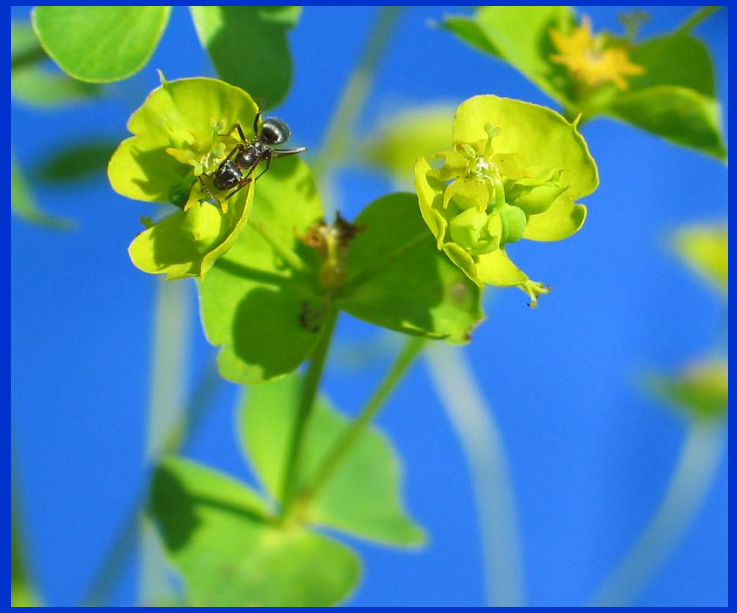
LONG-TERM SUCCESS STORY OF INVASIVE WEED CONTROL IN NORTH DAKOTA



WITH A SUMMARY OF ‘ALL’ WEED BIOLOGICAL CONTROL AGENTS RELEASED IN THE STATE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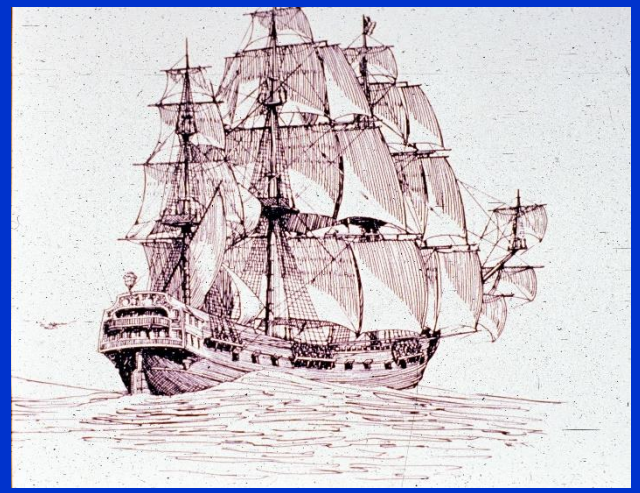


INTIAL DISCOVERY AND INVASION

- **FOUND GROWING ALONG A STREET IN FARGO IN 1909**

NP Ave from 1909 postcard
NDSU archives

INTIAL DISCOVERY AND INVASION

- NOT ADDED TO THE STATE NOXIOUS WEED LIST BECAUSE THREAT NOT RECOGNIZED
- PORTER AND STEVENS WROTE “IT (LEAFY SPURGE) SEEMS TO SPREAD FREELY FROM THE ROOTS AND SHOUD BE WATCHED CLOSELY”
- ONLY CONTROL OPTIONS WERE SMOTHERING AND CULTIVATION IN CROPS OR MOWING AND HOEING IN PASTURE

INTIAL DISCOVERY AND INVASION

- **FIRST IN-DEPTH ANALYSIS WAS CONDUCTED BY VELVA RUDD FROM 1931-1932 AS PART OF HER MASTERS DEGREE RESEARCH**

DR. RUDD
1994 NDSU HOMECOMING

HER THESIS CONTAINS A COMPLETE DESCRIPTION OF THE PLANT, SEED PRODUCTION AND SPREAD BY ROOT.
DETAILED DRAWINGS OF THE PLANT REMAIN IN USE TODAY.

HER WORK WAS CONDUCTED IN NORTH FARGO, WHERE THE PLANT WAS "GROWING DENSLEY"

Hanson ar eafy spurge

Bulletin 266

Leafy

Life History

Herbert
a
Velva

AGRICULTURAL EX
NORTH DAKOTA AG
Fargo, N

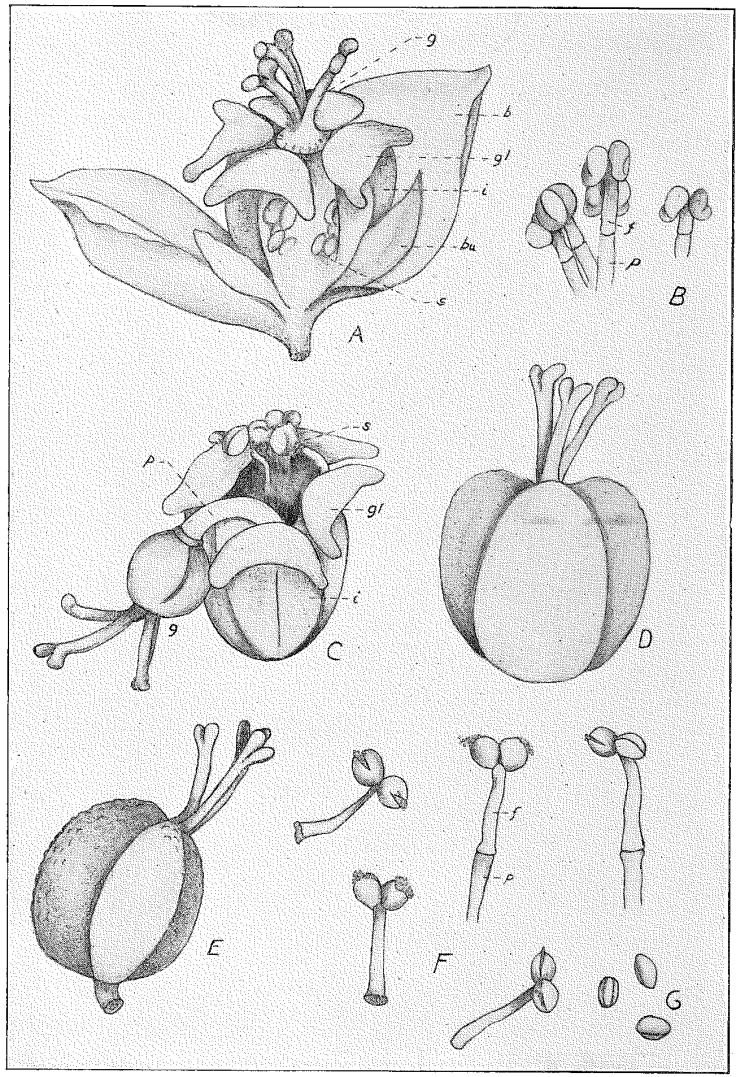


Figure 3. DRAWING OF FLORAL PARTS AND FRUIT OF LEAFY SPURGE

A, the cyathium or flower cluster surrounded by involucre; B, cluster of immature staminate flowers; C, mature flower cluster showing pistillate flower extruding from involucre; D, mature fruit with all three carpels developed; E, mature fruit with only one carpel developed; F, stamens with anthers dehiscing; G, pollen grains; b, bract; bu, flower bud; f, filament; g, gynoecium; gl, involucral gland; i, involucre; p, pedicel; s, stamen.

May, 1934

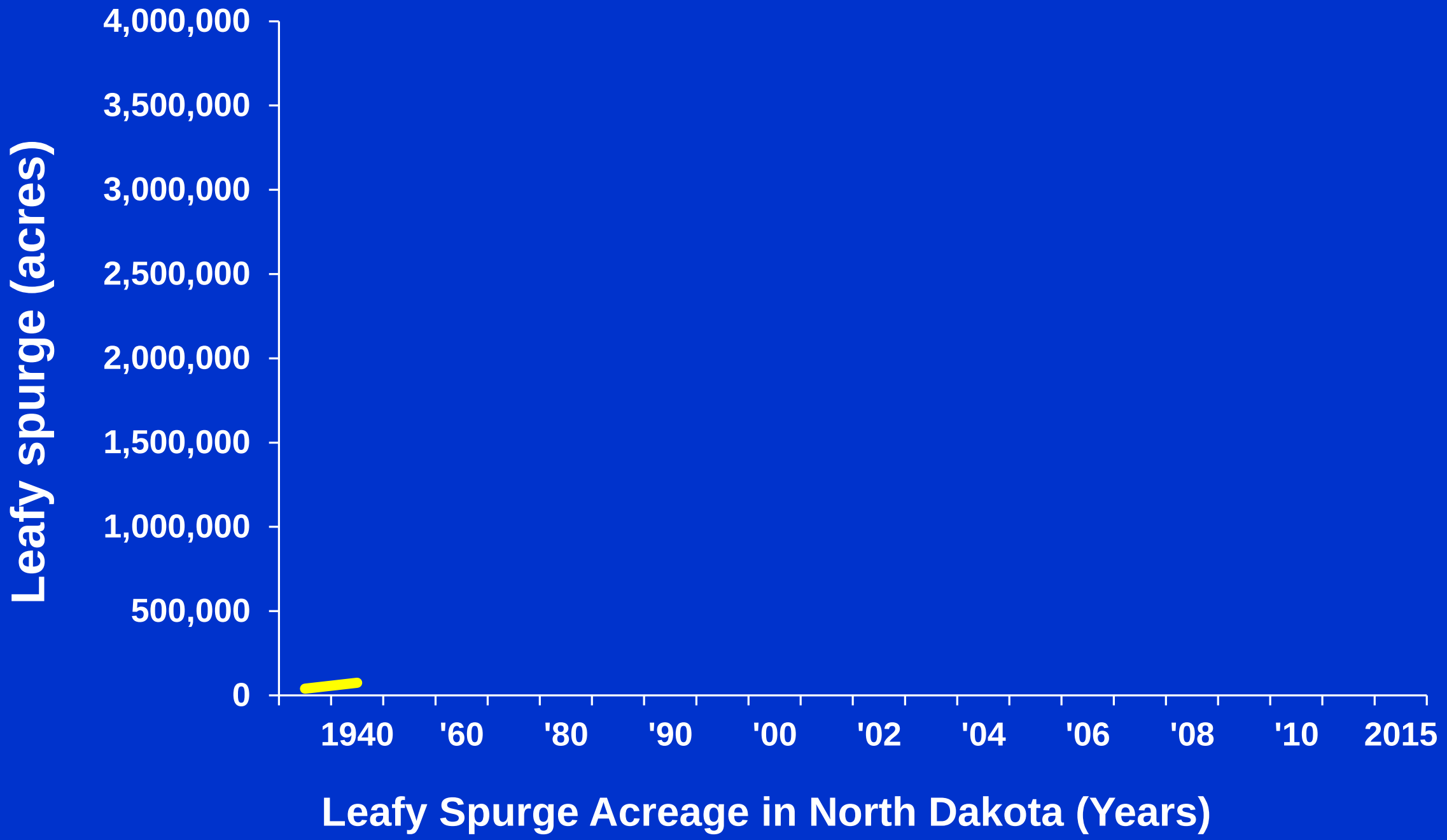
eafy Spurge

ıre on Chemical ɔntrol

Barnett

Hanson

RIMENT STATION
ULTURAL COLLEGE
Dakota


Leafy spurge (acres)
4,000,000
3,500,000
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2,000,000
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1940
'60
'80
'90
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'10
2015
Leafy Spurge Acreage in North Dakota (Years)

