Ecology and Management of Invasive Weeds: prioritizing weed management

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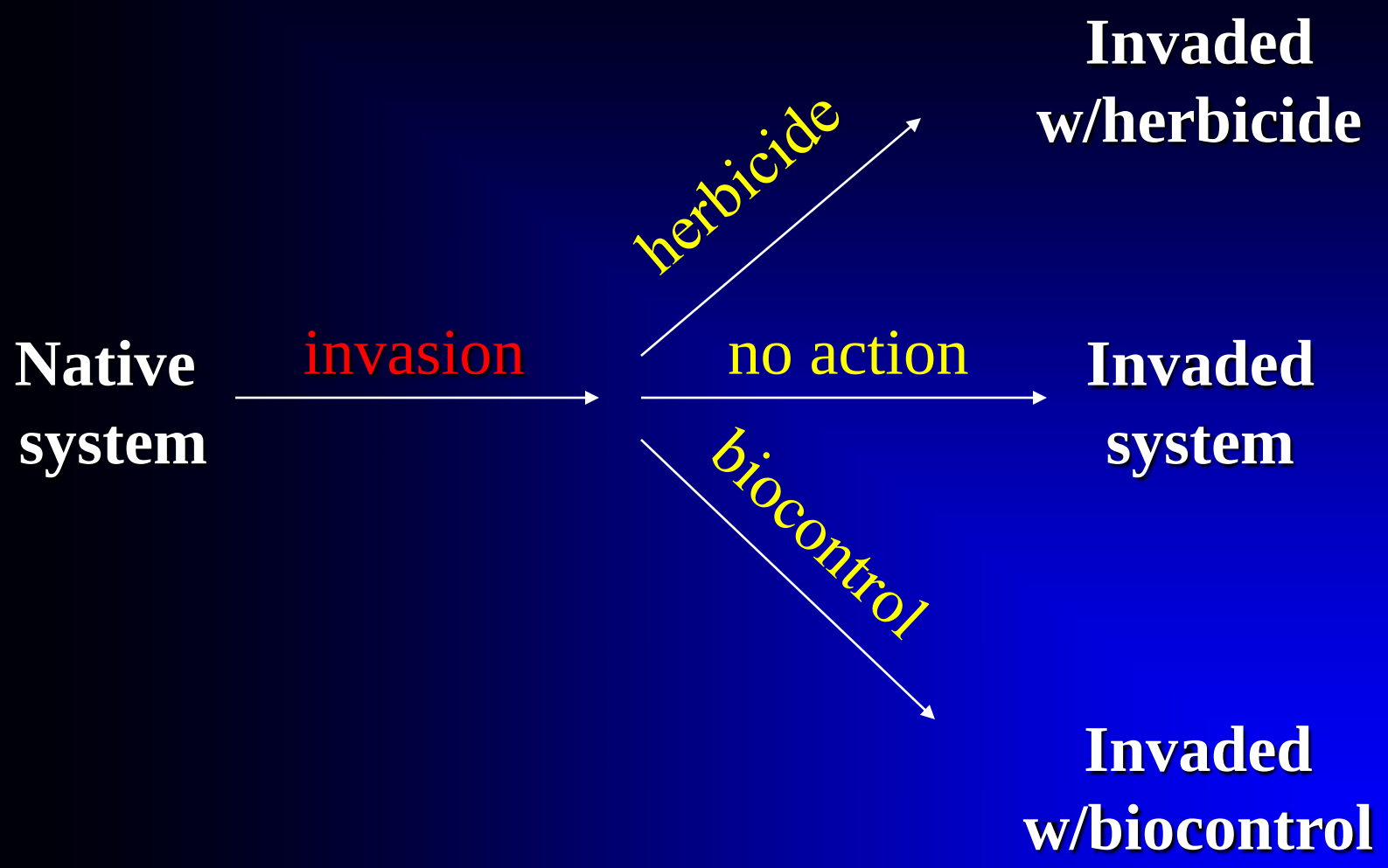
A conceptual framework

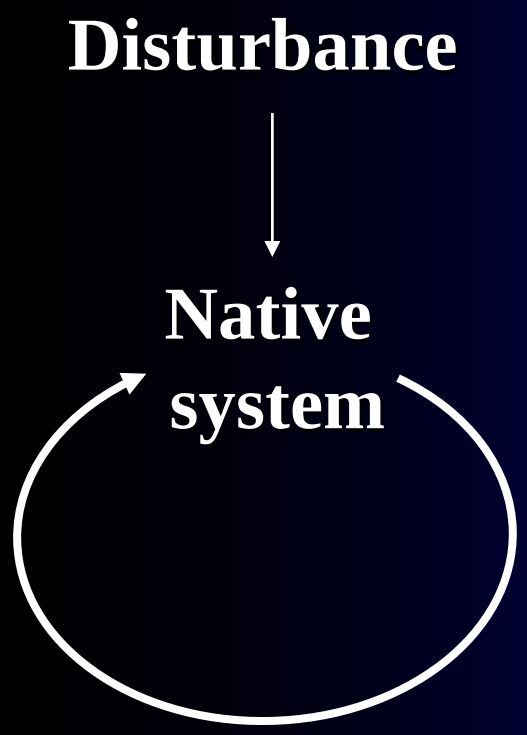


Native system

Disturbance

↓

Native system


Disturbance
Native
system

Invasion

↓

Native system

Invasion

↓

Native system → **Invaded system**

Invasion

↓

Native system → → **Invaded system**

We’re not in Kansas anymore, Todo!!
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Invasion

