UNIVERSITY OF CALIFORNIA SIERRA FOOTHILL RESEARCH AND EXTENSION CENTER

The Ecology and Management of Medusahead & Barb Goatgrass on California Rangeland

RECS

University of California
Agriculture and Natural Resources

Sierra Foothill Research & Extension Center

The Ecology and Management of Medusahead and Barb Goatgrass on California Rangeland

Nov 5th 2013

9:00-4:00

University of California Sierra Foothill Research and Extension Center

9:00	**Welcome and Introduction**	*Jeremy James*
9:15-9:45	**Setting the stage** An overview of needs, treatment options, and management barriers	*Mel George, Fadzayi Mashiri, Elise Gornish*
9:45-10:30	**Invasive annual grass ecology** Invasion and invasion resistance, seed dispersal, and Grazing	*Meghan Skaer, Joanne Heraty, Emily Farrer, Morgan Doran*
10:30-12:00	**Field trip** Medusahead and plant community dynamics Adaptive grazing for multiple ecosystem services Goatgrass ecology and management and oak woodland ecology	 *Erica Spotswood* *Ken Tate & Leslie Roche* *Meghan Skaer, Josh Davy, Joe DiTomaso & Doug McCreary*
12:00-1:00	**Lunch**	
1:00-2:20	**Linking invasive annual grass management and ecology** An overview of prevention and control concepts including herbicide, fire, grazing, seeding and fertilization with examples from different habitats	*Joe DiTomaso, Theresa Becchetti, Josh Davy, Rob Wilson, Sasha Berleman, Jamie Bartolome, Emilio Laca Glenn Nader*
2:20-2:50	**Agency resources and management examples** NRCS programs, examples of programs in action, management at a landscape-scale	*Alan Bower, Royce Larsen& Karl Striby, Cari Koopmann Rivers,, Justin Wages*
2:50-3:00	**Break**	
3:00-4:00	**Collaborative learning** Group Assessments and perspectives	

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Sierra Foothill Research & Extension Center

Presenter	Title	Location
Jeremy James	Director UC Sierra Foothill Research and Extension Center	Browns Valley
Mel George	CE Specialist	Dept. Plant Sciences, UC Davis
Fadzayi Mashiri	CE Livestock and Natural Resource Advisor	Mariposa, Merced and Madera, County
Elise Gornish	Post-doctoral Researcher	Dept. Plant Sciences, UC Davis
Meghan Skaer	Post-doctoral Researcher	Dept. Plant Sciences, UC Davis
Joanne Heraty	Eviner Lab Manager	Dept. Plant Sciences, UC Davis
Emily Farrer	Post-doctoral Researcher	Dept. ESPM, UC Berkeley
Morgan Doran	County Director and CE Livestock and Natural Resource Advisor	Solano, Napa and Yolo County
Erica Spotswood	Post-doctoral Researcher	Dept. ESPM, UC Berkeley
Ken Tate	CE Specialist	Dept. Plant Sciences, UC Davis
Leslie Roche	Post-doctoral Researcher	Dept. Plant Sciences, UC Davis
Doug McCreary	CE Specialist	Dept. ESPM, UC Berkeley
Joe DiTomaso	CE Specialist	Dept. Plant Sciences, UC Davis
Theresa Becchetti	CE Livestock and Natural Resource Advisor	Stanislaus and San Joaquin County
Josh Davy	CE Livestock and Natural Resource Advisor	Tehama, Colusa, and Glenn County
Rob Wilson	Director Intermountain Research and Extension Center	Tulelake
Sasha Berleman	Post-doctoral Researcher	Dept. ESPM, UC Berkeley
Jamie Bartolome	Professor	Dept. ESPM, UC Berkeley
Emilio Laca	Professor	Dept. Plant Sciences, UC Davis
Glenn Nader	CE Livestock and Natural Resource Advisor	Yuba, Sutter and Butte County
Alan Bower	Rangeland Management Specialist NRCS	Red Bluff
Royce Larsen	CE Livestock and Natural Resource Advisor	San Luis Obispo and Monterey County
Karl Striby	Rangeland Management Specialist NRCS	Templeton
Cari Koopmann Rivers	Manager Audubon Bobcat Ranch	Winters
Justin Wages	Land Manager Placer Land Trust	Auburn

Recent Needs Assessments and the Importance of Rangeland Weed Management in Mariposa, Madera and Merced counties

Fadzayi Mashiri
Livestock and Natural Resources Advisor

Objectives of my needs assessment:

