Canada Thistle Management In Minnesota Native Prairies

Roger Becker, University of Minnesota
Milt Haar, Badlands National Park

Applied Weed Science Efforts

- Natural Systems
  - Purple loosestrife
  - Leafy spurge
  - Garlic Mustard
  - Buckthorn
  - Canada Thistle
  - Prickly Ash
- Vegetable production
- Wild rice
- Pasture and Forages
- Herbicide x Water Quality Issues

Ceutorhynchus scrobicollis larvae

Larval Tunnel
Exit plant to pupate

Photos and Slides by: Brian McCornack

Native Prairie Efforts

- Canada Thistle Work
  - Seed production/flight
  - Herbicide optimization
  - BMPs for waterfowl production areas
  - Functional Groups
  - Forb tolerance
  - Planned Sequential Program
  - Rotation intervals
    - forage species
    - native grasses and forbs
- Brome Suppression in Warm Season Prairie
- Brush control
  - (Cottonwood, Aspen, Buckthorn, Prickly Ash)

Brome suppression in warm grass prairies

Buckthorn and

Prickly Ash Control

Cottonwood, Boxelder,

and Aspen work

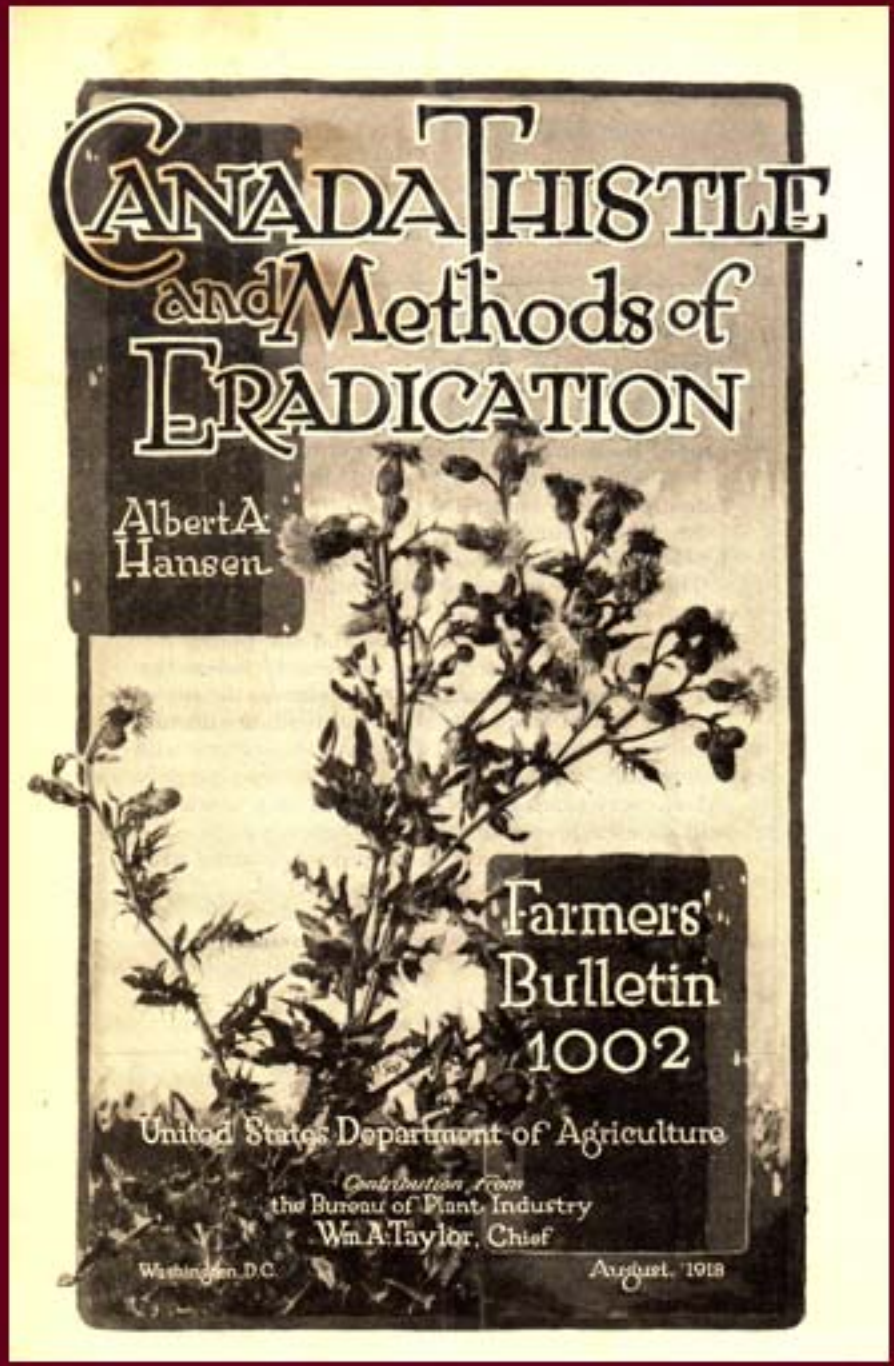
with Litchfield USFWS

Native Prairie Efforts

- Canada Thistle Work
  - Seed production/flight ✔
  - Herbicide optimization
  - BMPs for waterfowl production areas ✔
  - Functional groups that resist invasion ✔
  - Forb tolerance ✔
  - Planned Sequential Program ✔
  - Plantback rotation intervals
    - forage species
    - native grasses and forbs
- Brome Suppression in Warm Season Prairie
- Brush Control
  - (Cottonwood, Aspen, Buckthorn, Prickly Ash)

The Elusive Holy Grail of Weed Management

- Eradication!



Rusts for biocontrol?
Thistle rust
(*Puccinia punctiformis)*

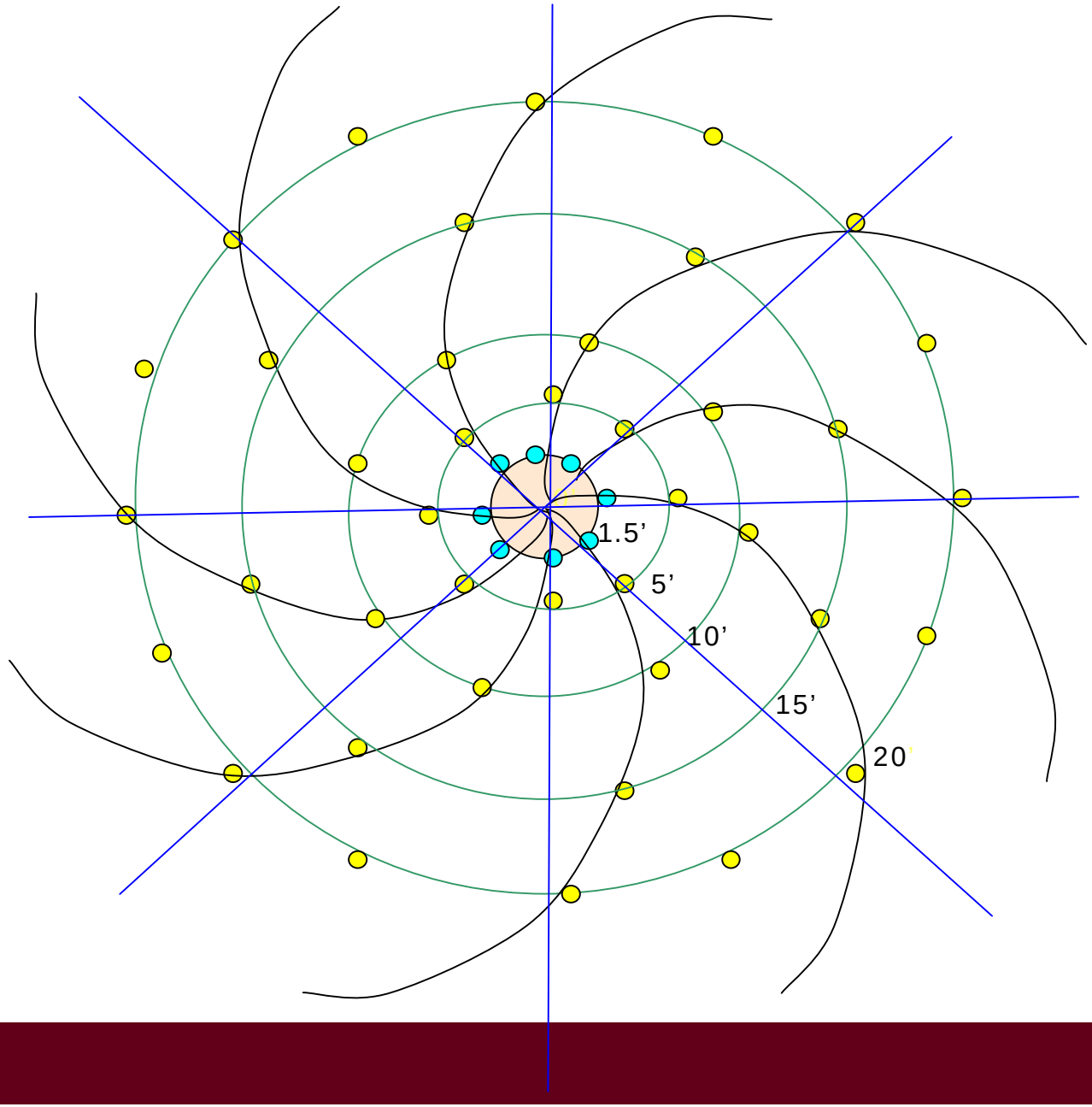
Bacteria for biocontrol?
Pseudomonas syringae

Check (top left)
plus 4 degrees
of control

Jurg Hiltbrunner

University of Minnesota Extension


Becker U of Mn 2006©


1.5’
5’
10’
15’
20’

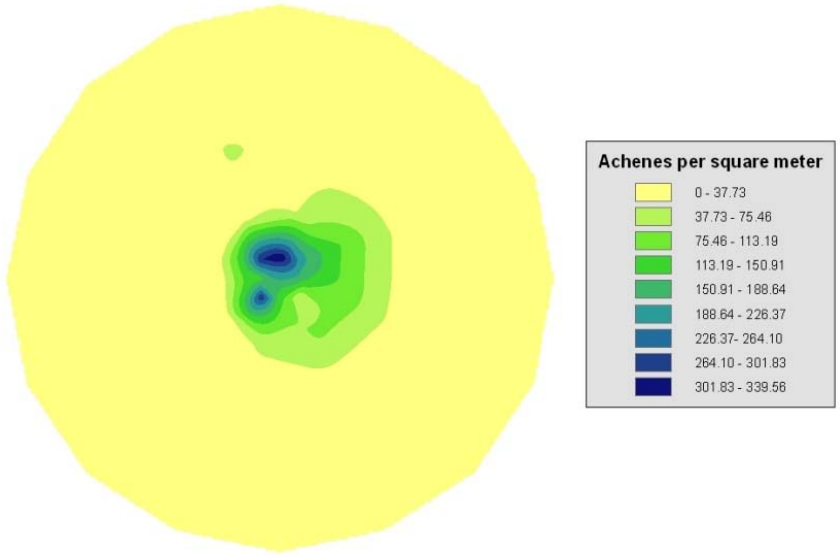

Becker U of Mn 2006©

Male Flower

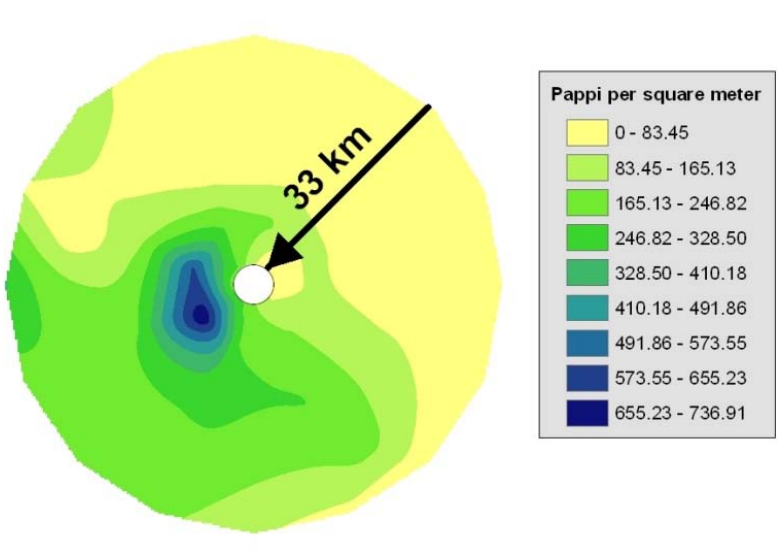
Female Flower


Normal
Shrunken
Empty

Effect of Wind of direction and distance of Canada thistle dispersal



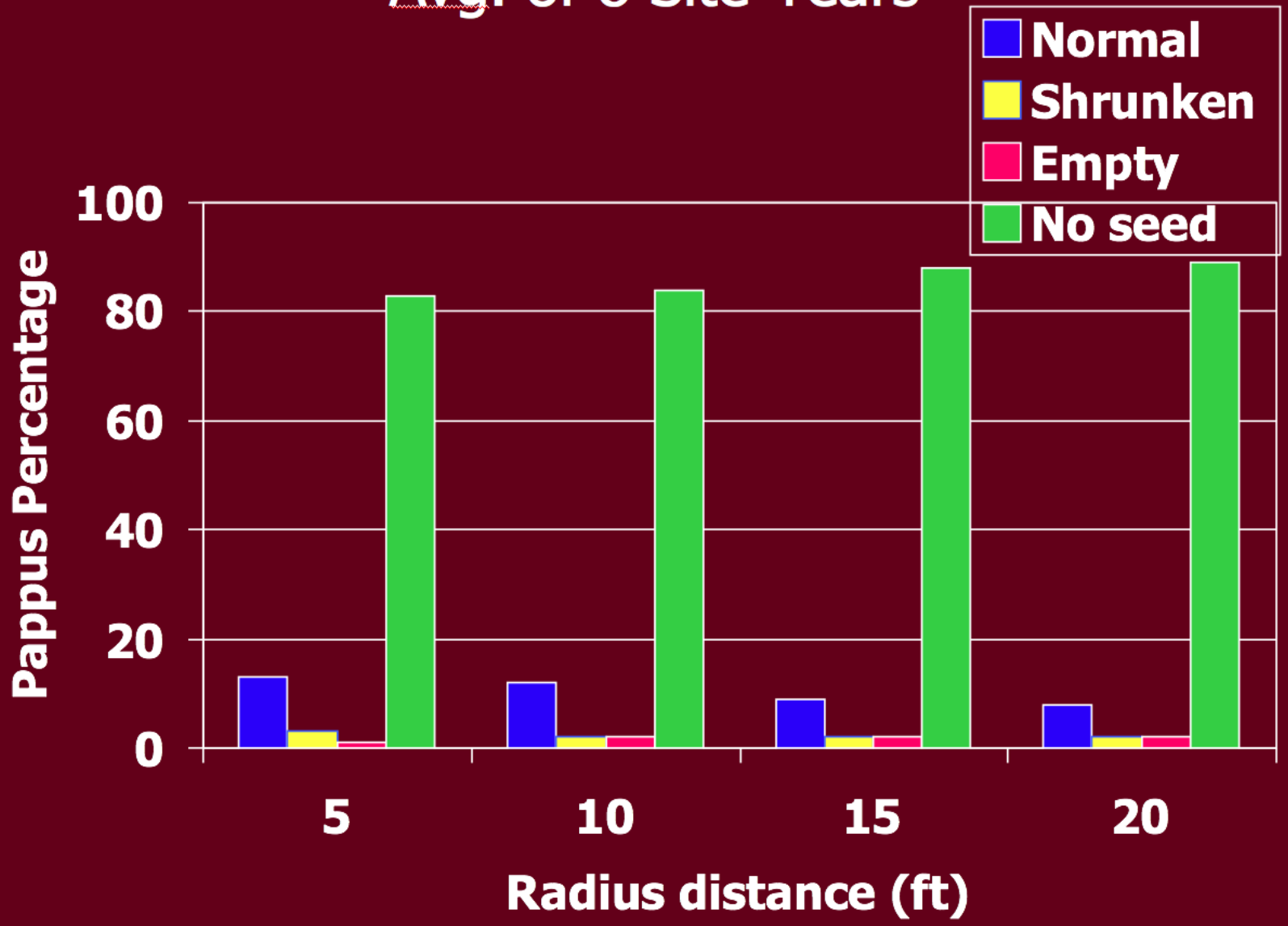
Seeds



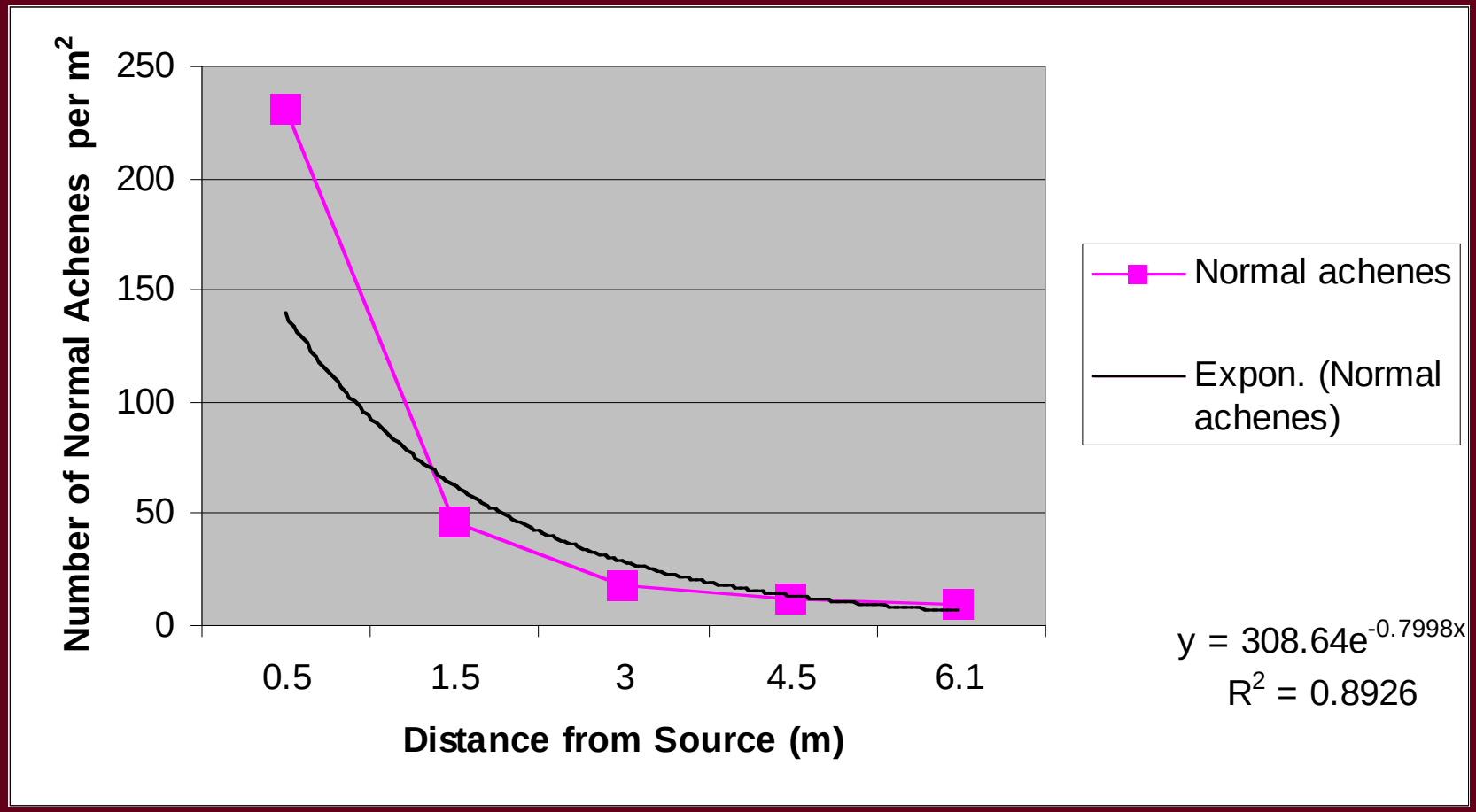
Pappi

Open (spiral) trapping scheme

Avg. of 8 Site-Years



Dilution of seed and pappi as area expands



Put it in the bank

- Seed dispersal local

- Where already endemic or epidemic, avoid heroic control at dispersal time

- Where rare on a landscape scale, be heroic!