PRE-WAR CONTROL AND EDUCATION

- **LEAFY SPURGE WAS ADDED TO THE ND NOXIOUS WEED LIST IN 1935 FOLLOWING A SURVEY FOR FIVE "CANCEROUS WEEDS"**

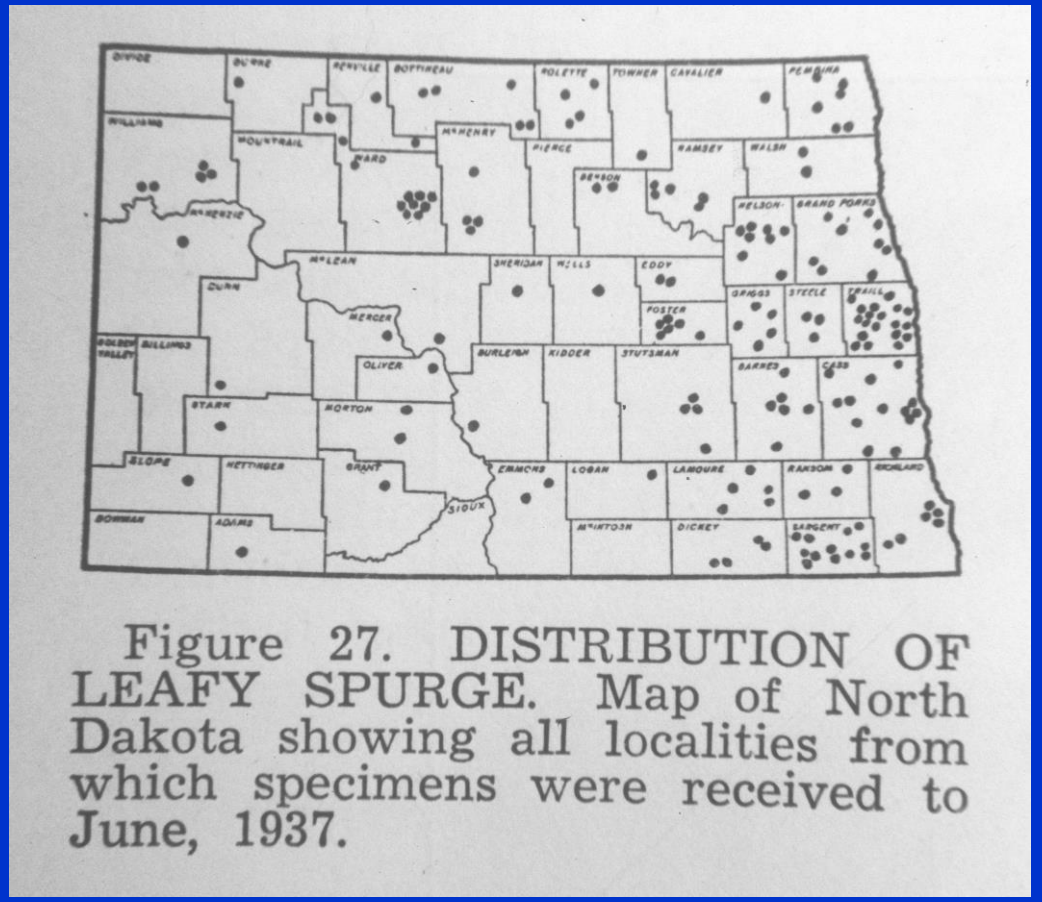


Figure 27. DISTRIBUTION OF LEAFY SPURGE. Map of North Dakota showing all localities from which specimens were received to June, 1937.

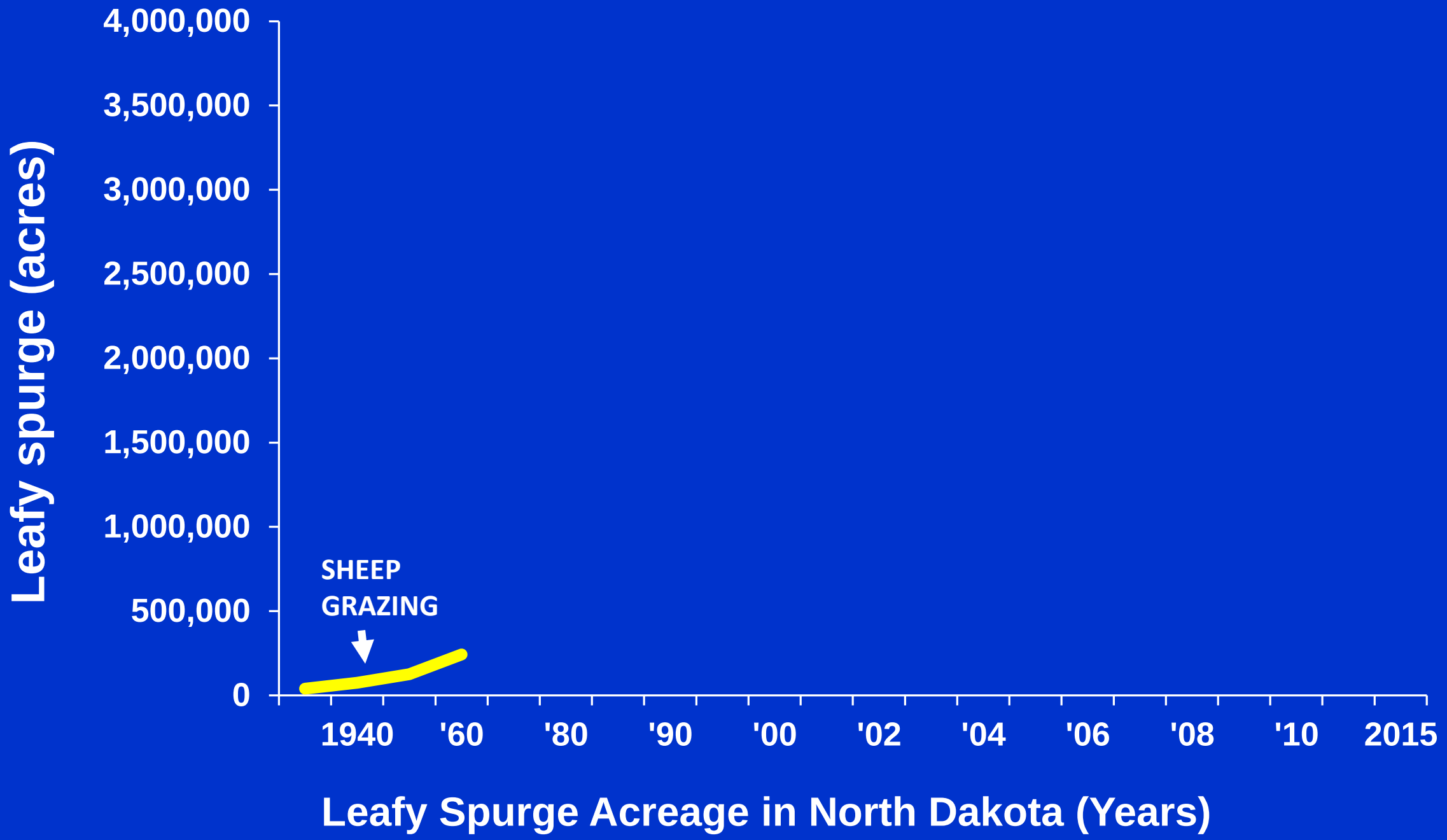
PRE-WAR CONTROL AND EDUCATION

CHEMCIAL CONTROL RECOMMENDATIONS FROM NDAC

- **SODIUM CHLORIDE 2 -13 LB/SQ ROD (320-2080 LB/A)**
- **SODIUM ARSENITE, CALCIUM CAYANAMID, ARSENIC PENTOXIDE**
- **APPLY TO LEAFY SPURGE AT FLOWERING**

CHEMICAL RECOMMENDATIONS REMAINED UNCHANGED FOR THE NEXT TWO DECADES

THE USE OF SHEEP TO GRAZE LEAFY SPURGE WAS BEGUN ≈ 1938


Leafy spurge (acres)
4,000,000
3,500,000
3,000,000
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1,500,000
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SHEEP
GRAZING
1940
'60
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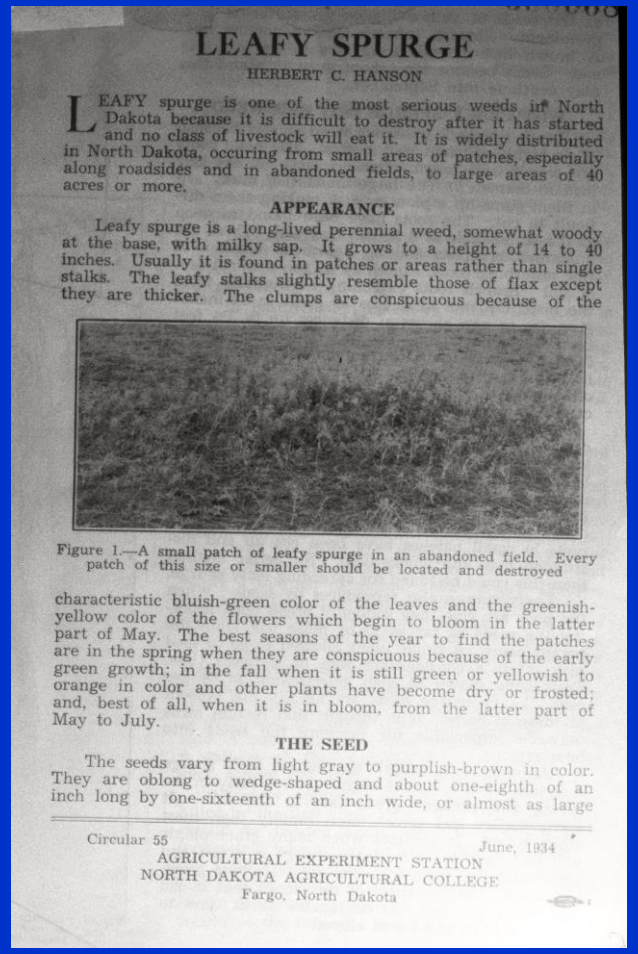
2015
Leafy Spurge Acreage in North Dakota (Years)

WW-II CONTROL AND EDUCATION



LEAFY SPURGE

HERBERT C. HANSON

LEAFY spurge is one of the most serious weeds in North Dakota because it is difficult to destroy after it has started and no class of livestock will eat it. It is widely distributed in North Dakota, occuring from small areas of patches, especially along roadsides and in abandoned fields, to large areas of 40 acres or more.

APPEARANCE

Leafy spurge is a long-lived perennial weed, somewhat woody at the base, with milky sap. It grows to a height of 14 to 40 inches. Usually it is found in patches or areas rather than single stalks. The leafy stalks slightly resemble those of flax except they are thicker. The clumps are conspicuous because of the

Figure 1.—A small patch of leafy spurge in an abandoned field. Every patch of this size or smaller should be located and destroyed

characteristic bluish-green color of the leaves and the greenish-yellow color of the flowers which begin to bloom in the latter part of May. The best seasons of the year to find the patches are in the spring when they are conspicuous because of the early green growth; in the fall when it is still green or yellowish to orange in color and other plants have become dry or frosted; and, best of all, when it is in bloom, from the latter part of May to July.

