

Researched-based Restoration – Dynamic Reference Concept



2015



2016

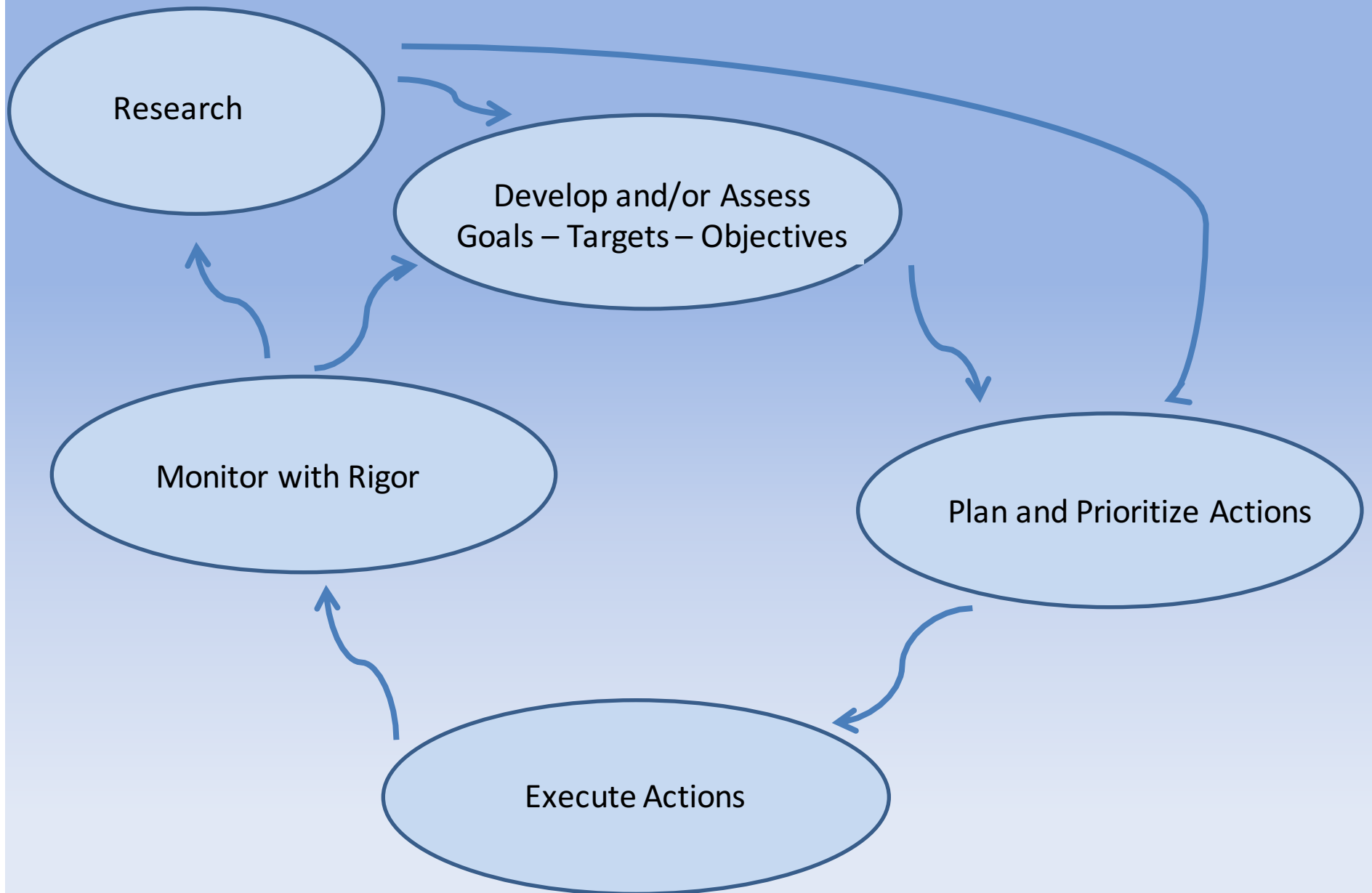


2017



Center for Natural Lands Management

Adaptive Management



Selecting & Measuring Targets

Challenges

- ❖ Landscapes are not static
 - ❖ Pre-settlement 'pristine' states do not exist
 - ❖ Animal population are also not static
 - ❖ Populations respond to available conditions



Responses

- Targets based on habitat criteria
 - not prior conditions
- Measure progress against a Reference Site
 - capture background influences