Best Management Practices for Canada Thistle in Native Prairies

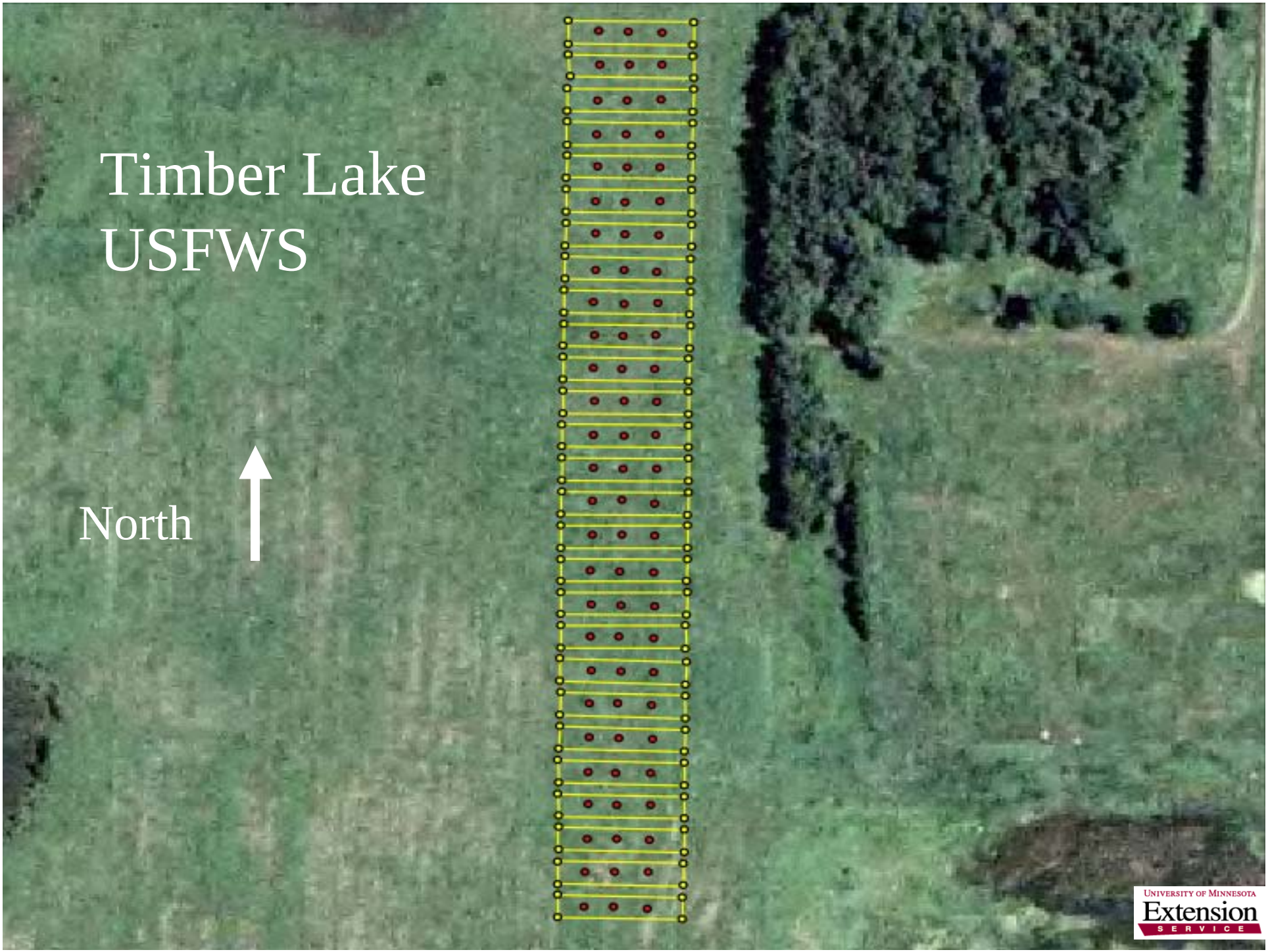
Roger Becker, Milt Haar

University of Minnesota

Luke Skinner, Mark Gulick*,

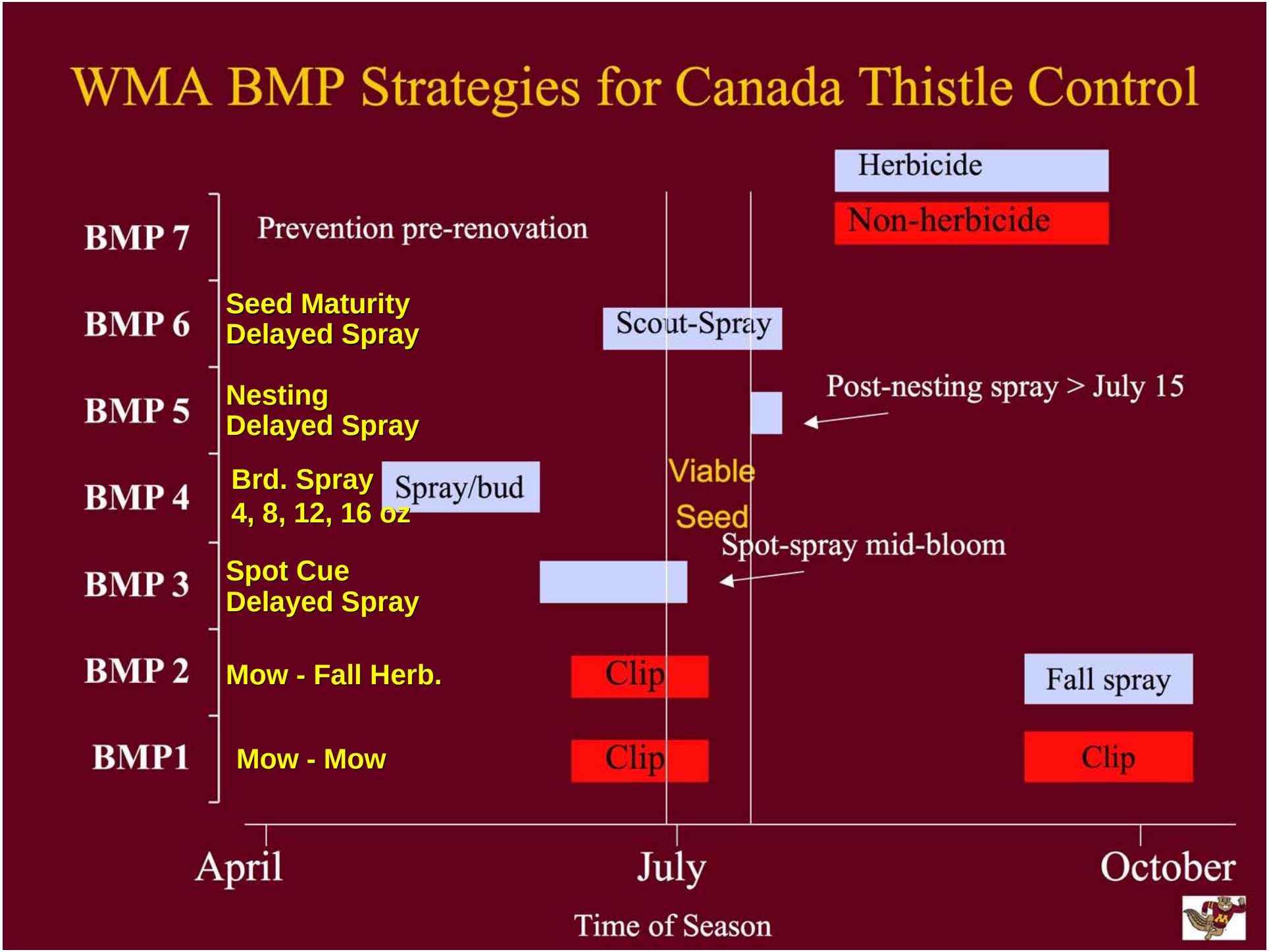
Judy Markl, and Dennis Opdahl

Mn DNR. *Now Ia DNR

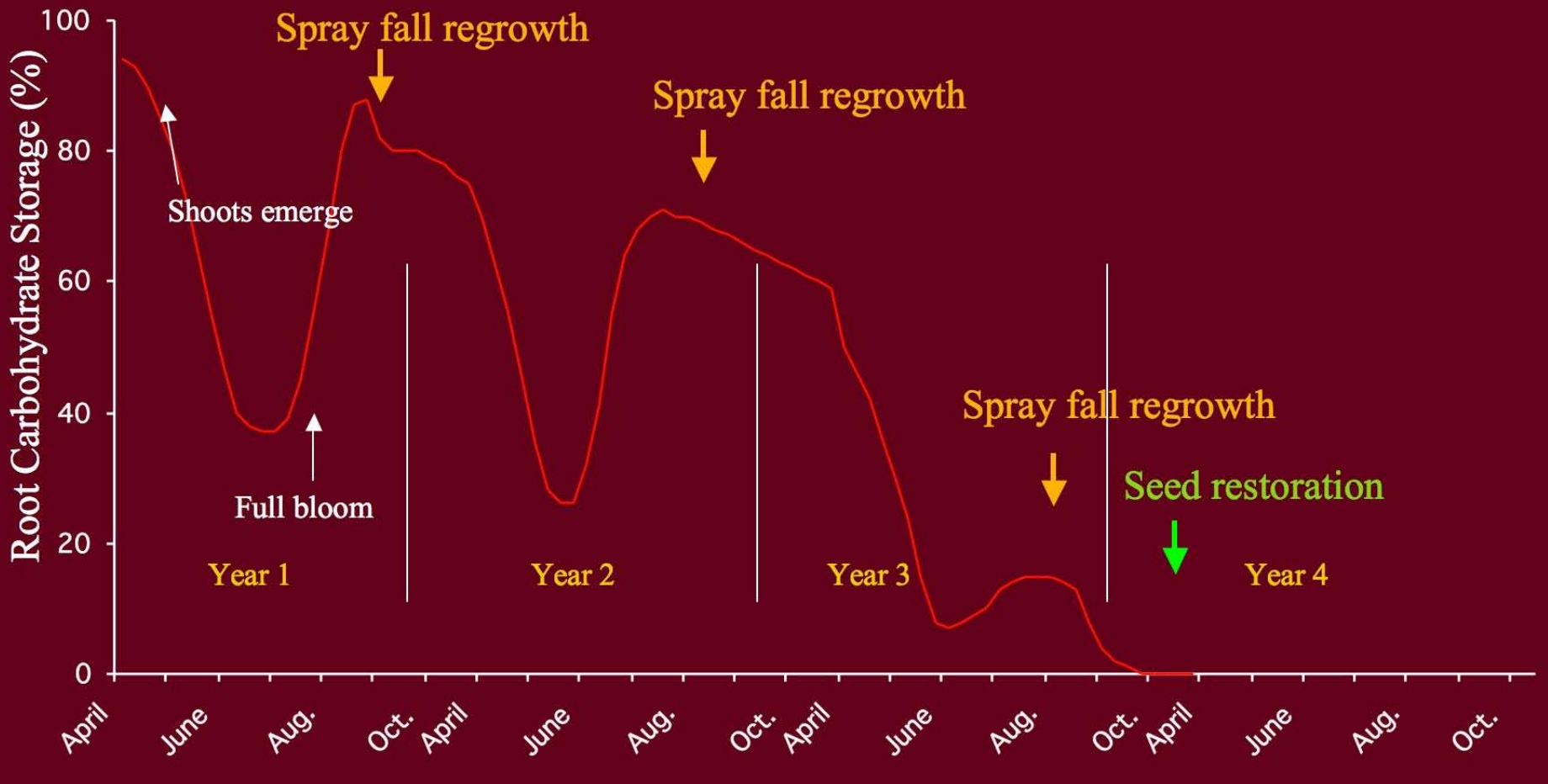

Timber Lake
USFWS
North
University of Minnesota
Extension
SERVICE


West Graham
WMA
North

WMA BMP Strategies for Canada Thistle Control

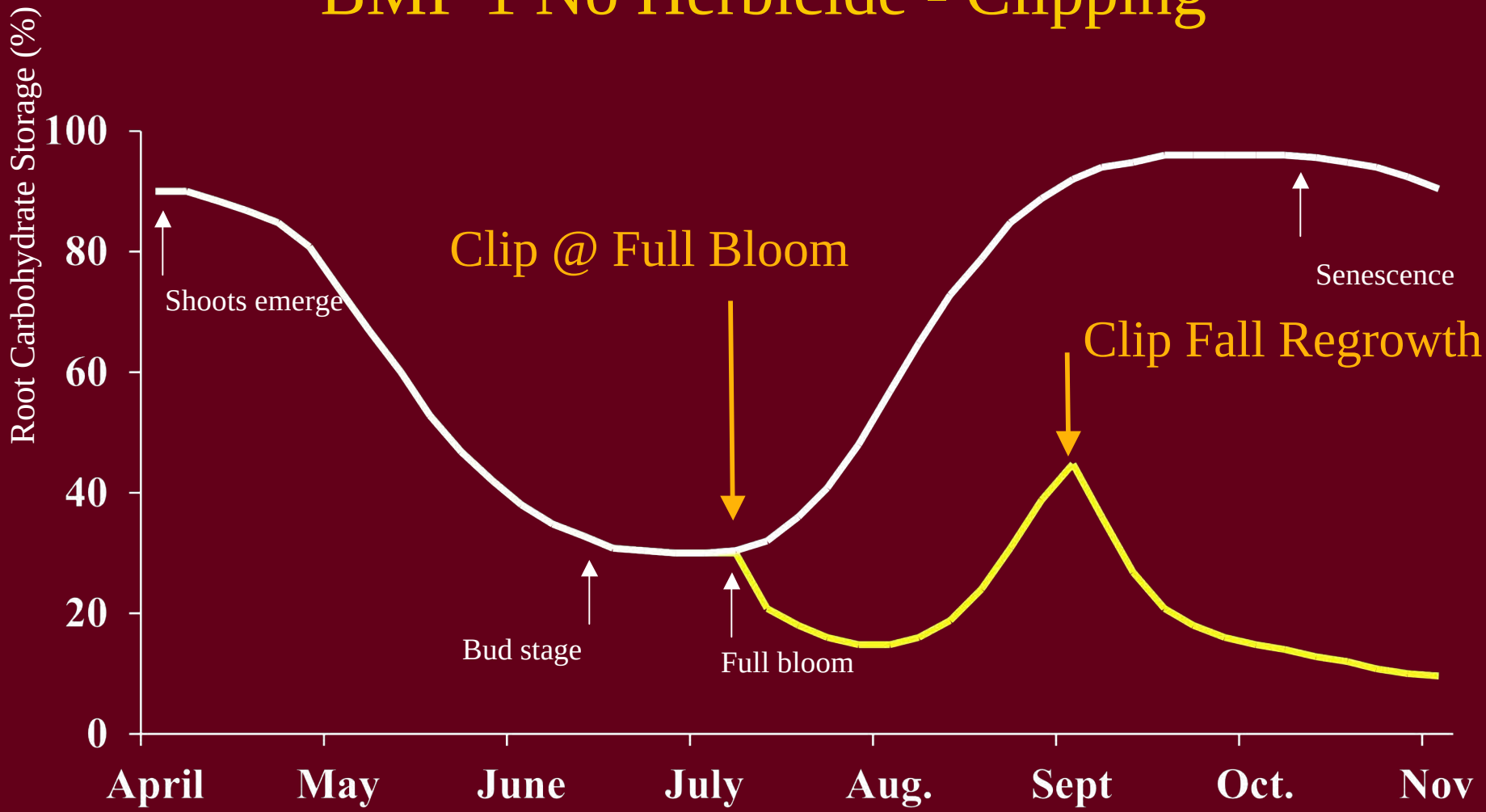


Canada Thistle Carbohydrate Flow
BMP 7 Pre-restoration Management



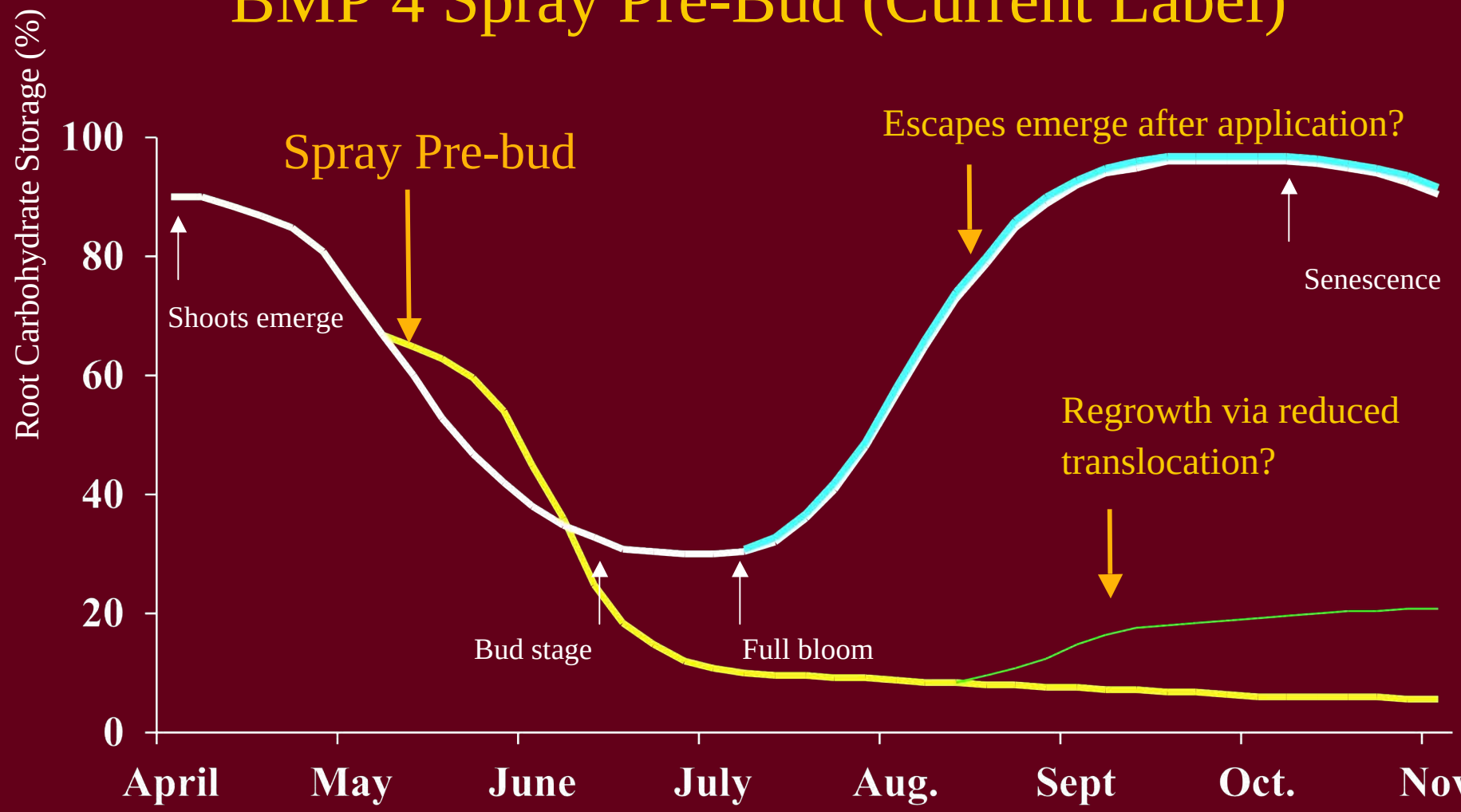
Canada Thistle Carbohydrate Flow

BMP 1 No Herbicide - Clipping



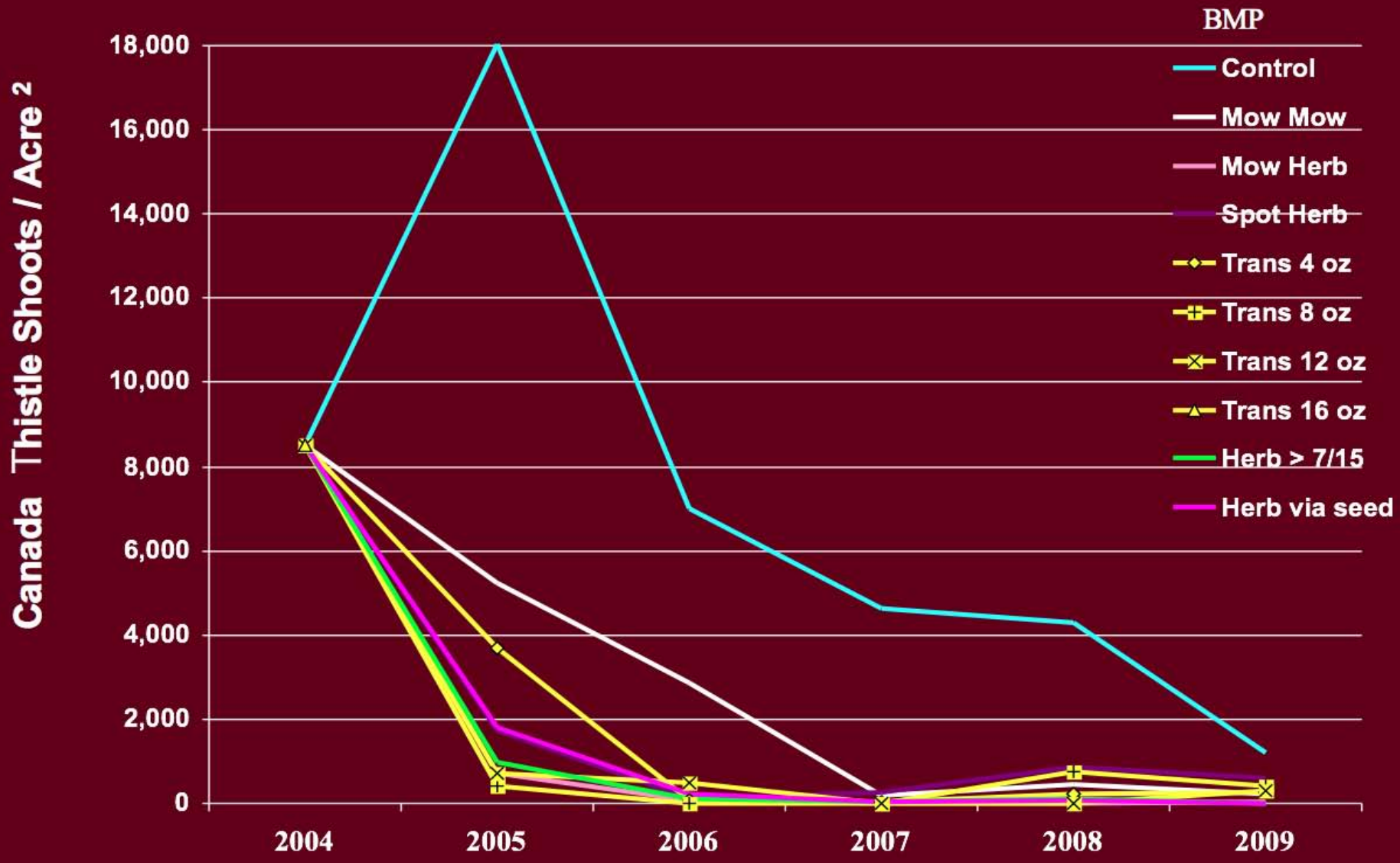
Canada Thistle Carbohydrate Flow

BMP 4 Spray Pre-Bud (Current Label)