THE SEED

The seeds vary from light gray to purplish-brown in color. They are oblong to wedge-shaped and about one-eighth of an inch long by one-sixteenth of an inch wide, or almost as large

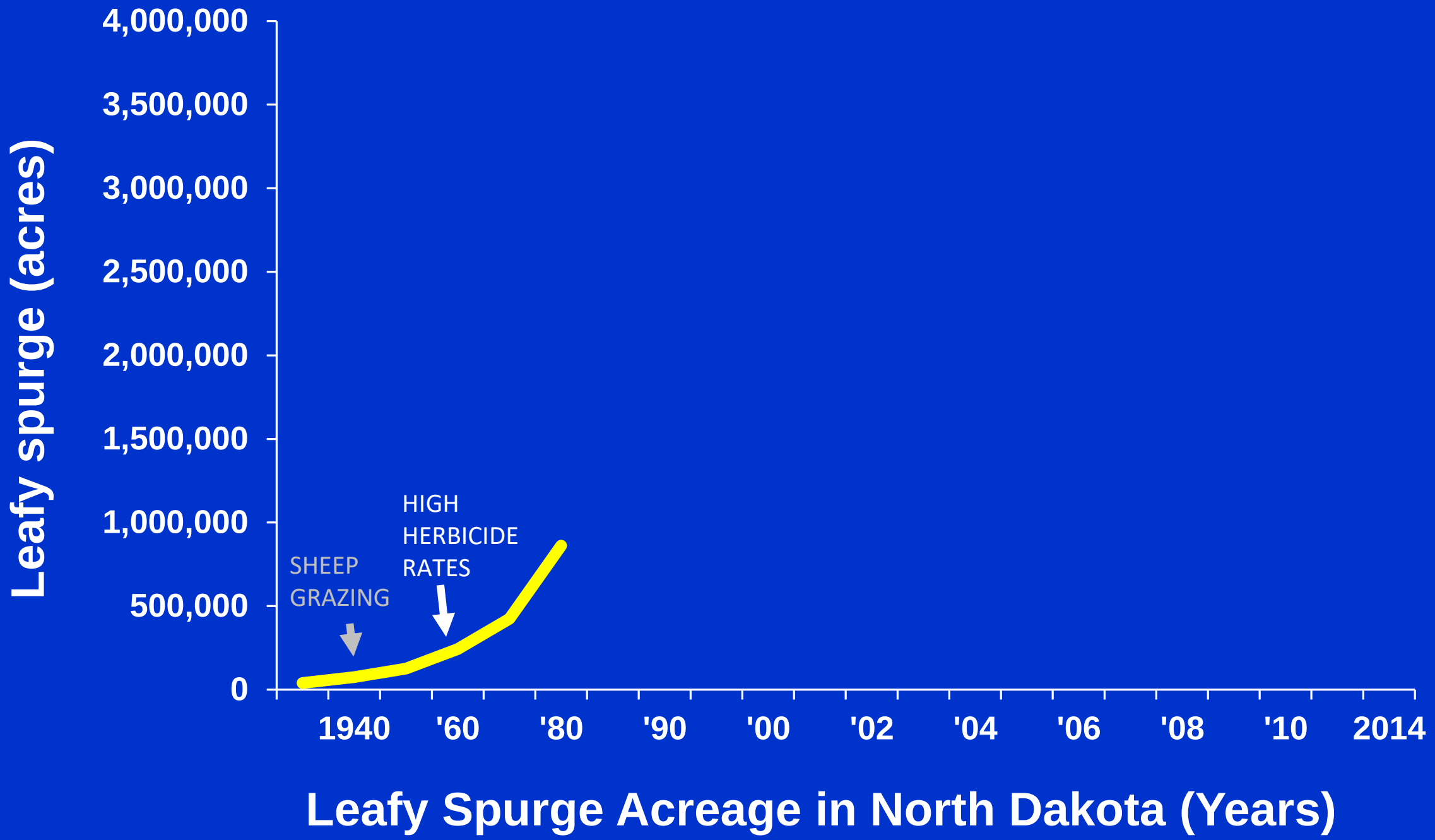
Circular 55 June, 1934

AGRICULTURAL EXPERIMENT STATION
NORTH DAKOTA AGRICULTURAL COLLEGE
Fargo, North Dakota

IN A 1944 BULLETIN THE DANGERS OF USING SODIUM CHLORATE WERE NOTED. "WHEN MIXED WITH ORGANIC MATTER, SUCH AS CLOTHING OR WOOD….BECOMES A SERIOUS FIRE HAZARD

"ONE SHOULD USE CAUTION WHEN STARTING THE WOOD STOVE AFTER SPRAYING LEAFY SPURGE!"

ALSO RECOMMENDED USING CULTIVATION WITH CHEMICALS, THE FIRST INTEGRATED APPROACH TO LEAFY SPURGE CONTROL


Leafy spurge (acres)
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
SHEEP GRAZING
HIGH HERBICIDE RATES
1940
'60
'80
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'00
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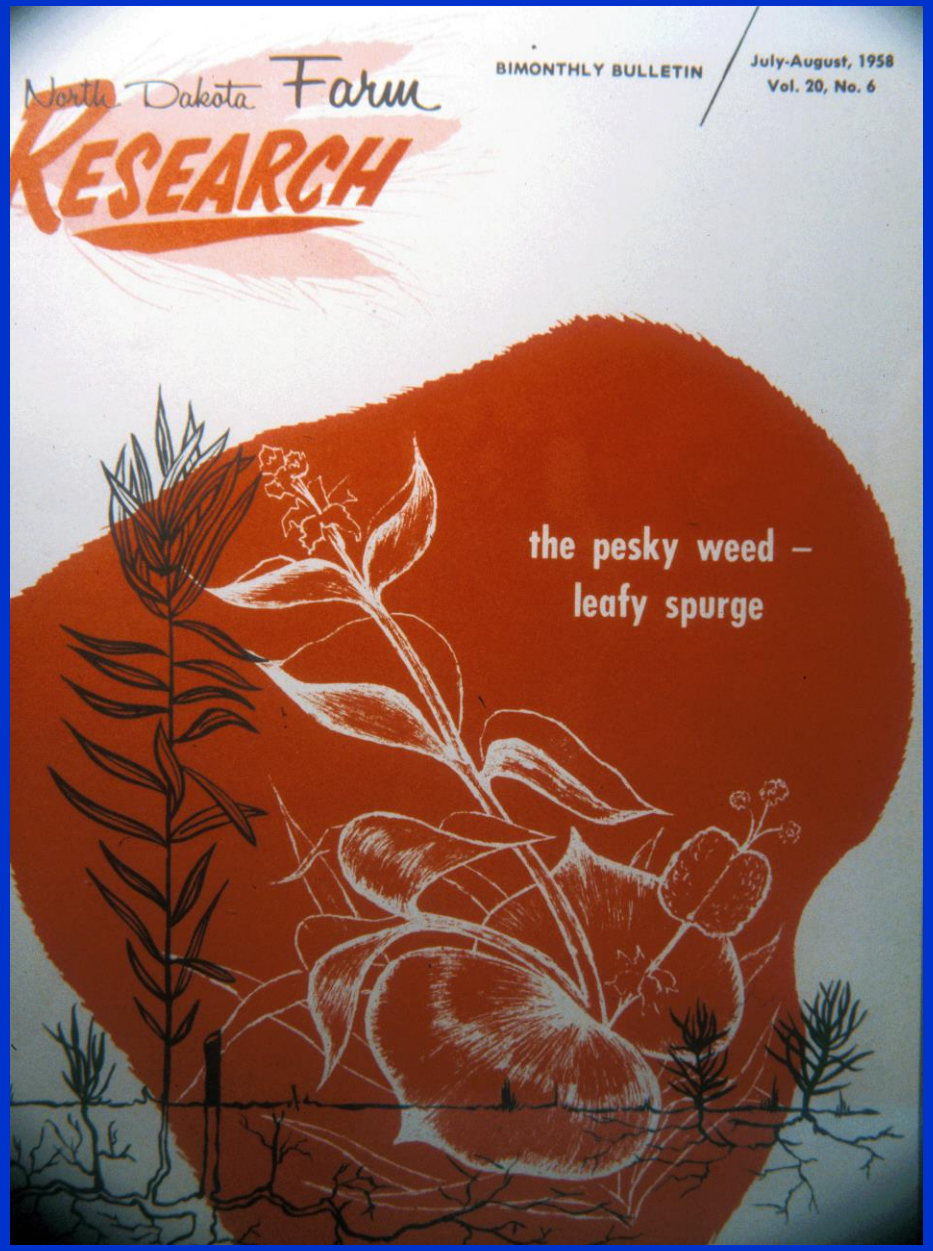
'04
'06
'08
'10
2014
Leafy Spurge Acreage in North Dakota (Years)

POST-WAR CONTROL AND EDUCATION

- **EXTENSION SERVICE BEGAN A STATE WIDE LEAFY SPURGE CONTROL DEMONSTRATION PROGRAM IN 1953**
- **FIRST NORTH DAKOTA FARM RESEARCH ARTICLE SPOKE OF USING GA TO BREAK ROOT BUD DORMANCY**
- **STATE WEED LAW REVISED IN 1960 – LEGISLATURES TOLD COUNTY COMMISIONERS TO "DESTROY NOXIOUS WEEDS IN THE PUBLIC INTEREST" AND OH BY THE WAY DO NOT SPEND MORE THAN $3000/YEAR.**



SECOND RESEARCH ARTICLE LISTED THE SAME CONTROL OPTIONS AS 6 YEARS EARLIER EXCEPT A SECTION CALLED “HOW SERIOUS IS LEAFY SPURGE ?” WAS NO LONGER INCLUDED.

SURVEY OF LANDOWNERS SHOWED ONLY 30% CONSIDERED LEAFY SPURGE A BIG PROBLEM, 30% HAD NEVER HEARD OF THE WEED.