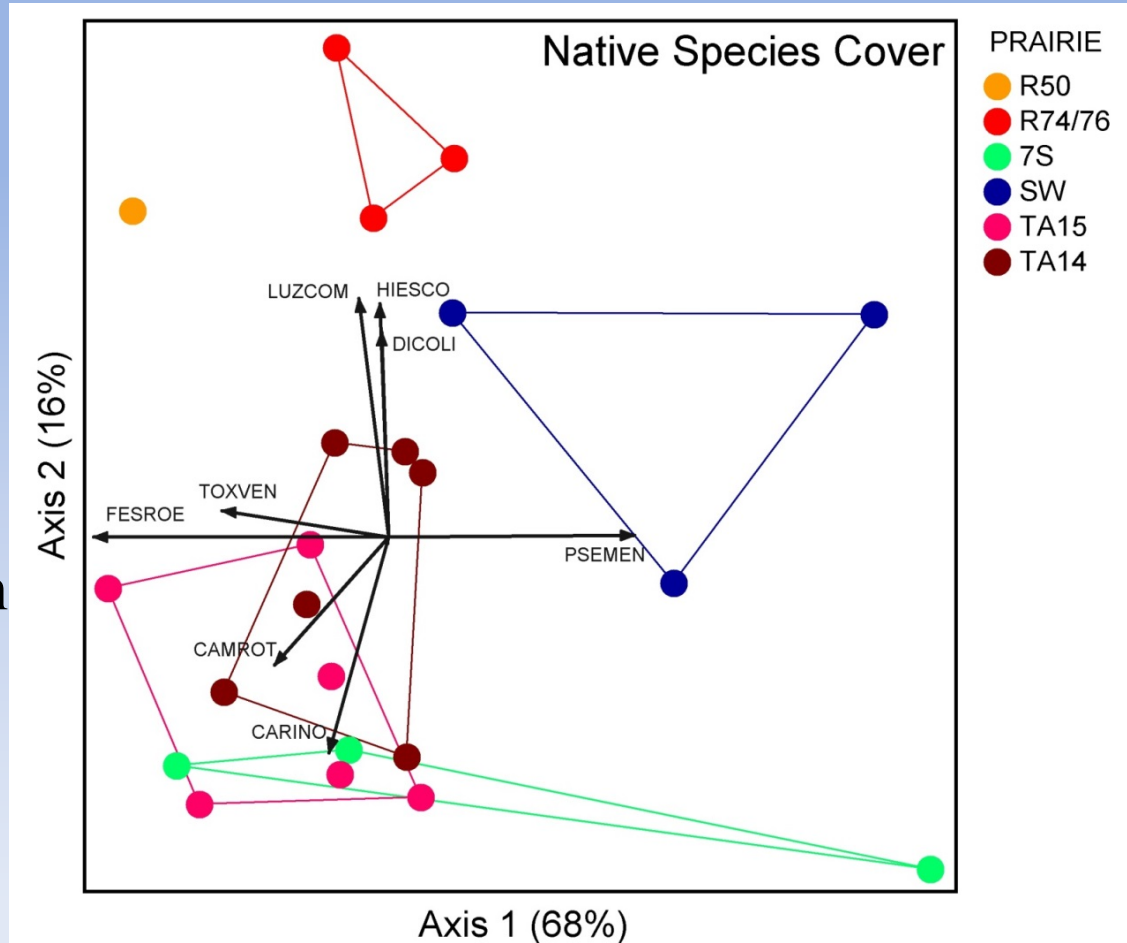
Dynamic Reference Site

- Accounts for temporal and *spatial* variation

- Not a True Control –
*Fire & Noxious Weed
Treatment Continue*

- Represents desired condition

- Adapted here to capture
short-term trends



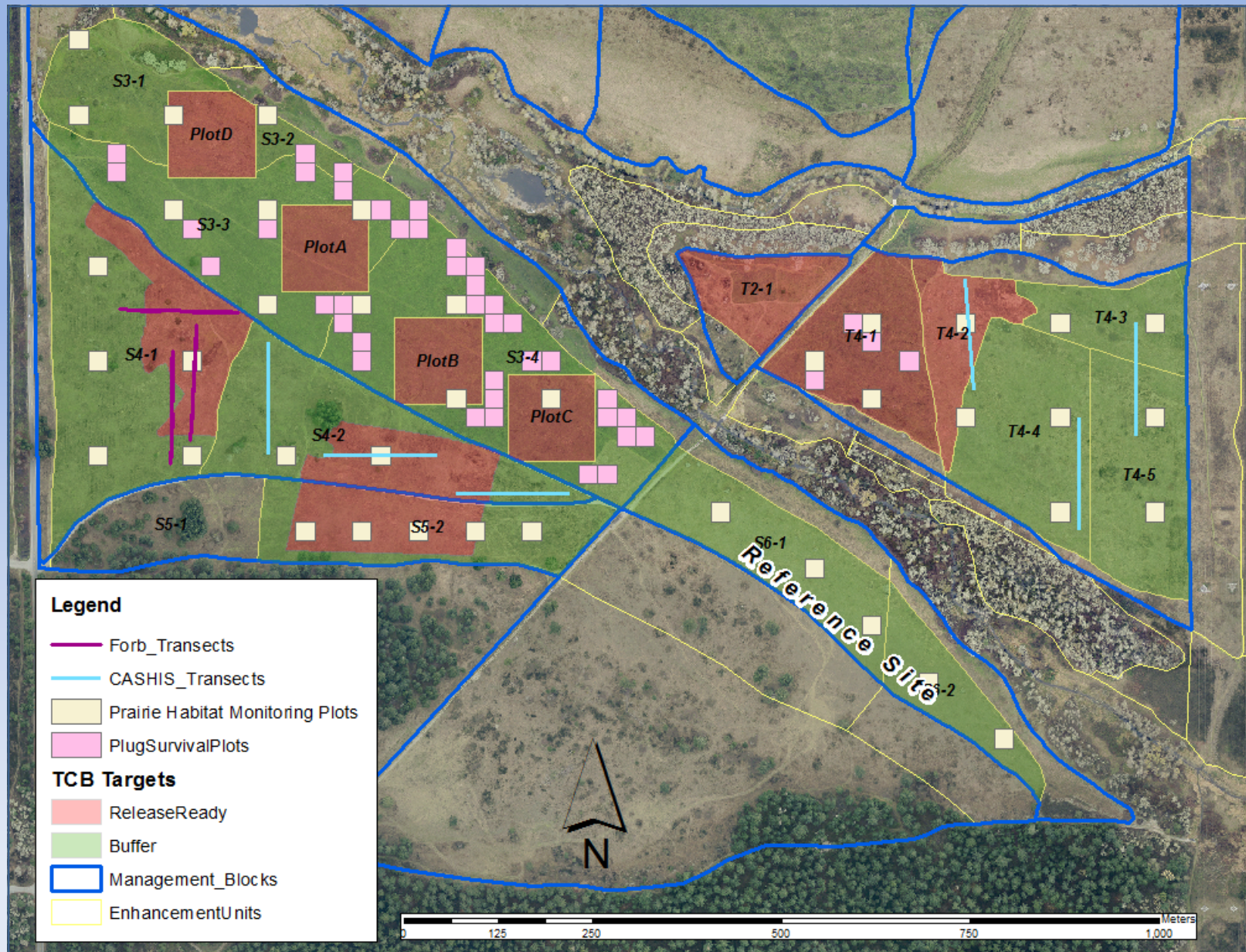
Habitat Enhancement Goals

Habitat	Percent Cover					Height (cm)	Other Habitat Components
	Tree	Shrub	Native Herb	Exotic Herb	Openness ¹		
Buffer	< 5	< 10	> 30	< 50	5 to 15	> 20	≥ 2 larval host and key nectar species present
Release Ready / Occupied	< 5	< 10	> 30	< 40	5 to 15	≥ 20	1) ≥ 2 larval host species abundantly distributed in patches (PLALAN: 10 individuals per m² in contiguous 4-m² area, CASHIS: 2 individuals per m² in contiguous 4-m² area). 2) Abundant presence of <u>Balsamorhiza deltoidea</u>, or other roosting structure vegetation. 3) Retain small shrub/tree patches.

