

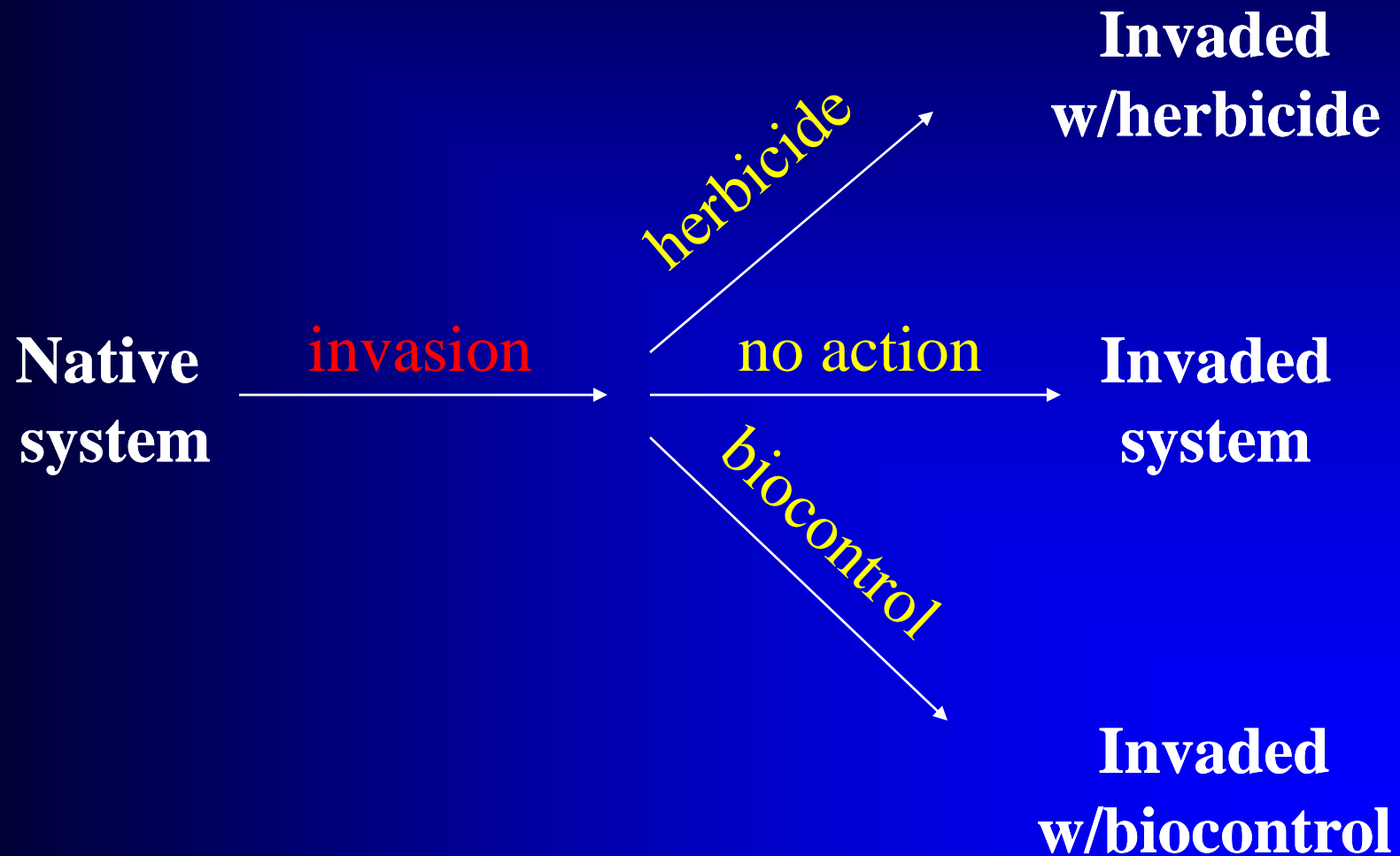
Ecology and Management of Invasive Species

Dean Pearson and Yvette Ortega

USFS Rocky Mountain Research Station,
Missoula, MT

<http://www.fs.fed.us/rm/wildlife/invasives/>

Conceptual Model for Ecology and Management of Invasive Weeds



**Native
system**

Disturbance

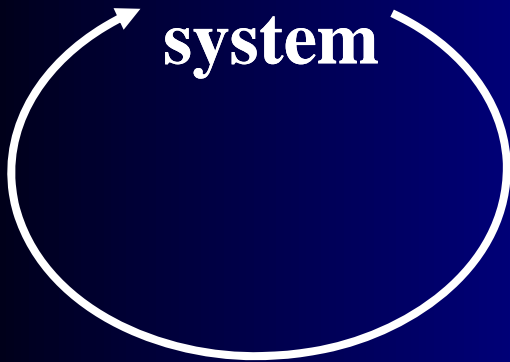


**Native
system**

Disturbance



**Native
system**



Invasion



**Native
system**

Invasion



**Native
system**



**Invaded
system**

Invasion



**Native
system**



**Invaded
system**



We're not in
Kansas
anymore, Todo!!