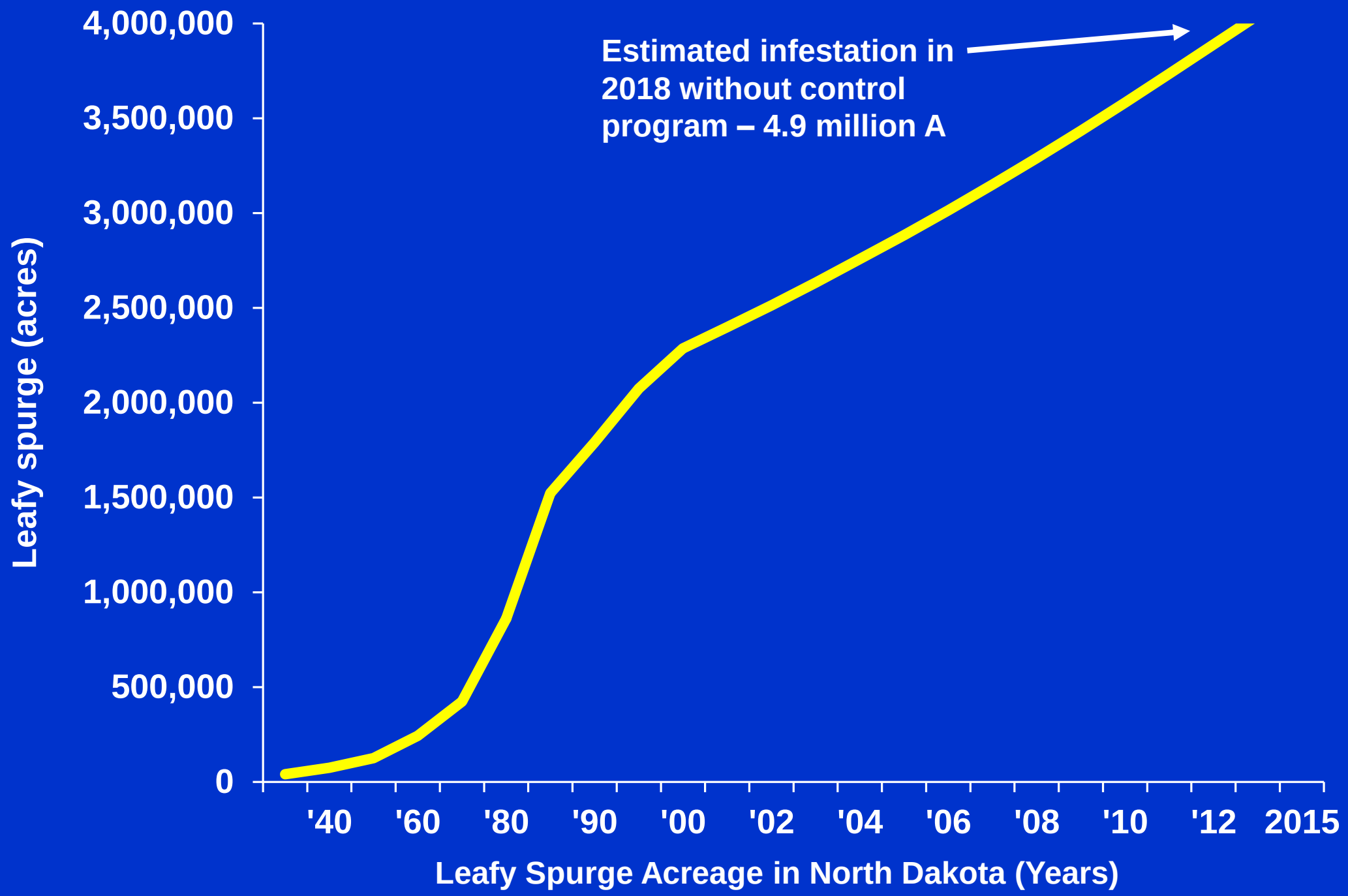
FIRST STATE WIDE CONTROL PROGRAM IN 1966
JUNE WAS DECLARED LEAFY SPURGE CONTROL MONTH

HERBICIDES INCLUDED

- **BANVEL D AT 6 YO 8 LBS/A**
- **TORDON AT 1 TO 2 LBS/A**
- **2,4-D UP TO 40 LBS/A IN THE FALL**

- LARRY MITICH BEGAN A SMALL RESEARCH AND DEMONSTRATION TRIAL IN THE LATE ’60’s. LETTERS IN HIS FILE NOTE THAT LEAFY SPURGE HAD INFESTED 377,215 A STATE WIDE OF WHICH 133,468 WERE TREATED. THE INFESTATION WAS INCREASING BY 6700 A/YR!!!

BY THE EARLY 1970’S OVER 500,000 ACRES HAD BEEN INVADED AND THE INFESTATON WAS DOUBLING IN SIZE EVERY 10 YEARS.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Leafy spurge (acres)
Estimated infestation in 2018 without control program – 4.9 million A
'40
'60
'80
'90
'00
'02
'04
'06
'08
'10
'12
2015
Leafy Spurge Acreage in North Dakota (Years)

1979 LEAFY SPURGE SYMPOSIUM

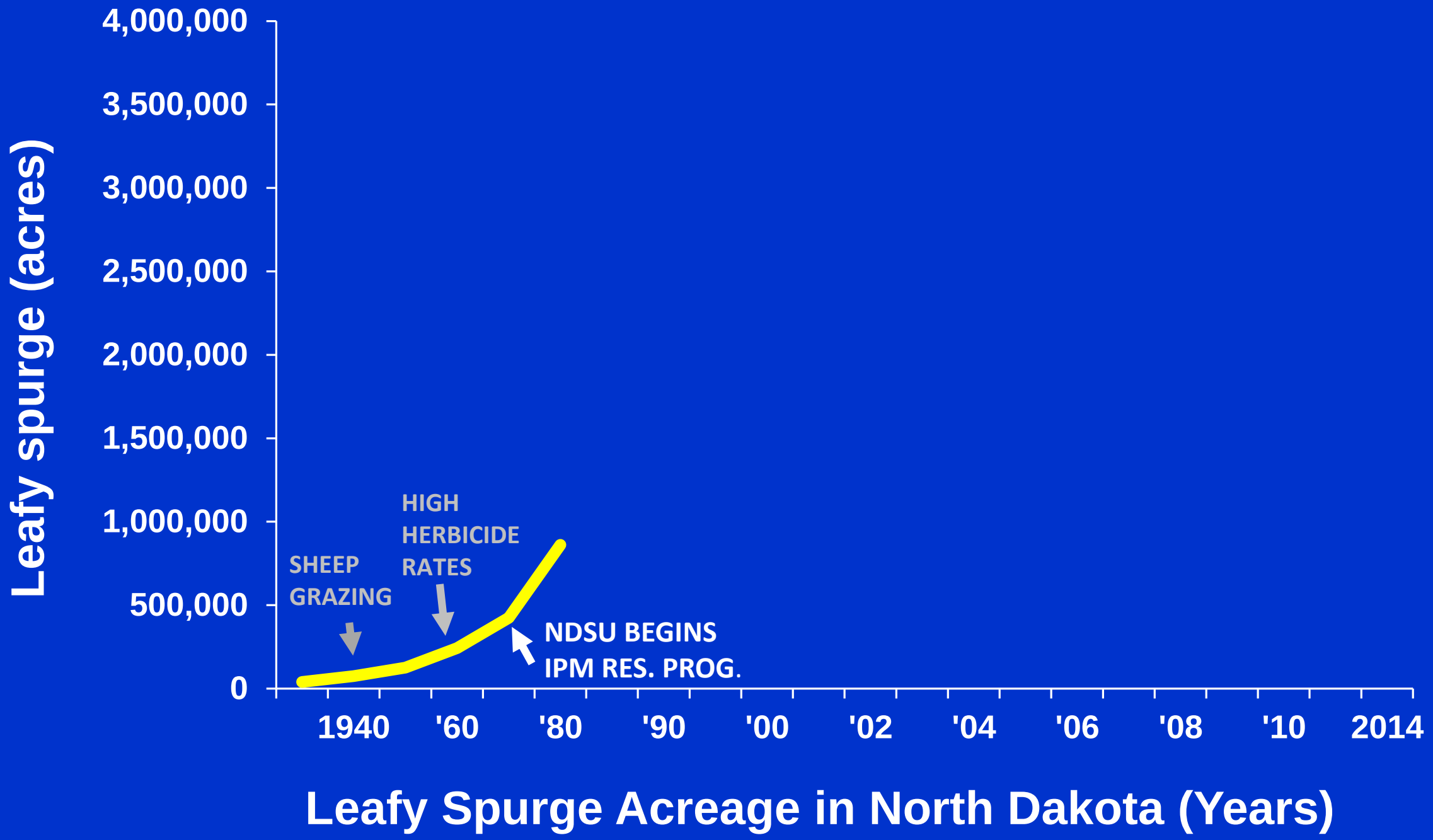
- Dan McIntyre, supervisor with the Custer National Forest worked with NDAES director H. R. Lund to initiate the symposium
- A cooperative project of the Agricultural Experiment Stations from five states was begun, Montana, Nebraska, South Dakota, and Wyoming, with North Dakota as the lead state.
- Major boost to the program was through redirection and enhancement of research efforts by the Agricultural Experiment Stations and by the USDA, initially by the ARS and then APHIS.

1979 LEAFY SPURGE SYMPOSIUM

- NDSU BEGINS INTEGRATED PROJECT
  - CAL MESSERSMITH – HERBICIDES
    - ROD LYM HIRED AS A POST-DOC
  - BOB CARLSON – ENTOMOLOGY
  - BOB HOSFORD – PLANT PATHOLOGY
  - DON KIRBY – RANGE SCIENCE
  - LARRY LEISTRITZ and JAY LEITCH - ECONOMICS
  - DON GALITZ – BOTANY
- USDA-ARS in Fargo reassigned D. G. Davis and D.S. Frear with S.E. Lingle hired as a post-doc to conduct leafy spurge research

Leafy spurge infestation
Western North Dakota - 1979

Leafy spurge infestation Western North Dakota - 1985


Leafy spurge (acres)
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SHEEP GRAZING
HIGH HERBICIDE RATES
NDSU BEGINS IPM RES. PROG.
1940
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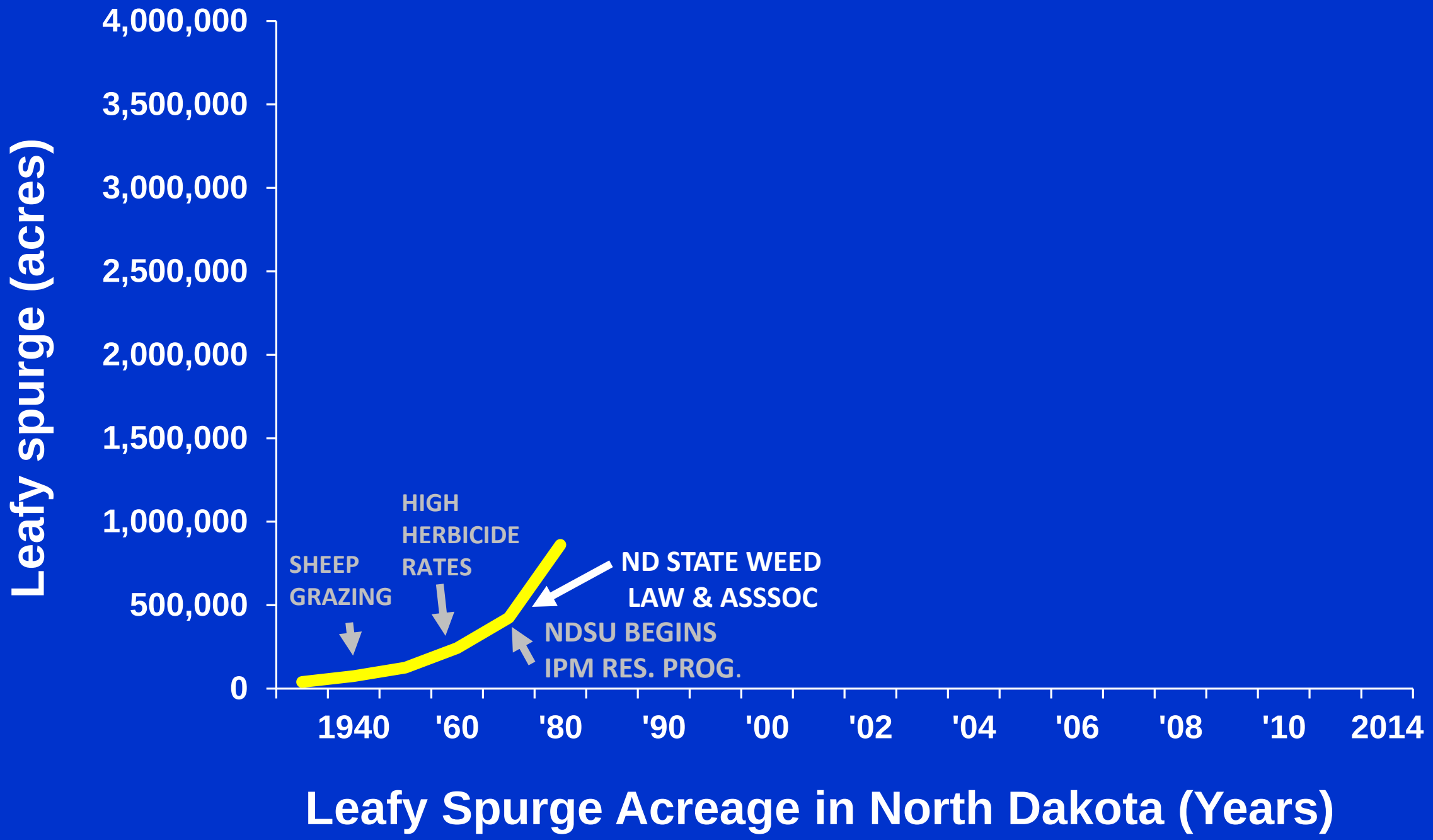
2014
Leafy Spurge Acreage in North Dakota (Years)