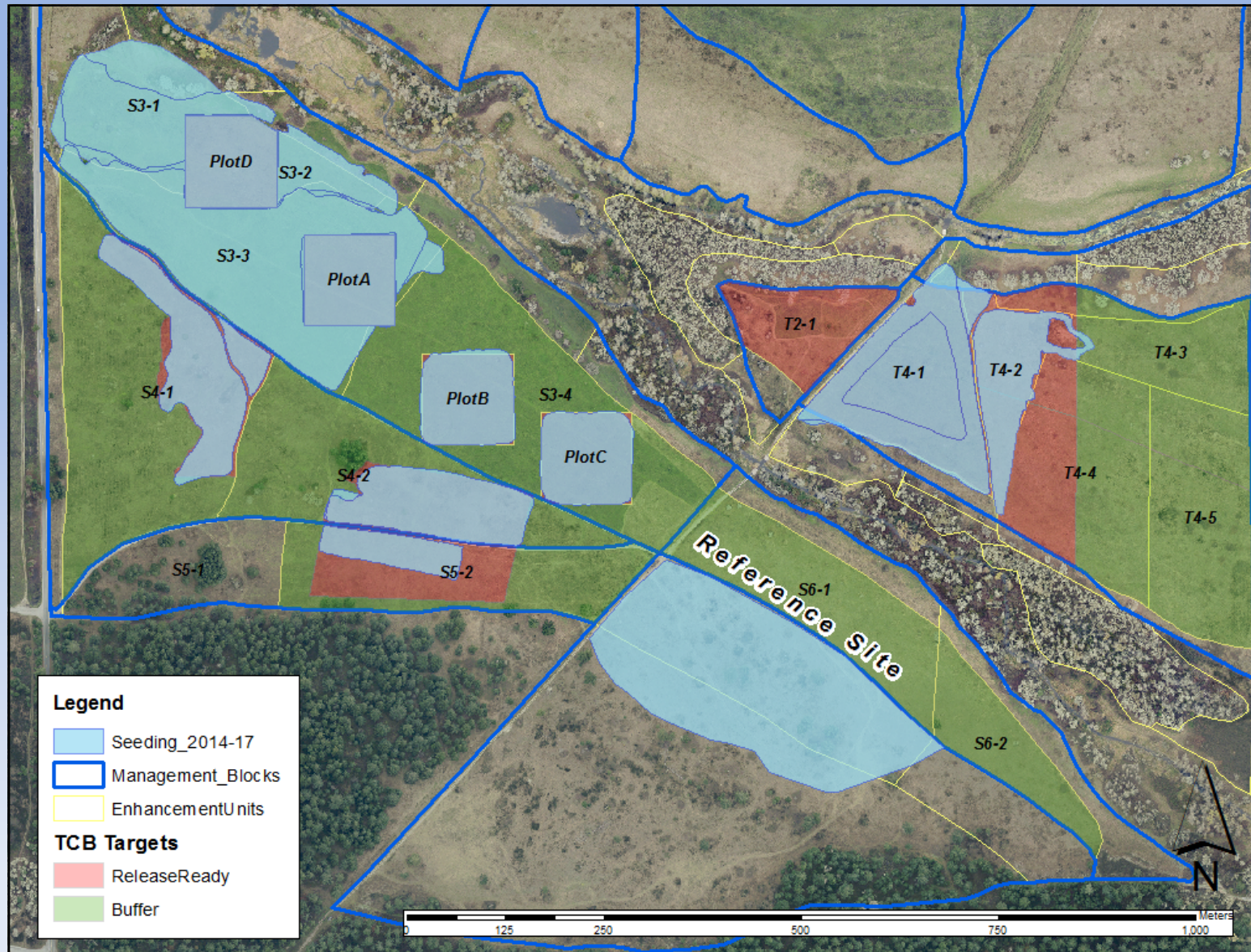
¹Non-vegetation openings with ground cover consisting of bare ground, litter, short-turf moss < 2 cm, or rock.

²Alpha richness defined as the mean number of native species within 25 m x 25 m monitoring cells.

Training Area 15



Seeding Efforts – 2014 to 2016



Site-specific Efforts

Pre-seeding Treatment

	EAf	EAG	EPF	EPG	EW	ExoticHerb
Actual-2017	0.4128	0.0116	0.3837	0.4012	0.0581	0.8488
Target	-	-	-	-	<0.1	<0.5
Prescription	✓	-	✓	✓	-	0.4000