Invasion



**Native
system**



**Invaded
system**

Invasion



**Native
system**



no action



**Invaded
system**

Invasion



**Native
system**



herbicide



no action



**Invaded
system**

Invasion



**Native
system**

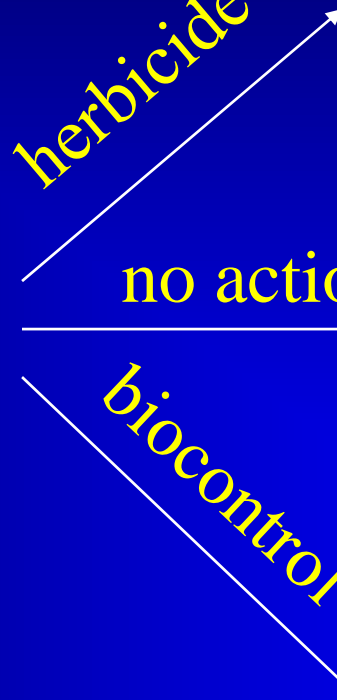


herbicide

no action

biocontrol

**Invaded
system**





Invasion



**Native
system**



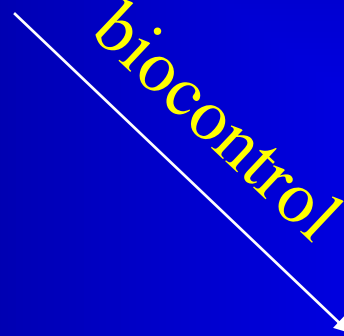
herbicide



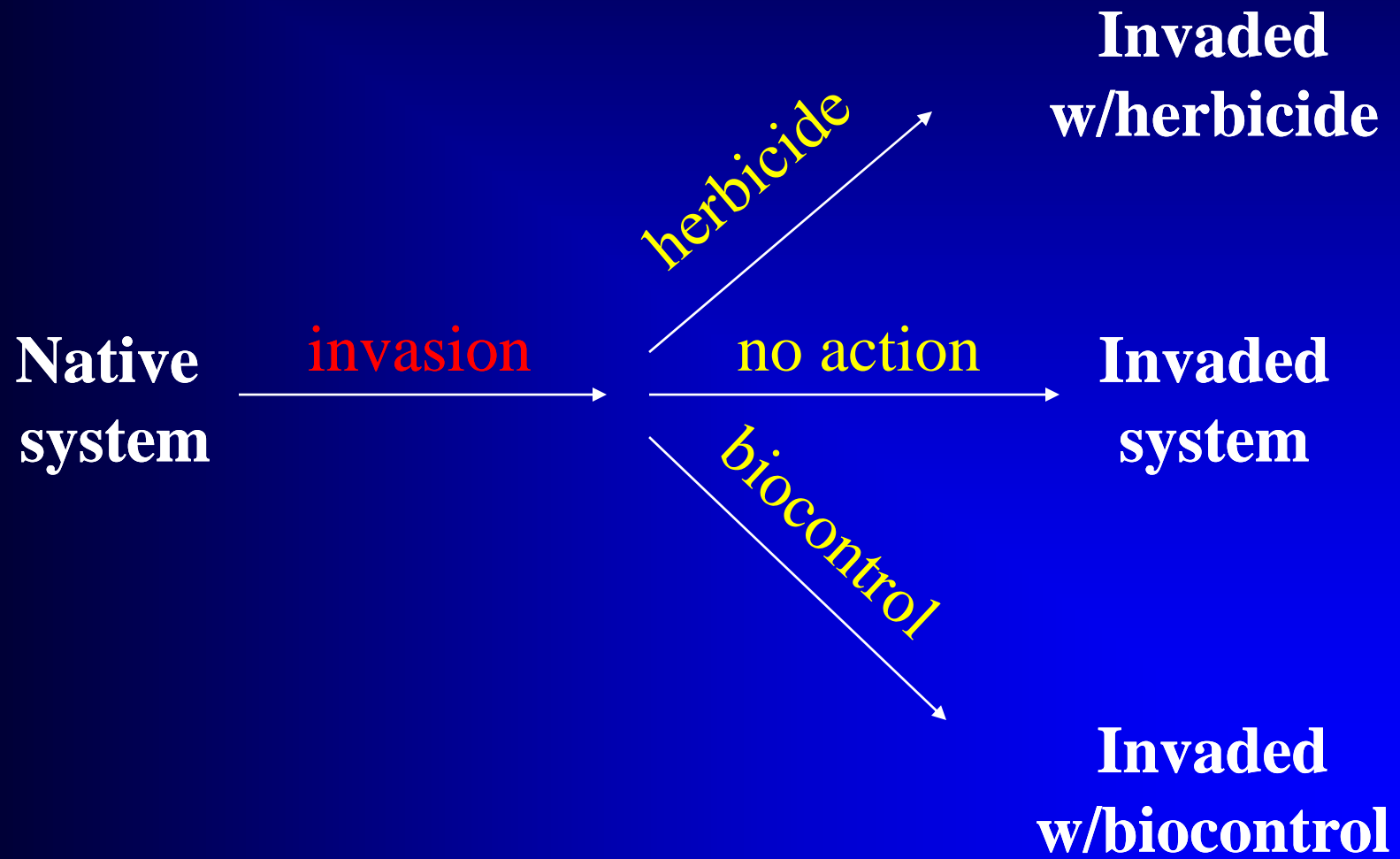