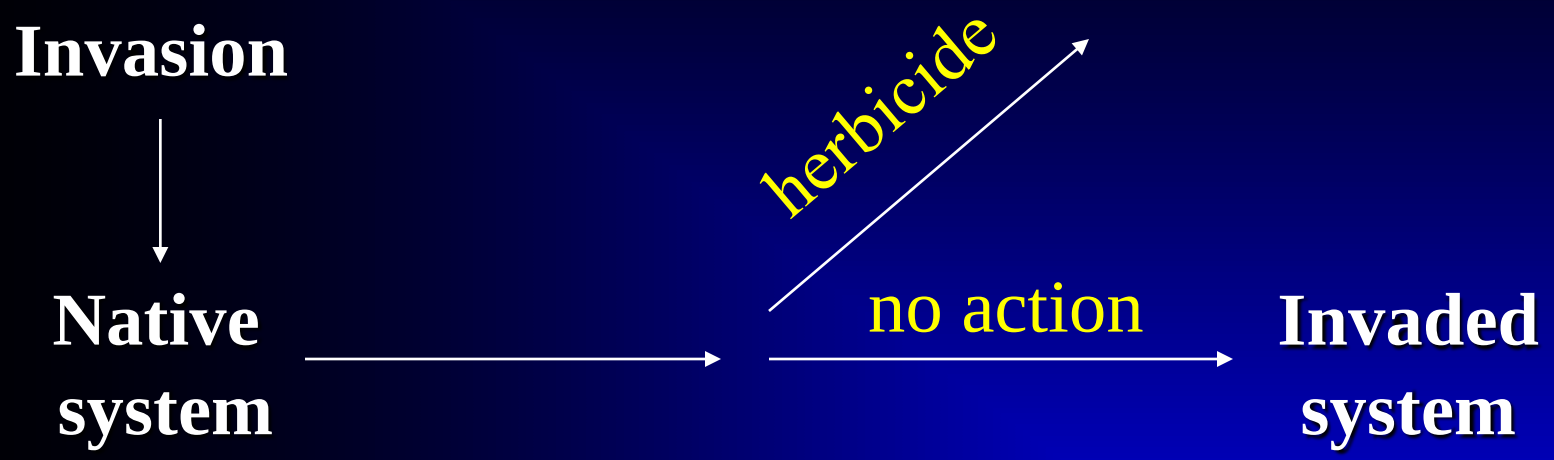
↓

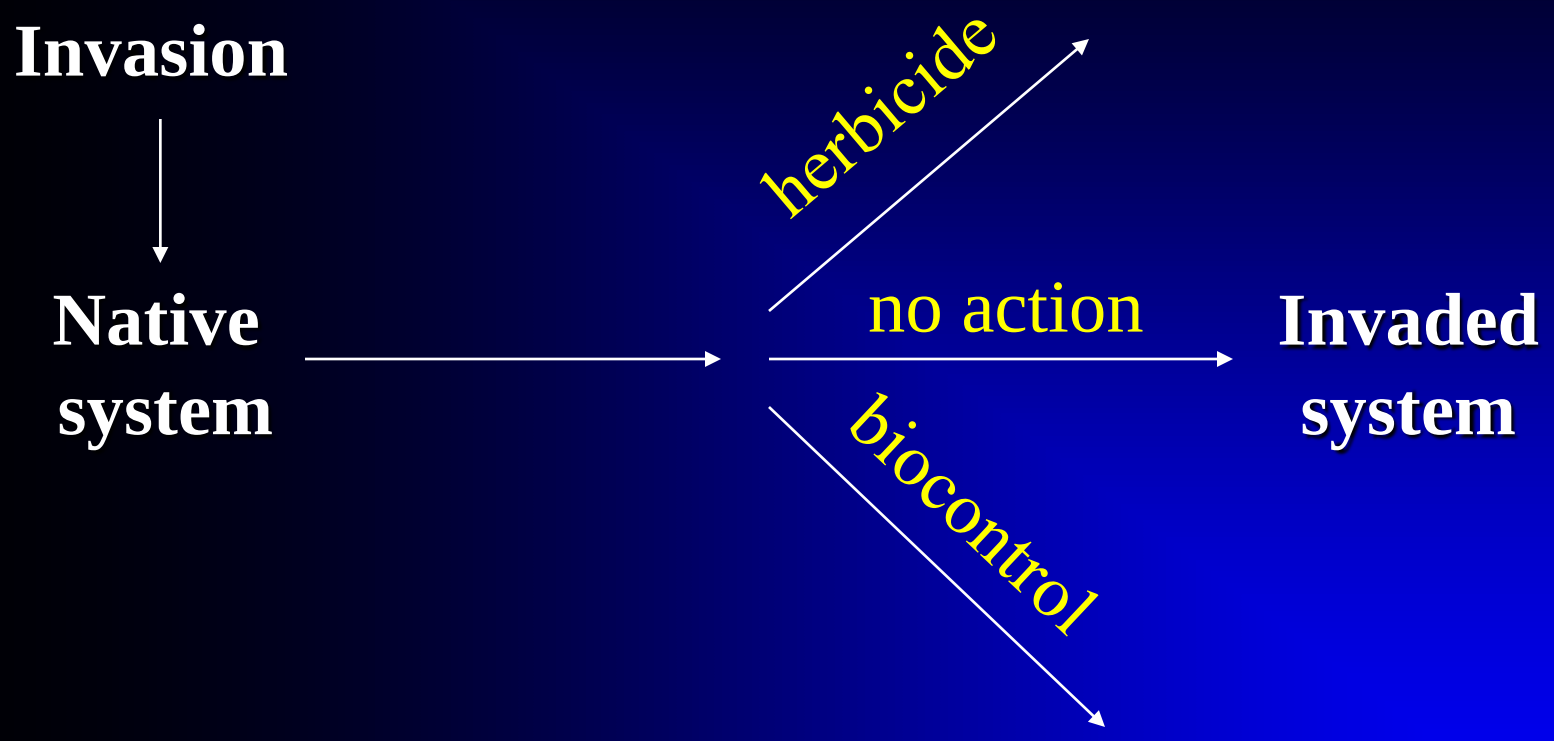
Native system → → **Invaded system**

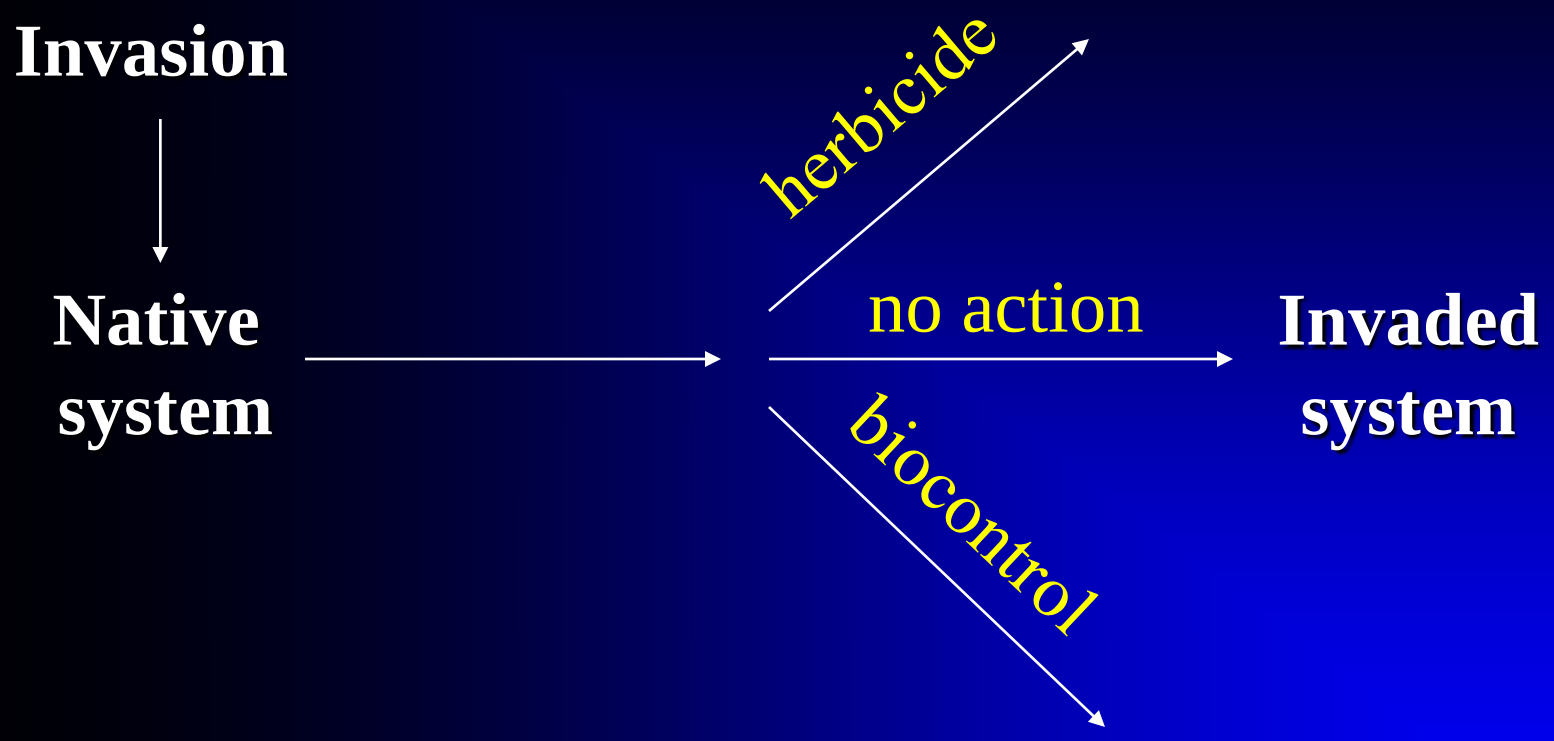
Invasion

↓

Native system → no action → **Invaded system**


Invasion
Native system
herbicide
no action
Invaded system


Invasion
Native system
herbicide
no action
biocontrol
Invaded system


Invasion
Native system
herbicide
no action
biocontrol
Invaded system