Leafy spurge (acres)
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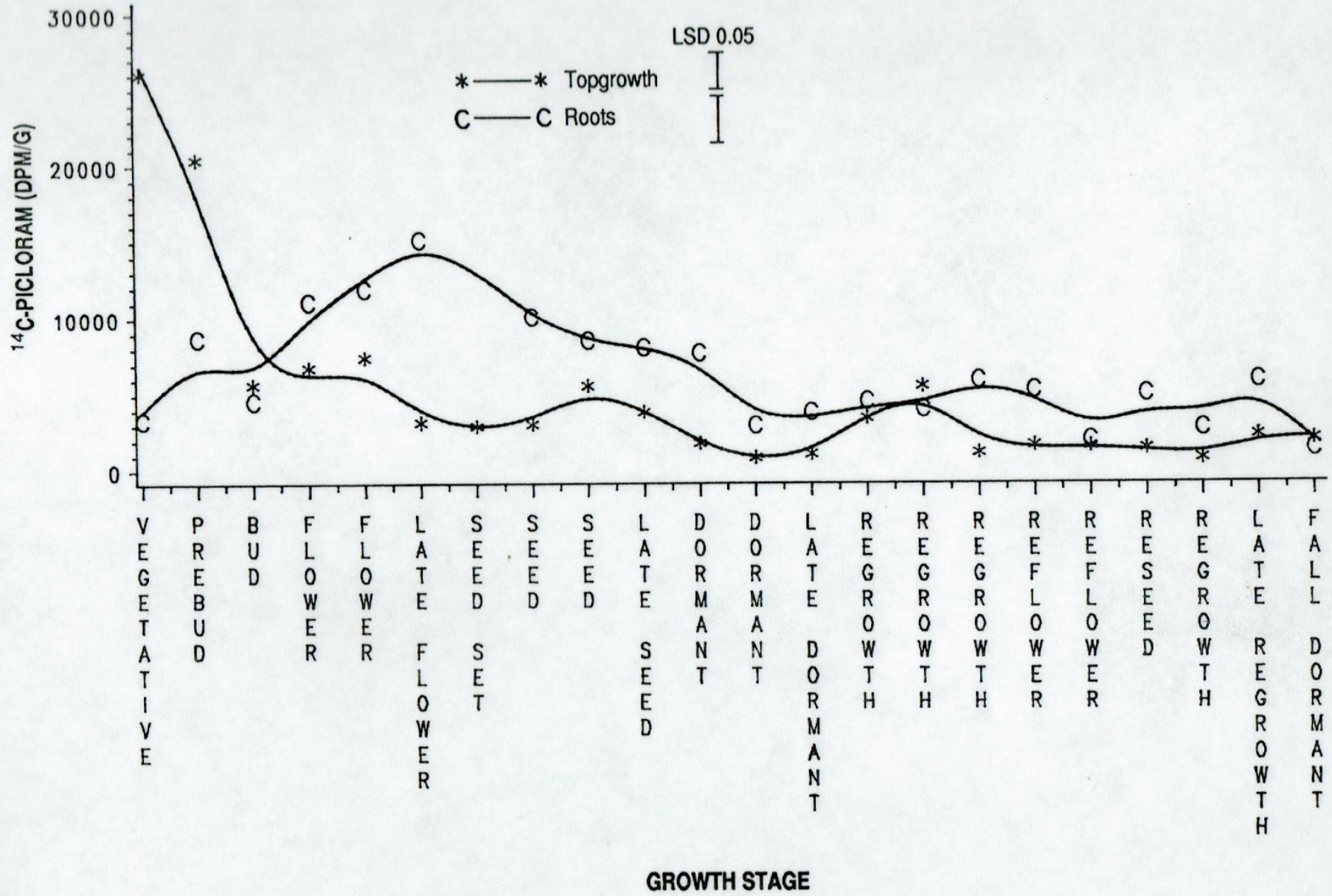
2014
SHEEP GRAZING
HIGH HERBICIDE RATES
ND STATE WEED LAW & ASSSOC
NDSU BEGINS IPM RES. PROG.
Leafy Spurge Acreage in North Dakota (Years)

1980’s EMPHASIS WAS ON HERBICIDES

THE STATE HAD A COST SHARE PROGRAM

BIOCONTROL WAS IN RESEARCH AND DISCOVERY PHASE


30000
20000
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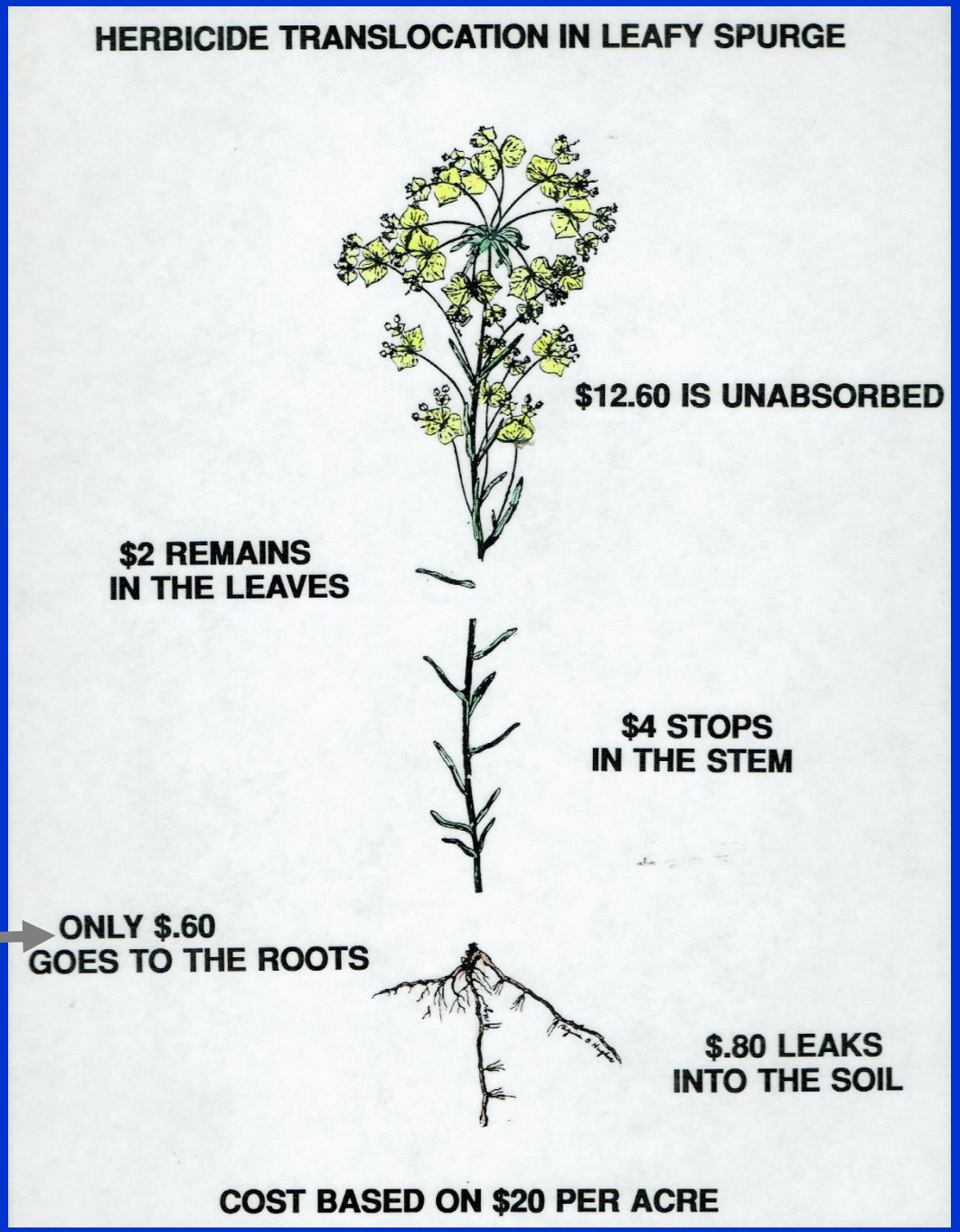
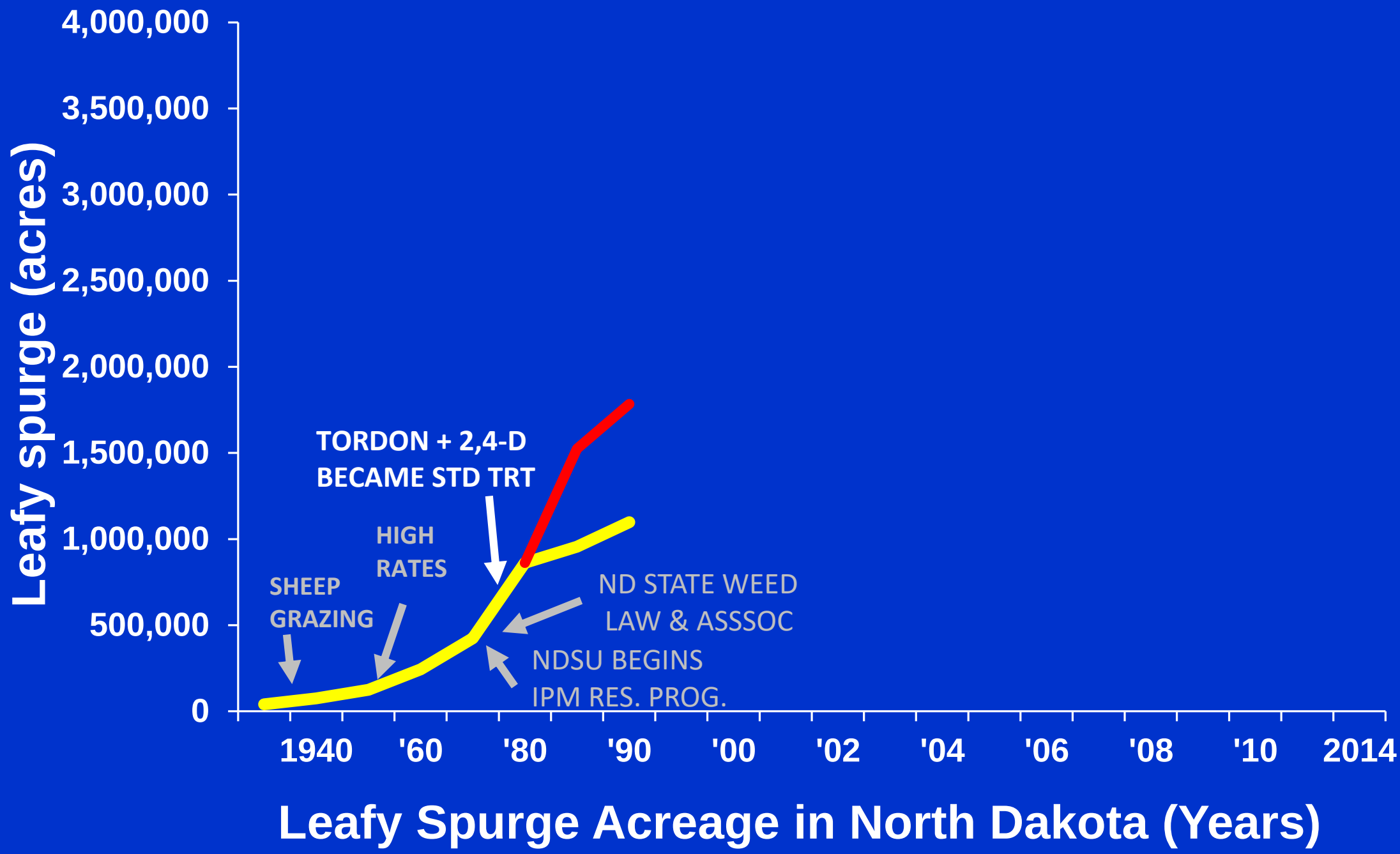
^{14}C-PICLORAM (DPM/G)
LSD 0.05
* —— * Topgrowth
C —— C Roots
VEGETATIVE
PREBUD
BUD
FLOWER
FLOWER
LATE FLOWER
SEED SET
SEED
SEED
LATE SEED
DORMANT
DORMANT
LATE DORMANT
REGROWTH
REGROWTH
REGROWTH
REFLOWER
REFLOWER
RESEED
REGROWTH
LATE REGROWTH
FALL DORMANT
GROWTH STAGE

Tordon at 1 qt/A
Cost was $20/A

Became known as the 60¢ war!