Seeding Targets

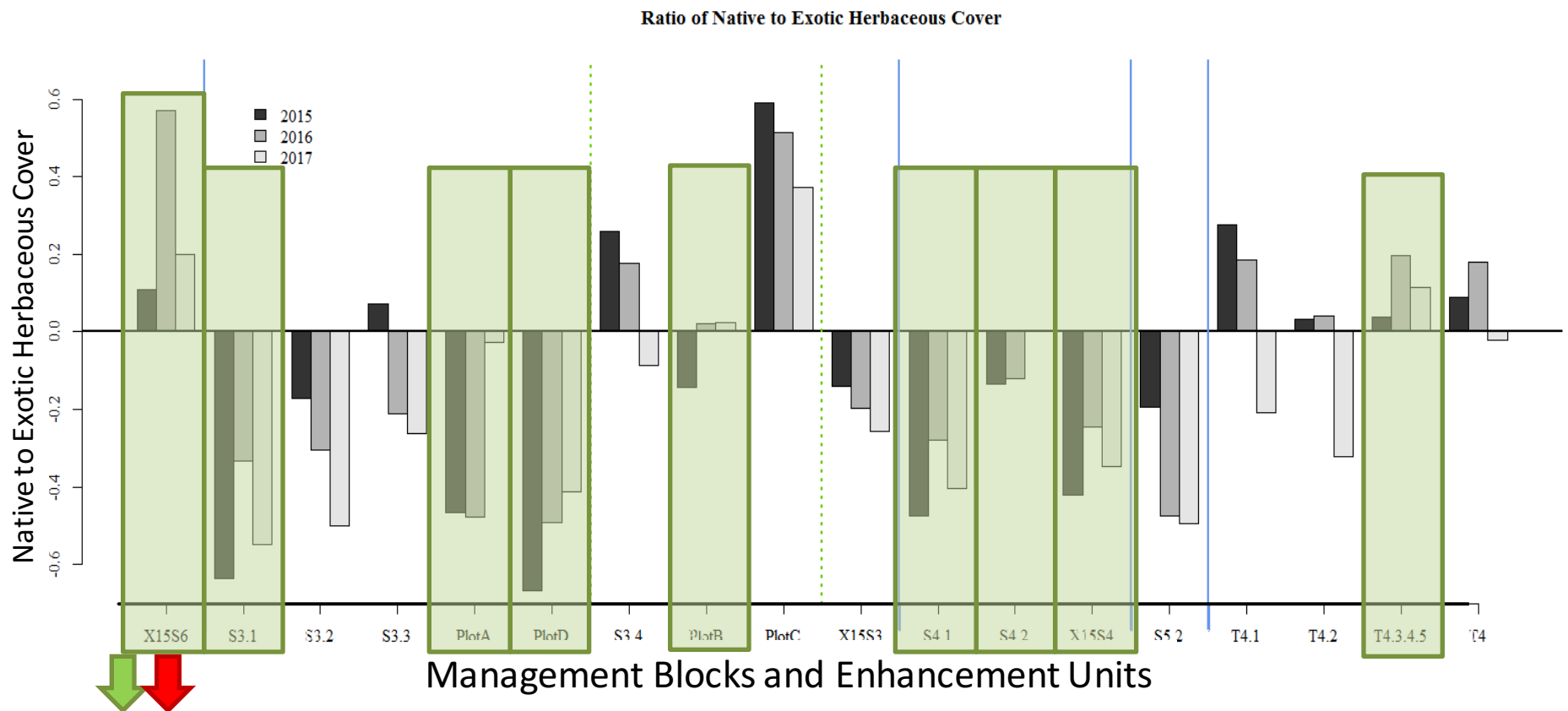
	NAF	NPF	NPG	NW	NativeHerb	Openess	α -Richness
Actual-2017	0.0698	0.0581	0.2849	0.0174	0.3837	0.0465	14.0000
Target					>0.3	0.05-0.15	20.0000
Prescription	0.2000	0.2000	0.1500		0.5500		6.0000

Site-specific Seed Mixes

Pounds of Seed Needed = (((((% cover target / % cover of one individual per m²) * 4046.86 m²) / establishment rate) / seeds per pound) / PLS) * target acres

Species	Pounds/ Acre	Total Pounds	Total Grams	Lot	Year Harvest	New Species	NAF_Cover	NPF_Cover	NPG_Cover
<i>Elymus glaucus</i>	0.83	5.64	2558.50	19727	2017	1	-	-	0.0250
<i>Festuca roemerii</i>	3.17	21.53	9765.30	BFI	2016	-	-	-	0.1545
<i>Collinsia grandiflora</i>	0.19	1.26	570.00	19793	2017	-	0.0645	-	-
<i>Collinsia grandiflora</i>	0.08	0.567029	257.20	3143	2016	-	0.0200	-	-
<i>Collinsia grandiflora/parviflora</i>	0.18	1.20	543.00	3138	2016	-	0.0038	-	-
<i>Collinsia parviflora</i>	0.19	1.26	570.00	19691	2017	-	0.0678	-	-
<i>Collinsia parviflora</i>	0.07	0.444011	201.40	3140	2016	-	0.0306	-	-
<i>Leptosiphon bicolor</i>	0.07	0.459444	208.40	3115	2016	1	0.0239	-	-
<i>Armeria maritima</i>	0.10	0.65	296.30	19638	2017	1	-	0.0400	-
<i>Armeria maritima</i>	0.06	0.41	185.20	NA	2016	-	-	0.0250	-
<i>Balsamorhiza deltoidea</i>	0.33	2.25	1021.00	19712	2017	-	-	0.0100	-
<i>Cerastium arvense</i>	0.06	0.41	184.00	3115	2016	-	-	0.0003	-
<i>Eriophyllum lanatum</i>	0.48	3.26	1479.00	3273	2016	-	-	0.0398	-
<i>Lithophragma parviflorum</i>	0.06	0.40	181.40	3116	2016	1	-	0.0000	-
<i>Lupinus albicaulis</i>	0.34	2.28	1033.50	19724	2017	-	-	0.0500	-
<i>Microseris laciniata</i>	0.02	0.14	65.20	3313	2016	-	-	0.0080	-
<i>Potentilla gracilis</i>	1.15	7.83	3549.49	3186	2015	-	-	0.0581	-
	7.35	49.98	22668.89			4	0.2106	0.2312	0.1795