Climate change

Native system

invasion

no action

herbicide

biocontrol

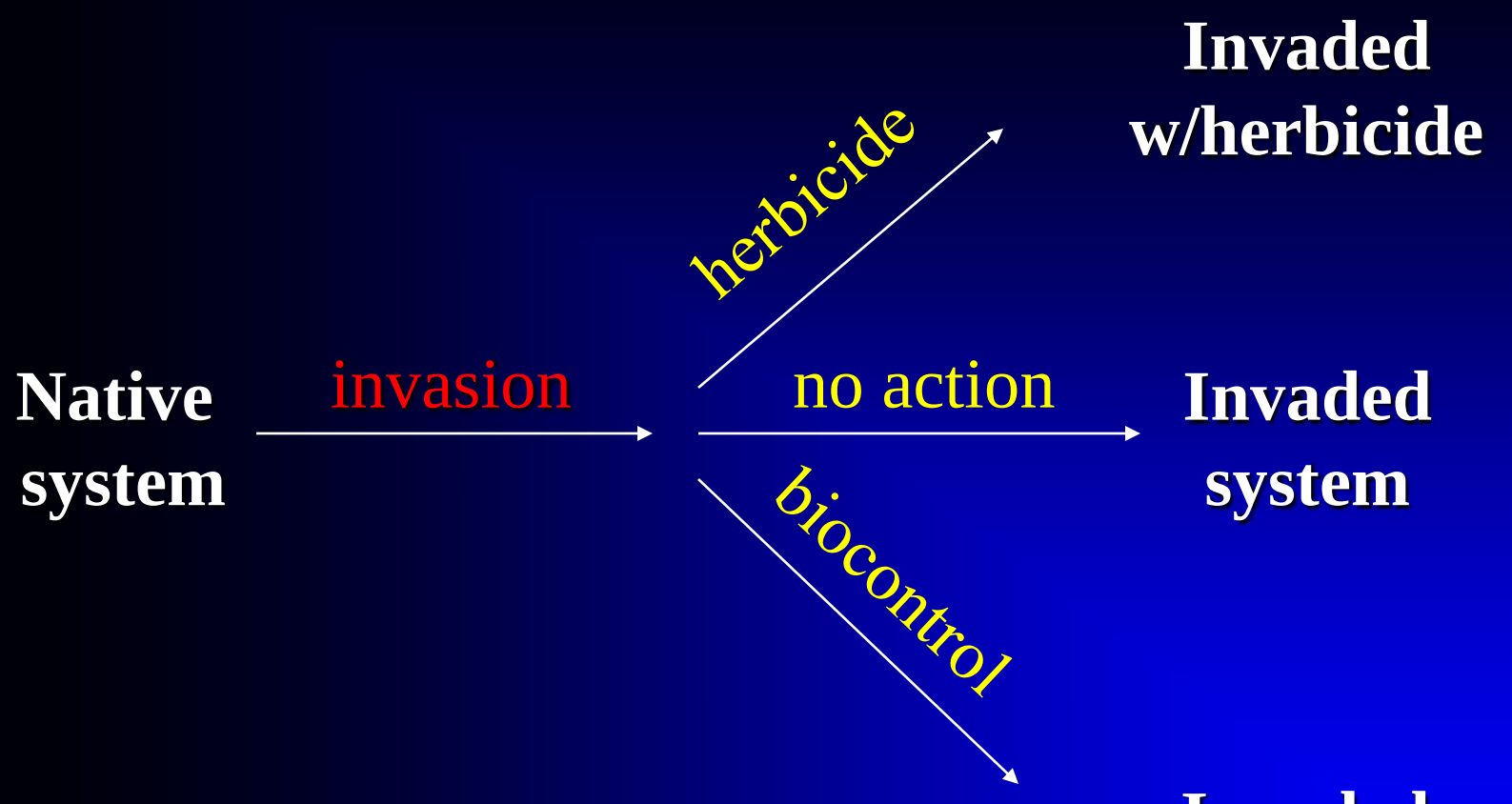
Invaded w/herbicide

Invaded system

Invaded w/biocontrol

Eutrophication

Disturbance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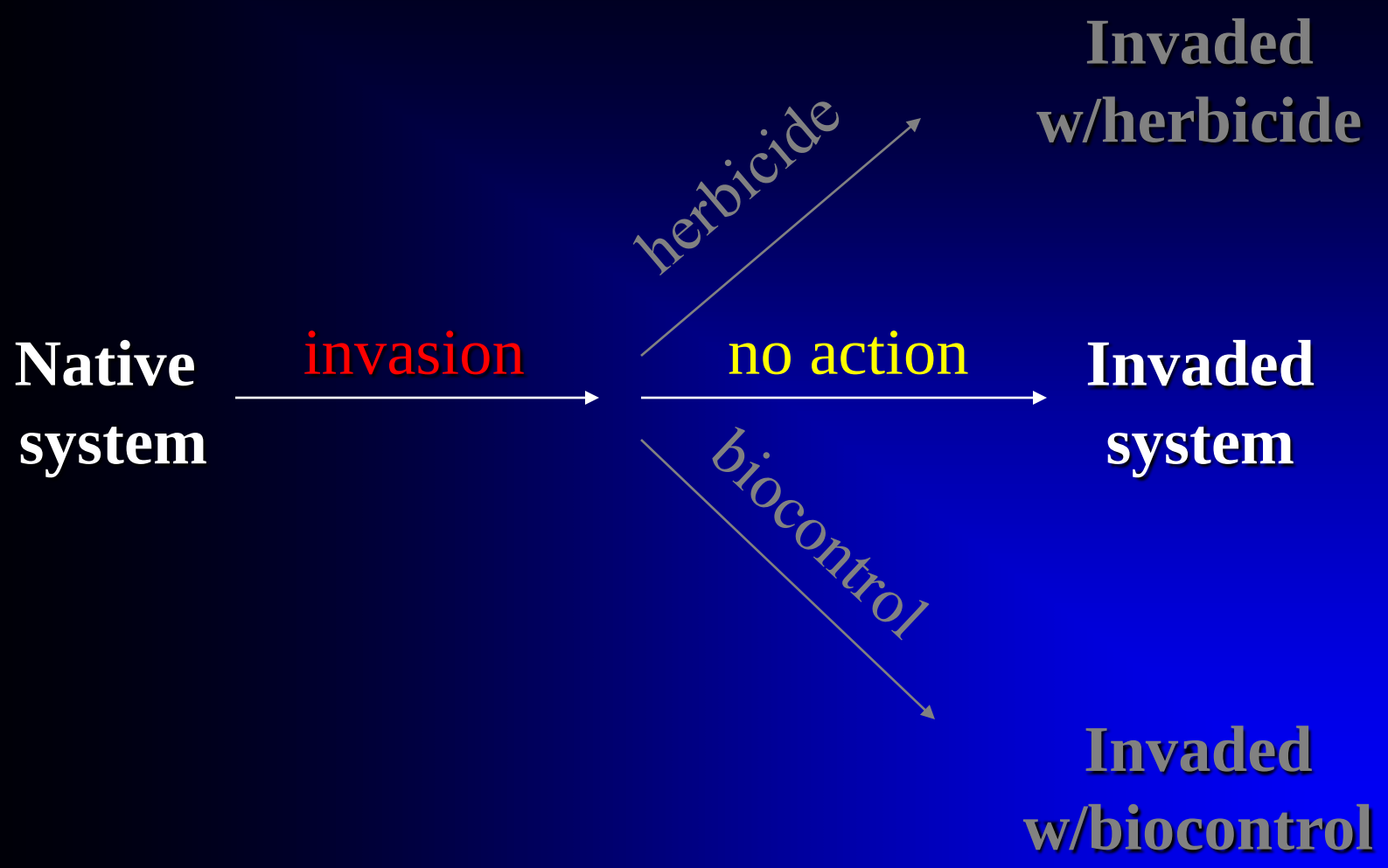
Invaded system
Invaded w/biocontrol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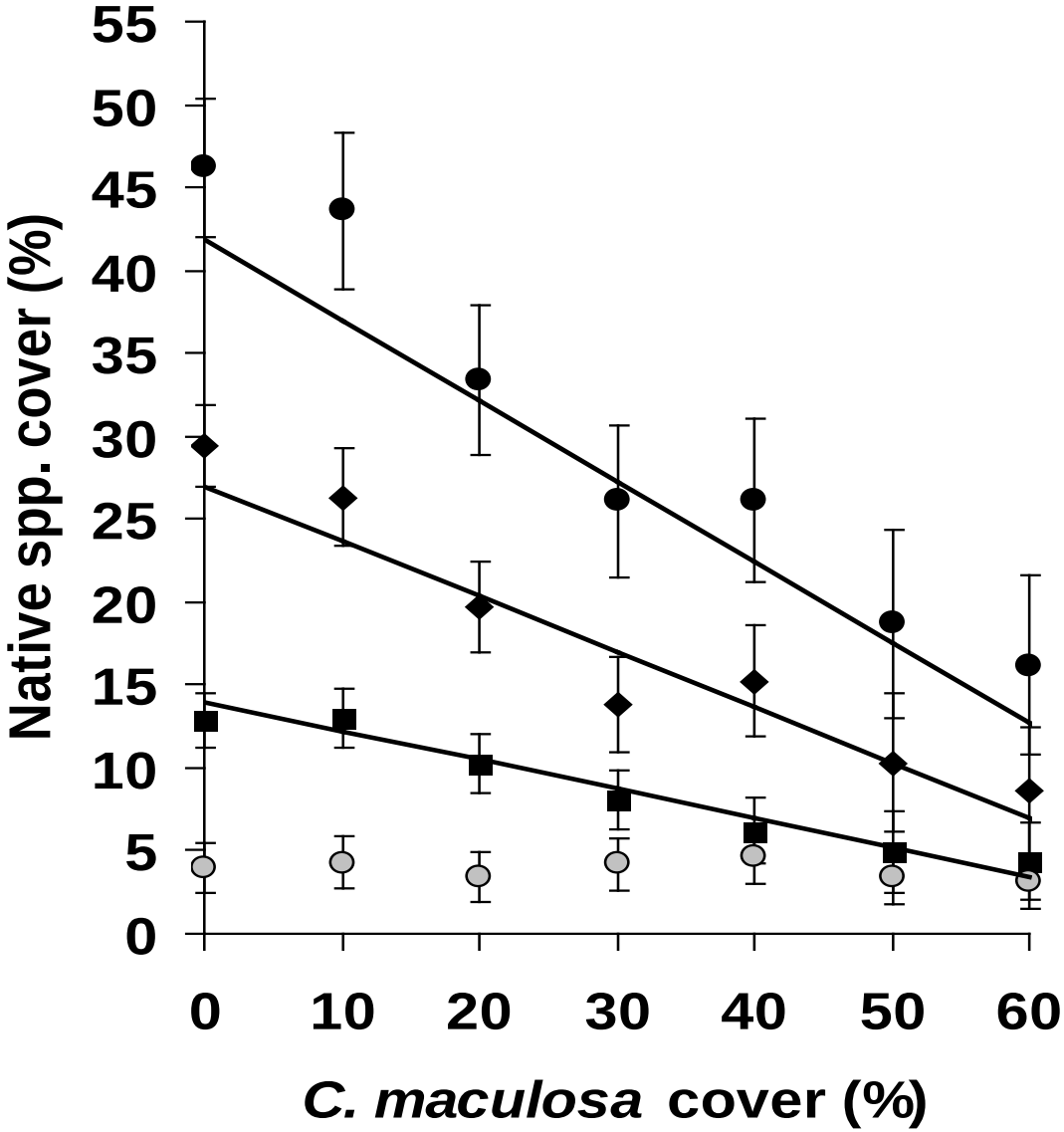