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Leafy spurge (acres)
TORDON + 2,4-D
BECAME STD TRT
HIGH
RATES
SHEEP
GRAZING
ND STATE WEED
LAW & ASSSOC
NDSU BEGINS
IPM RES. PROG.
1940
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2014
Leafy Spurge Acreage in North Dakota (Years)

Leafy spurge hawkmoth

BIOLOGICAL CONTROL

- Promise of biological control revitalized the control efforts in the late 1980s
- Kelly Miller, a Towner, ND rancher and Bob Thoft, a Montana state legislator went to Europe to explore possibilities
- Russ Lorenz of USDA-ARS in Mandan wrote a proposal to the federal gov.

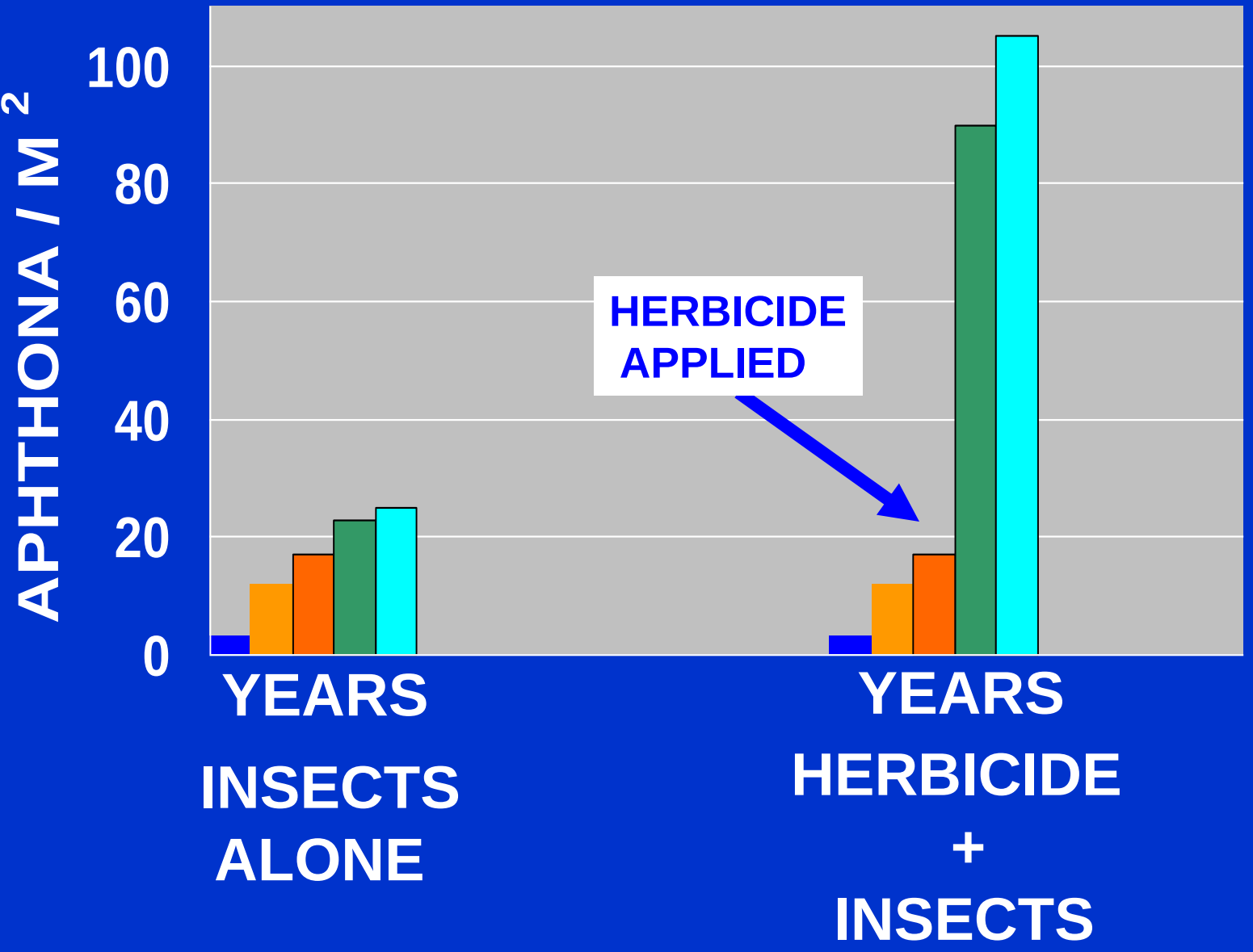
A. FLAVA

A. NIGRISCUTIS

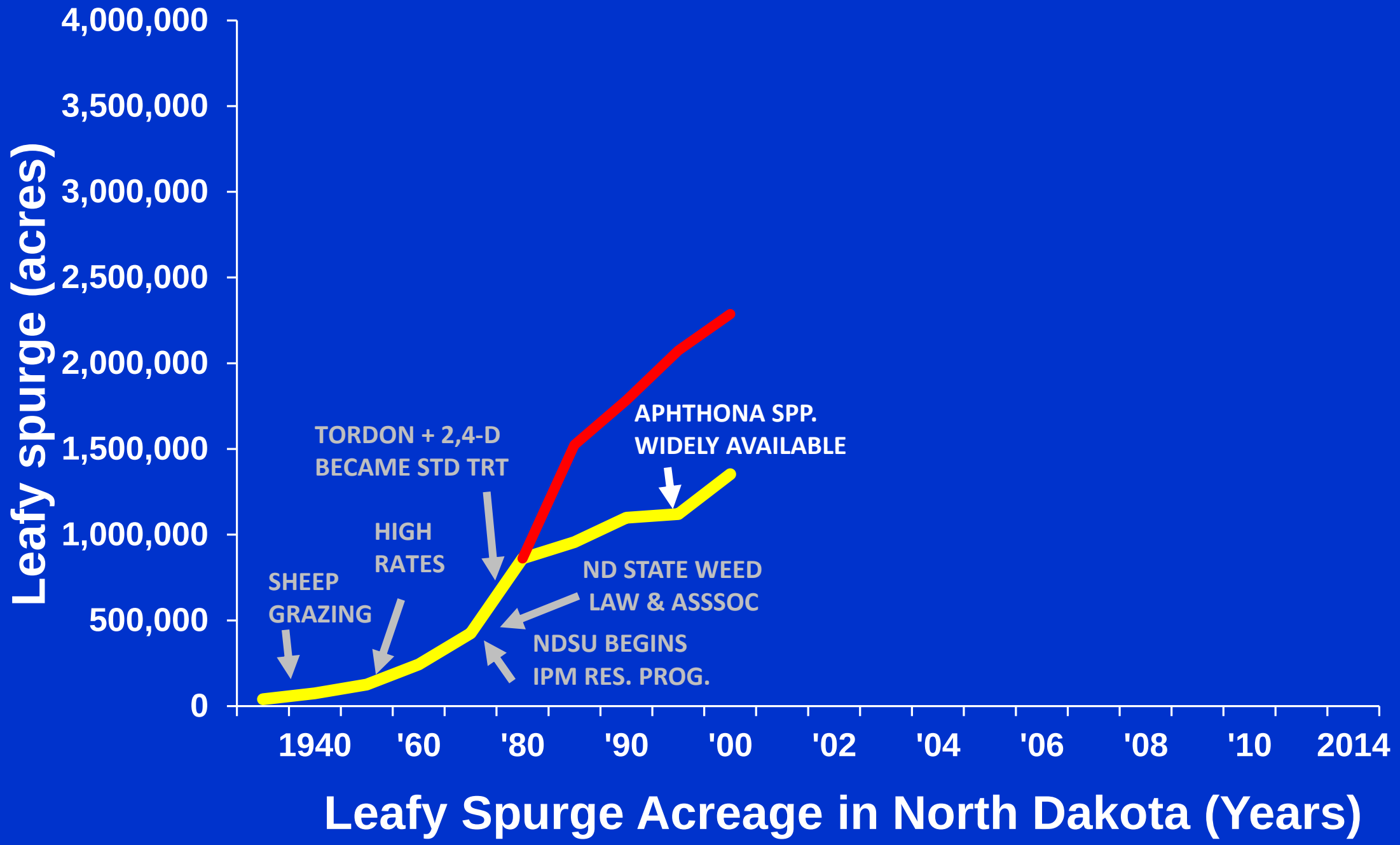
A. LACERTOSA /CZW

Accidental overspray of A. nigriscutis insectary near Minot.

APHTHONA POPULATION INCREASE



Fall regrowth after *Aphthona* feeding.