Canada Thistle BMPs in Native Prairies

June C. Thistle Shoots / Acre Timber Lake USFWS WPA



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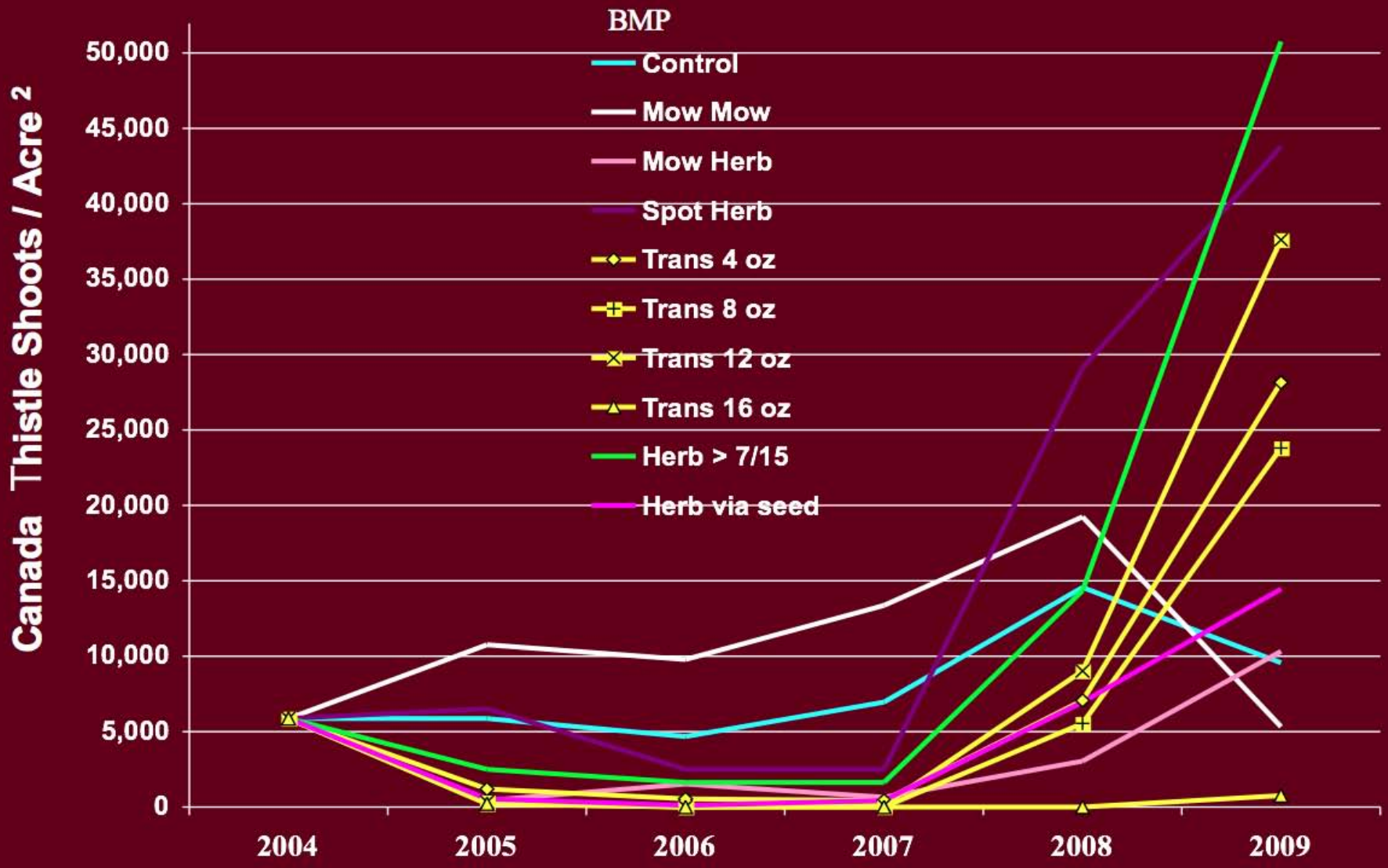

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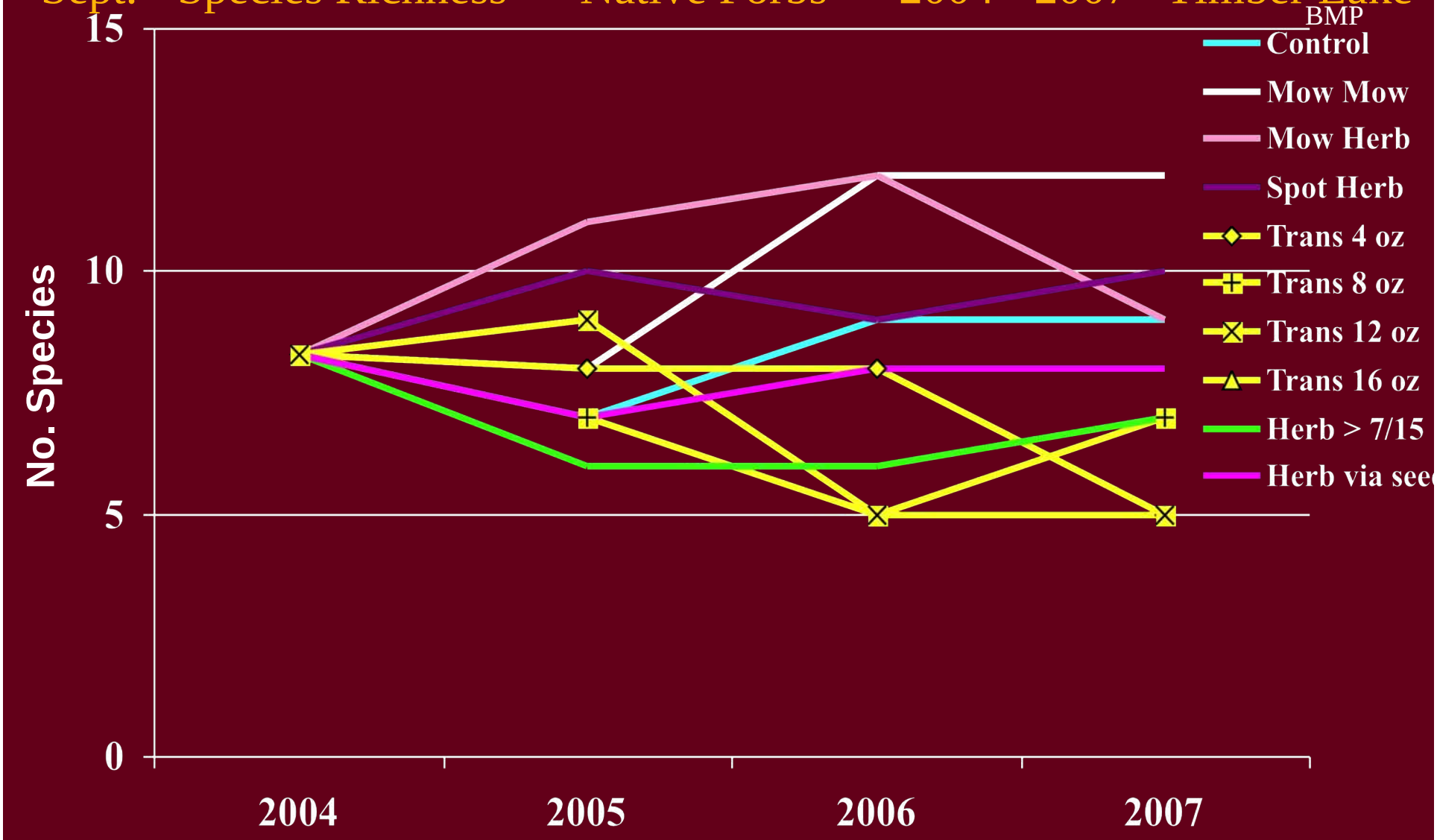
Canada Thistle BMPs in Native Prairies

Sept. - Species Richness Native Forbs 2004 - 2007 Timber Lake



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Canada Thistle BMPs in Native Prairies

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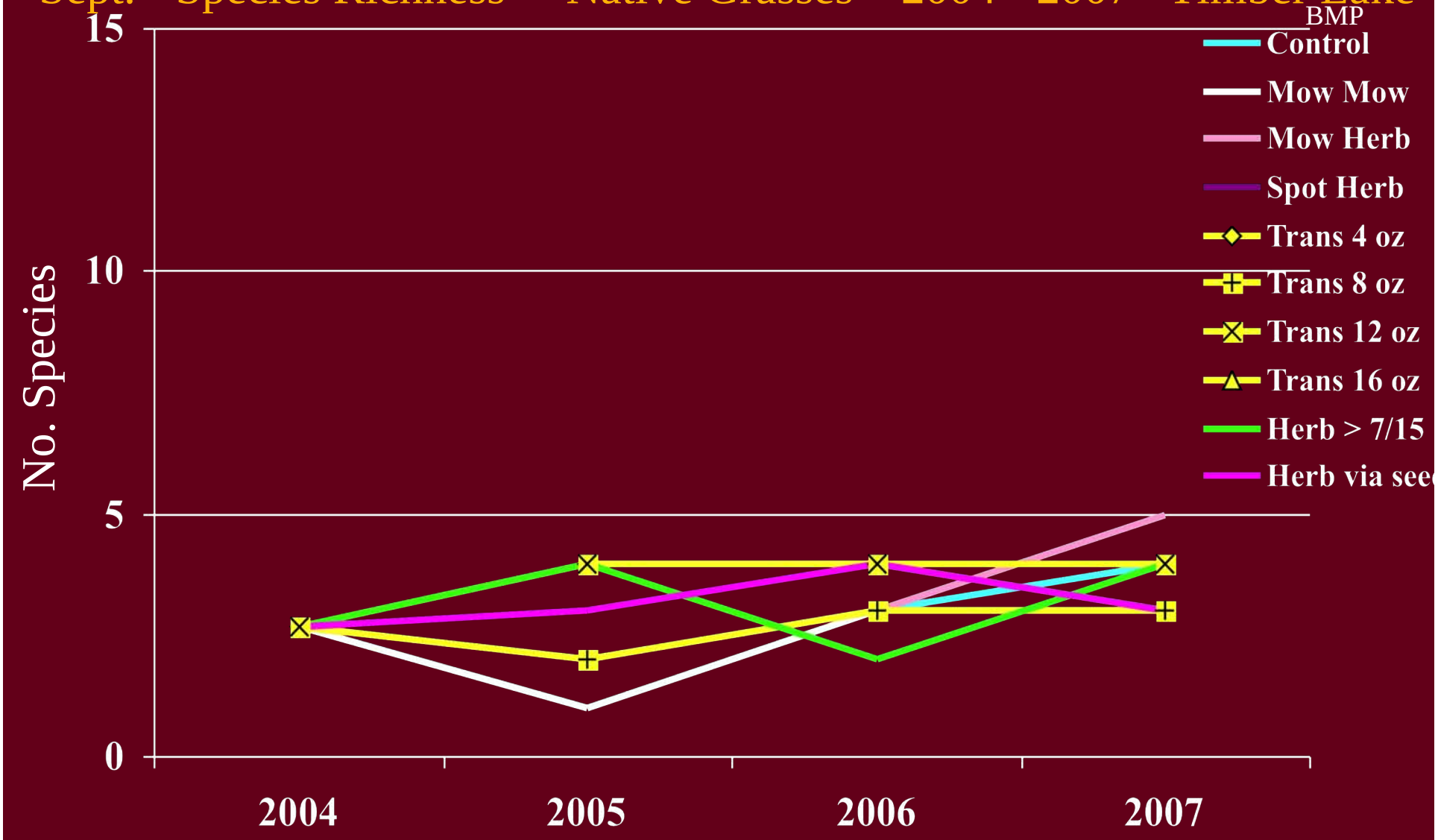

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Canada Thistle BMPs in Native Prairies

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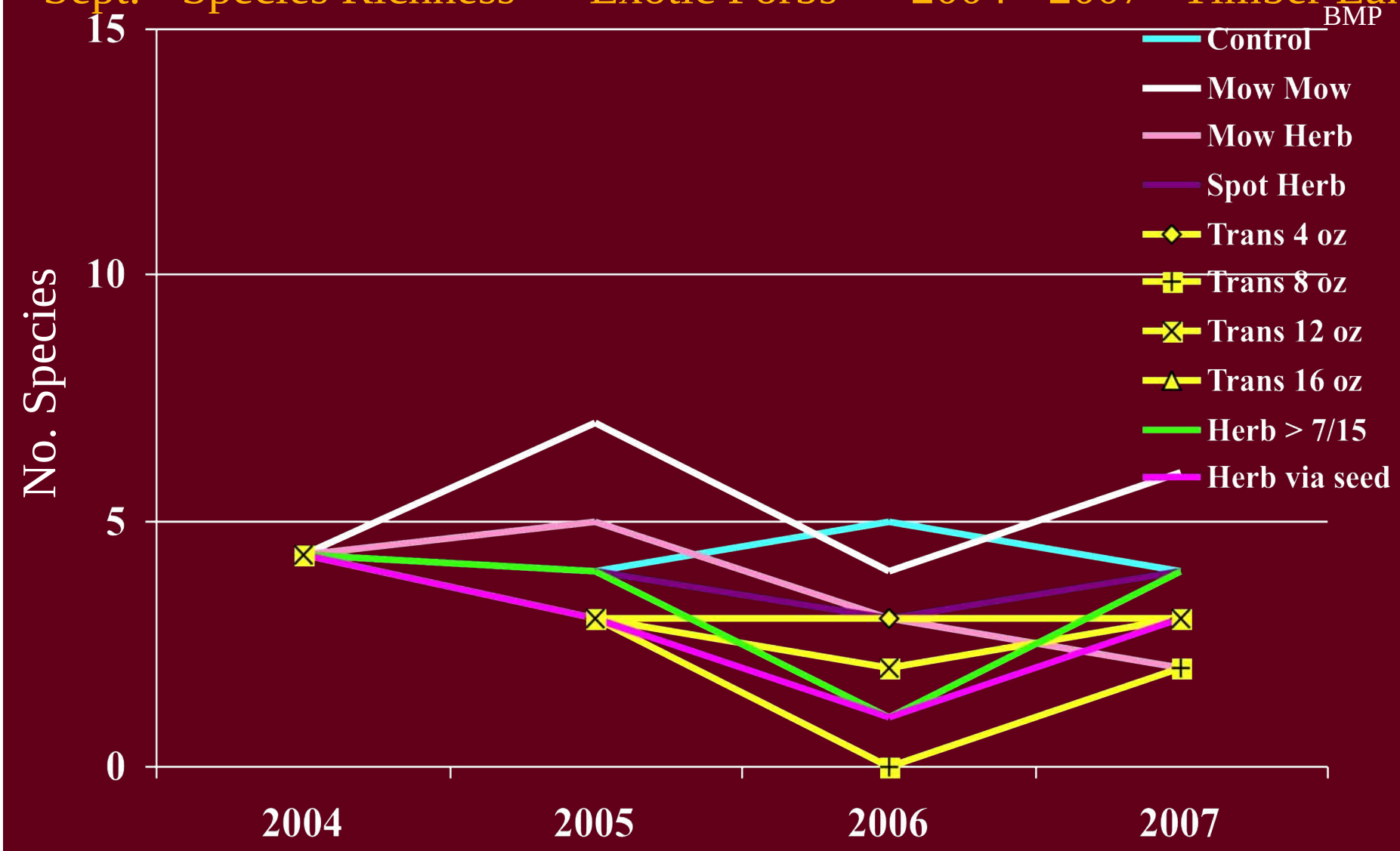

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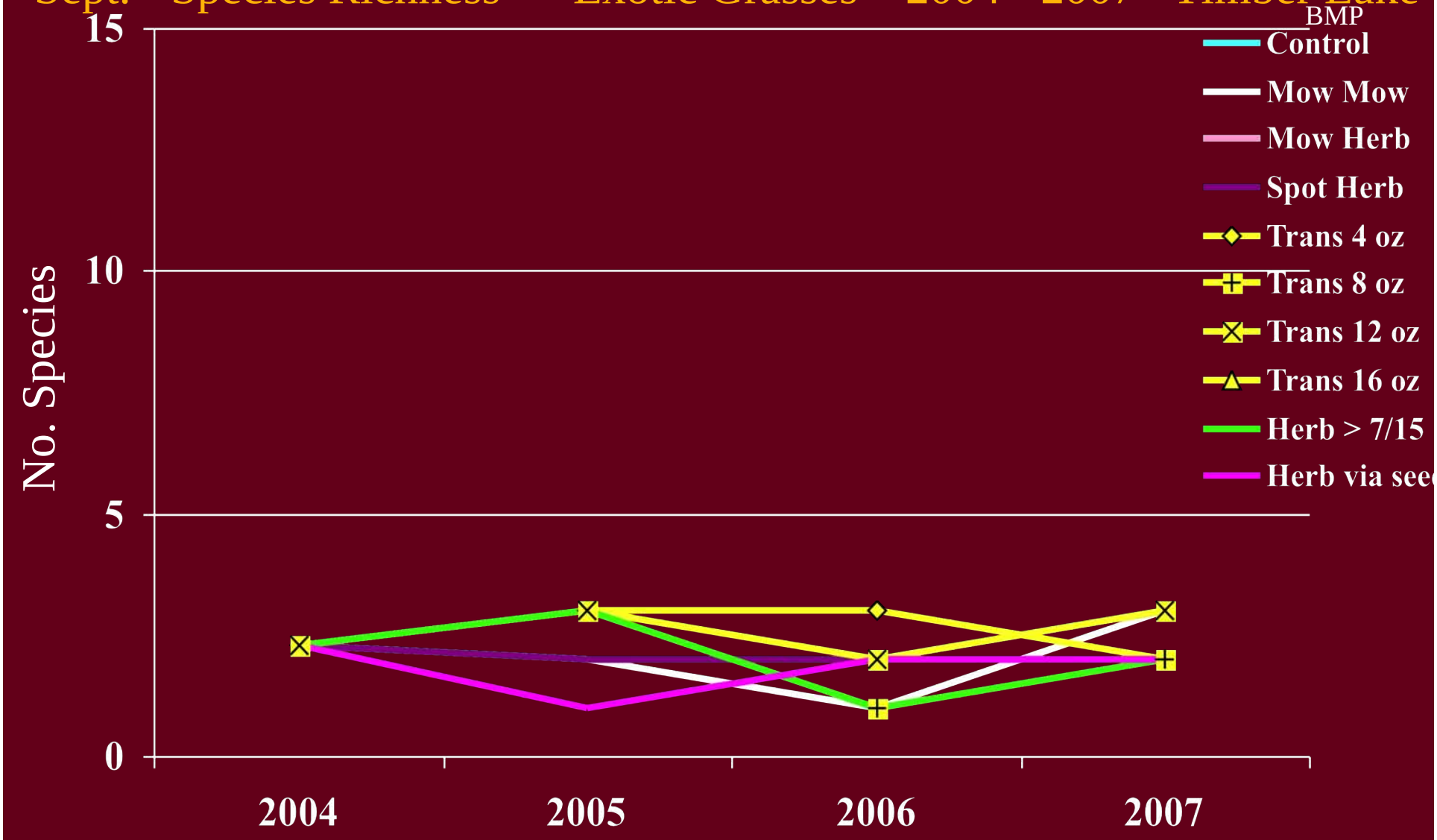