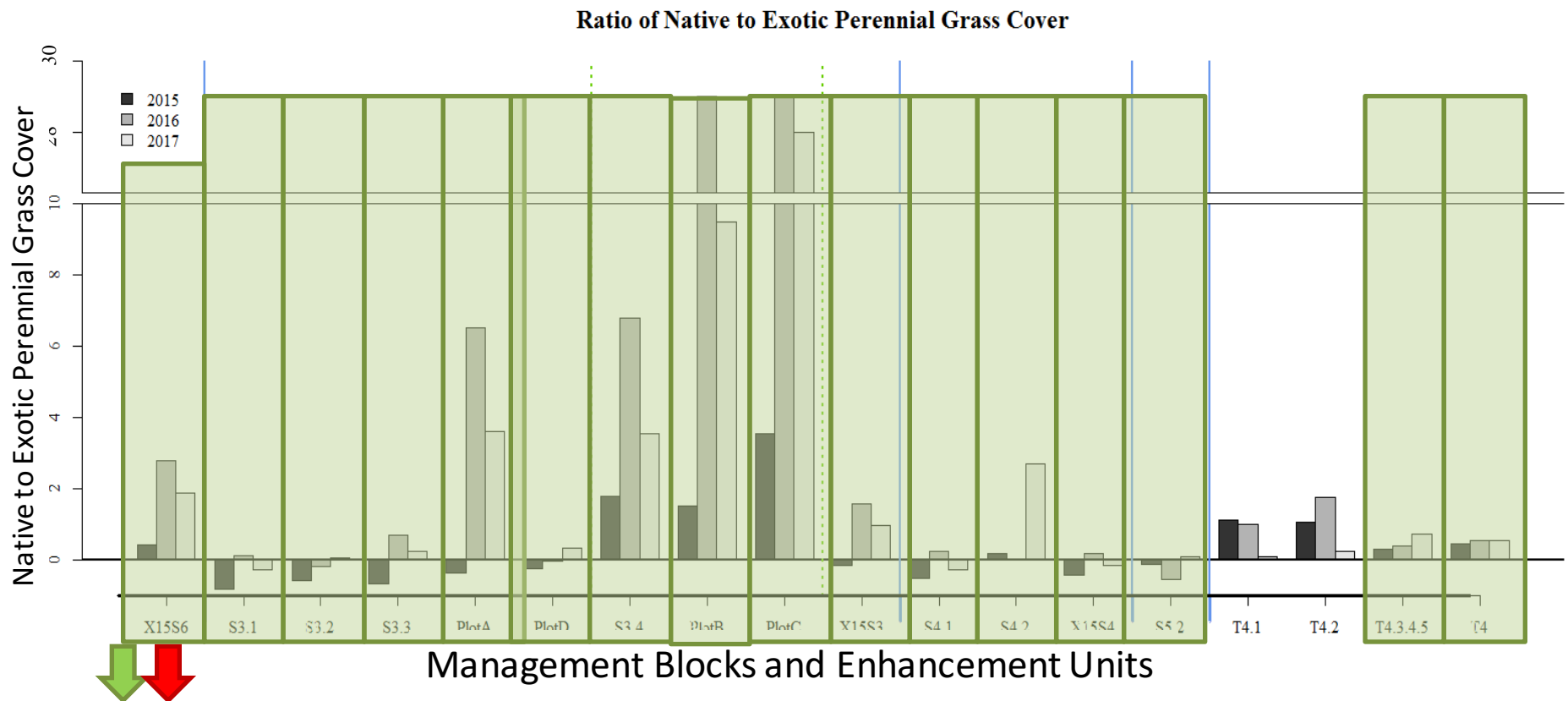
Ratio of Native to Exotic Herbaceous Cover