no action



biocontrol



**Invaded
system**



**Native
system**

invasion

herbicide

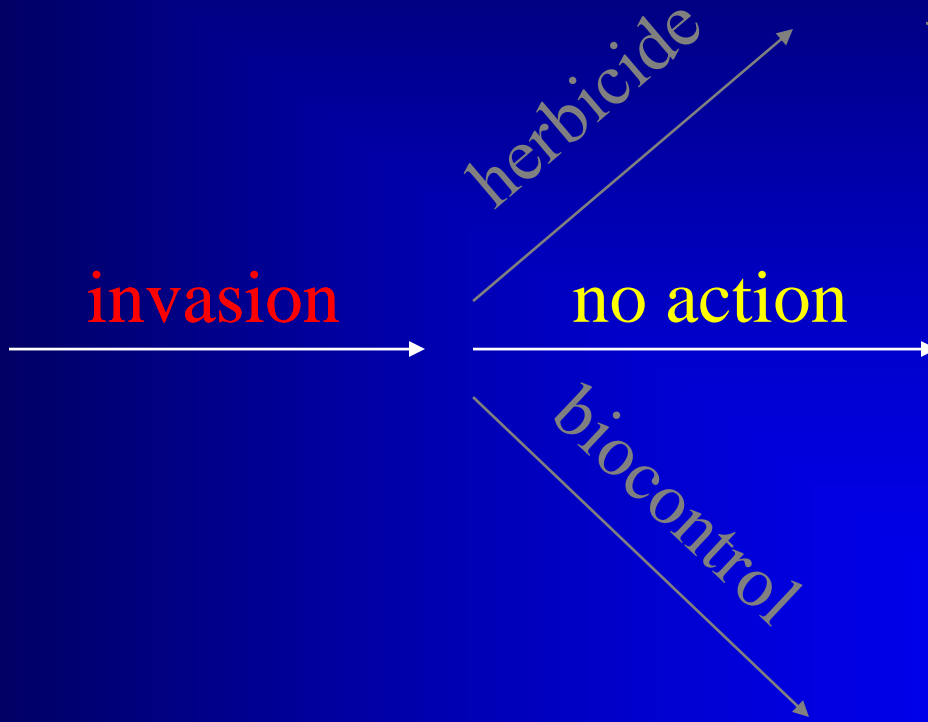
no action

biocontrol

**Invaded
w/herbicide**

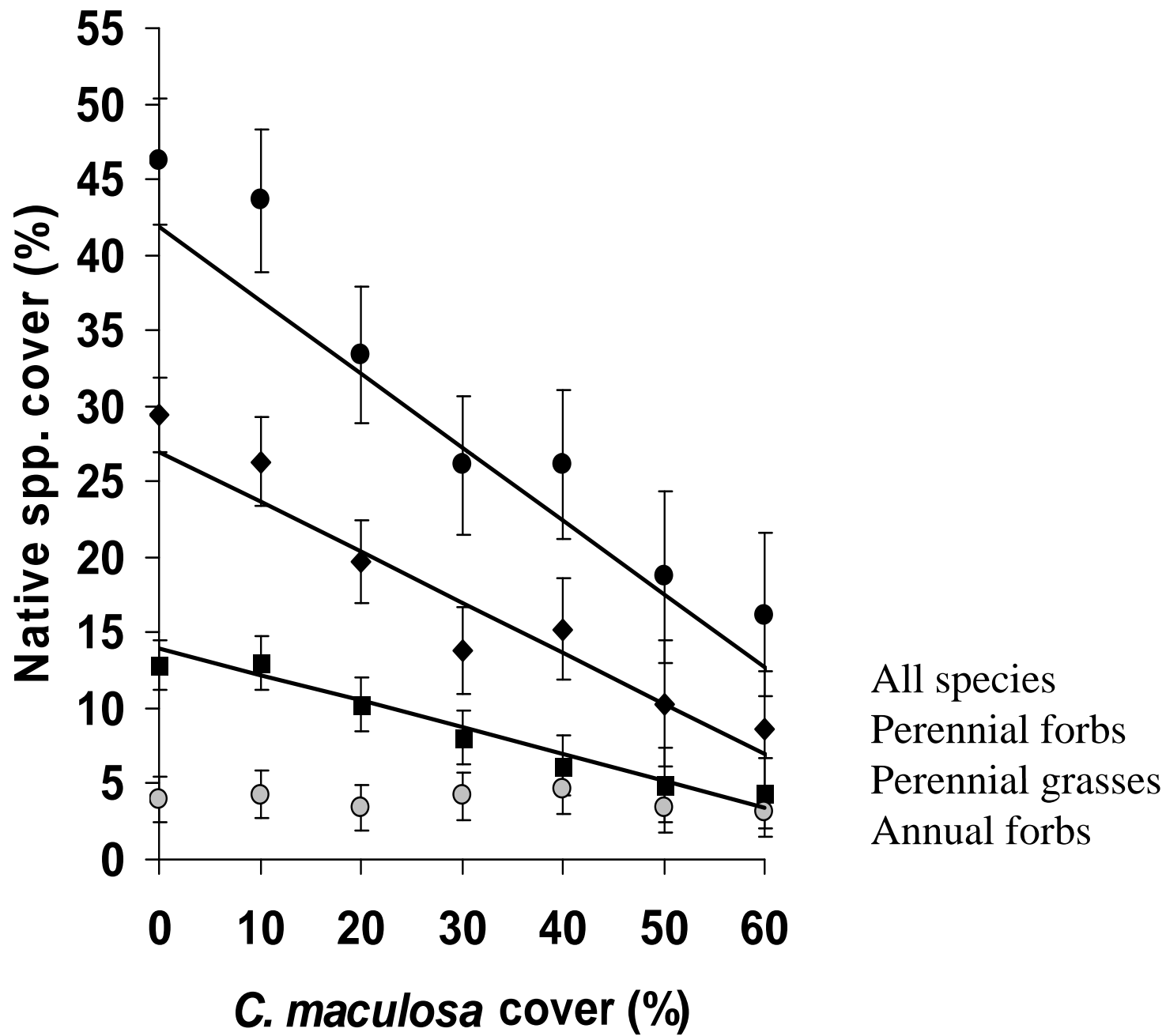
**Invaded
system**

**Invaded
w/biocontrol**





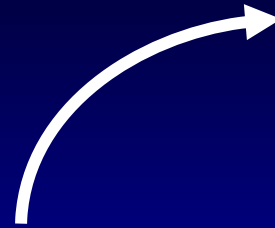
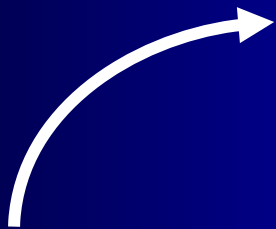








Thompson 1996 NW Sci



Ortega et al. 2006 *Oecologia*





Pearson 2009 Oecologia



Pearson 2010 Am. Nat.