All species
Perennial forbs
Perennial grasses
Annual forbs

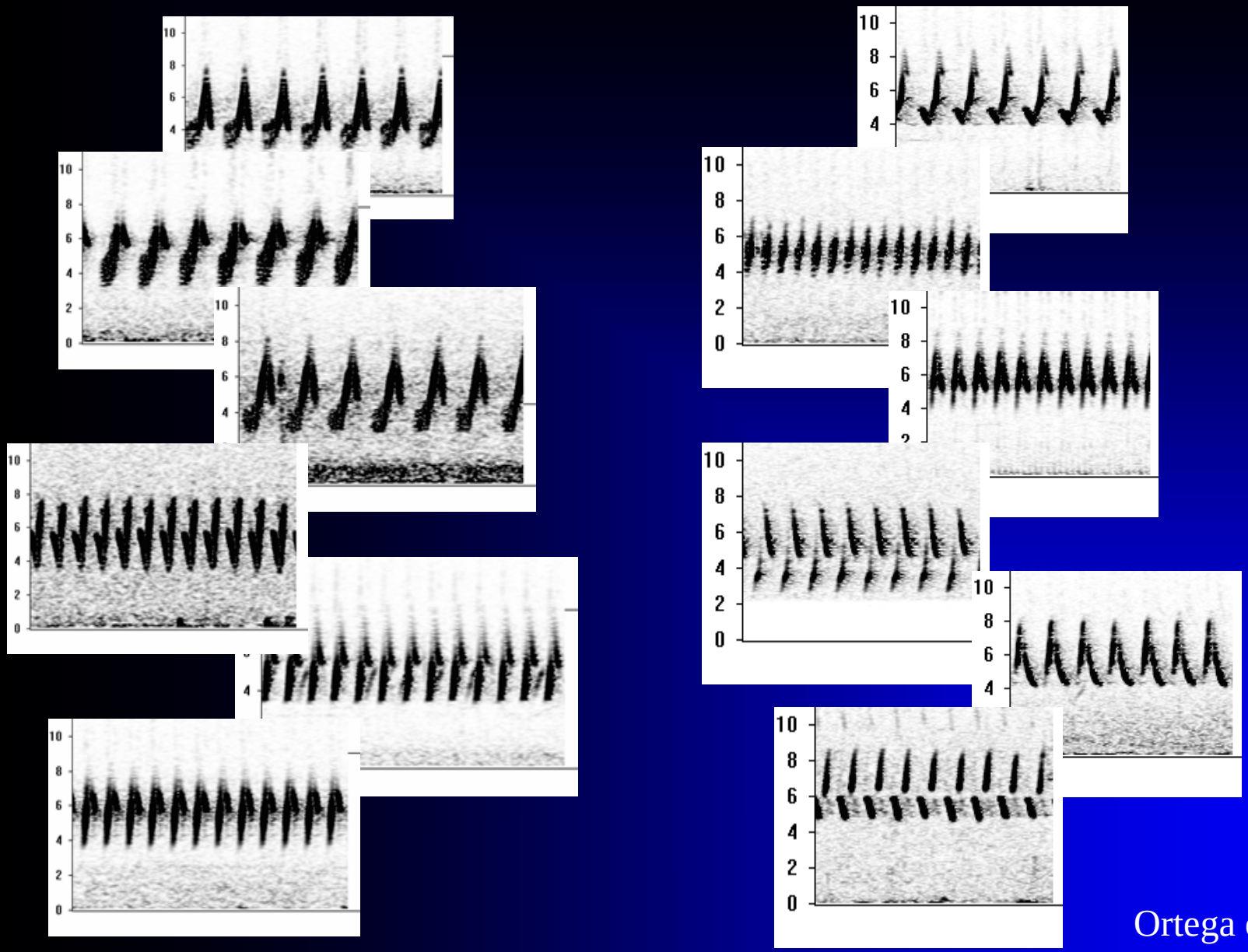
Ortega and Pearson 2005

Thompson 2005

- Reduced nest success
- Disruption of singing

Ortega et al. 2006, 2014

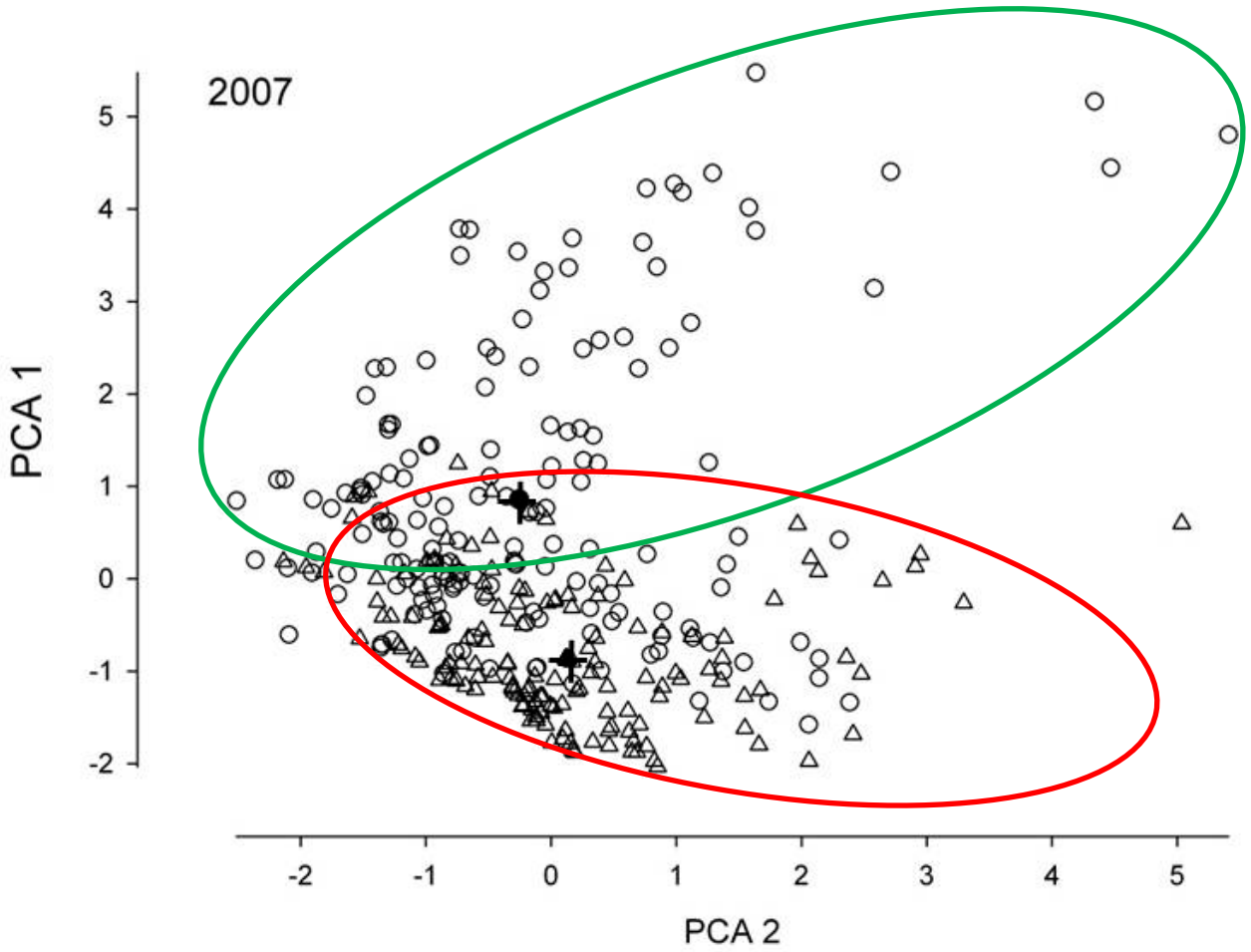
Song Structure at Native vs. Invaded Sites



