science Foundation


Cumulative Introduced Plant Species in Harding County and Cumulative Stock Dam Construction in South Dakota
Number of Dams
Number of Introduced Plant Species
3000
2500
2000
1500
1000
500
0
80
70
60
50
40
30
20
10
0
Before 1900
1900-1909
1910-1919
1920-1929
1930-1939
1940-1949
1950-1959
1960-1969
1970-1979
1980-1989
1990-1999
2000-present
Cumulative South Dakota Dams
Cumulative Harding County Introduced Plant Species