**Native
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invasion

herbicide

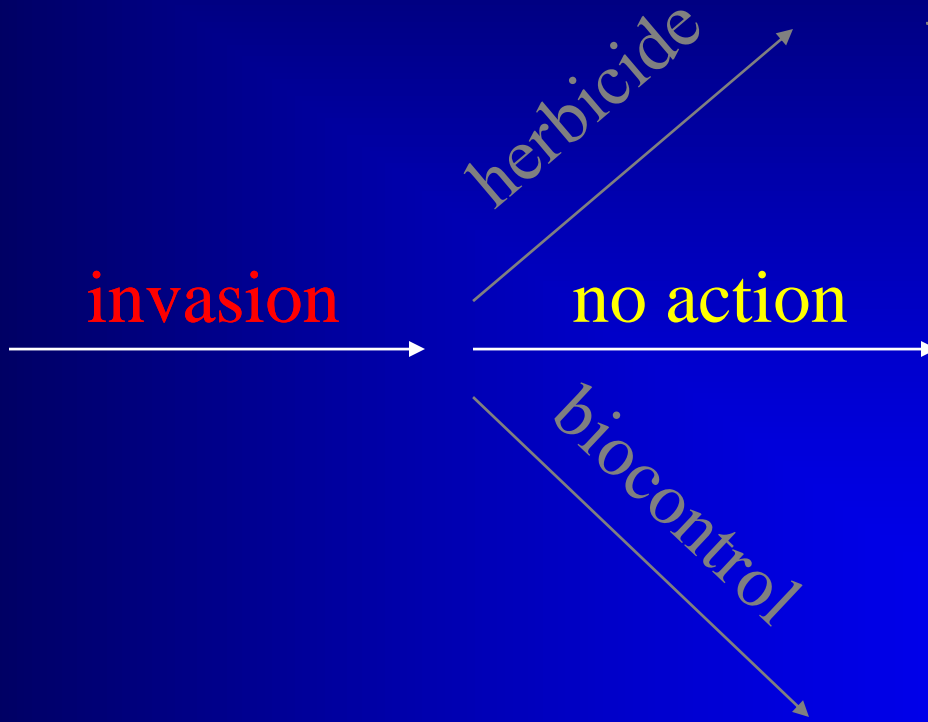
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biocontrol

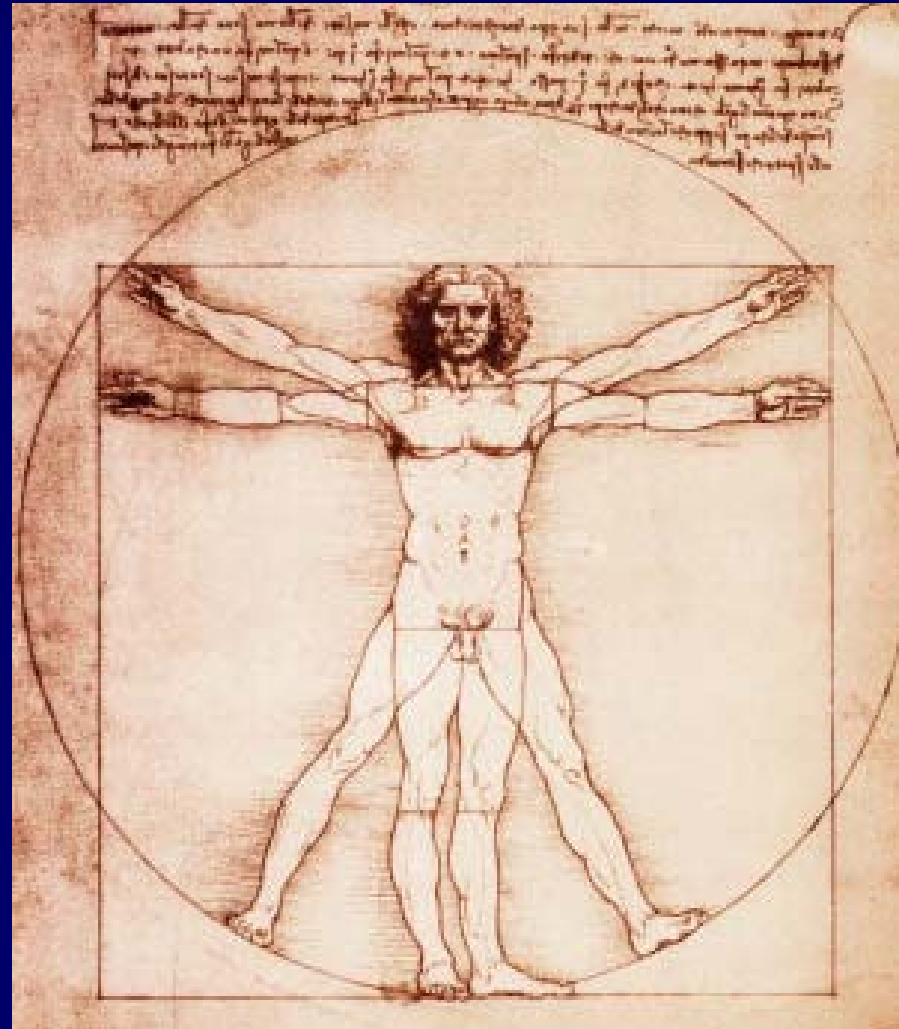
**Invaded
w/herbicide**

**Invaded
system**

**Invaded
w/biocontrol**



Human medicine analogy



Pearson and Ortega 2009

Side effects

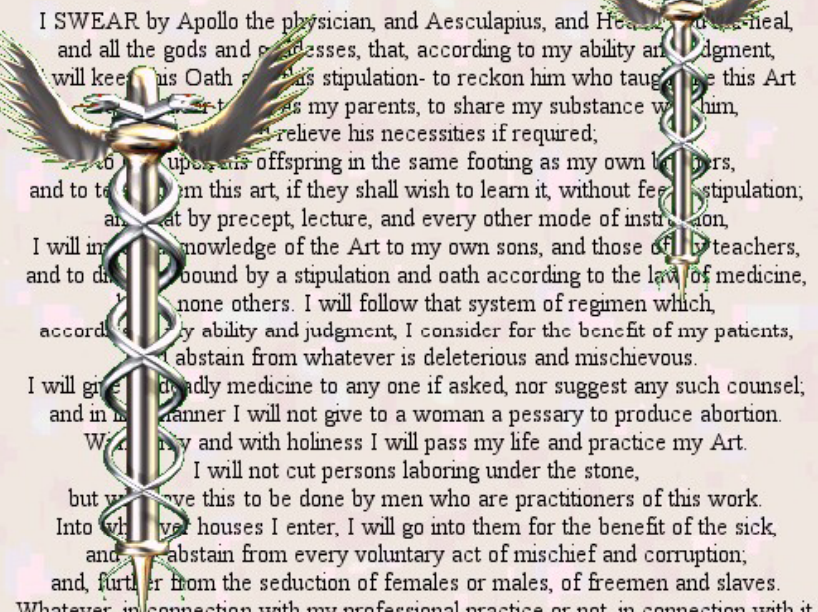
- Nausea
- Insomnia
- Diarrhea
- Chest palpitations
- Dry mouth
- Fatigue
- Drowsiness
- Hallucinations
- Suicidal thoughts or behavior