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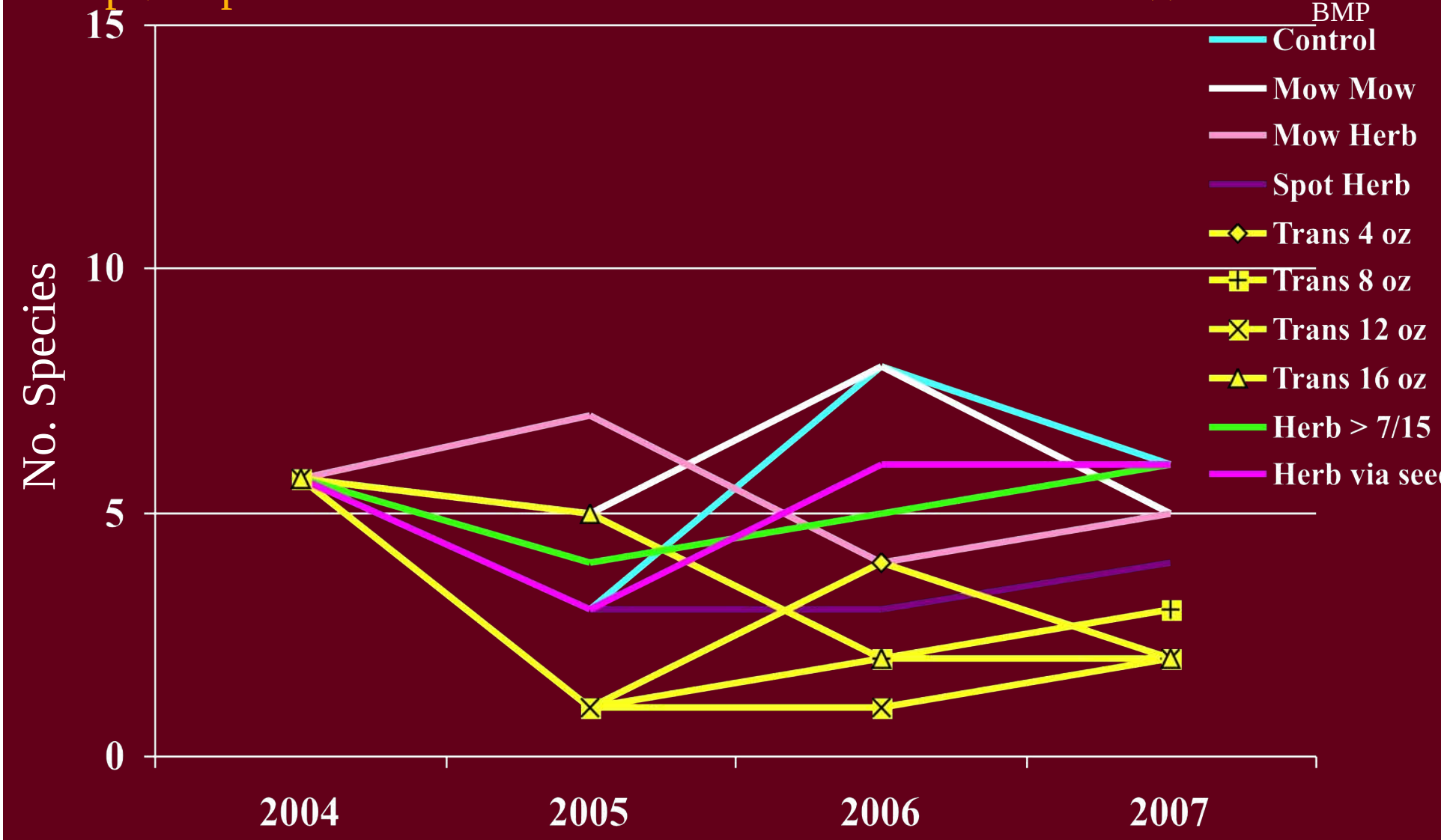

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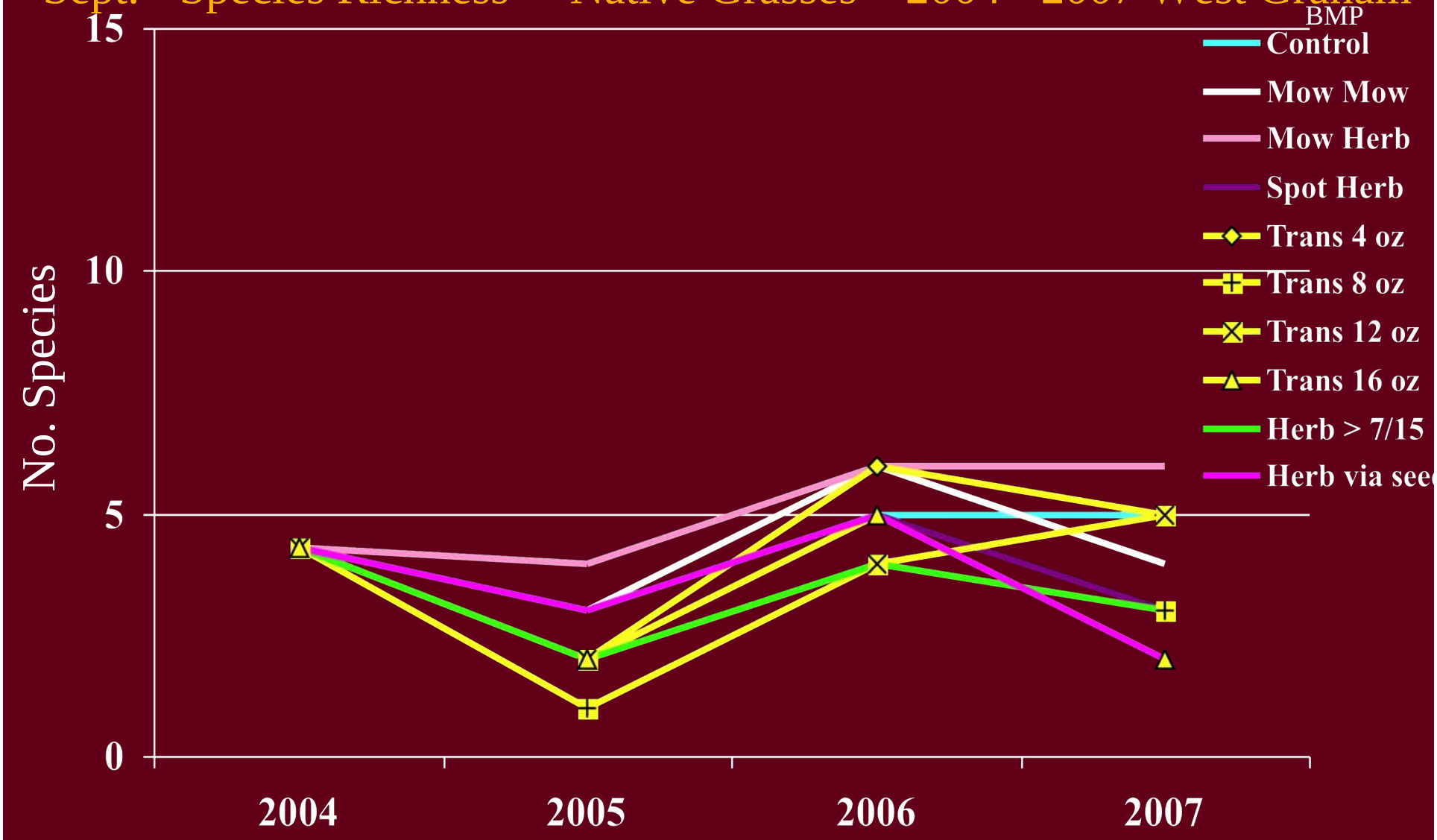

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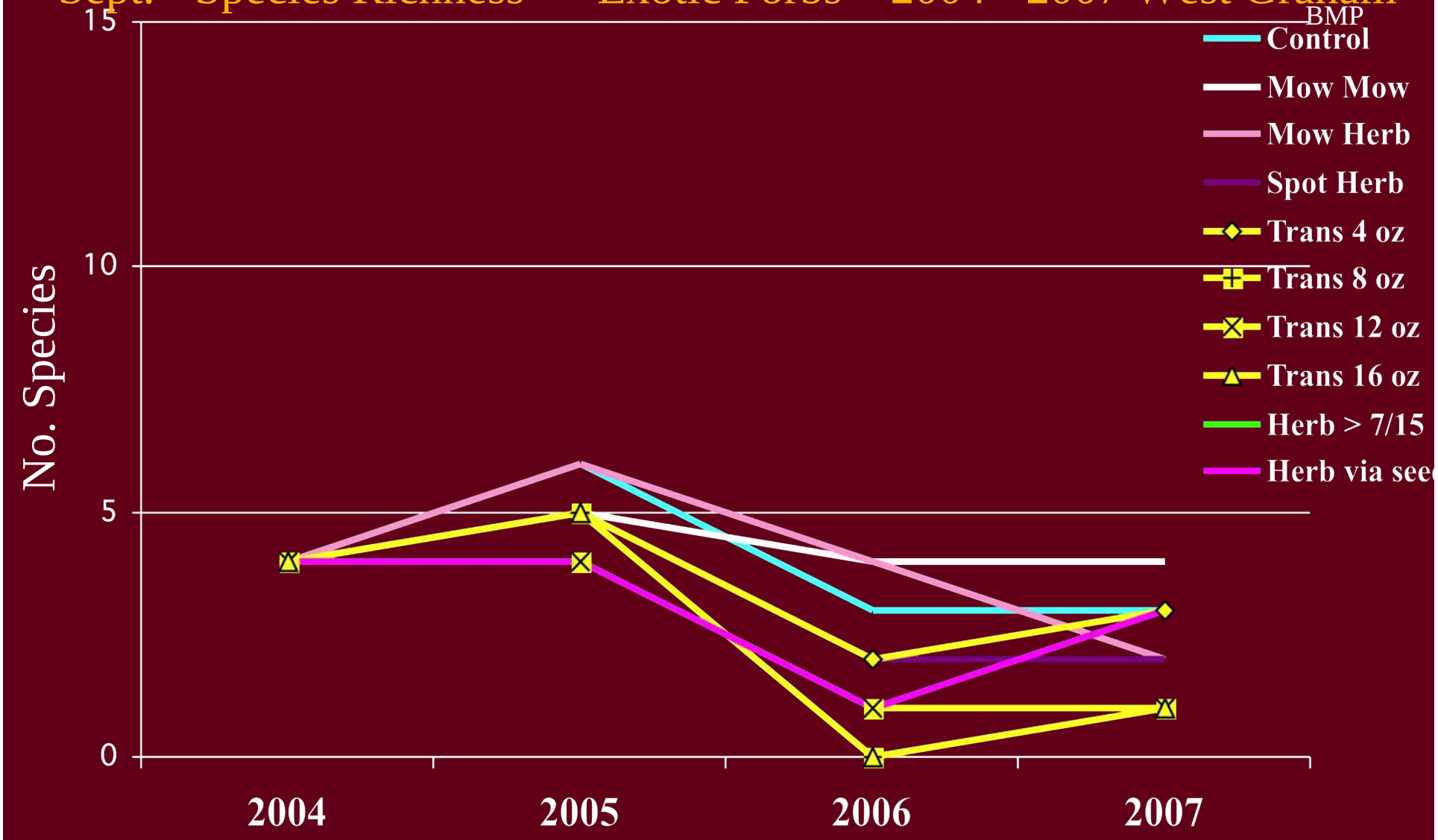

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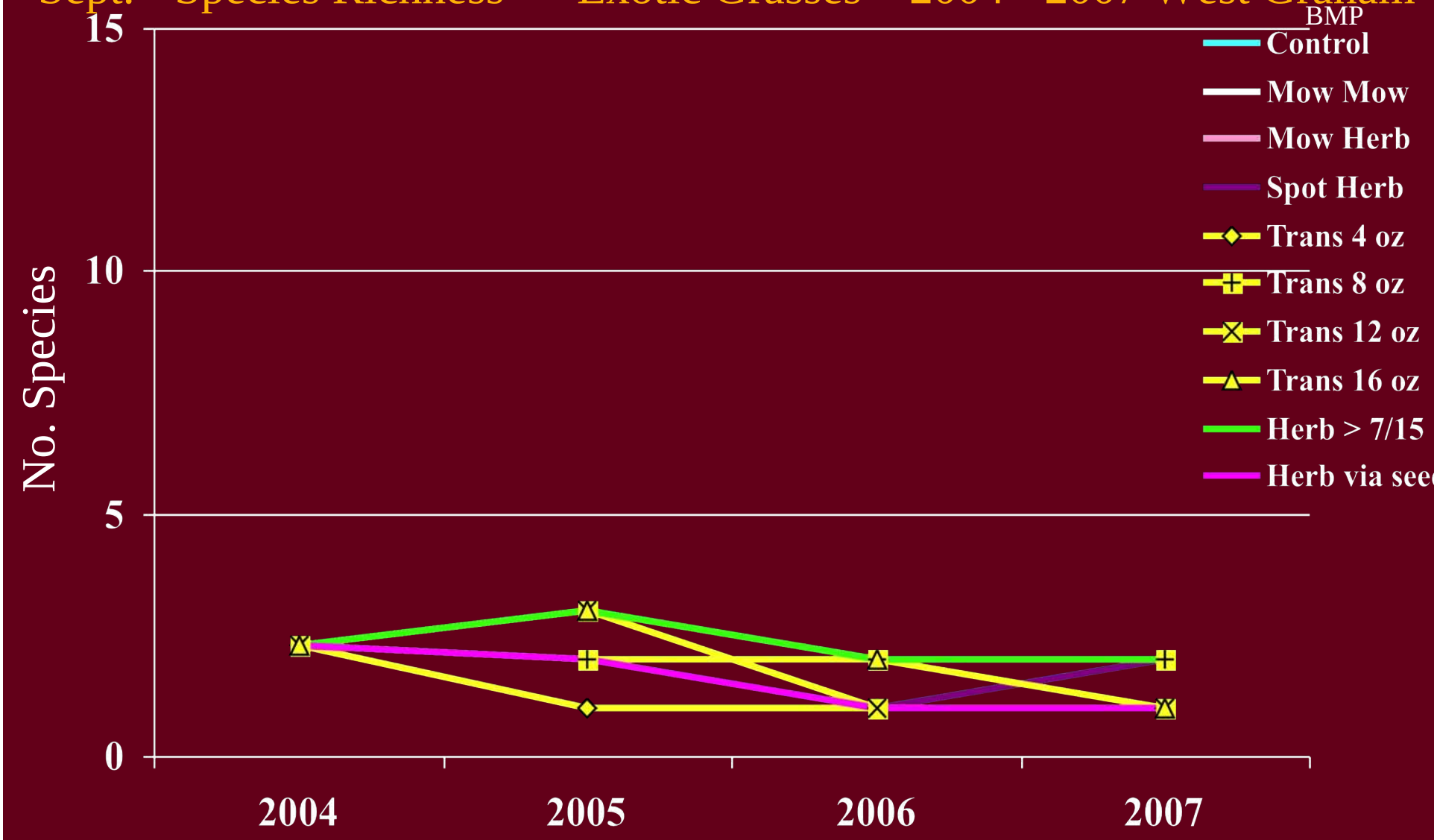

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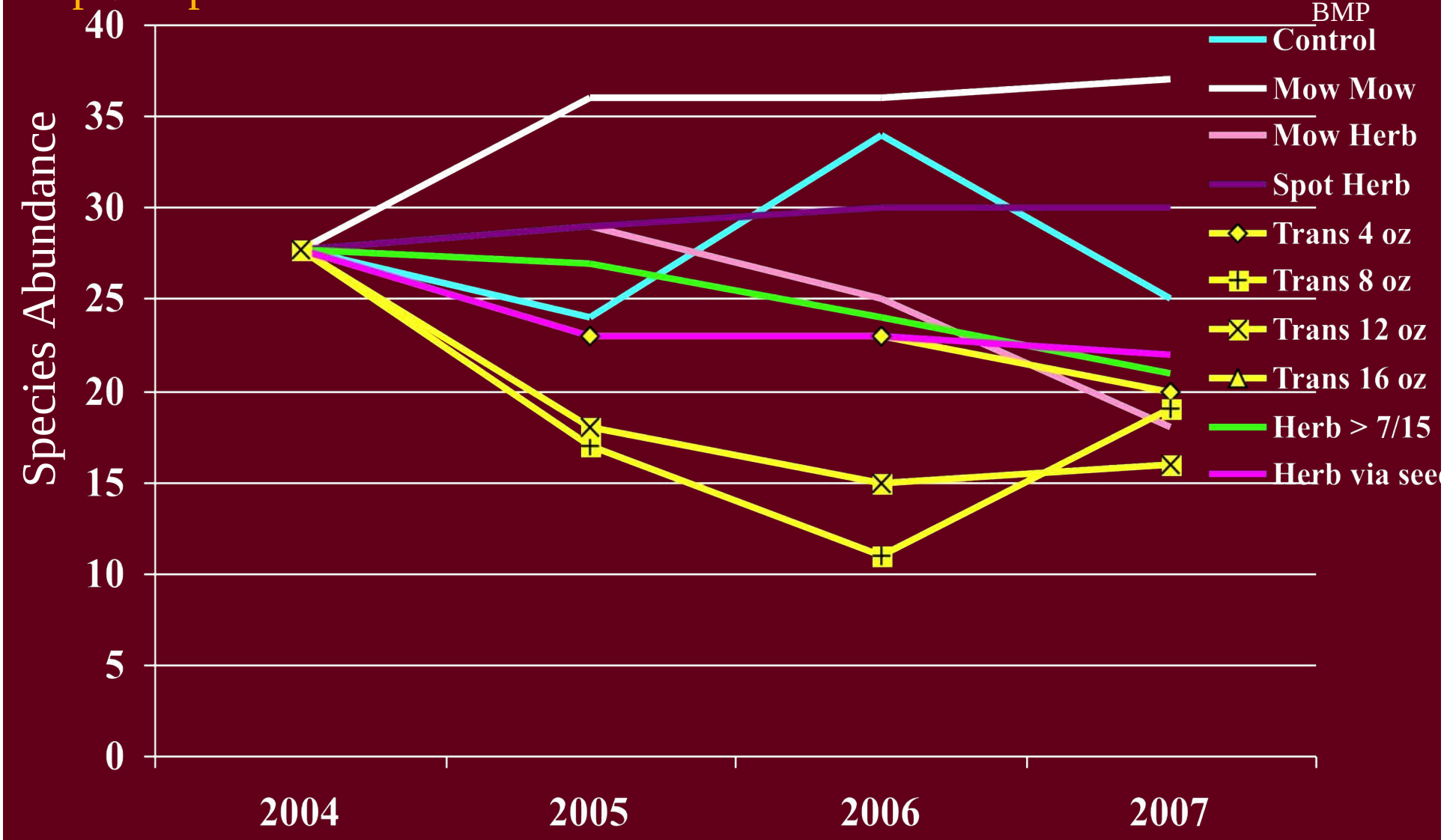