Leafy spurge (acres)
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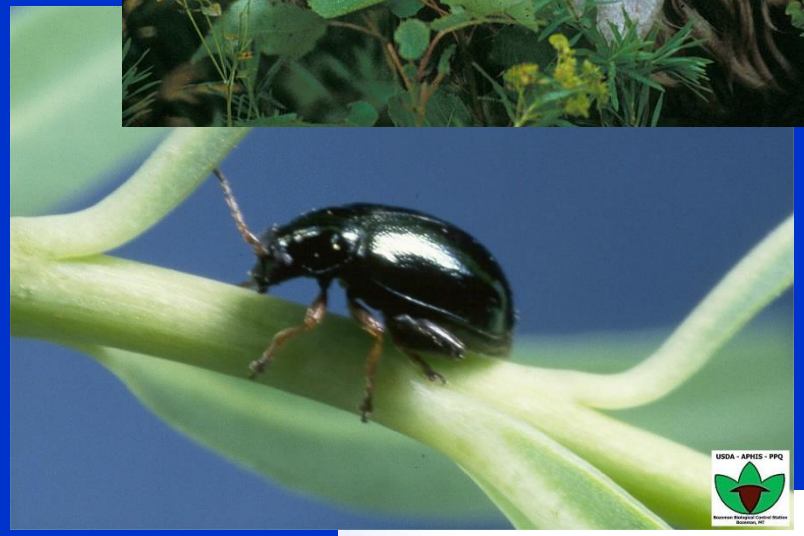
2014
SHEEP GRAZING
HIGH RATES
TORDON + 2,4-D BECAME STD TRT
NDSU BEGINS IPM RES. PROG.
ND STATE WEED LAW & ASSSOC
APHTHONA SPP. WIDELY AVAILABLE
Leafy Spurge Acreage in North Dakota (Years)

Gall midge (*Spurgia esula*)

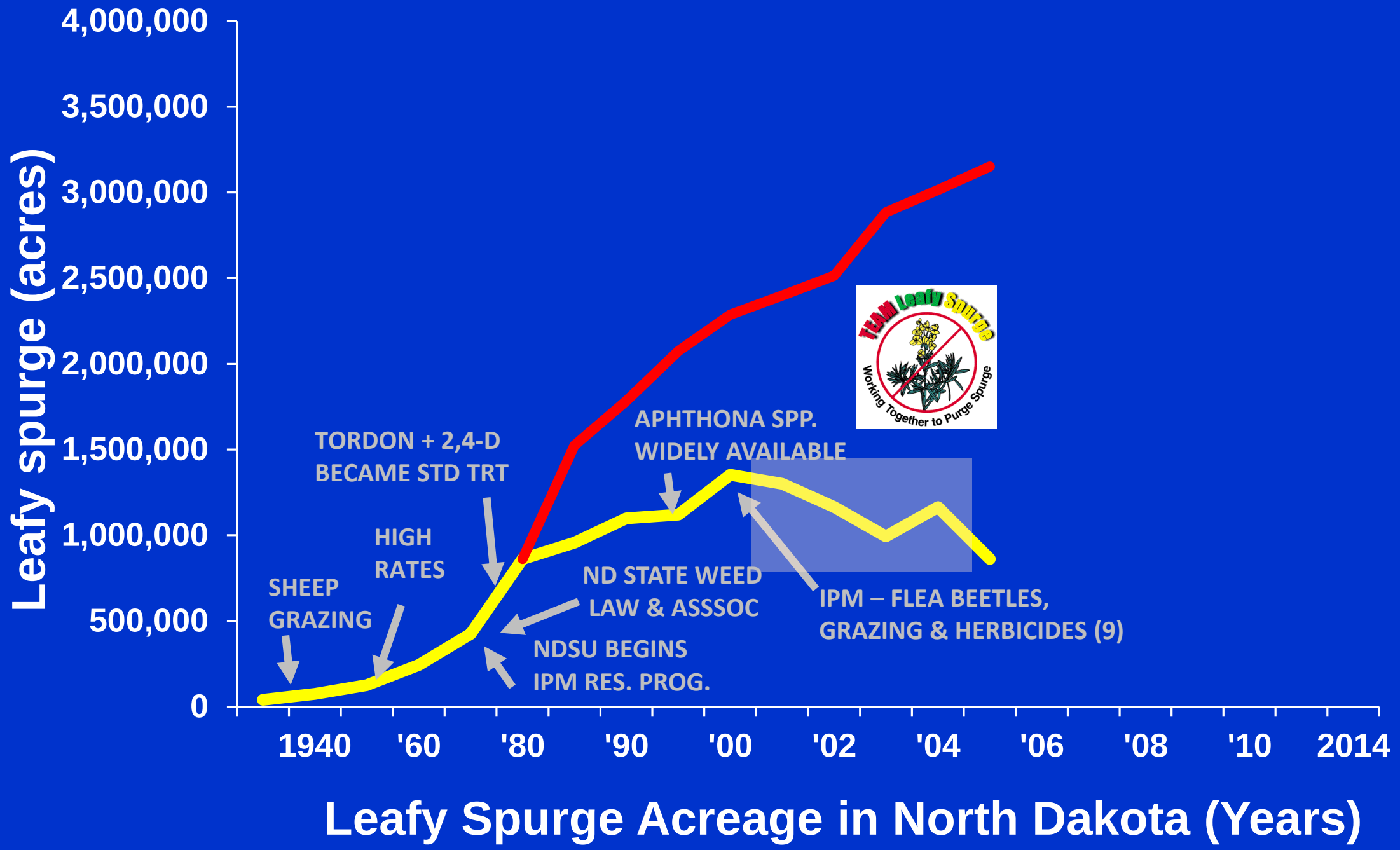
Long-horned beetle (*Oberea erythrocephala*)

Useful in wooded and moist areas

Very slow to increase in pop.


USDA - APHIS - PPQ


1100
FORD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0
Leafy spurge (acres)
1940
'60
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'04
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2014
SHEEP GRAZING
HIGH RATES
TORDON + 2,4-D BECAME STD TRT
NDSU BEGINS IPM RES. PROG.
ND STATE WEED LAW & ASSSOC
APHTHONA SPP. WIDELY AVAILABLE
IPM – FLEA BEETLES, GRAZING & HERBICIDES (9)
Working Together to Purge Spurge
Leafy Spurge Acreage in North Dakota (Years)

The Ecological Area-wide Management Leafy Spurge project.

Theodore Roosevelt NP – ND

Badlands NP – SD

Ekalaka Range– MT

Devils Tower NM – WY

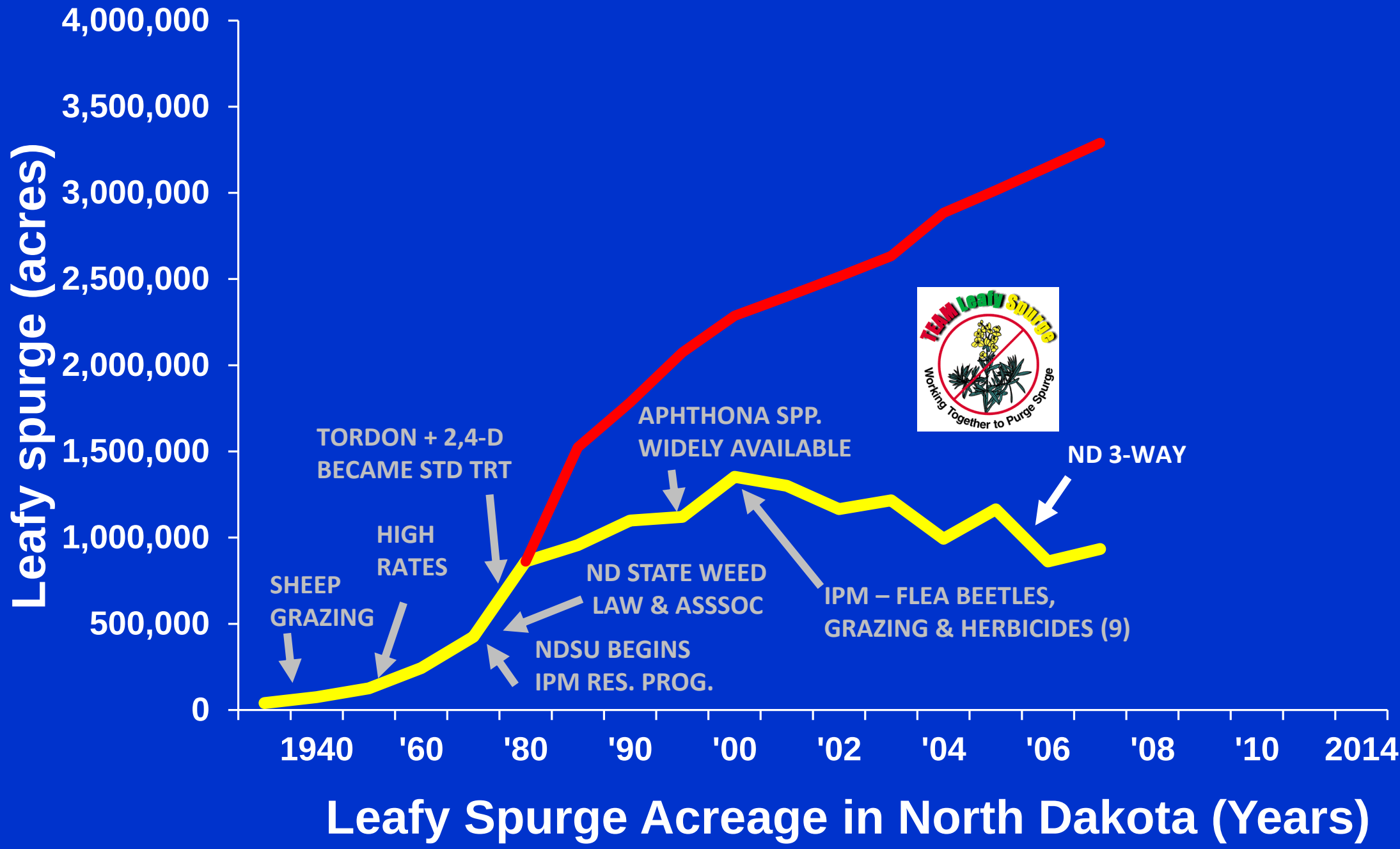
TEAM Program

- TEAM members included BLM, Forest Service, NPS, BIA, Reclamation, USGS, State Ag Depts, Ag Colleges
- Approximately $5.5 million for the 5 year project – 13 partners
- Research and outreach programs coordinated with the four states