Hippocratic Oath

The Oath

By Hippocrates

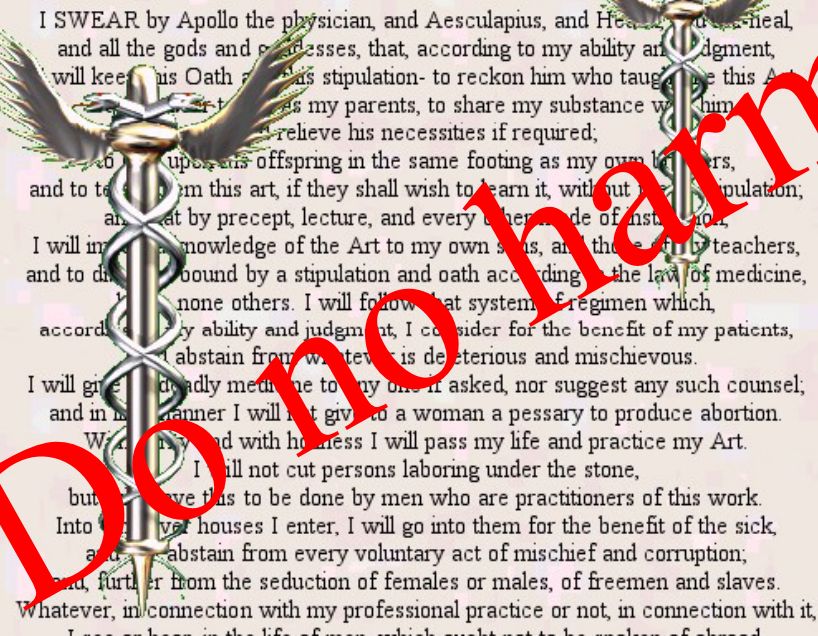


I SWEAR by Apollo the physician, and Aesculapius, and Health, and Panacea, and all the gods and goddesses, that, according to my ability and judgment, I will keep this Oath and this stipulation- to reckon him who taught me this Art as my father and my teacher, whom I will regard as such, and will share my substance with him, and will relieve his necessities if required; to support his offspring in the same footing as my own teachers, and to teach them this art, if they shall wish to learn it, without fee or stipulation; and that I will give to all men the benefit of my knowledge of the Art to my own sons, and those of my teachers, and to all who desire to be bound by a stipulation and oath according to the law of medicine, for none others. I will follow that system of regimen which, according to my ability and judgment, I consider for the benefit of my patients, I will abstain from whatever is deleterious and mischievous. I will give no deadly medicine to any one if asked, nor suggest any such counsel; and in like manner I will not give to a woman a pessary to produce abortion. With purity and with holiness I will pass my life and practice my Art. I will not cut persons laboring under the stone, but will leave this to be done by men who are practitioners of this work. Into whatever houses I enter, I will go into them for the benefit of the sick, and I will abstain from every voluntary act of mischief and corruption; and, further 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

The Oath

By Hippocrates



I SWEAR by Apollo the physician, and Aesculapius, and Health, and Panacea, and all the gods and goddesses, that, according to my ability and judgment, I will keep this Oath and this stipulation- to reckon him who taught me this Art as my father and my teacher, whom I will regard as such, and will share my substance with him, and will relieve his necessities if required; to support his offspring in the same footing as my own teachers, and to teach them this art, if they shall wish to learn it, without stipulation; and that by precept, lecture, and every other mode of instruction, I will impart my knowledge of the Art to my own sons, and those of my teachers, and to disciples bound by a stipulation and oath according to the law of medicine, according to my ability and judgment, I consider for the benefit of my patients, I will abstain from whatever is deleterious and mischievous. I will give no deadly medicine to any one if asked, nor suggest any such counsel; and in like manner I will not give to a woman a pessary to produce abortion. With purity and with holiness I will pass my life and practice my Art. I will not cut persons laboring under the stone, but I will leave this to be done by men who are practitioners of this work. Into whatever houses I enter, I will go into them for the benefit of the sick, and I will abstain from every voluntary act of mischief and corruption; and, further 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!