- Relative **Native** cover increasing
- Relative **Exotic** cover increasing

Relative native cover
INCREASED on 50% of units

Ratio of Native to Exotic Perennial Grass Cover

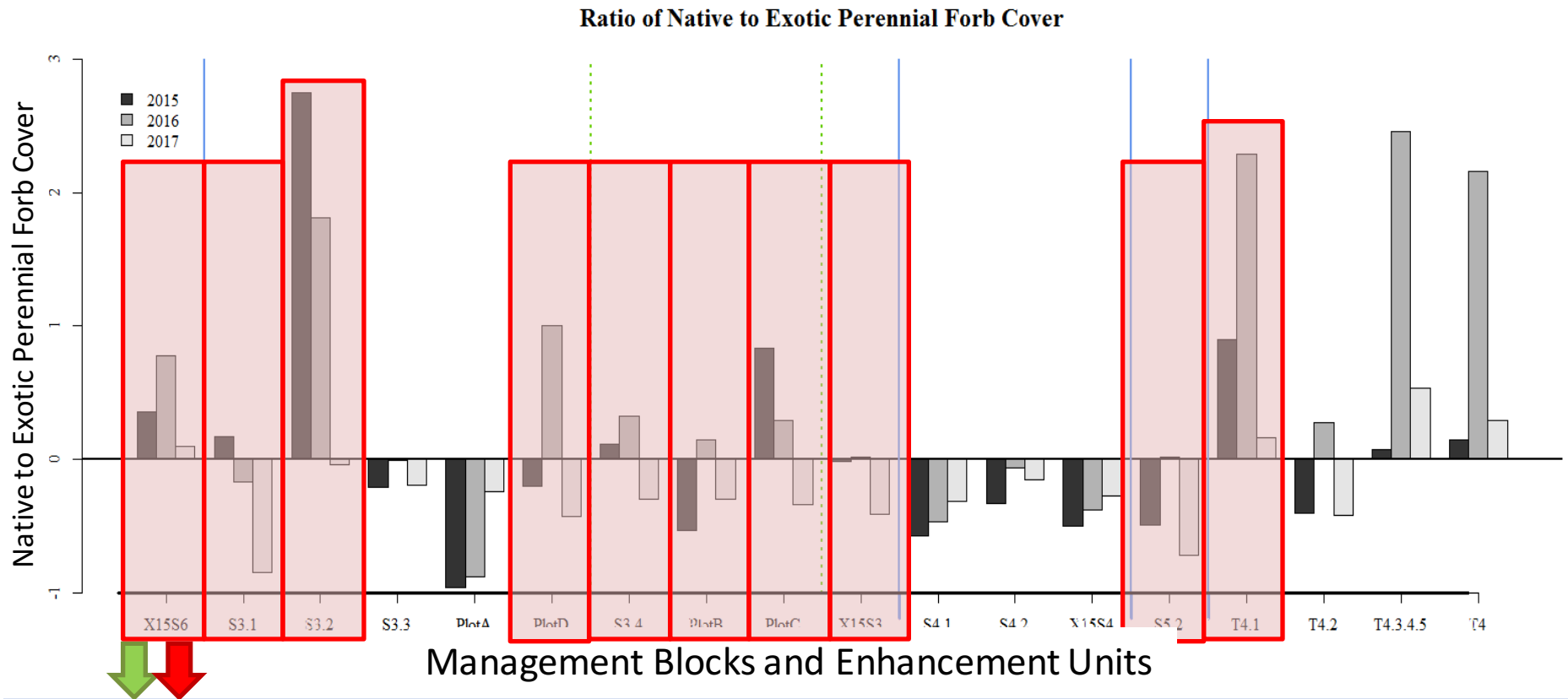


Relative **Native** cover increasing

Relative **Exotic** cover increasing

Relative native grass cover
INCREASED on 89% of units

Ratio of Native to Exotic **Perennial Forb** Cover



- Relative **Native** cover increasing
- Relative **Exotic** cover increasing

Relative native forb cover
DECREASED on 56% of units

Target Monitoring

Target ^α	Unit ^α	n ^α	$\bar{x}$ Percent Cover ^α					$\bar{x}$ Native Richness ^α	$\bar{x}$ Height (cm) ^α	Host ^{†α}		Nectar ^{†α}
			Tree ^α	Shrub ^α	Native Herb ^α	Exotic Herb ^α	Openness ^α			$\bar{x}$ Patches/Plot ^α	Species (n) ^α	
Release-ready ^α	Plot-A ^α	1 ^α	0.0 ^α	0.0 ^α	48.8 ^α	50.0 ^α	25.6 ^α	14 ^α	9 ^α	4 ^α	1 ^α	2 ^α
	Plot-B ^α	1 ^α	1.2 ^α	0.0 ^α	48.8 ^α	47.7 ^α	18.6 ^α	21 ^α	8 ^α	0 ^α	2 ^α	4 ^α
	Plot-C ^α	1 ^α	1.2 ^α	1.2 ^α	81.4 ^α	59.3 ^α	2.3 ^α	18 ^α	22 ^α	11 ^α	2 ^α	3 ^α
	Plot-D ^α	1 ^α	1.2 ^α	1.2 ^α	50.0 ^α	84.9 ^α	1.2 ^α	15 ^α	14 ^α	1 ^α	3 ^α	2 ^α
	S4-1 ^α	1 ^α	0.0 ^α	5.8 ^α	48.8 ^α	66.3 ^α	14.0 ^α	31 ^α	16 ^α	6 ^α	2 ^α	7 ^α
	S4-2 ^α	1 ^α	0.0 ^α	2.3 ^α	66.3 ^α	66.3 ^α	8.1 ^α	31 ^α	11 ^α	19 ^α	4 ^α	8 ^α
	S5-2 ^α	4 ^α	0.9 ^α	2.6 ^α	40.4 ^α	76.5 ^α	14.0 ^α	20 ^α	10 ^α	12.8 ^α	2 ^α	4 ^α
	T4-1 ^α	3 ^α	0.0 ^α	2.3 ^α	60.9 ^α	76.7 ^α	5.4 ^α	25 ^α	23 ^α	36.3 ^α	3 ^α	5 ^α
	T4-2 ^α	1 ^α	0.0 ^α	1.2 ^α	64.0 ^α	94.2 ^α	1.2 ^α	22 ^α	19 ^α	6 ^α	2 ^α	3 ^α
Buffer ^α	S3-1 ^α	2 ^α	0.0 ^α	2.9 ^α	38.4 ^α	84.9 ^α	4.7 ^α	14 ^α	22 ^α	2.0 ^α	3 ^α	2 ^α
	S3-2 ^α	1 ^α	0.0 ^α	4.7 ^α	43.0 ^α	86.1 ^α	4.7 ^α	16 ^α	19 ^α	0 ^α	3 ^α	4 ^α
	S3-3 ^α	3 ^α	0.0 ^α	2.3 ^α	47.7 ^α	64.7 ^α	12.0 ^α	22 ^α	10 ^α	8.3 ^α	3 ^α	5 ^α
	S3-4 ^α	2 ^α	0.0 ^α	0.0 ^α	61.6 ^α	67.4 ^α	7.0 ^α	22 ^α	16 ^α	0.5 ^α	2 ^α	5 ^α