Untreated WPFO

WPFO TREATED WITH QUINCLORAC

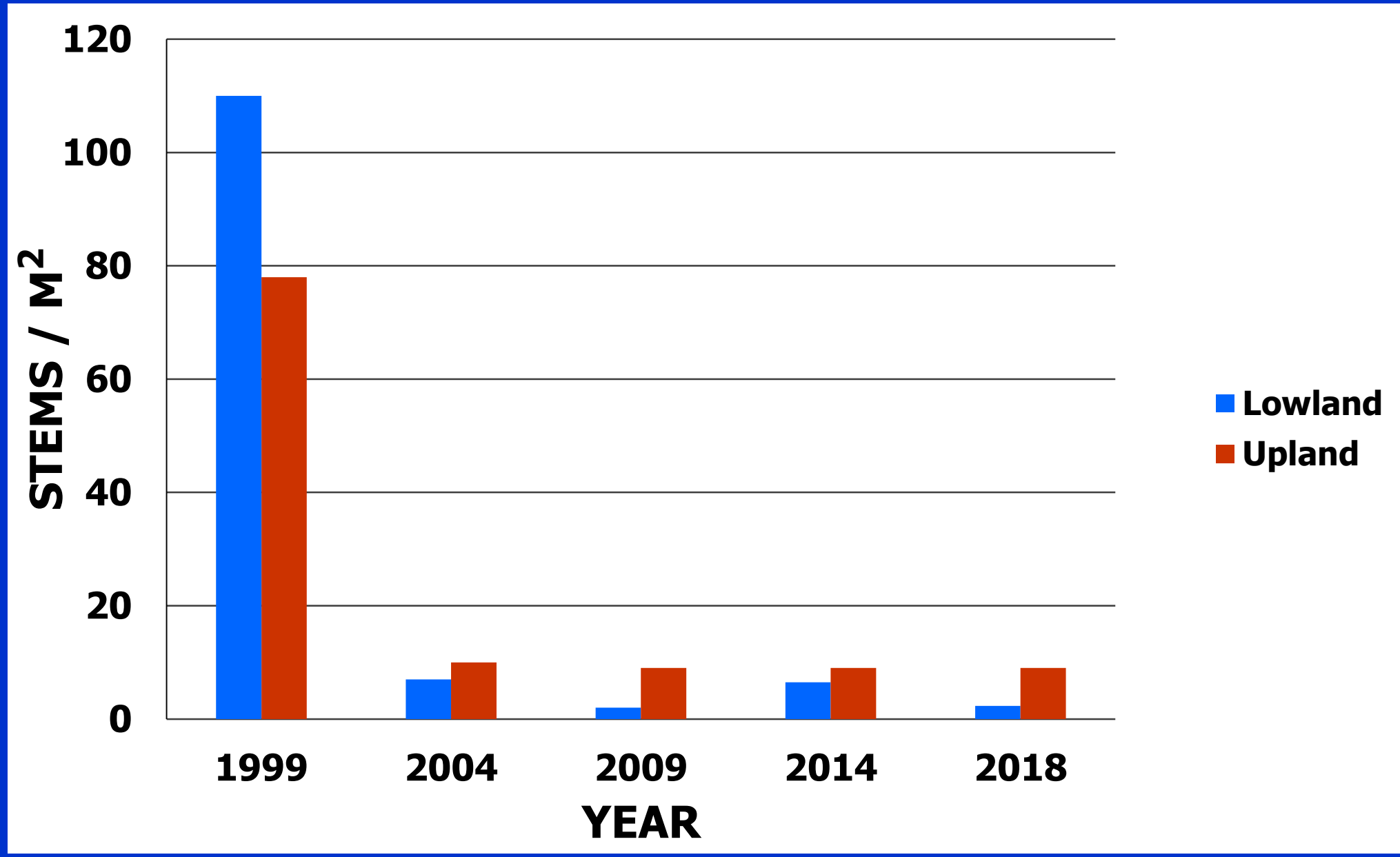
WPFO treated with imazapic 10 MAT



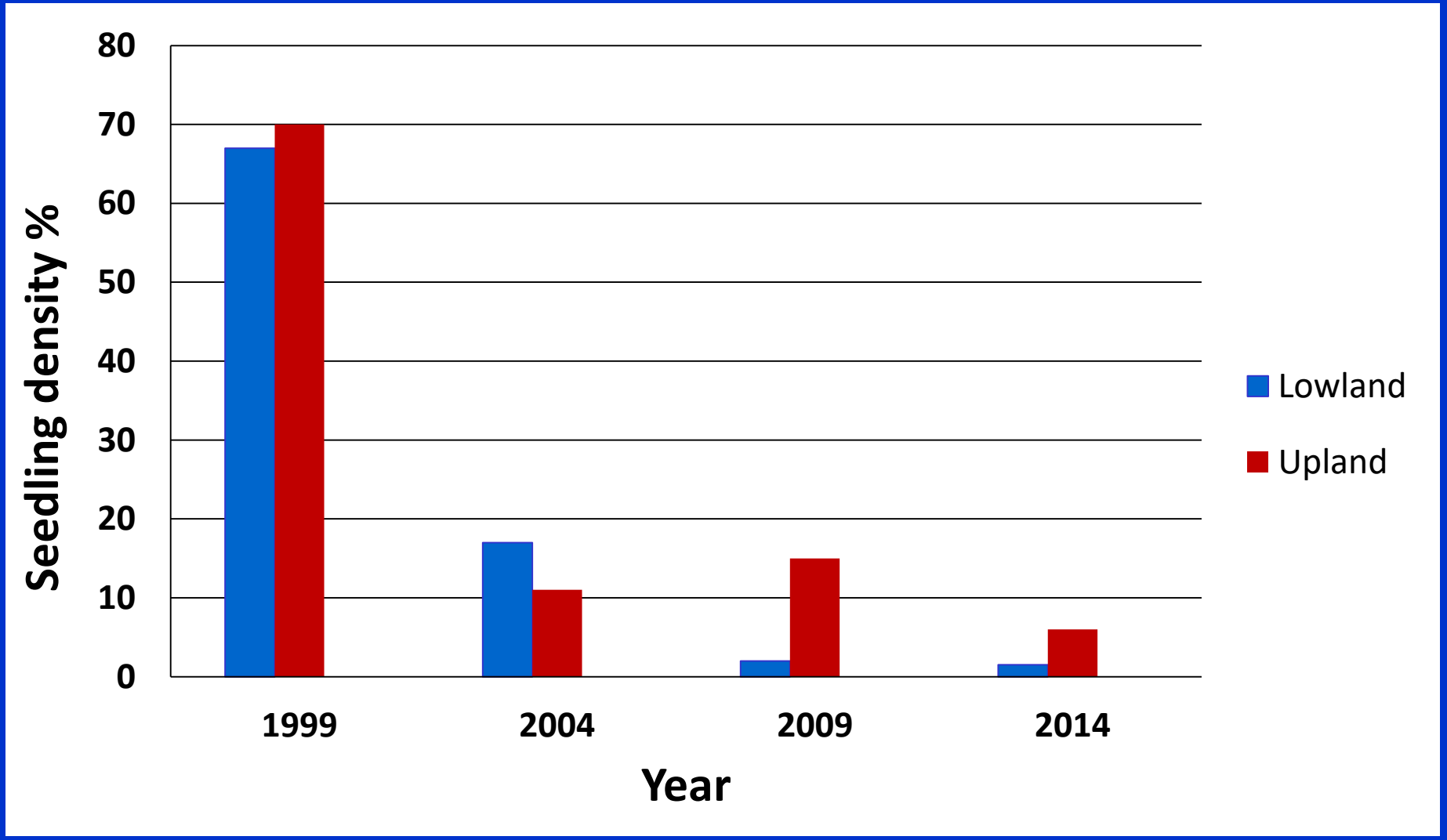
Leafy Spurge Acreage in North Dakota (Years)

WE HAVE BEEN MONITORING RESULTS SINCE THE 1999 APHTHONA RELEASES

Leafy Spurge Stem Density



Percentage of Leafy Spurge Seedlings



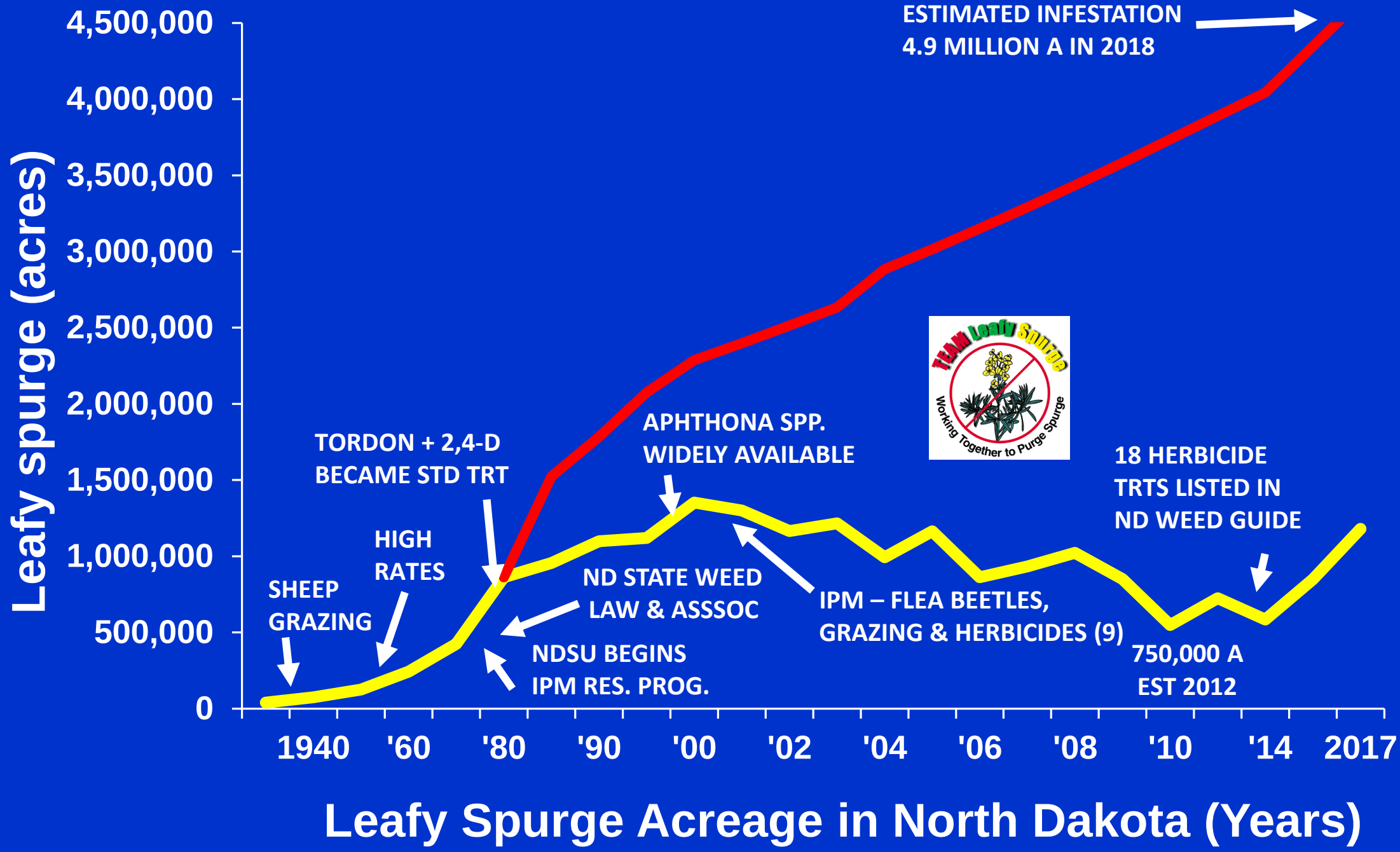
Changes in Native and Introduced Species

Upland sites

- Native species
  - 1999: 32
  - 2014: 45
- Introduced species
  - 1999: 12
  - 2014: 29

Lowland sites

- Native species
  - 1999: 31
  - 2014: 65
- Introduced species
  - 1999: 13
  - 2014: 31



Leafy Spurge Acreage in North Dakota (Years)

Lythrum – Purple loosestrife

- Introduced into North America in the1800s from Eurasia and Africa
- Horticultural value
  - Brilliant color
  - Hardiness
  - Low maintenance

Horticultural Plant

Planted throughout North Dakota

Added to the State Noxious Weed list in1999, last state in the northern tier

Galerucella calmariensis and *G. pusilla*

- First released in North America in 1992 for biological control of purple loosestrife
- Host specific leaf-feeding beetle
- One generation/yr

Photo by Bob Richard, USDA-APHIS-PPQ


NPSU

Galerucella spp. Feeding Damage


1997
2004
2000
2002


2007


Provided by:
APHIS
USI
222
Tele
Collected 6/14/05
E. Bruno
Collectors: ~~D. Jepson~~, L. Skillesta


PREVIOUS WEIGHT
279
CURRENT WEIGHT
279
DIFFERENCE
-0
happycrumb.com

LEAF SHAPE, FLOWER COLOR, SPINES VARY. SOME ECOTYPES ARE HARDER TO CONTROL

BIOLOGICAL CONTROL OF CANADA THISTLE

- PAINTED LADY BUTTERFLY IS NATIVE, PROVIDES VERY GOOD CONTROL, BUT IS INCONSISTENT

Several agents released for Canada thistle control

- *Ceutorhynchus litura* – stem weevil most potential
  - Research results are mixed, released in 1972, so how affective could it be?

Other thistle agents

- Musk thistle – *Rhinocyllus conicus*
  - Released in 1969, terrible poster child for biocontrol programs

Pseudomonas syringae MAY RELEASE A TOXIN INTO THE STEM.

INFECTION IS MOST WIDE SPREAD DURING WET PERIODS

SUMMARY

- Leafy spurge biological control program recognized as one of the most successful in the world
  - All of the A. lacerstosa came from Valley City release
  - Lost track at somewhat over 75 million
  - Example of an integrated success story
- Lythrum successful
- Toadflax not successful
- Thistle control program not especially helpful

Questions?