Ortega et al. 2014

- Reduced nest success
- Disruption of singing

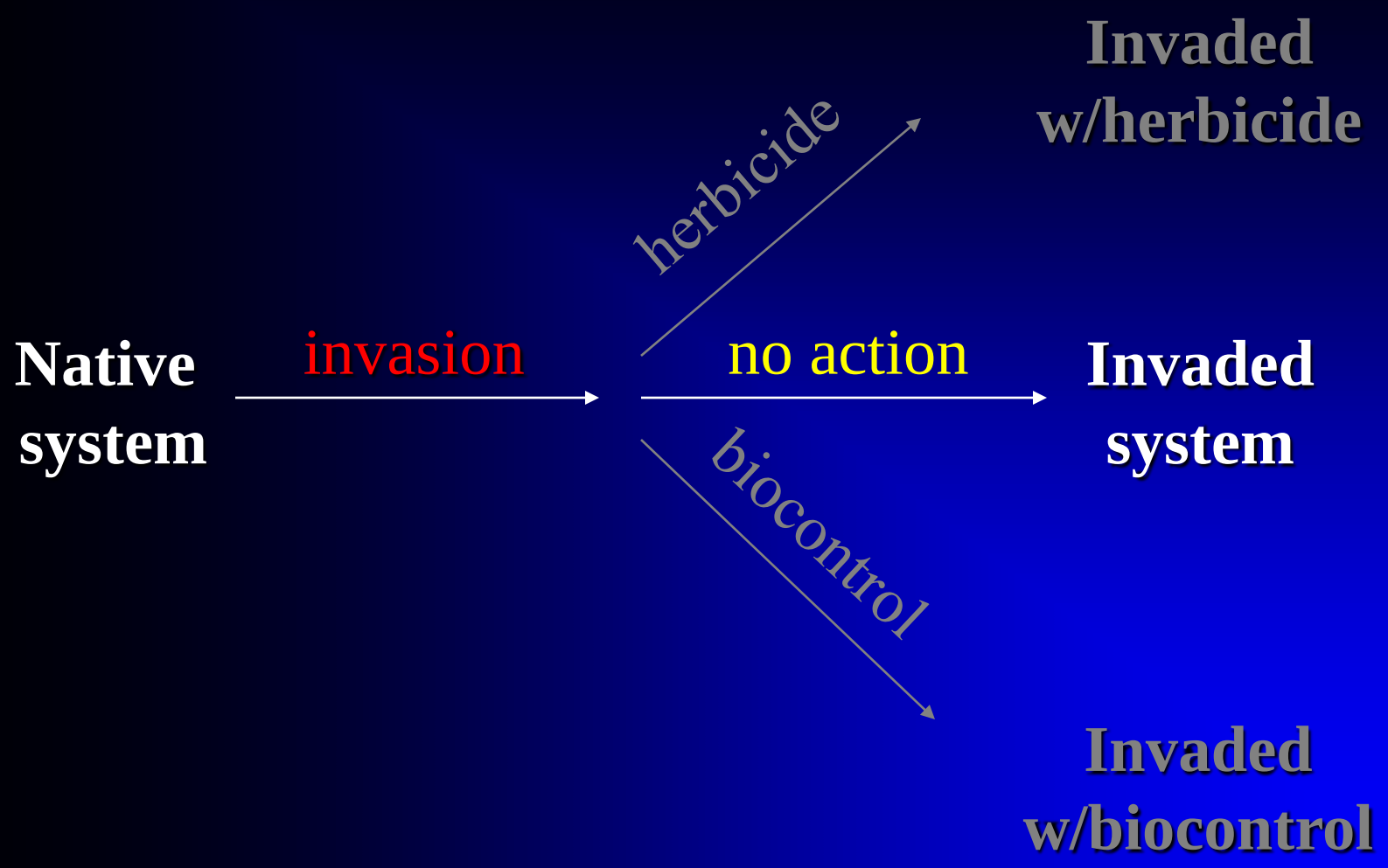
○ native
△ exotic



Pearson et al. 2012

Pearson 2009

Pearson 2010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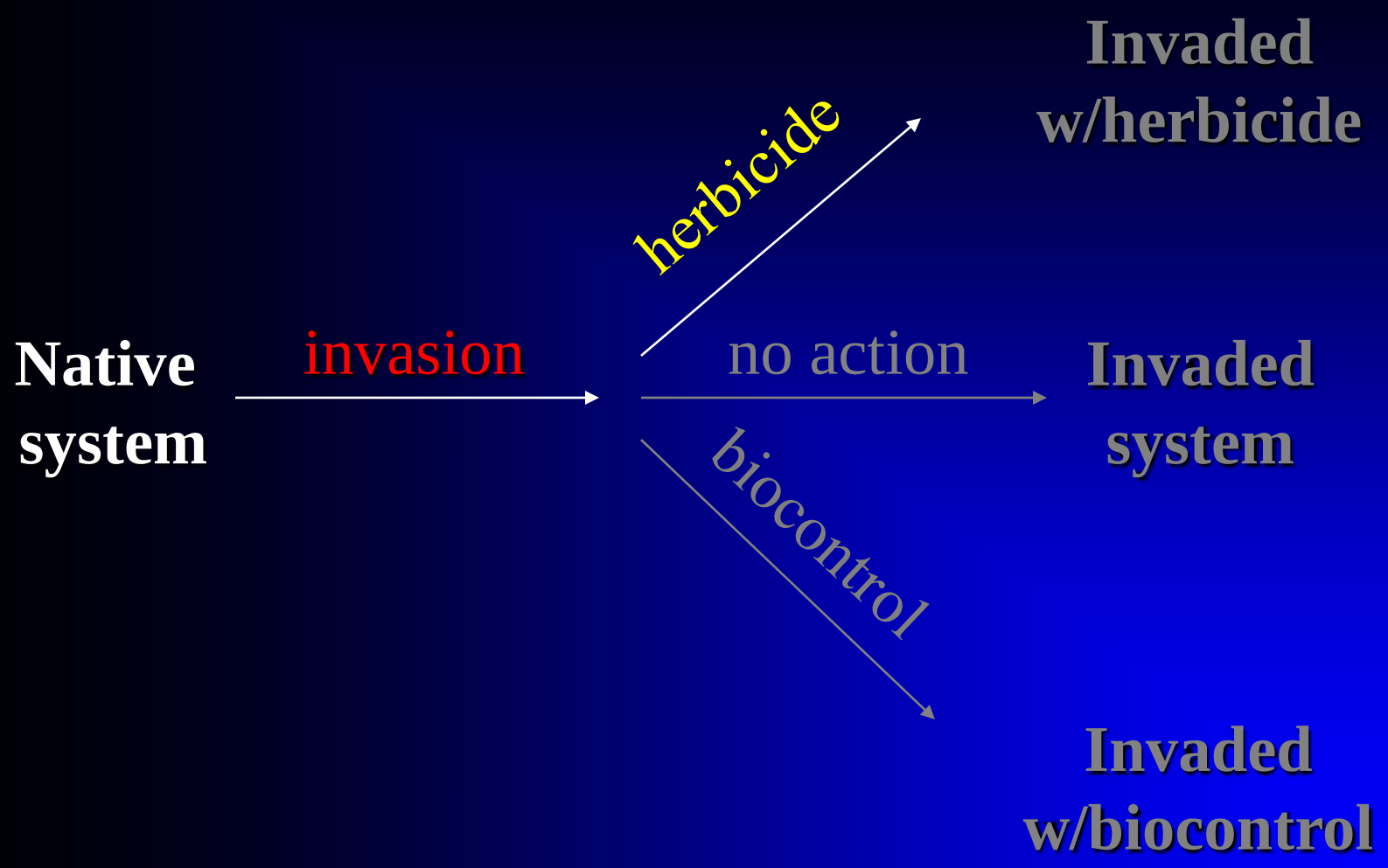
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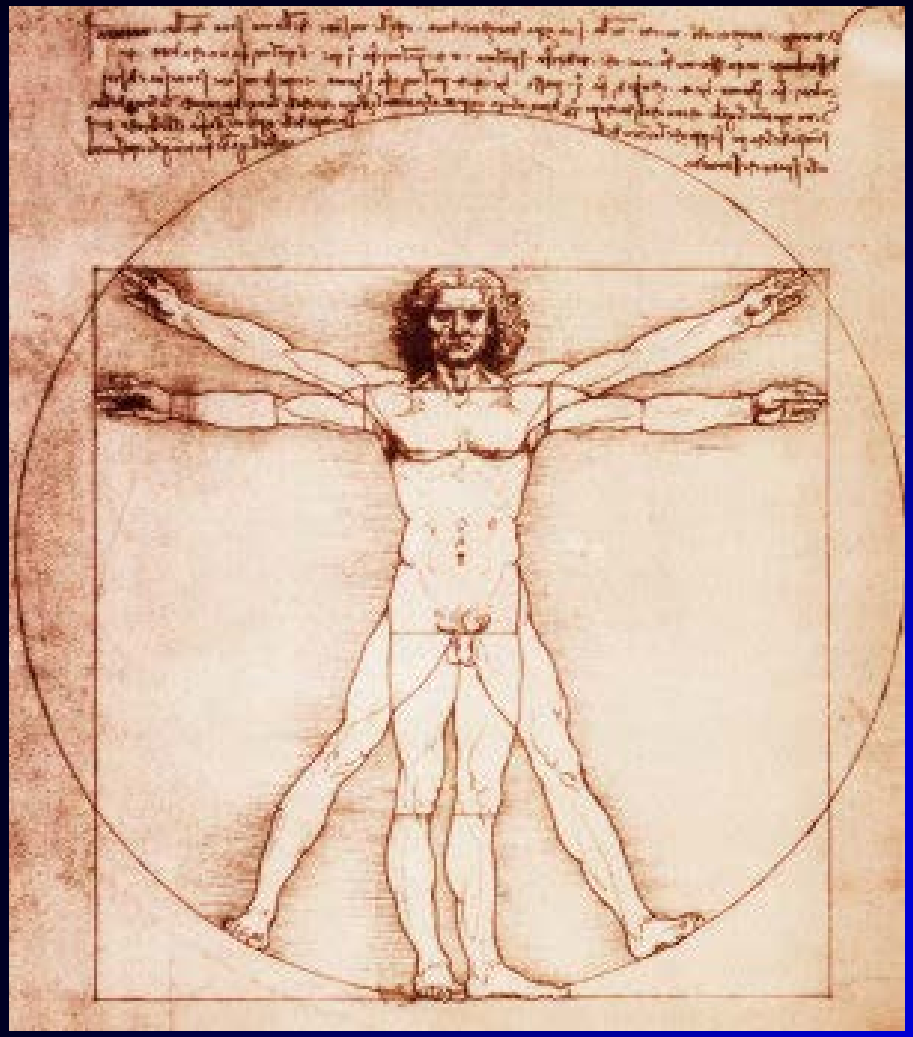
Human medicine analogy