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invasion

herbicide

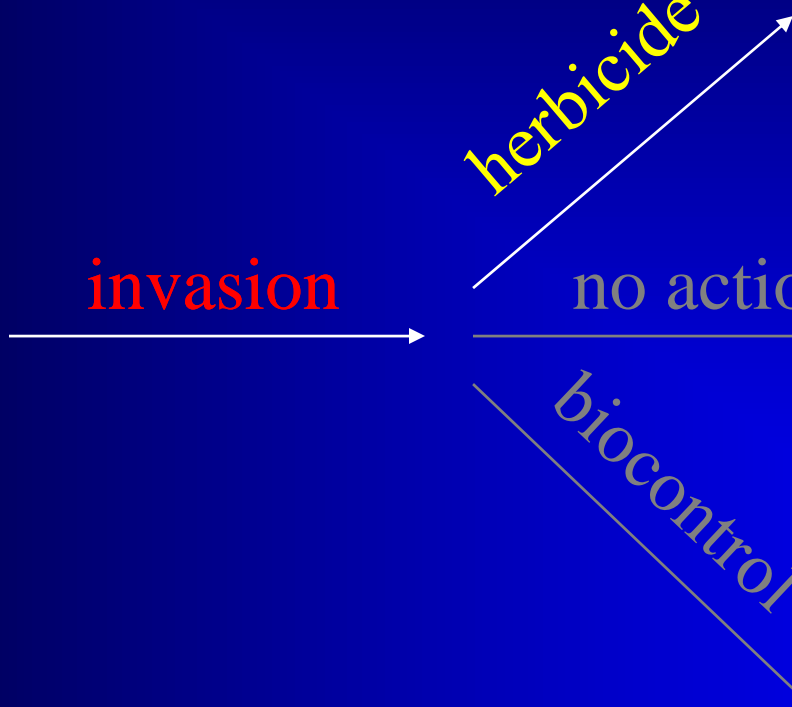
no action

biocontrol

**Invaded
w/herbicide**

**Invaded
system**

**Invaded
w/biocontrol**







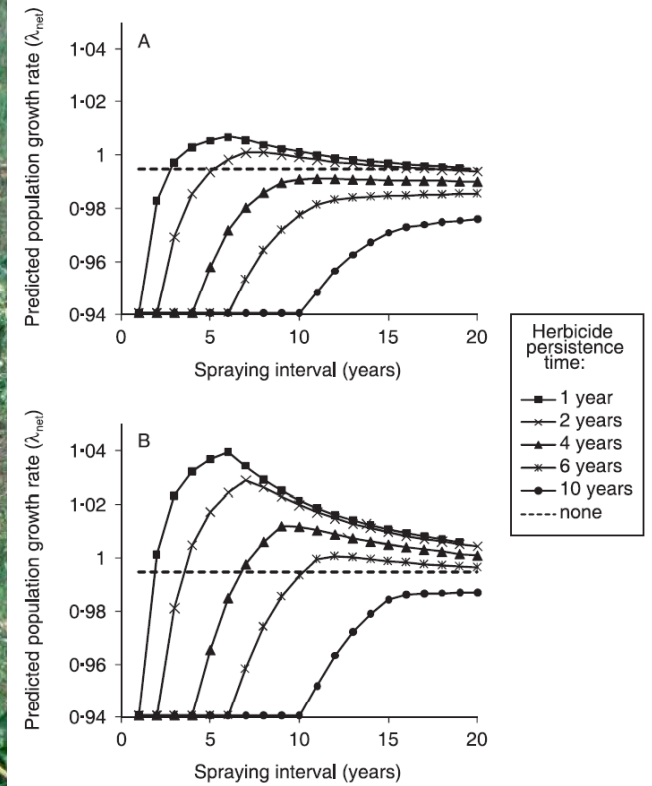


Fig. 3. Predicted population growth rate vs. spraying return interval and persistence time in soil. 'None' refers to no herbicide use. (A) 65% increase in fecundity during the release period; (B) 5% increase in survival and 65% increase in fecundity during the release period.



Ortega and Pearson 2010 IPSM

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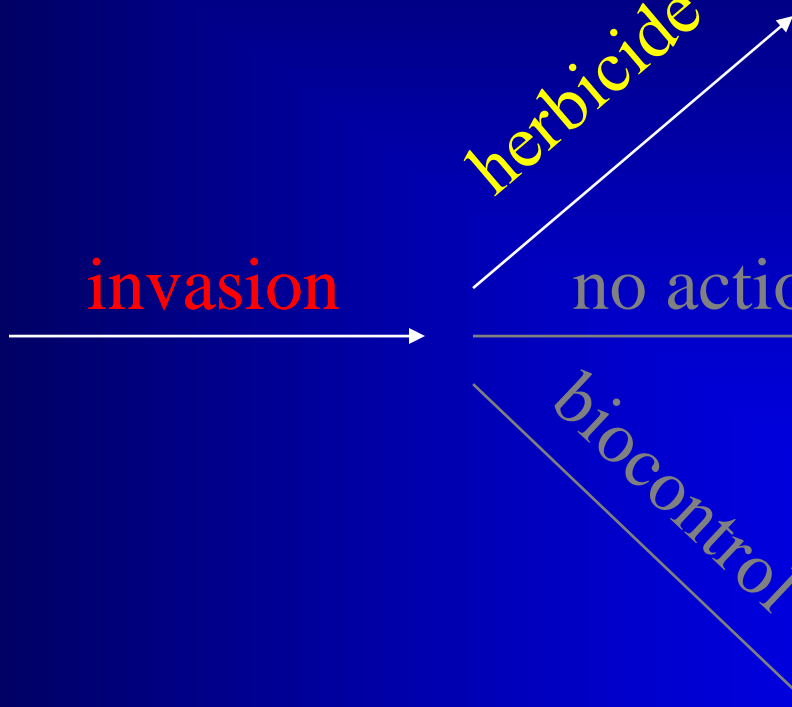
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invasion

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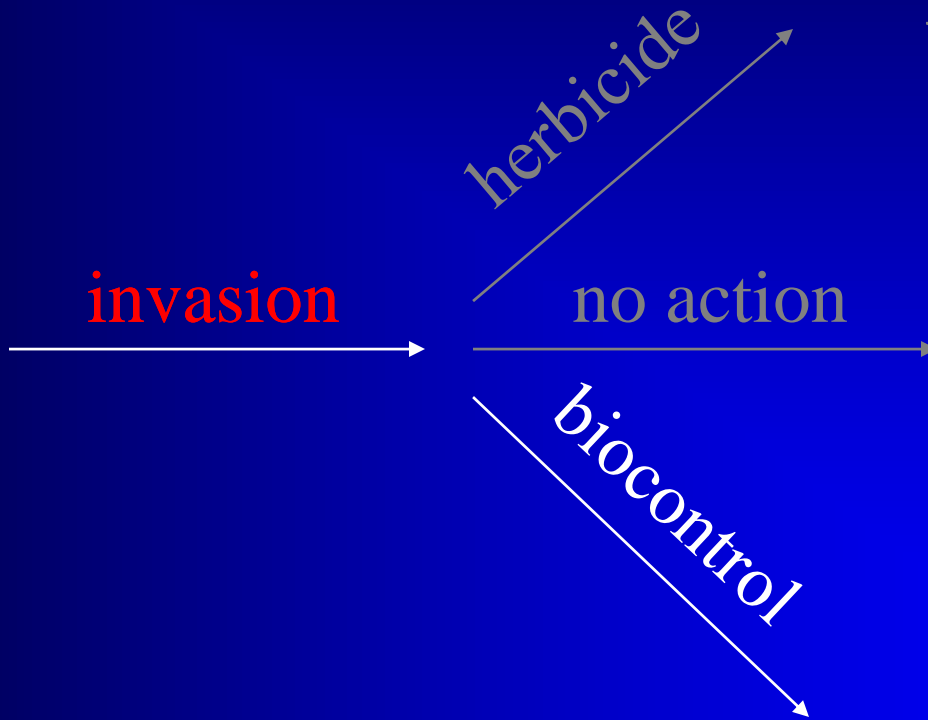
no action

biocontrol

**Invaded
w/herbicide**

**Invaded
system**

**Invaded
w/biocontrol**



Biological Control



Knapweed Biocontrol Program



Gallfly



Gallfly biology

- Adults oviposit in immature seedheads
- Resulting larvae induce gall formation
- Galls create an energy sink that reduces seed production
- Larvae overwinter from September to June



Gallfly success?