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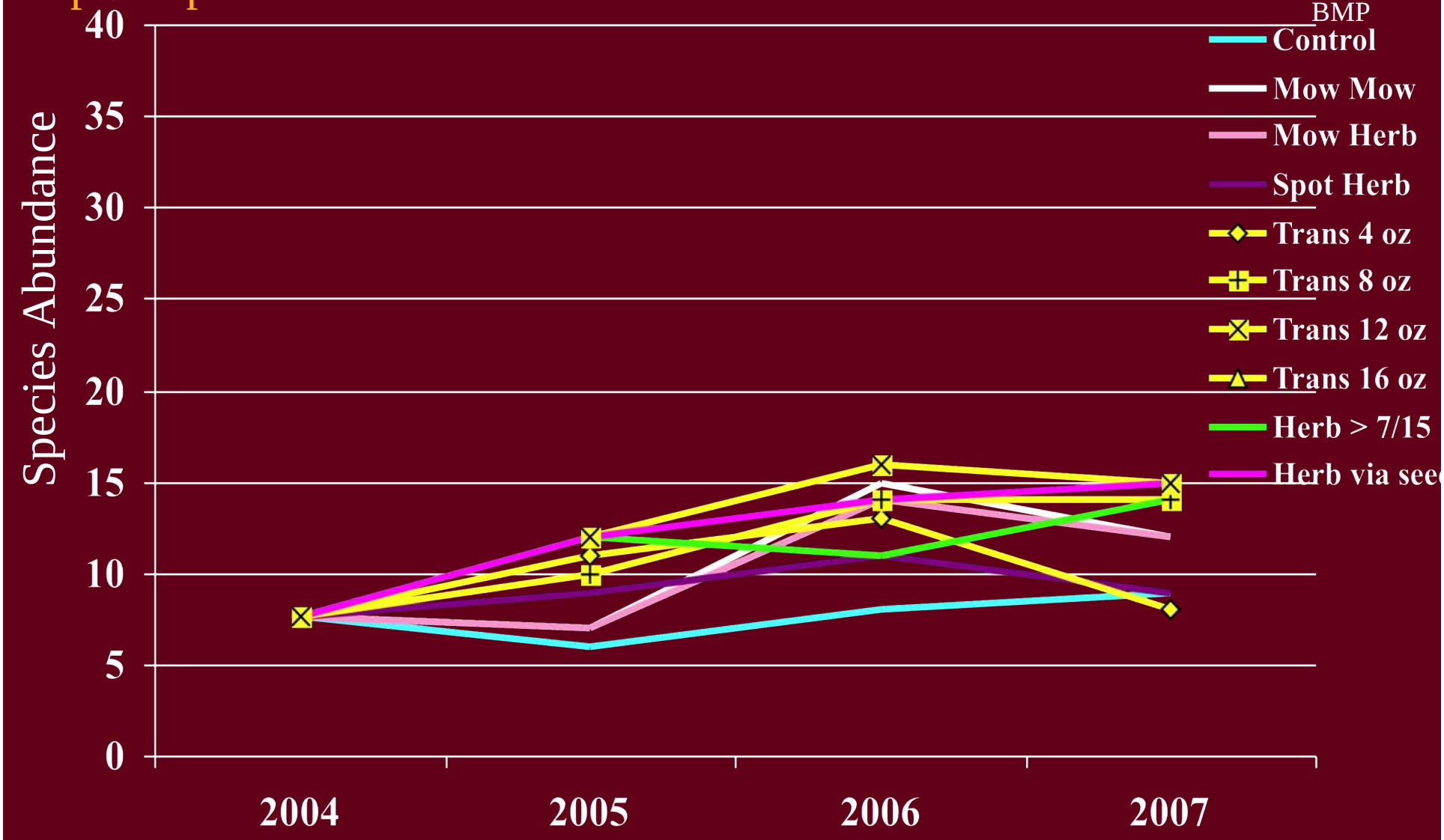

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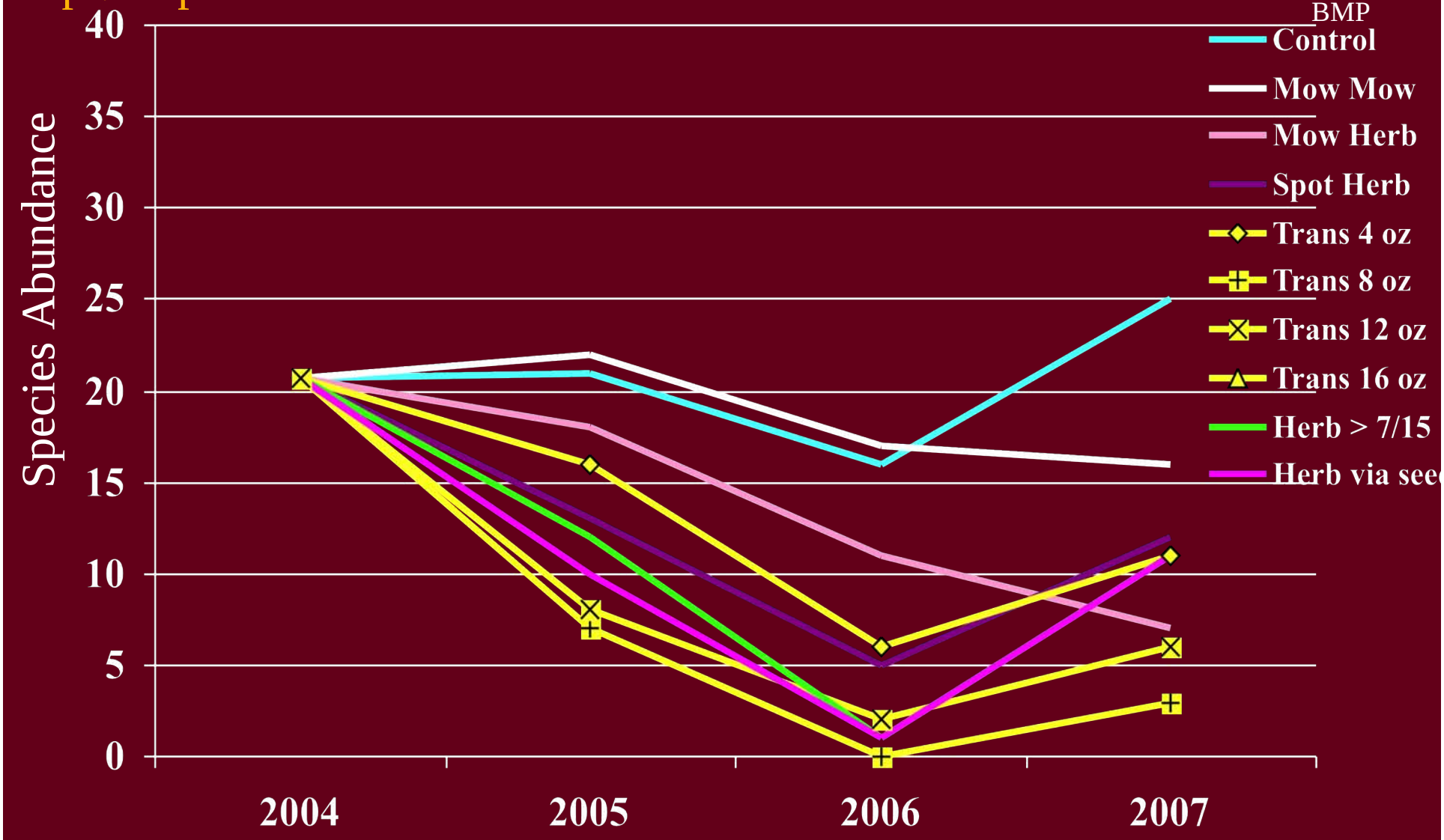

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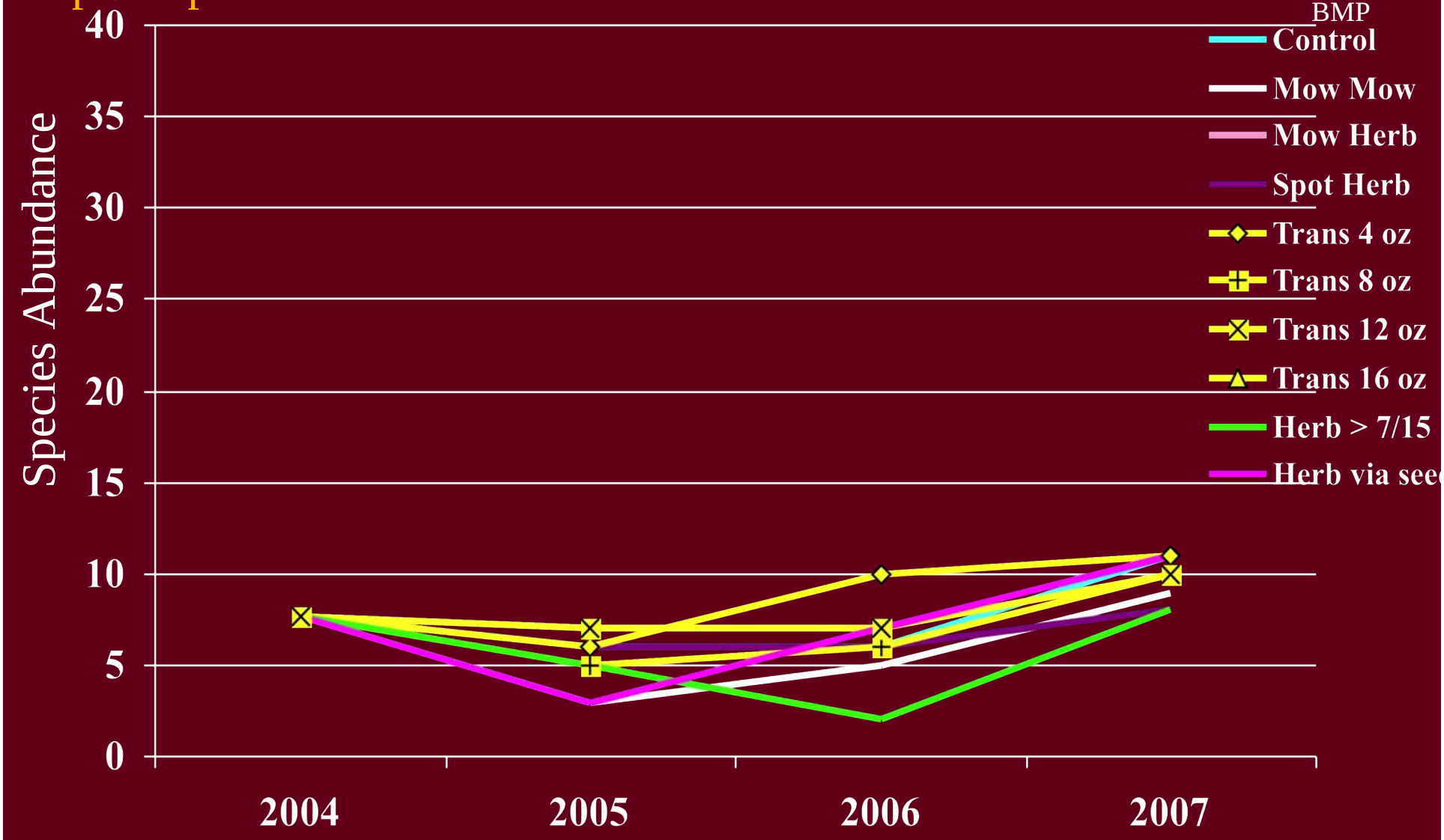

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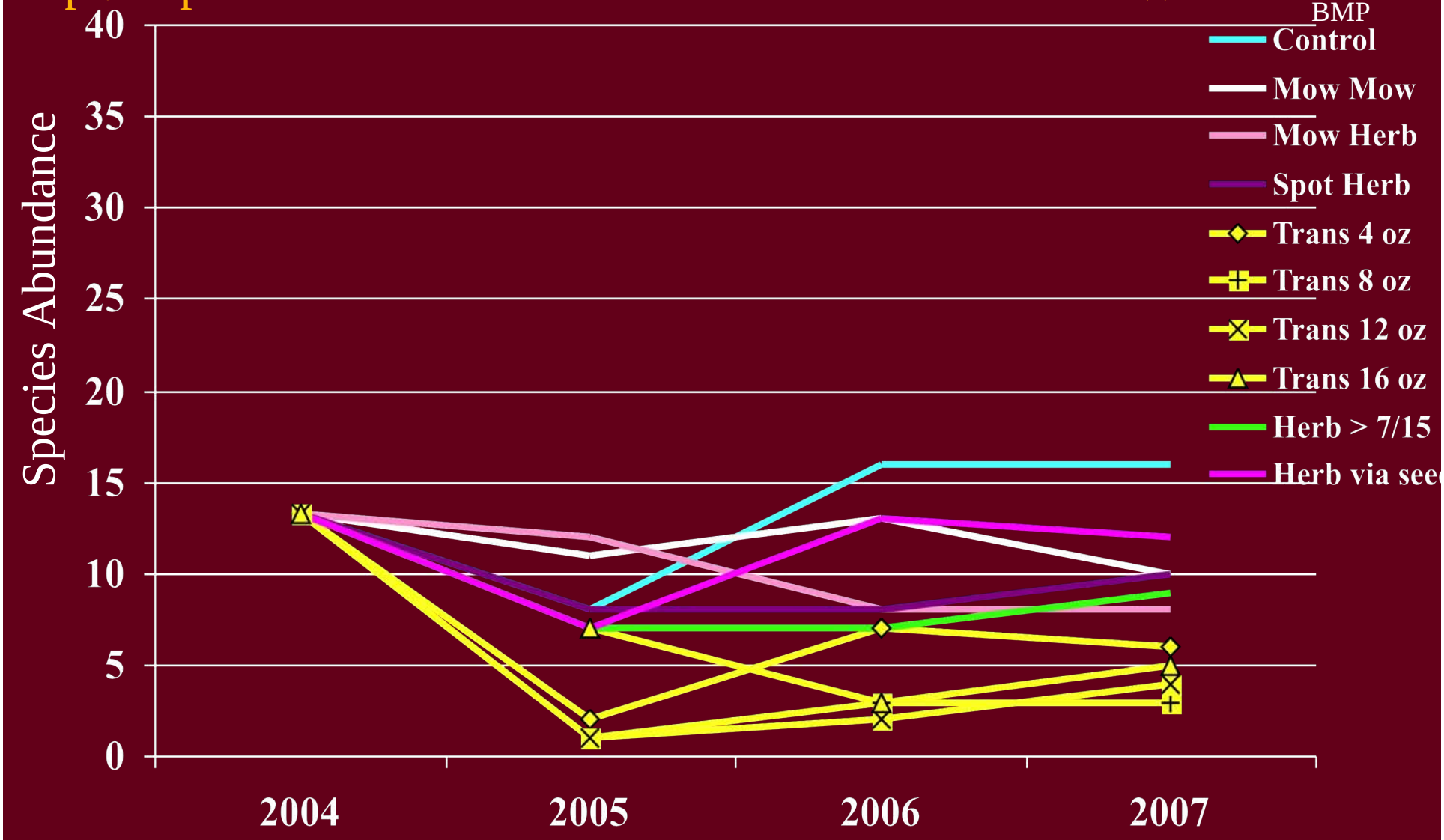

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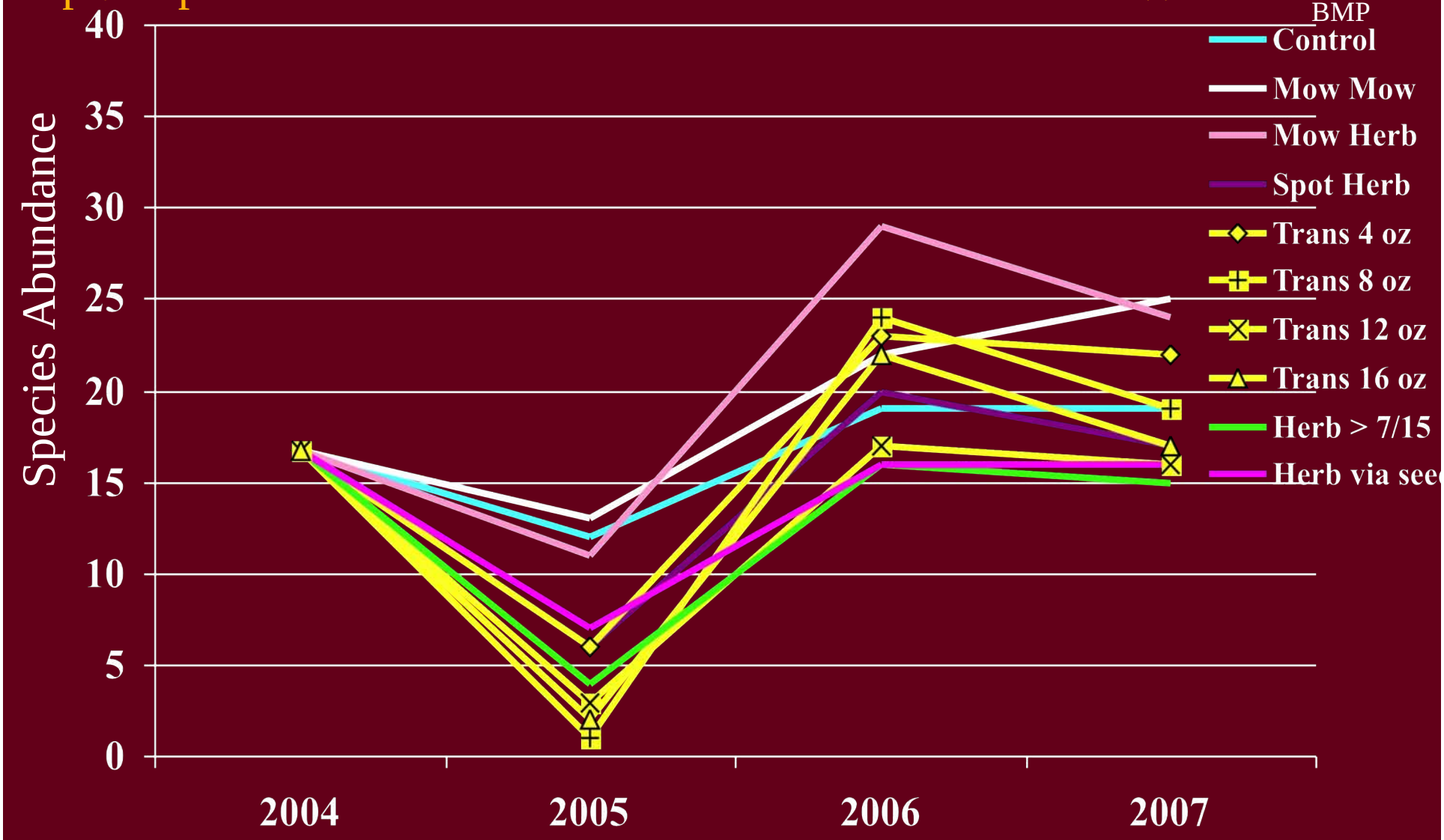