Pearson and Ortega 2009

Side effects

- Nausea
- Insomnia
- Diarrhea
- Chest palpitations
- Dry mouth
- Fatigue
- Drowsiness
- Hallucinations
- Suicidal thoughts or behavior

Hippocratic Oath

The Oath

By Hippocrates

I SWEAR by Apollo the physician, and Aesculapius, and He[illegible]-neal,
and all the gods and [illegible]desses, that, according to my ability an[illegible]dgment,
will kee[illegible]his Oath a[illegible]is stipulation- to reckon him who taug[illegible]e this Art
[illegible]s my parents, to share my substance w[illegible] him,
[illegible] relieve his necessities if required;
[illegible] up[illegible]is offspring in the same footing as my own b[illegible]ers,
and to te[illegible]m this art, if they shall wish to learn it, without fee[illegible]stipulation;
an[illegible]at by precept, lecture, and every other mode of instr[illegible]ion,
I will im[illegible]nowledge of the Art to my own sons, and those o[illegible] teachers,
and to di[illegible]bound by a stipulation and oath according to the law of medicine,
[illegible] none others. I will follow that system of regimen which,
accord[illegible]y ability and judgment, I consider for the benefit of my patients,
[illegible] abstain from whatever is deleterious and mischievous.
I will gi[illegible]dly medicine to any one if asked, nor suggest any such counsel;
and in [illegible]anner I will not give to a woman a pessary to produce abortion.
W[illegible]y and with holiness I will pass my life and practice my Art.
I will not cut persons laboring under the stone,
but w[illegible]ve this to be done by men who are practitioners of this work.
Into wh[illegible]ver houses I enter, I will go into them for the benefit of the sick,
and [illegible] abstain from every voluntary act of mischief and corruption;
and, furth[illegible]r from the seduction of females or males, of freemen and slaves.
Whatever, in connection with my professional practice or not, in connection with it,
I see or hear, in the life of men, which ought not to be spoken of abroad,
I will not divulge, as reckoning that all such should be kept secret.
While I continue to keep this Oath unviolated,
may it be granted to me to enjoy life and the practice of the art,
respected by all men, in all times! But should I trespass and violate this Oath,
may the reverse be my lot!

Hippocratic Oath

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While I continue to keep this Oath unviolated,
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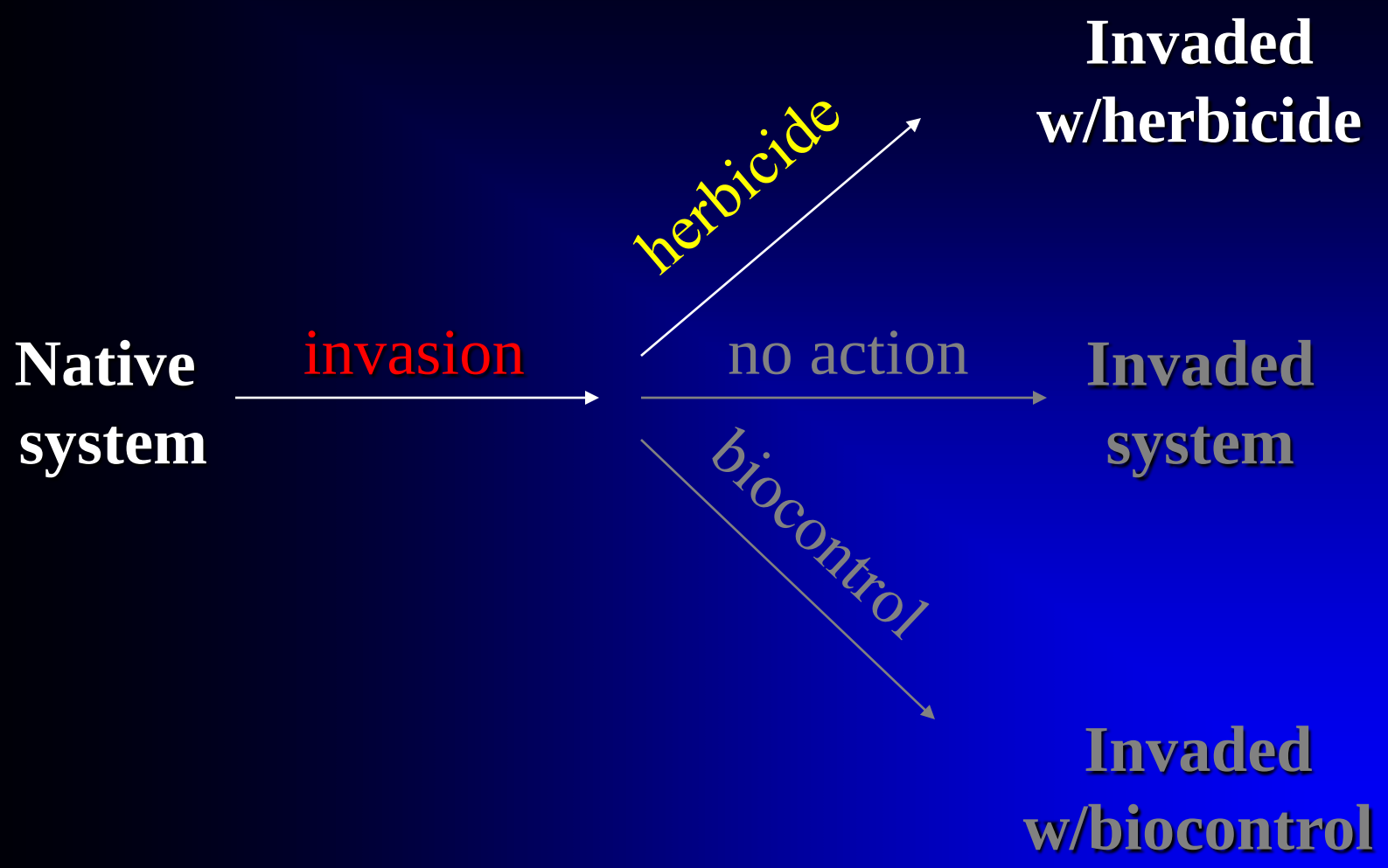
Do no harm!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Crone et al. 2009