	S4-1 ^α	4 ^α	0.3 ^α	8.7 ^α	48.0 ^α	84.3 ^α	2.9 ^α	23 ^α	24 ^α	6.0 ^α	1 ^α	4 ^α
	S4-2 ^α	1 ^α	- ^α	- ^α	- ^α	- ^α	- ^α	- ^α	- ^α	- ^α	- ^α	- ^α
	S5-2 ^α	1 ^α	0.0 ^α	25.6 ^α	38.4 ^α	90.7 ^α	3.5 ^α	21 ^α	19 ^α	3 ^α	1 ^α	3 ^α
	S6-1&2 ^α	5 ^α	0.0 ^α	10.2 ^α	70.0 ^α	58.4 ^α	3.5 ^α	23 ^α	29 ^α	4.8 ^α	2 ^α	3 ^α
	T4-3 ^α	3 ^α	0.0 ^α	1.2 ^α	80.2 ^α	90.3 ^α	0.0 ^α	19 ^α	24 ^α	0.3 ^α	1 ^α	4 ^α
	T4-4 ^α	1 ^α	0.0 ^α	5.8 ^α	94.2 ^α	59.3 ^α	2.3 ^α	24 ^α	33 ^α	2 ^α	1 ^α	6 ^α
	T4-5 ^α	3 ^α	0.0 ^α	2.3 ^α	81.0 ^α	62.8 ^α	0.8 ^α	21 ^α	25 ^α	11.0 ^α	1 ^α	6 ^α

[†] Patches consist of *Plantago lanceolata* at 10 individuals per m² in a contiguous 4-m² area or *Castilleja hispida* at 2 individuals per m² in a contiguous 4-m² area; Species consist of the presence of *Plantago lanceolata*, *Castilleja hispida*, *Plectritis congesta*, or *Collinsia parviflora*.

Conclusions

- Success with converting Exotic Perennial Grass cover
At least when there is general decline of exotic grass cover
- Controlling Exotic Perennial Forbs while increasing natives remains a challenge
 - Especially when natives are decreasing*
 - Slow maturity, low germination rates, and scarcity of native forb seed*
- Sown Native Annuals persist
At least where sown at “high” rates



Adjusting Tactics

Adjust Seeding Rates

- Continue to tailor seeding rates and seed mixes

Targeted forb seeding

- Adjust seeding rates and micro-site sowing locations
- Focus on species we can grow

Plug Augmentation

- Enhance plug plantings based on known survival
- Limited out-planting in favor of seeding

Adjusting Targets

- Animal Response to Guide Future Targets

 - Taylor's Checkerspot translocated in March 2018*

 - Synthesize data from all monitoring projects*



THANK YOU!



Field Biologists

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-Kathryn Hill, CNLM

-All of Our Seasonal Technicians & AmeriCorps