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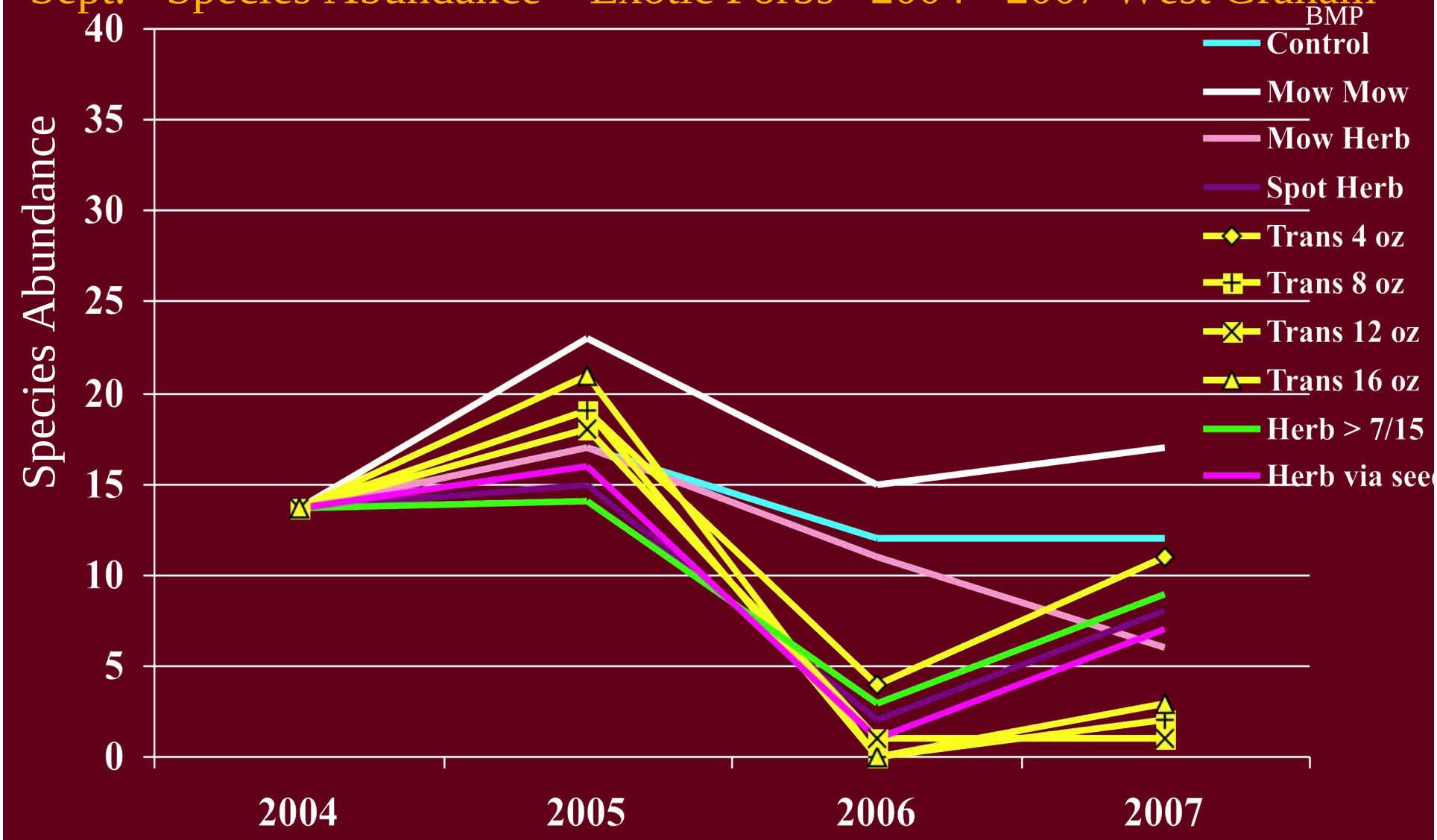

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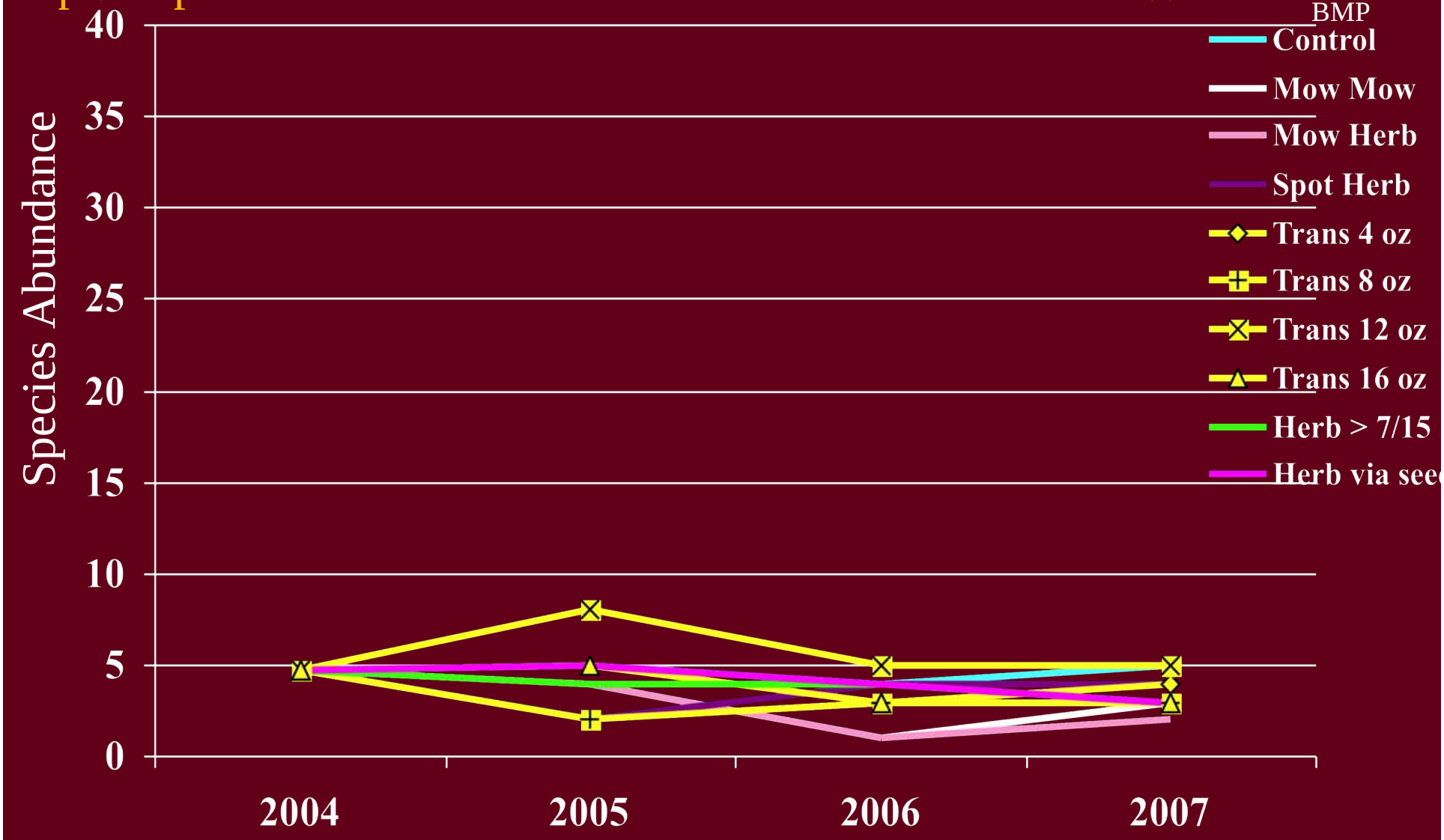

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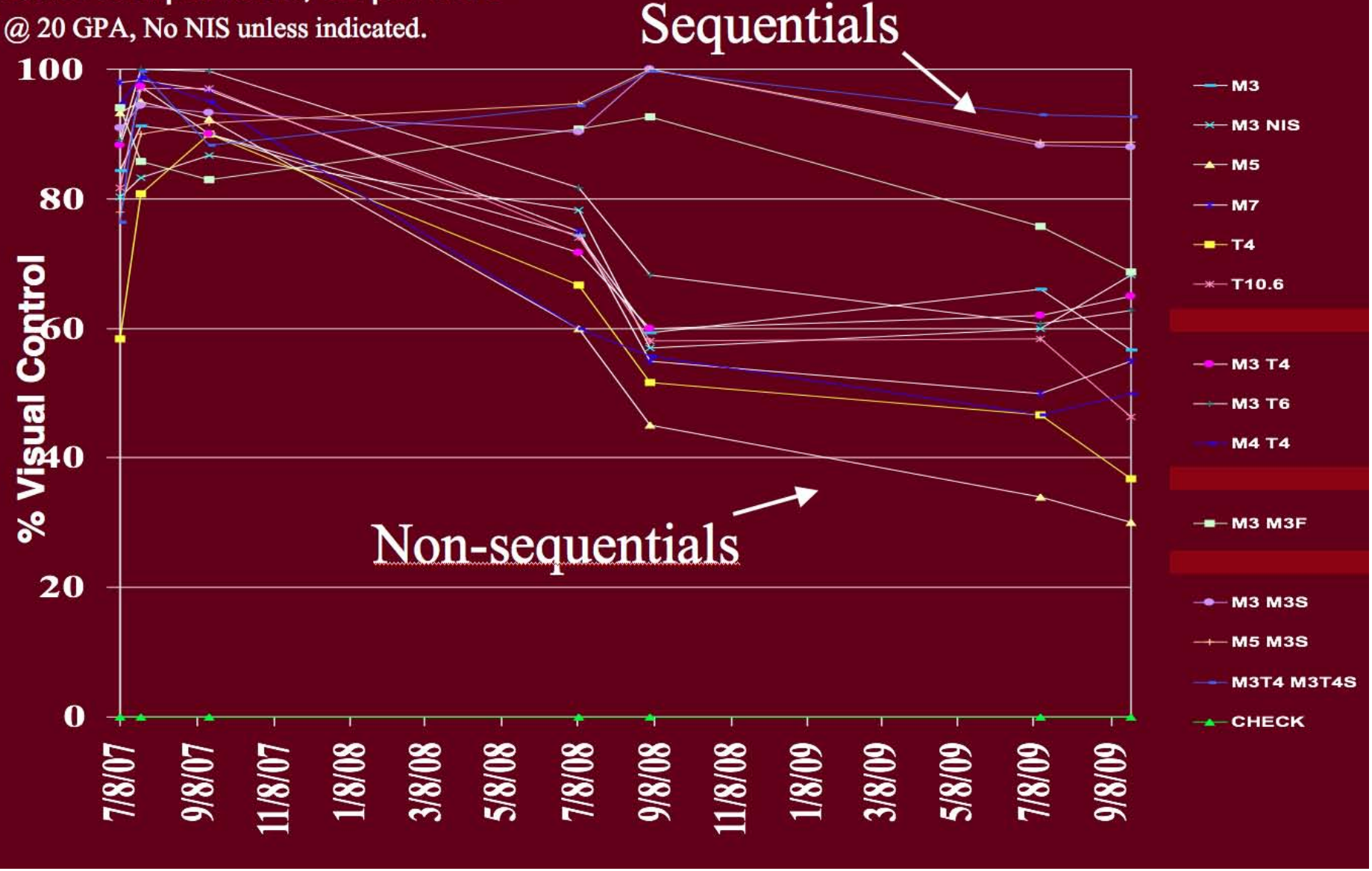
Milestone Transline Sequential Trial
Rosemount, MN 2007 - 2008

Canada Thistle Spring Emergence Control

Milestone Transline Sequential Trial, Rosemount MN 2007 - 2009

Product comparisons, oz per acre

All @ 20 GPA, No NIS unless indicated.

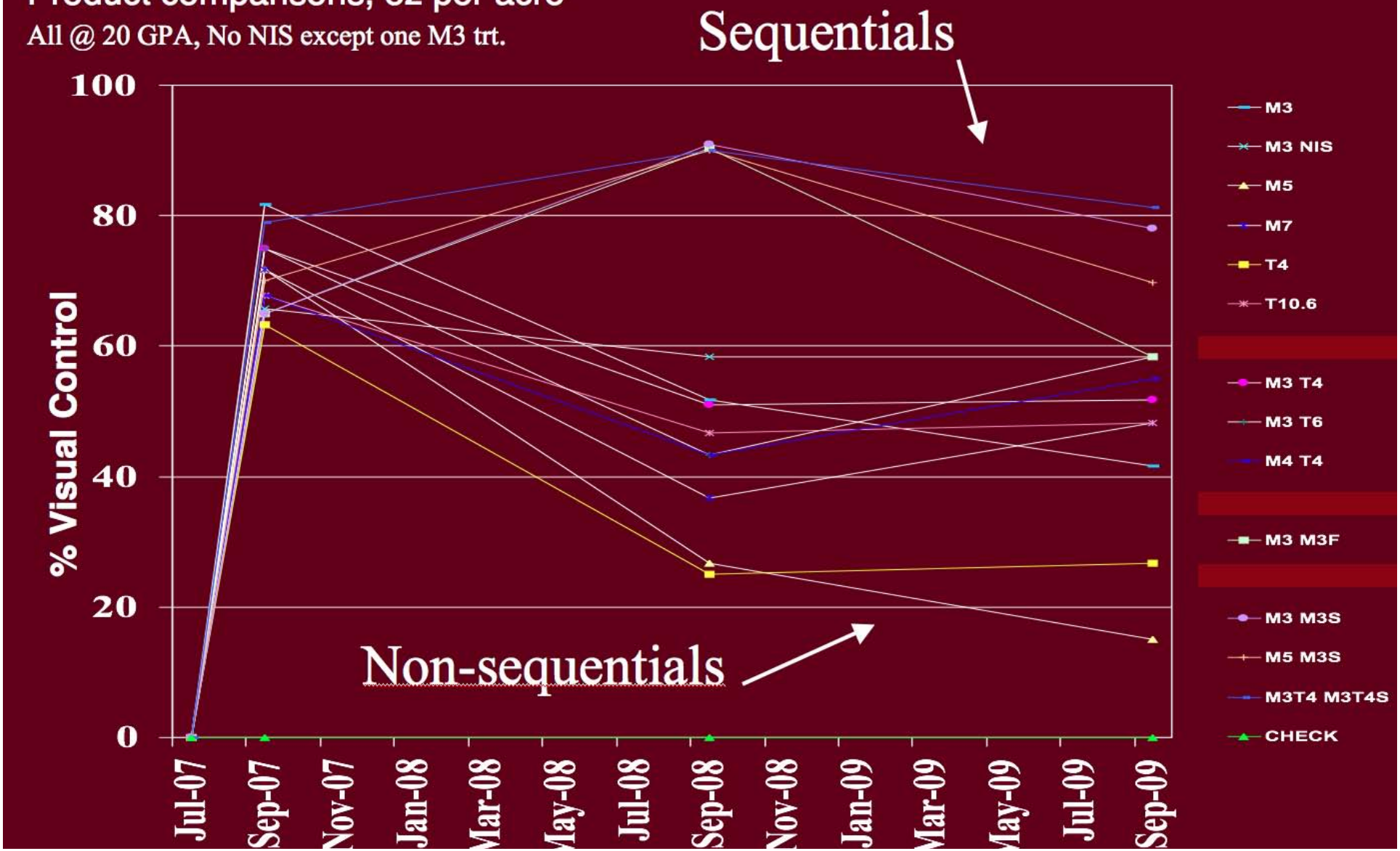


Canada Thistle Fall Regrowth Control

Milestone Transline Sequential Trial, Rosemount MN 2007 - 2009

Product comparisons, oz per acre

All @ 20 GPA, No NIS except one M3 trt.



Lamberton MN Canada Thistle x Burn Study

May 29 2009. Shoot Counts, Heights (Includes only plots used in trial)

	counts / 20X20 ft plot	Min ht (in)	Max ht (in)	Avg. Canth / sq yd
Not Burned	22.6	3.4	7.3	0.5
Burned	42.5	1.0	3.5	1.0

- Spring burn resulted in more C. thistle shoots and delayed maturity

Lamberton, MN Herbicide x Burn Canada Thistle Control

			Grams (g) / sq. yard Dry Weight						
Application Timing	Burn Trt.	n =	Native Grass	Native Forbs	Non Native Grasses	Non Native Forbs w/o CT	Non Native Forbs w/ CT	Canada thistle	Pre 09 dead litter
Burned	AVG.	15	348.0	23.6	25.0	1.7	3.7	1.9	0.0
No Burn	AVG.	15	239.2	14.0	6.1	16.1	17.9	1.8	226.8
Herbicide Early	AVG.	12	337.6	15.5	12.0	0.7	1.4	0.7	107.8
Herbicide at Bud	AVG.	12	251.6	22.4	18.8	19.7	22.6	2.9	119.1

*Burn trt. Included checks, Herbicide timing trt. did not. Harvested Sept. 2, 2009

By fall, spring burning increased native grass and forb biomass, more exotic annual grass filling open niches.
Canada thistle was not affected.

Put it in the bank

- Think sequentials

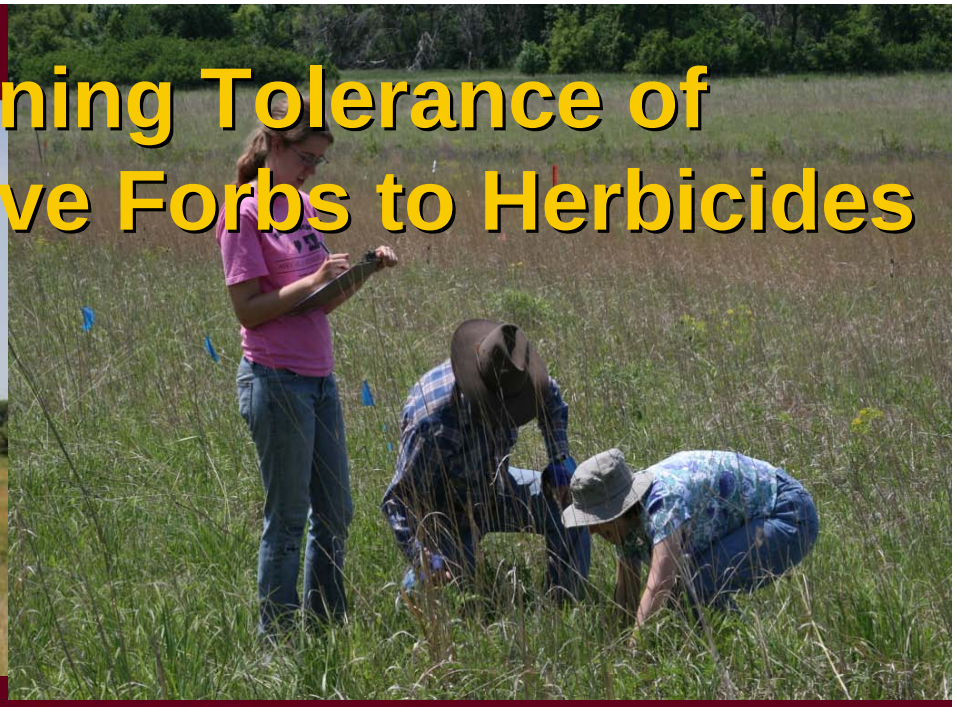
- Spring or fall?
    - Spray when fits your operation

- There are over-riding forces at work

- Burn for targets other than thistle

Defining Tolerance of Native Forbs to Herbicides

Two Rivers Forb Tolerance Site



Hedquist Forb Tolerance Site

- Two locations, forb rich native prairies
- Replicated strip trials 30 x 150 ft to pick up less common forbs
- Sprayed in 2006
  - Spring vs. Fall
  - Milestone vs. Transline
- Visual presence-absence, transect counts
  - June and September 1 and 2 YAT

Two Rivers Control
Aug 7 ‘06

Species either missing or not flowering 1 year after treatment

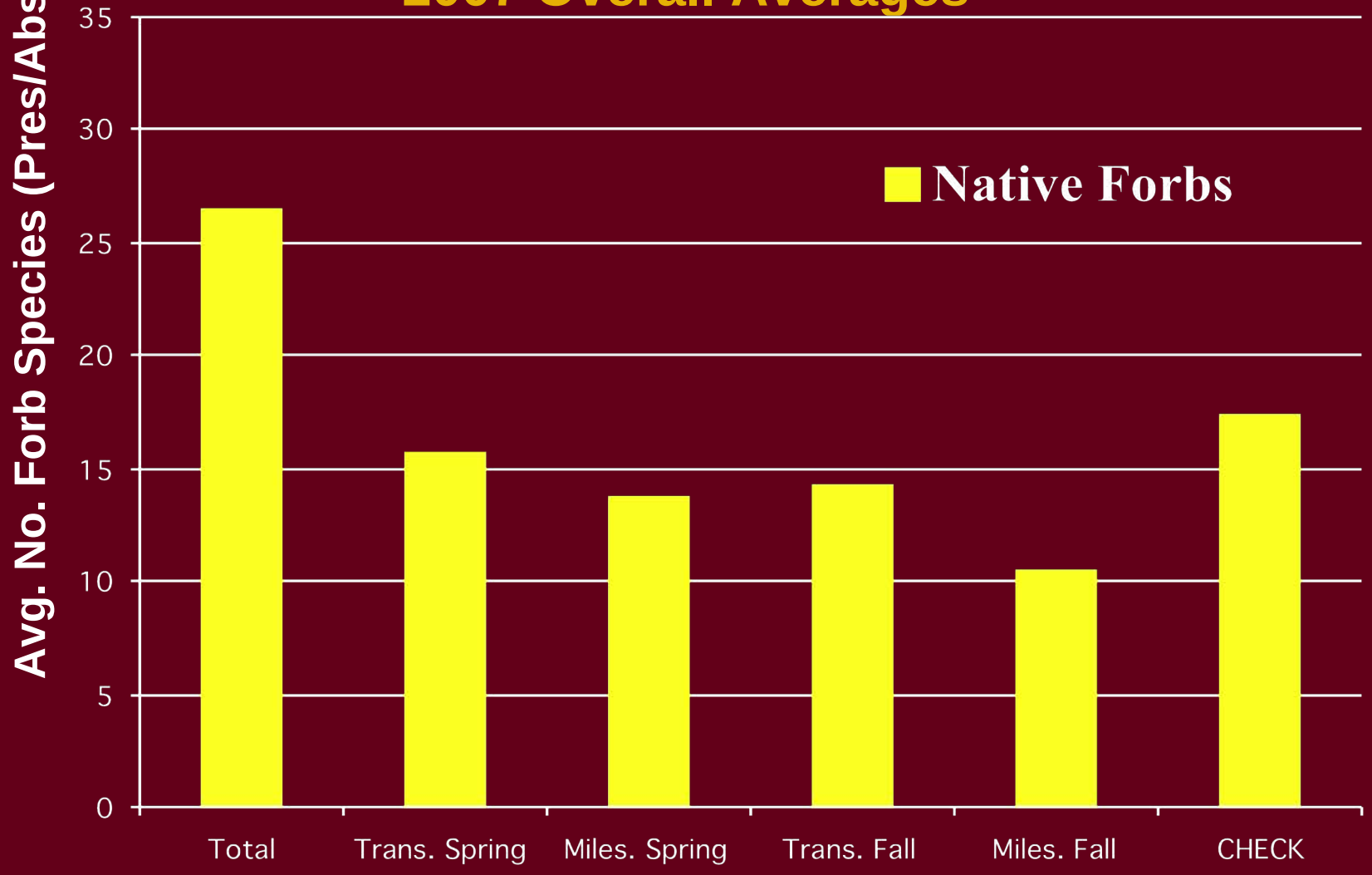
Yellow Prairie Coneflower
Black-eyed Susan
Sunflowers