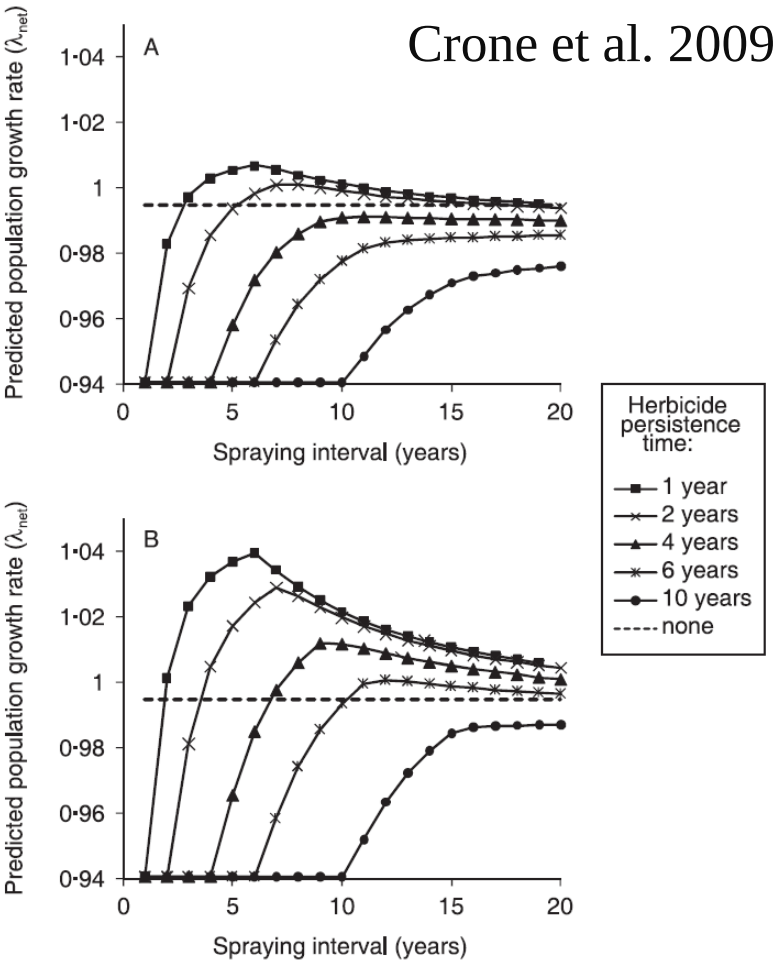


Fig. 3. Predicted population growth rate vs. spraying return interval and persistence time in soil. 'None' refers to no herbicide use. (A) 65% increase in fecundity during the release period; (B) 5% increase in survival and 65% increase in fecundity during the release period.

Secondary invasion

the bane of weed management

- Most studies suppressed targe
- Primary response to con condary invasion
- 89% of secondary i noxious/invasive

We need better restoration tools!

Pearson et al. 2016b

Quantifying weed impacts to prioritize management

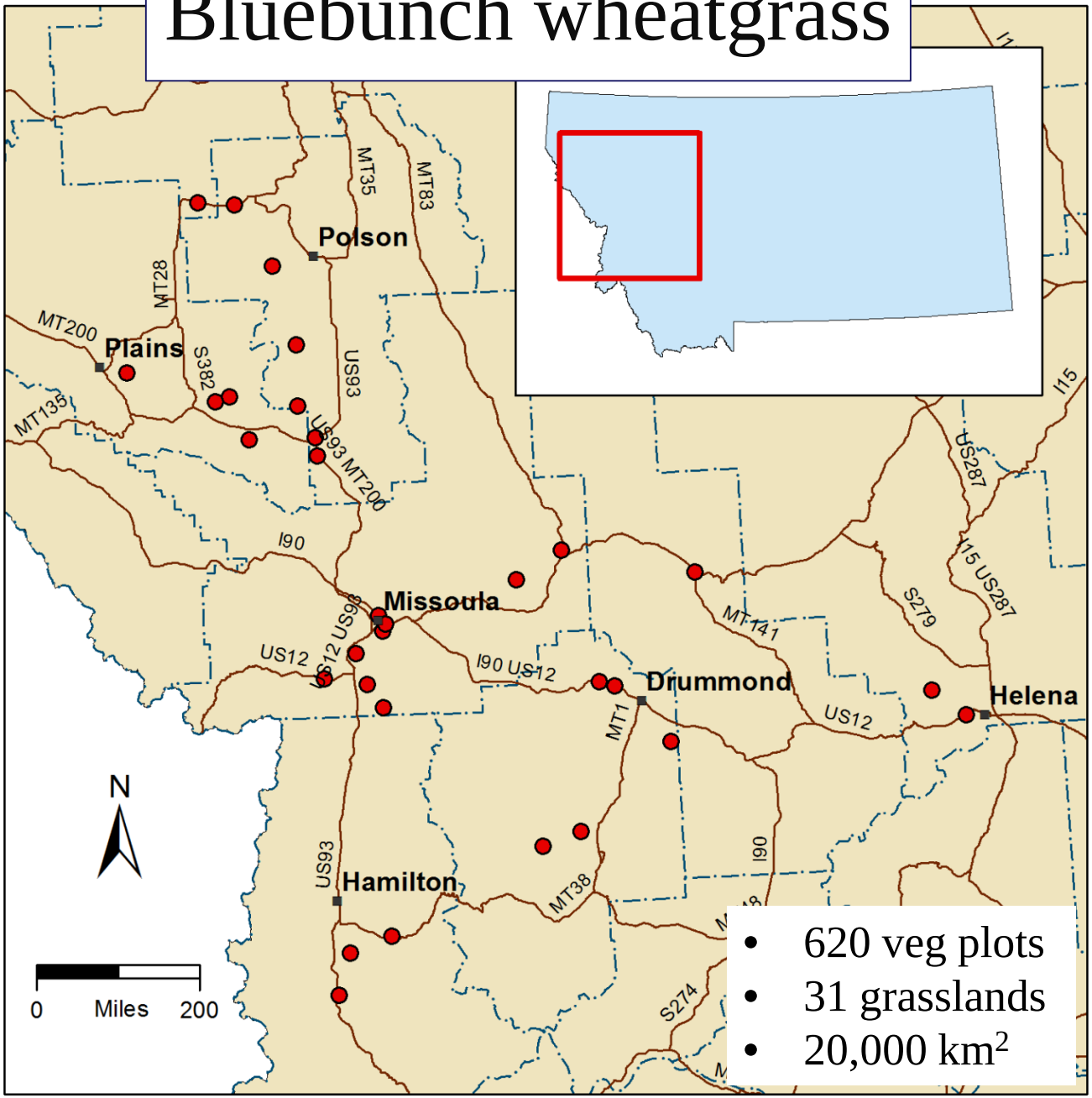
What if we had weed impact metrics for all weeds by habitat?

Weed	Impact rank	Habitat a (lost biomass)
Species a	1	30%
Species b	2	15%
Species c	3	10%
Species d	4	8%
Species e	5	6%
Species f	6	6%
Species g	7	5%
Species h	8	3%
Species i	9	2%
Species j	10	0%
…….	…….	…….

?