- Quickly established
- Dispersed readily
- Reduce seed production
- Host-specific



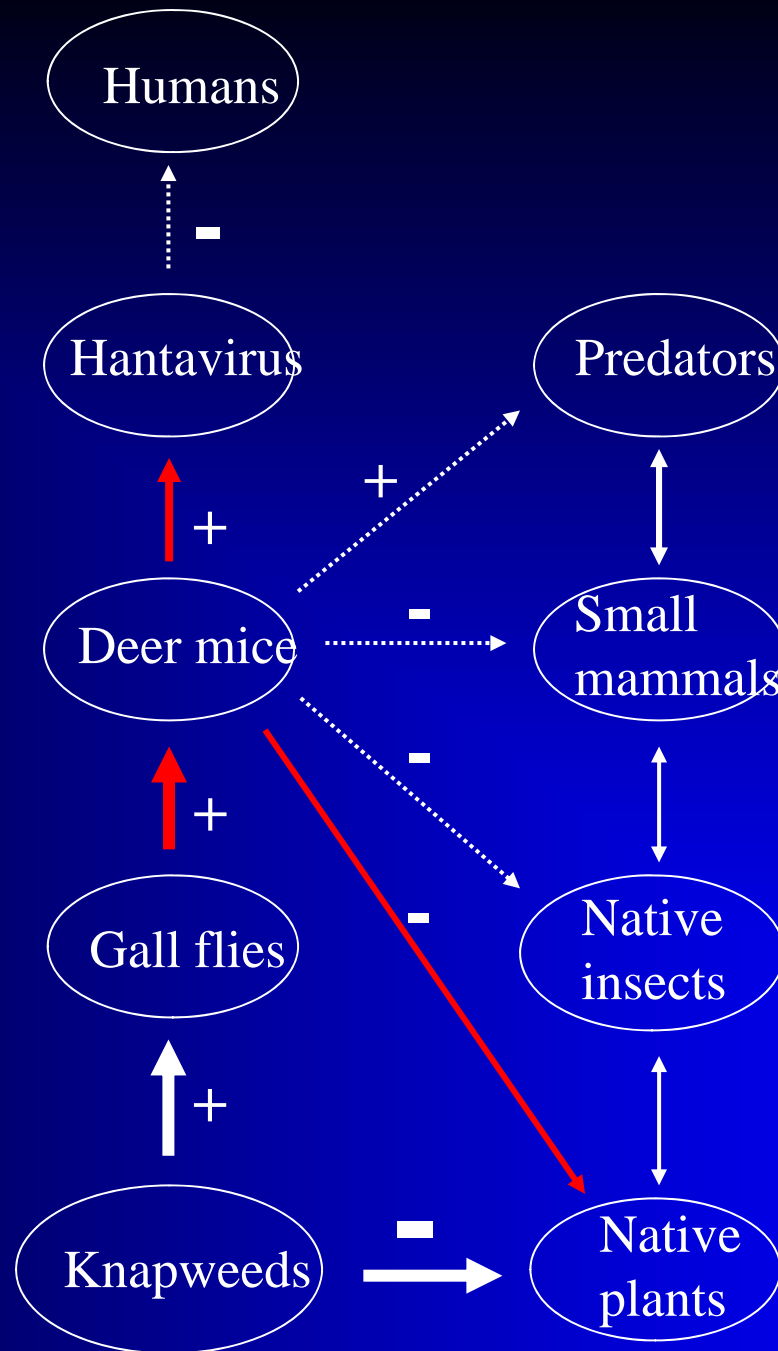


The Gallfly Diet

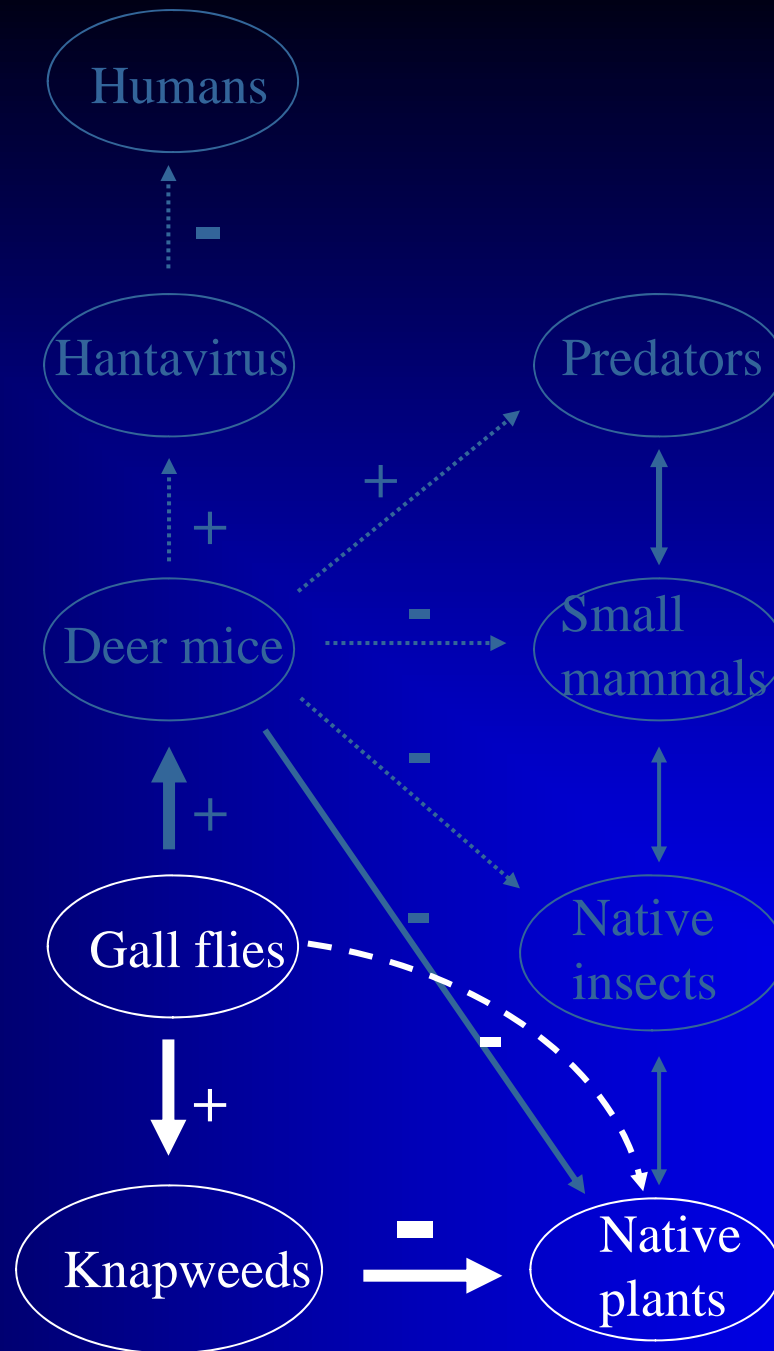
Before

After

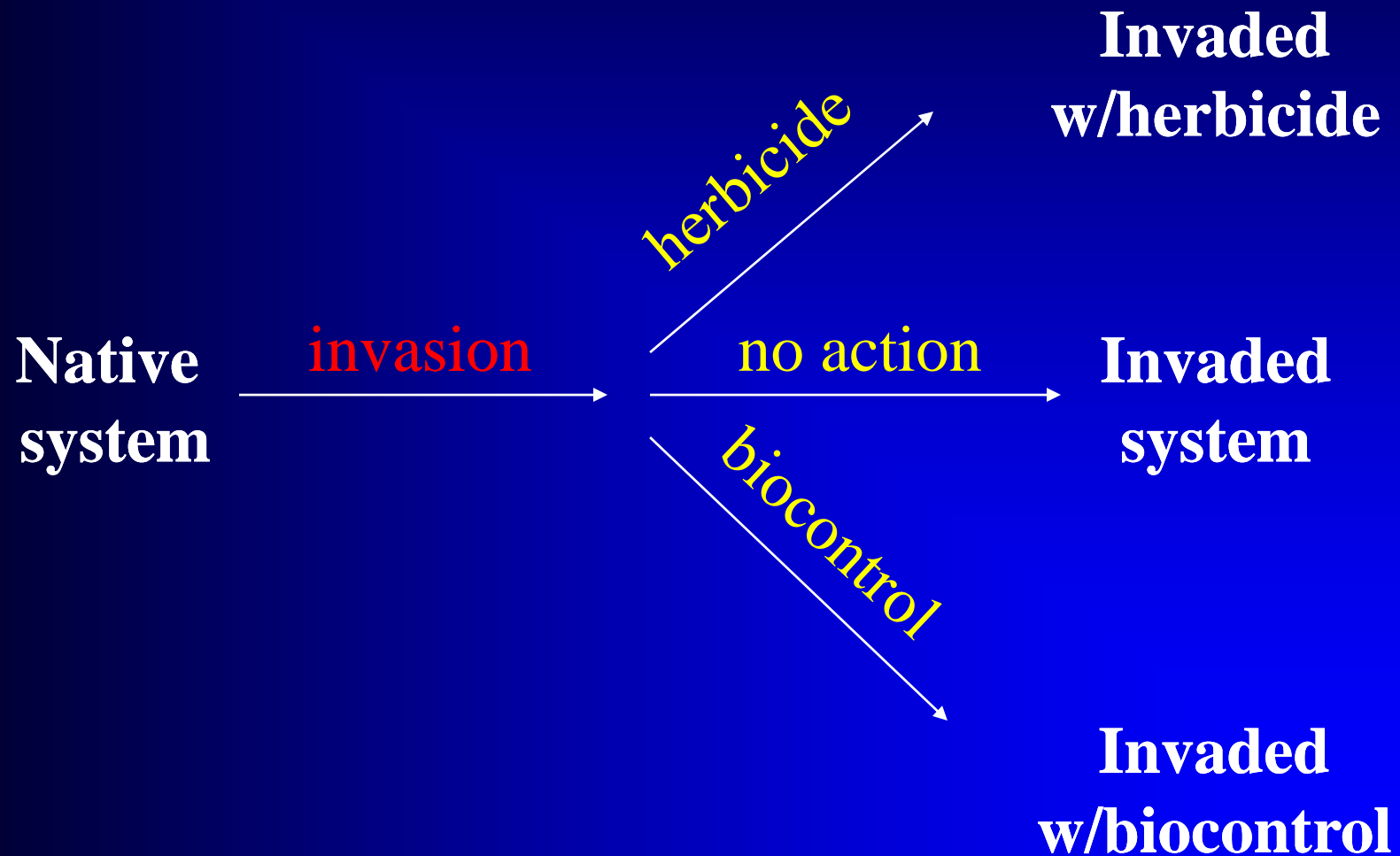




Pearson and Callaway 2006
 Pearson and Fletcher 2008
 Pearson and Callaway 2008



Conceptual Model for Ecology and Management of Invasive Weeds



Conclusions

- Exotics create invasion trajectories – we are not in Kansas any more

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- Management tools are not ruby slippers – they all have side effects and rarely get us back to Kansas

Conclusions

- 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 management tools to maximize intended outcomes and minimize side effects



Huffaker and Kennett 1959 J. Range Manag.