Hedquist Forb Tolerance Site

Native Forbs Tolerance to Milestone vs. Transline

Hedquist and Two Rivers WMAs MN Species Richness

2007 Overall Averages

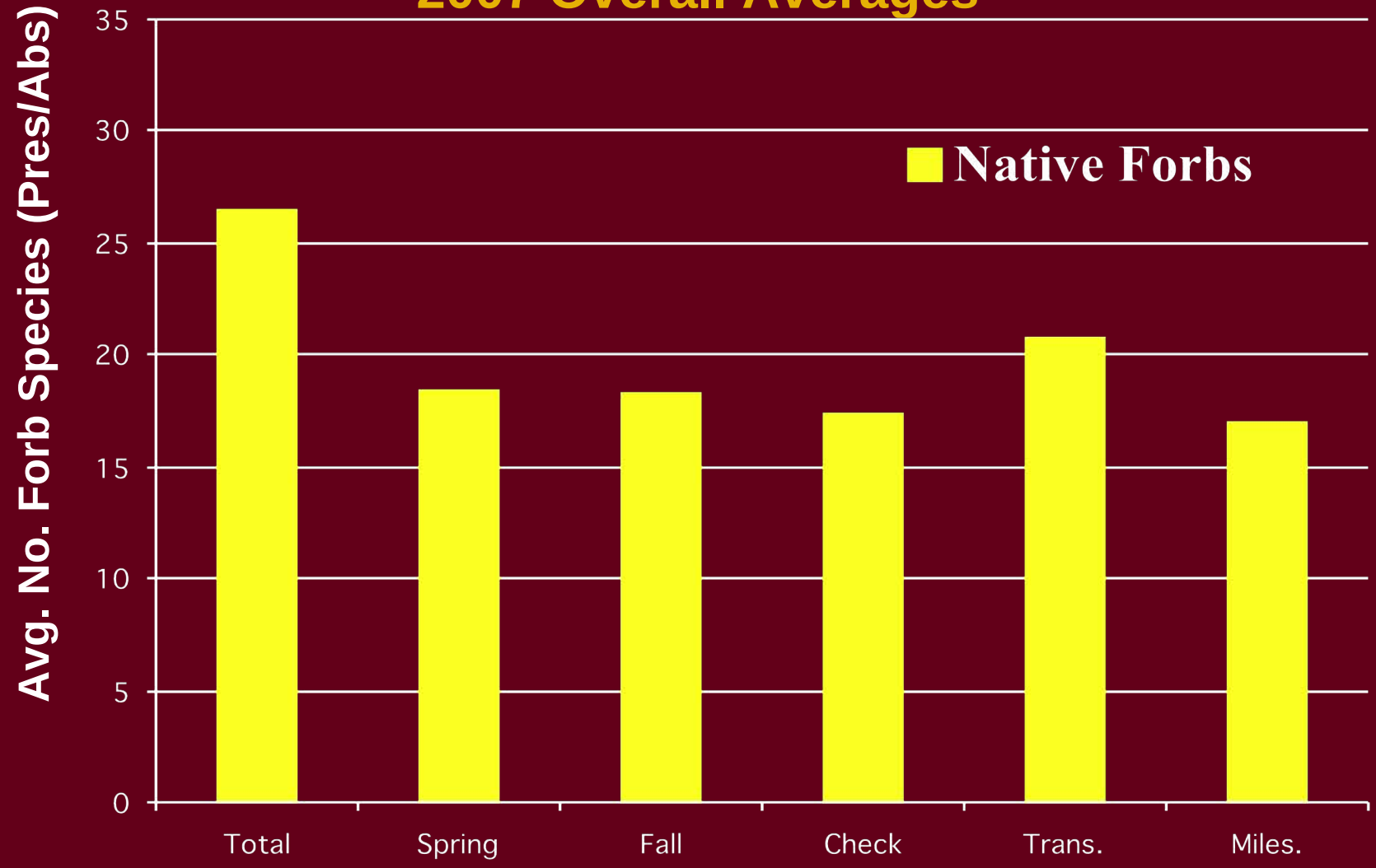


Milestone 2 SL 5 oz./A and Transline 3 SL 10.3 pts./A spring or fall 2006.
30 x 150 ' plots walked in June and Sept 2007 for presence absence ratings.

Native Forbs Tolerance to Milestone vs. Transline

Hedquist and Two Rivers WMAs MN Species Richness

2007 Overall Averages



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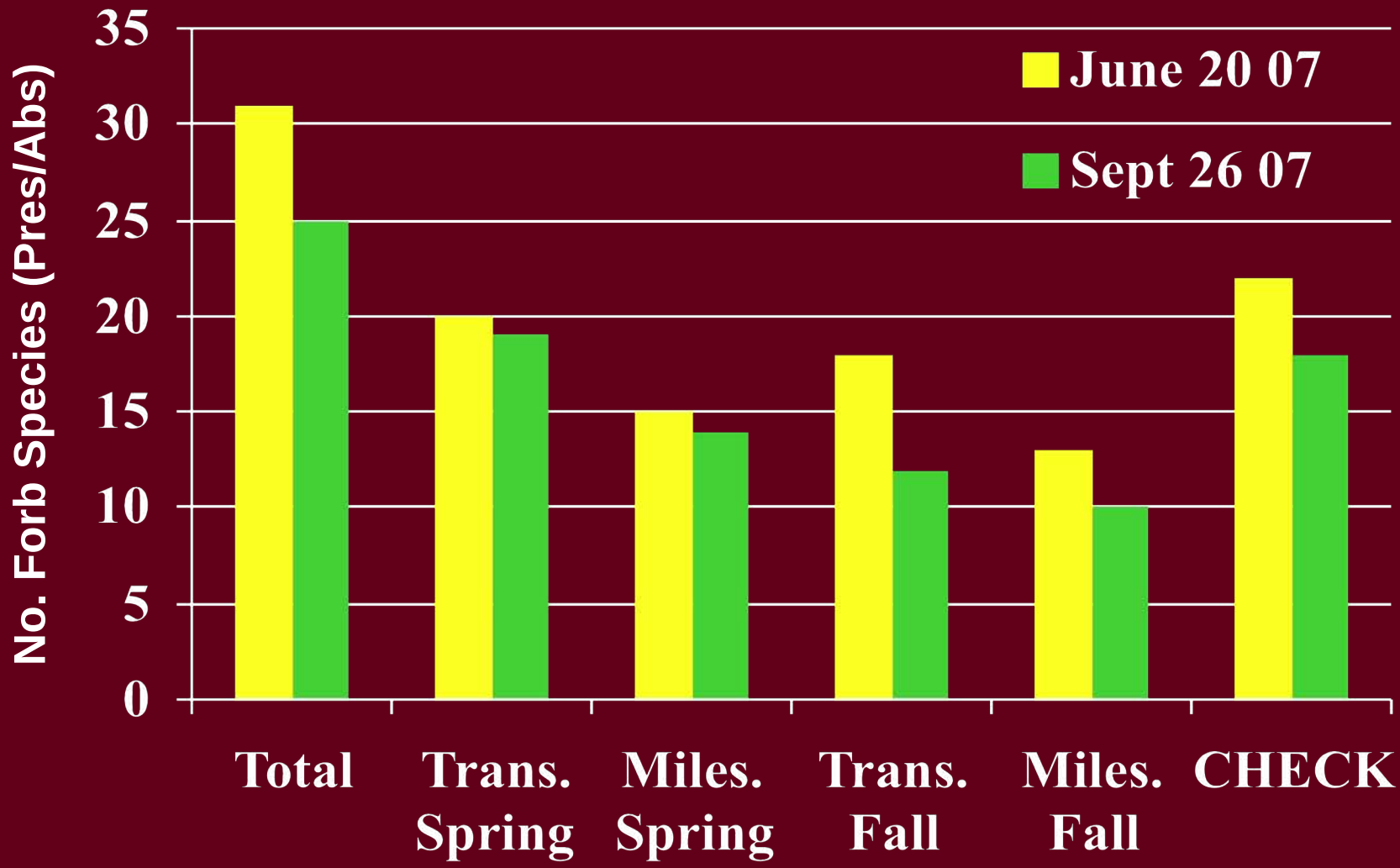
Native Forbs Tolerance to Milestone vs. Transline

Hedquist WMA MN Native Forb Species Richness



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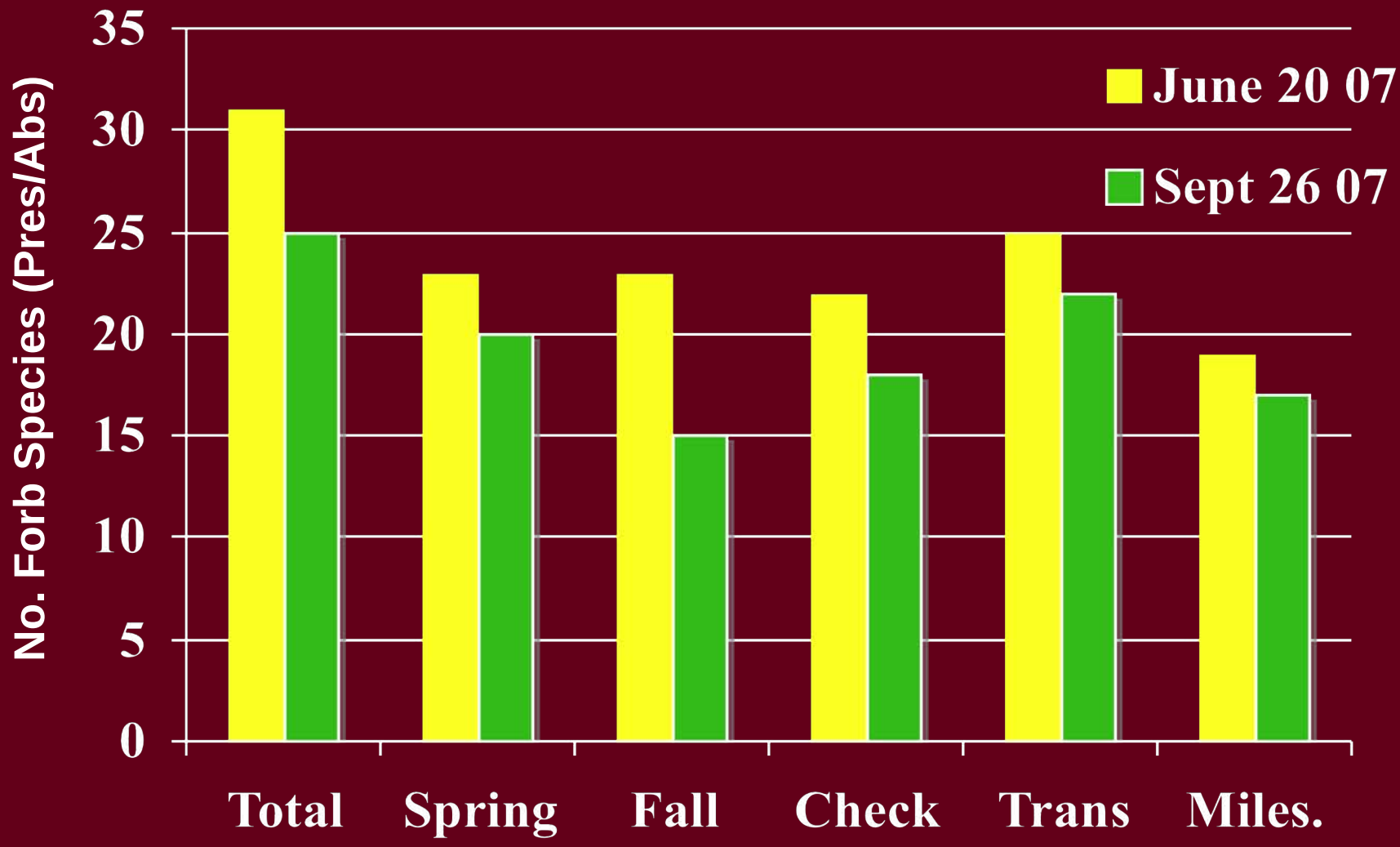
Native Forbs Tolerance to Milestone vs. Transline

Hedquist WMA MN Native Forb Species Richness



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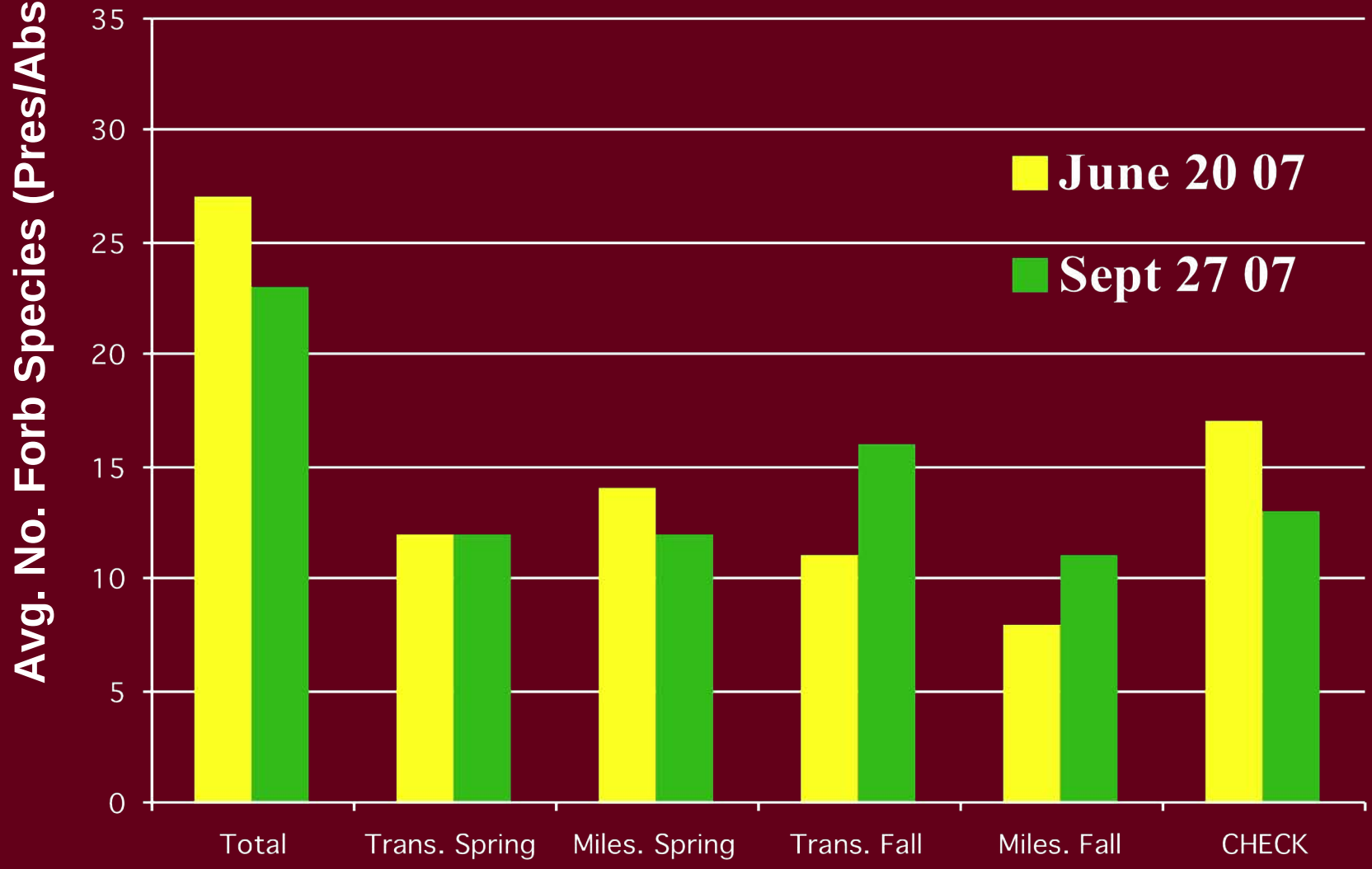
Native Forbs Tolerance to Milestone vs. Transline

Two Rivers WMA MN Native Forb Species Richness



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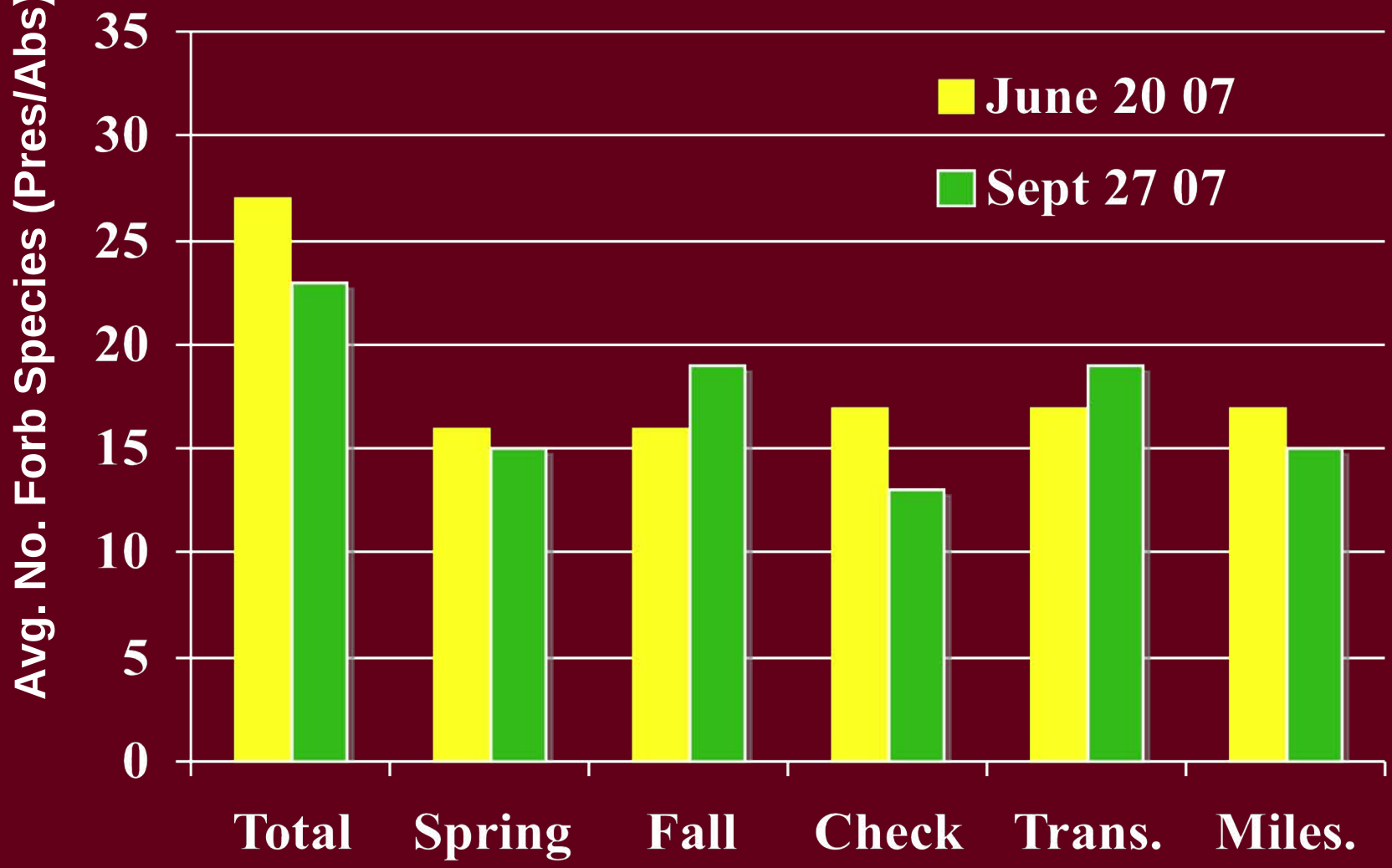
Two Rivers WMA MN Native Forb Species Richness



Milestone 2 SL 5 oz./A and Transline 3 SL 10.3 pts./A spring or fall 2006.
Base plot 30 x 150 ' walked in 2007 for presence absence ratings.