Grassland surveys

Bluebunch wheatgrass



- 620 veg plots
- 31 grasslands
- 20,000 km^2

Bluebunch wheatgrass
Impact Ranking

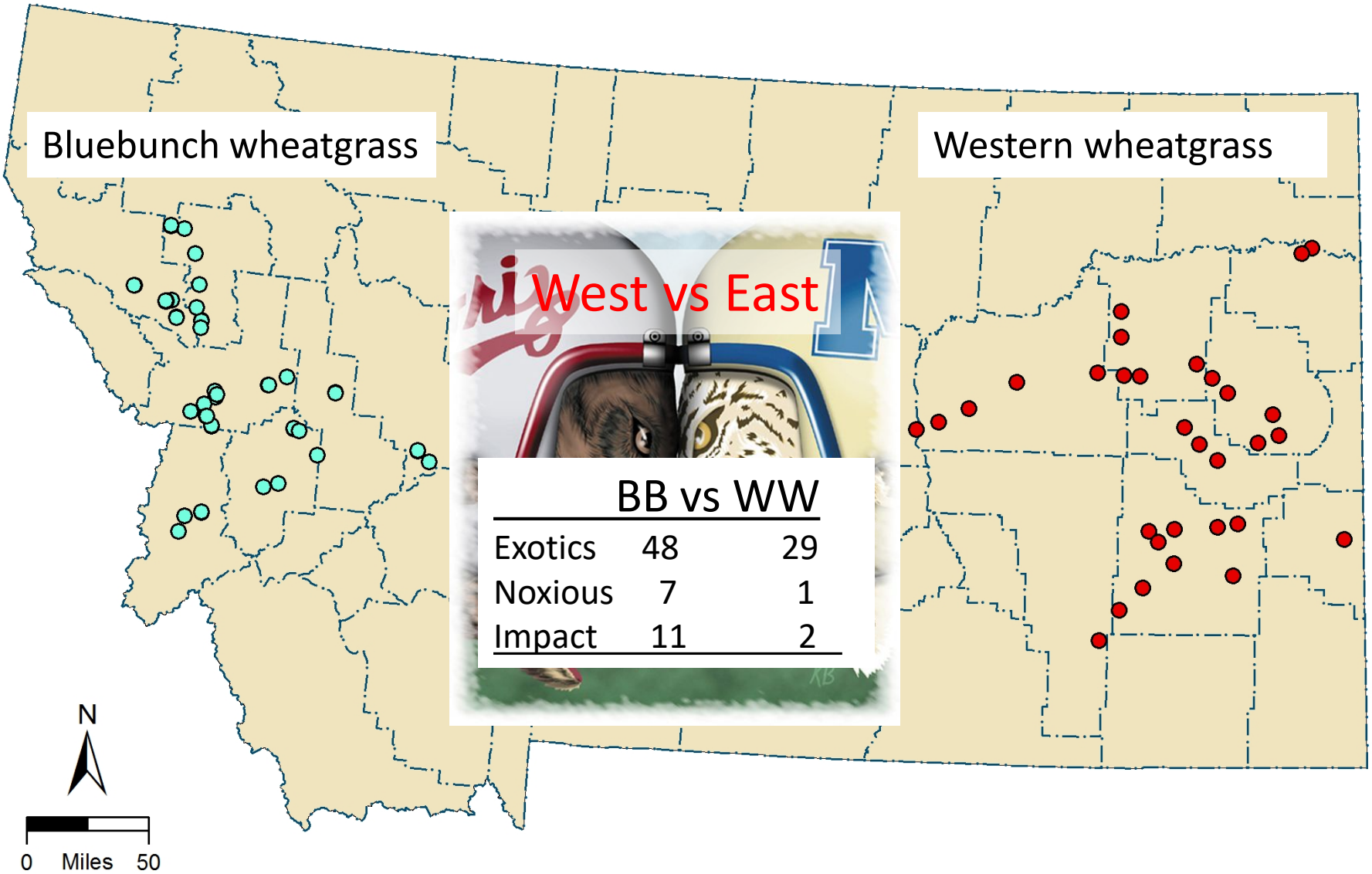
		Invasiveness				Impact		
Exotic species	Type	R	A	Score	Rank	E	Score	Rank
Bromus tectorum	AG	461	14.9	6860.5	1	-0.39	2676	1
*Centaurea stoebe**	PF	233	6.7	1555.0	2	-0.72	1120	2
*Euphorbia esula**	PF	87	12.8	1111.0	3	-0.53	589	3
*Potentilla recta**	PF	148	6.3	936.5	4	-0.50	468	4
Poa bulbosa	PF	74	7.7	567.5	5	-0.06[†]	0	-
Veronica verna[‡]	AF	180	3.1	564.0	6	-0.57	322	5
*Hypericum perforatum**	PF	47	7.8	367.0	7	-0.44	162	10
Poa pratensis	PG	38	9.4	357.5	8	-0.64	229	7
*Linaria dalmatica**	PF	84	3.8	315.5	9	-0.75	237	6
Verbascum blattaria	BF	40	6.7	268.0	10	-0.59	158	11
Arenaria serpyllifolia	AF	114	2.0	232.0	11	-0.16[†]	0	-
Poa compressa	PG	48	4.8	229.0	12	-0.79	181	9
Tragopogon dubius	BF	166	1.4	227.5	13	-0.44[†]	0	-
Agrostis interrupta	AG	100	2.1	212.0	14	0.14[†]	0	-
Bromus japonicus	AG	88	2.3	204.0	15	-0.06[†]	0	-
Alyssum alyssoides[§]	AF	114	1.7	188.0	16	-1.17	220	8
Erodium cicutarium	AF	68	2.7	185.5	17	-0.44[†]	0	-
Sisymbrium altissimum	ABF	69	1.9	132.0	18	-0.74[†]	0	-
Taraxacum officinale	PF	81	2.3	108.0	19	-0.91[†]	0	-
Myosotis micrantha	AF	151	0.7	99.5	20	-2.20[†]	0	-
Holosteum umbellatum	AF	158	0.6	96.5	21	0.69[†]	0	-
Lactuca serriola	ABF	77	1.0	77.5	22	-1.09[†]	0	-

22 of 48 spp shown

Pearson et al. 2016

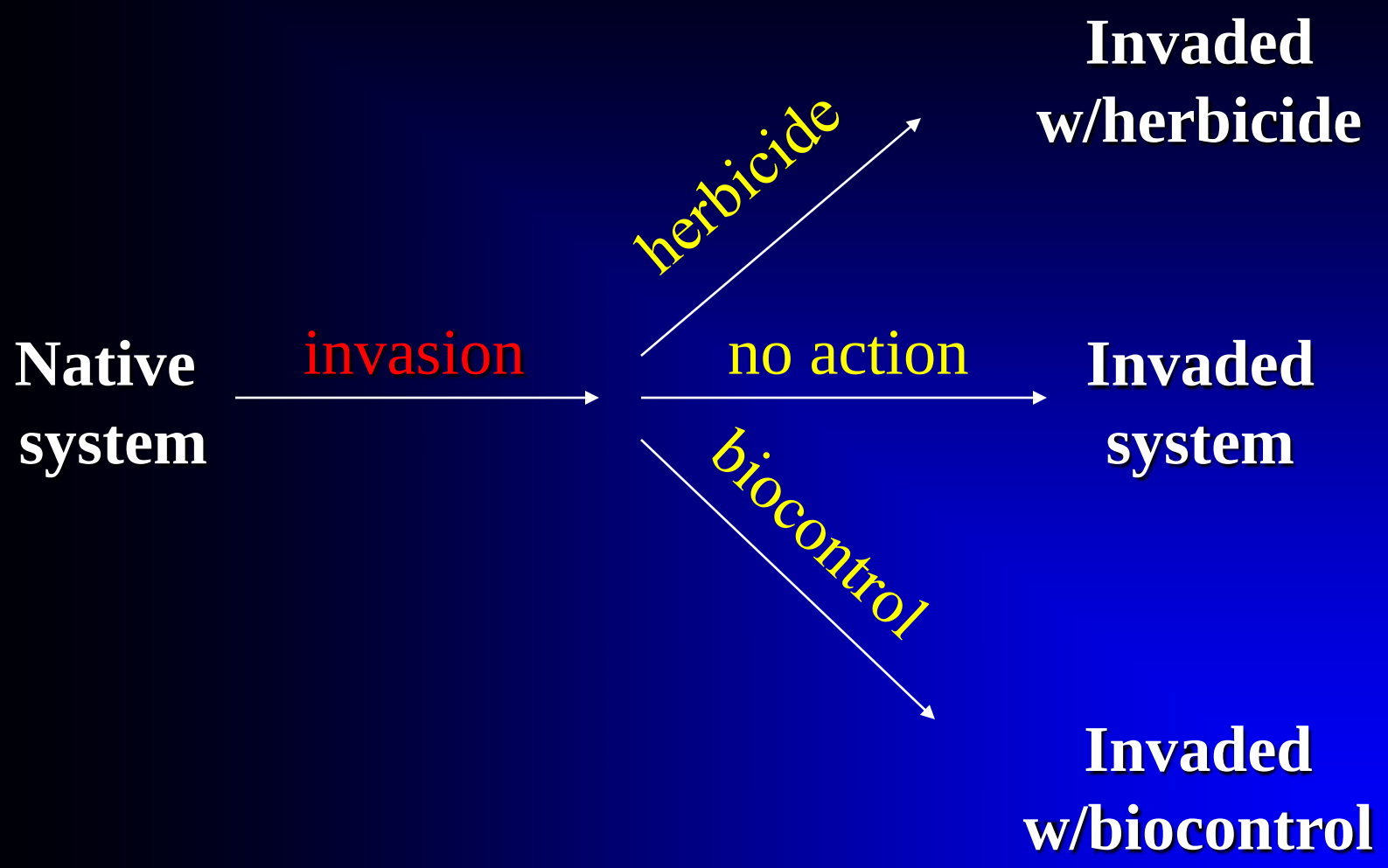
http://www.fs.fed.us/rmrs-beta/science-spotlights/invasiveness-and-impact-48-exotic-plant-species-native-grasslands

Comparisons among communities



	BB	WW
Exotics	48	29
Noxious	7	1
Impact	11	2

Ecology & Management of Invasive Weeds



Conclusions

- Invasive plant management is more complicated than killing weeds!
- Exotics create invasion trajectories – we are not in Kansas any more
- Management tools are not ruby slippers – they all have side effects and rarely get us back to Kansas
- Good management requires understanding the system and the tools to maximize intended outcomes and minimize side effects
- Weed impact ranking allows targeted management

Acknowledgements

Cooperators

- Bitterroot National Forest
- Bureau of Land Management
- Confederated Salish and Kootenai Tribes
- Lee Metcalf National Wildlife Refuge
- Missoula Open Space
- Montana DNRC
- Montana FWP
- National Bison Range
- Plumb Creek
- MPG Ranch
- Rimel Ranch (John and Whitney)

Funding

- MT Weed Trust Fund
- PECASE
- RMRS, Forest Service

Field support

- Jenny Birdsall
- Chuck Casper
- Lance Glasgow
- Peter Lesica
- Eva Mason
- Ali Pons
- Jen Smith

Plant Id.

- Cedar Brandt
- Peter Lesica
- Peter Stickney

For references

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- Google scholar Dean Pearson