Native Forbs Tolerance to Milestone vs. Transline

Two Rivers and Hedquist WMAs. MN Presence / Absence Data

Number of Observed Differences in Forb Response by Trt.

	June 20 07		Sept.26/27 07		Avg.
	Two Rivers	Hed-quist	Two Rivers	Hed-quist	
Milestone = Transline	7	2	3	9	5.2
Milestone safer	8	13	7	7	8.8
Transline Safer	7	13	11	8	9.8
No. of Species Observed	22	28	21	24	

* Milestone 2SL 5 fl oz/A Transline 3 SL 10.3 fl oz/A

Native Forbs Tolerance to Milestone vs. Transline

Two Rivers and Hedquist WMAs. MN Presence / Absence Data

Number of Observed Differences in Forb Response by Trt.

	June 20 07		Sept.26/27 07		Avg.
	Two Rivers	Hed-quist	Two Rivers	Hed-quist	
Spring = Fall	6	4	6	6	5.5
Spring safer	10	10	7	9	9.0
Fall Safer	6	14	8	9	9.2
No. of Species Observed	22	28	21	24	

* Milestone 2SL 5 fl oz/A Transline 3 SL 10.3 fl oz/A


Two Rivers June 26 '06
Transline Spring


Two Rivers June 26 '06
Transline Spring


Two Rivers June 26 '06
Transline 10.3 oz Spring

Two Rivers Control
Aug 7 ‘06

Species either missing or not flowering from spring trt. most evident.

Yellow Prairie Coneflower
Black-eyed Susan
Sunflowers

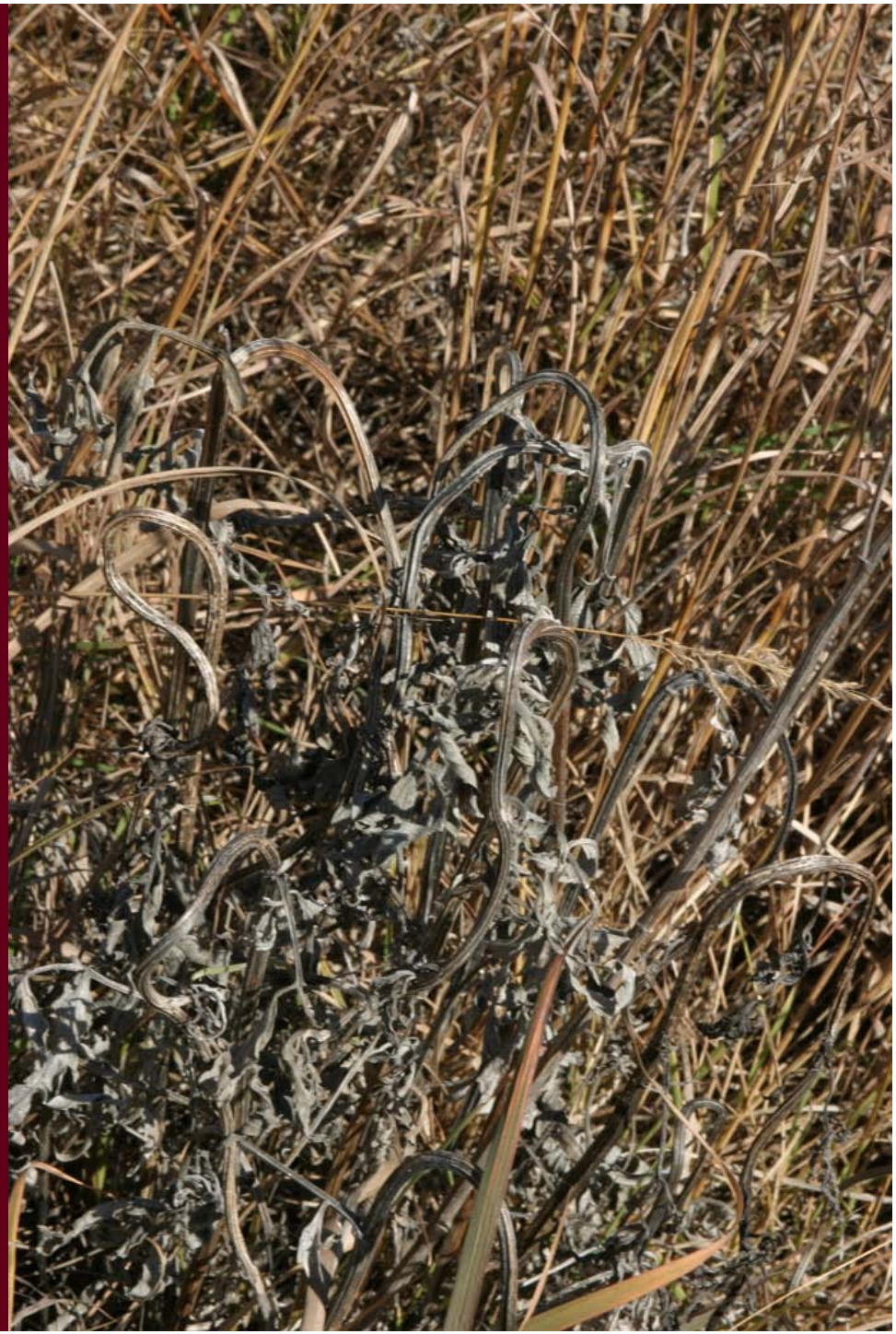

Two Rivers Control
Aug 7 ‘06
Black-eyed Susan
Max. Sunflower

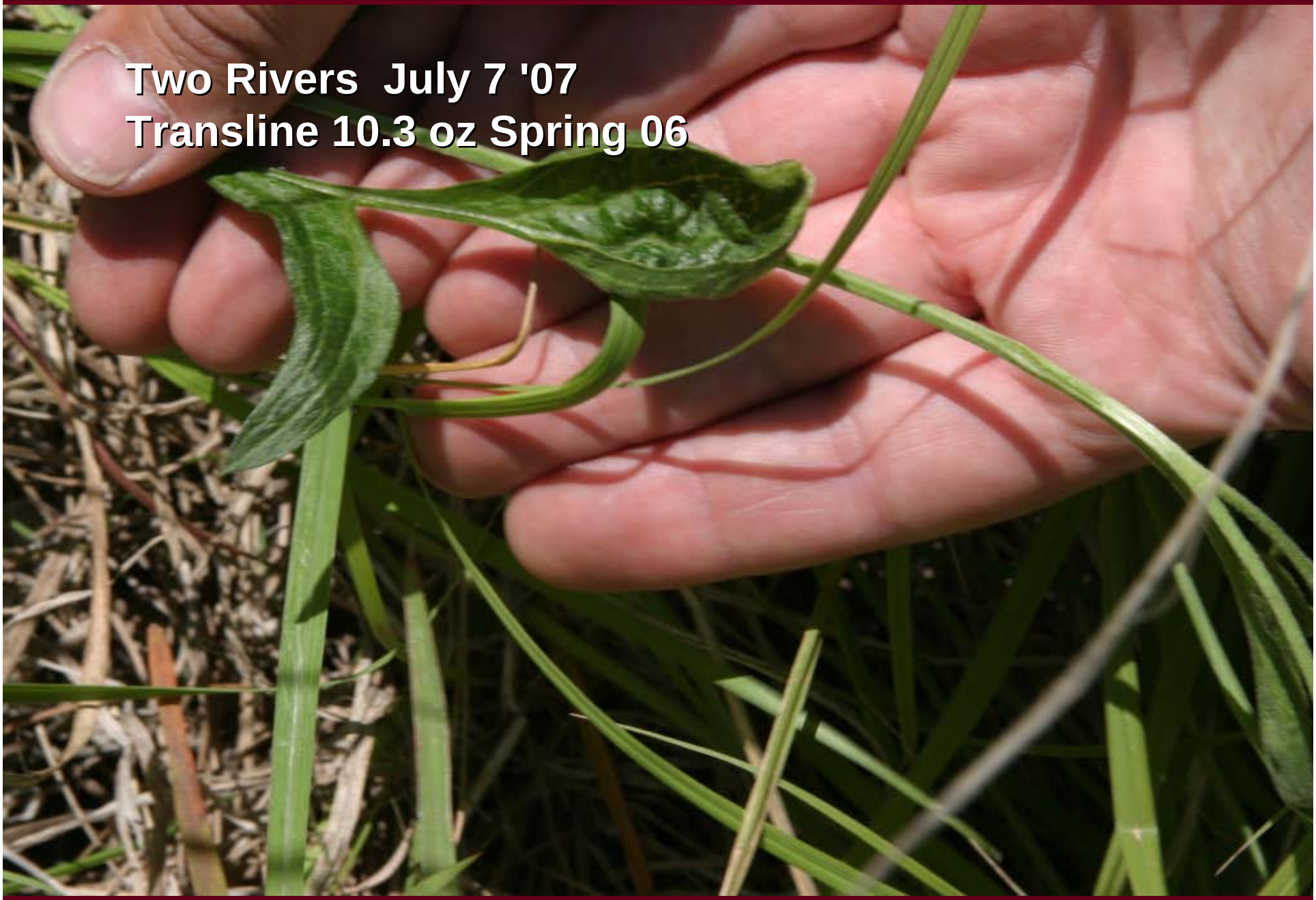

Two Rivers Control
Aug 7 ‘06
Sunflowers
False Sunflower (*Heliopsis*) damaged but not as much

Two Rivers Sept 5 '06
Milestone 5 oz Spring

Some Max. sunflowers survived but injured

Two Rivers Sept 5 '06
Milestone 5 oz Spring




Two Rivers July 7 '07
Transline 10.3 oz Spring 06


Hedquist June 19 '08
Transline Fall 06


Hedquist June 19 '08
Transline Fall 06

West Newton Sand Prairie
Kurt Brownell US Army Corp
Louanne Brooks, Dow AgroSciences


West Newton Project
July 16 '08
•Multiple Spring vs. Fall treatments
•Commerical sprayer, strips across field
• Milestone vs Transline and
T.M. of the two

West Newton Project, July 16 '08

Cow vetch, *Vicia cracca*
Hairy vetch, *Vicia villosa*

West Newton Project, July 16 '08

West Newton Project, July 16 '08

Round-headed Bush Clover, M + T (3 + 5 oz) Fall


Kufrin
WATERFOWL PRODUCTION AREA
U.S. Fish and Wildlife Service
Department of the Interior

June 25th, 2009. Heavy thistle pressure.

Fall trt. Sept. 25, 2009. Regrowth (larger) and remaining green shoot tips off orig. 09 shoot emergence (smaller).

June 29, 2010 Kufrin strip trial stage at application

Kufrin strip trial stage June 29, 2010 at application

Sept. 23, 2009. Sweet clover severe earlier intercepting spray in June trt. Blocked spray boom in Sept. trt.

Fall trt. applied 5 days before on Sept. 25, 2009.
C thistle shoots still with 30 to 45% green tissue.
Note apical areas of shoots / green tissue appear to suppress thistle regrowth shoot number vs. where sprayed or mowed in June


Kufrin
WATERFOWL PRODUCTION AREA
U.S. Fish and Wildlife Service
Department of the Interior

June 2, 2010 Kufrin WPA. Milestone 3 and 5 oz/A 1 YAT.

Transplanted Forb Tolerance Study

Sept 24, 2008 Trial Est. 2007

Transplanted Forb Tolerance Study

Lamberton, MN Est. 2007

Trt	Appl Timing	Product Rate/A	9.7.07 Cnts	5.27.08 Cnts	6.9.09 Cnts	6.9.09 % Inj
1	Summer	Milestone 3 oz	3.3	2.9	2.1	24.8
2	Summer	Milestone 5 oz	3.2	2.9	2.1	30.9
3	Summer	Transline 4 oz	3.1	2.8	2.4	16.2
4	Summer	Transline 10.6 oz	2.9	2.8	1.9	19.0
5	Summer	Milestone 3 oz+Transline 4 oz	2.7	2.9	2.0	38.7
6	Fall	Milestone 3 oz	3.3	3.2	2.0	34.6
7	Fall	Milestone 5 oz	3.2	3.1	1.9	38.3
8	Fall	Transline 4 oz	3.0	2.7	2.0	33.7
9	Fall	Transline 10.6 oz	2.7	2.7	2.0	40.8
10	Fall	Milestone 3 oz+Transline 4 oz	2.7	2.6	1.3	46.3
11	-	Untreated	3.0	3.0	2.5	14.4
	Avg Across Summer Apps		3.0	2.8	2.1	24.2
	Avg. Across Fall Apps		3.0	2.9	1.9	39.3
	Untreated 3-Rep Avg.		3.0	3.0	2.5	14.4

9.7.09 is fall the year of transplanting, 5.27.09 is spring after overwintered.
Herb applied Summer June 16 and Fall Sept. 16 2008. 6.9.09 is after overwintered after herbicide applied,

Lamberton MN — **July 13, 2010**

Forb Transplant Tolerance Study est. 2008 — **Avg Across 15 Forbs**

Timing	Rate	Counts (4 max)	% GR
Summer - Milestone n=6	3, 5 oz/ac	2.6	28.1
Fall - Milestone n=6	3, 5 oz/ac	2.1	44.8
Summer -Transline n=6	4, 10.6 fl oz/ac	2.8	20.3
Fall -Transline n=6	4, 10.6 fl oz/ac	2.9	22.3
Control n=3		2.9	0.0

- Cnts (Counts) 4 transplant species per plot planted one foot apart
- Inj (Injury) is % Growth Reduction and growth regulator deformitites

Minnesota Rankings for Native Forb Tolerance to Aminopyralid and Clopyralid Herbicides

This table reflect estimates of native forb tolerance to aminopyralid (Milestone VM™) and clopyralid (Transline®) based on field observations. Generally speaking, native forbs tolerated these herbicides better with spring applications compared to fall applications. If viable seed were present in the seedbank, neither herbicide prevented seedlings of susceptible species from establishing the growing season following herbicide application. These rankings reflect our experiences as of Fall 2008 and will be updated as more data becomes available.

T : Tolerant
M: Moderate tolerance
M-S: Moderate to Susceptible
S : Susceptible

Common Name	Aminopyralid	Clopyralid	Family	Genus	Species
Alexanders, Golden	T	T	Apiaceae	Zizia	aurea
Alexanders, Heart-leaved	T	T	Apiaceae	Zizia	aptera
Aster, Heath	M	M	Asteraceae	Aster	ericoides
Aster, Panicled	M	M	Asteraceae	Aster	lanceolatum
Aster, Smooth Blue	M	M	Asteraceae	Aster	laeve
Bergamot, Wild	T	T	Lamiaceae	Monarda	fistulosa
Blazingstar, Prairie	M	M	Asteraceae	Liatris	aspera
Cinquefoil, Prairie	S	T	Rosaceae	Potentila	arguta
Clover, Purple Prairie	M - S	M - S	Fabaceae	Dalea	purpurea
Clover, Round-headed Bush	M - S	M	Fabaceae	Lespedeza	capitata
Clover, Silky Prairie	M - S	M	Fabaceae	Petalostemum	villosum
Clover, White Prairie	M - S	M - S	Fabaceae	Dalea	candida
Coneflower, Yellow Prarire	S	S	Asteraceae	Ratibida	pinnata
Cup Plant	M	M	Asteraceae	Silphium	perfoliatum
Dewberry, C. (Rubus)	M	M	Rosaceae	Rubus	flagellaris
Dock, pale	S	M	Polygonaceae	Rumex	altissimus
Equisetum	T	T	Equisetaceae	Equisetum	arvense
Fleabane, Daisy	M	M	Asteraceae	Erigeron	strigosus
Goldenrod, Canadian	M	M	Asteraceae	Solidago	canadensis
Goldenrod, Giant	M	M	Asteraceae	Solidago	gigantea
Goldenrod, Stiff/Rigid	M	M	Asteraceae	Solidago	rigida
Groundcherry, clammy	S	M	Solanaceae	Physalis	heterophylla
Marestail (Conyza)	S	S	Asteraceae	Conyza	canadensis
Meadow Rue, Purple	T	T	Ranunculaceae	Thalictrum	pubescens
Milkweed, Common	M	T	Asclepiadaceae	Asclepias	syriaca
Nettle, Stinging	M	M	Urticaceae	Urtica	dioica
Onion, Prairie	T	T	Liliaceae	Allium	stellatum
Oxeye, Sweet Smooth	M	M	Asteraceae	Heliopsis	helianthoides
Primrose, Common	S	S	Onagraceae	Oenothera	biennis
Ragweed, Common	S	S	Asteraceae	Ambrosia	artemisiifolia
Ragweed, Western	S	S	Asteraceae	Ambrosia	coronopifolia
Rudbeckia, Black-Eyed Susan	S	S	Asteraceae	Rudbeckia	hirta
Spurge, Flowering	T	T	Euphorbacae	Euphorbia	corollata
Sage, White		T	Asteraceae	Artemisia	ludoviciana
Spiderwort, Prairie	M - S	M	Commelinaceae	Tradescantia	occidentalis
Sunflower, Maximilian's	S	S	Asteraceae	Helianthus	maximiliani
Sunflower, Prairie	S	S	Asteraceae	Helianthus	pauciflorus
Sunflower, Stiff/Sawtoothed	S	S	Asteraceae	Helianthus	grosseserratus
Sunflower, Tall	S	S	Asteraceae	Helianthus	giganteus
Tickfoil, Showy	M - S	M	Fabaceae	Desmodium	canadense
Trailing Wild Bean	T	T	Fabaceae	Strophostyles	helvola
Vervain, Blue	T	T	Verbenaceae	Verbena	hastata
Vervain, Hoary	T	T	Verbenaceae	Verbena	stricta
Wild Indigo, White	M	M	Fabaceae	Baptisia	alba
Yarrow, Common	M	T	Asteraceae	Achillea	millefolium

September 2008 R. Becker and M. Haar, University of Minnsota.

University of Minnesota Extension

Minnesota Rankings for Native Forb Tolerance to Aminopyralid and Clopyralid Herbicides

Key:

T = Tolerant: Minimal symptoms - may result in slight cupping but less than 15%. Occasionally may inhibit flowering.

M = Moderate tolerance: Symptoms include cupping, yellowing, and twisted stems. Often will inhibit flowering. Plants may be stunted. May reduce stand with recovery of surviving plants the first growing season after application.

M - S = Moderate to Susceptible Severity of response has been variable ranging from moderately tolerant to susceptible depending on environment, plant age, and site characteristics.

S = Susceptible: Injury greater than 75%. Injury can be severe. May kill established plants. Sensitive plants have been shown to reestablish from seedlings if an adequate seedbank is present as early as the first growing season after application.

Canada Thistle - Tolerance Conclusions

- Many native forbs tolerate Transline (clopyralid) or Milestone VM (aminopyralid) applied spring or fall
- Spray at timings to fit most limiting factor which may be labor, etc. - things other than tolerance
- Transline an edge on forb tolerance, Milestone an edge on Canada thistle efficacy

Canada Thistle - Tolerance Conclusions

- Flowering and seed production may be reduced or eliminated during the treatment season(s) for many forbs
- Notable exceptions - Helianthus, Rudbeckia, Ratibida are severely injured or killed
  - Seem to be re-establishing from the seed bank or from the few survivors

Put it in the bank

- If need to spray, spray when it works for you

- Many species survive
  - Will interrupt flowering so looks can be deceiving

- They will come back

Special thanks to:

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MnDOT: Bob Jacobson

Dow AgroSciences: Mary Halstvedt, Louanne Brooks