- To get an insight about the important local issues and problems in order to develop a relevant program that is focused on important issues.
- To learn about the existing knowledge gaps
- To develop an extension (educational and research) program that is effective, useful and acceptable to the clientele

Methods:

A) Direct methods

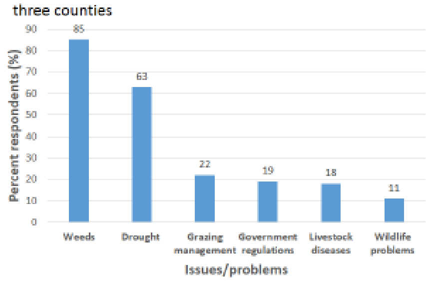
- Informal interviews with ranchers/property owners visited
- Short questionnaire asking about production systems, knowledge gaps and issues the clients want addressed

B) Indirect methods

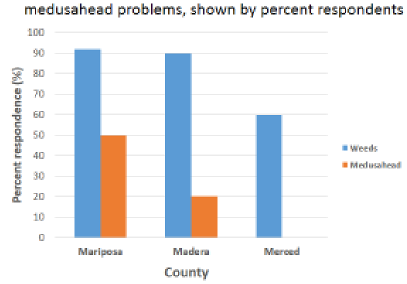
- Interviewing university, local, federal, NGO personnel about previous work; current issues, and areas needing attention
- Secondary data reviews

Results:

Percent (%) respondents listing problem or issue in all three counties



County differences in the importance of weed and medusahead problems, shown by percent respondents



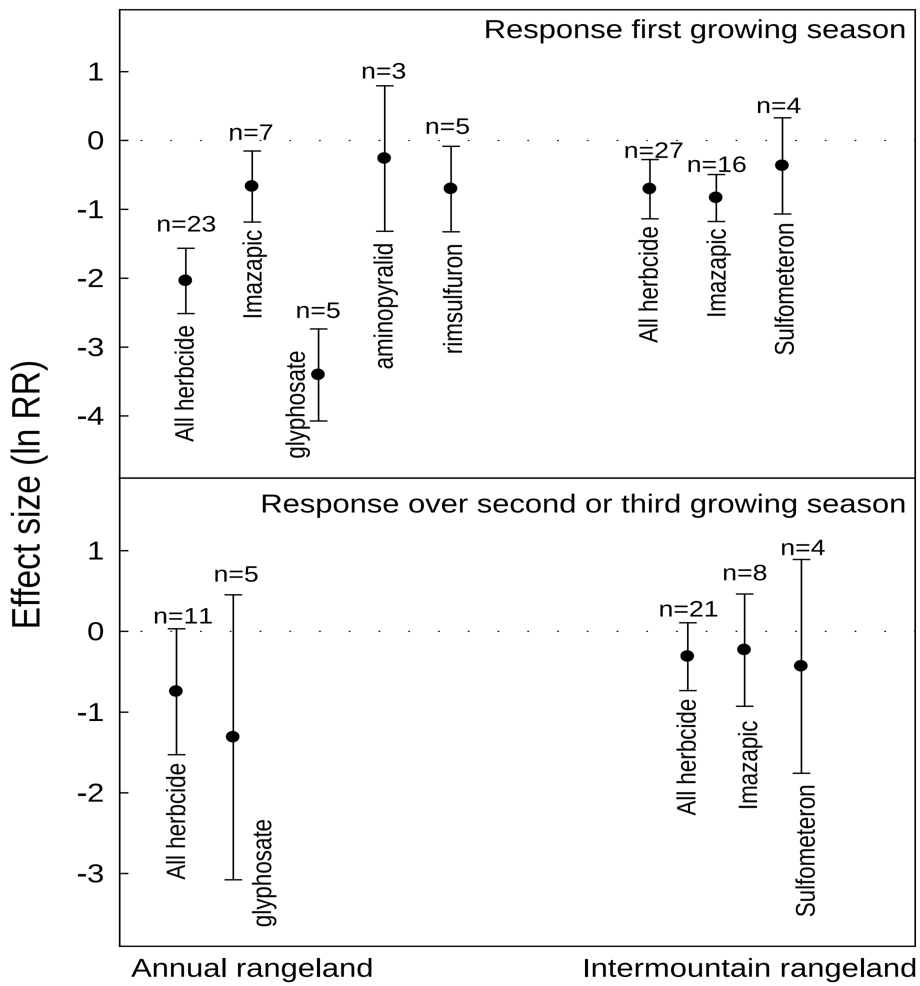
Challenges of medusahead control:

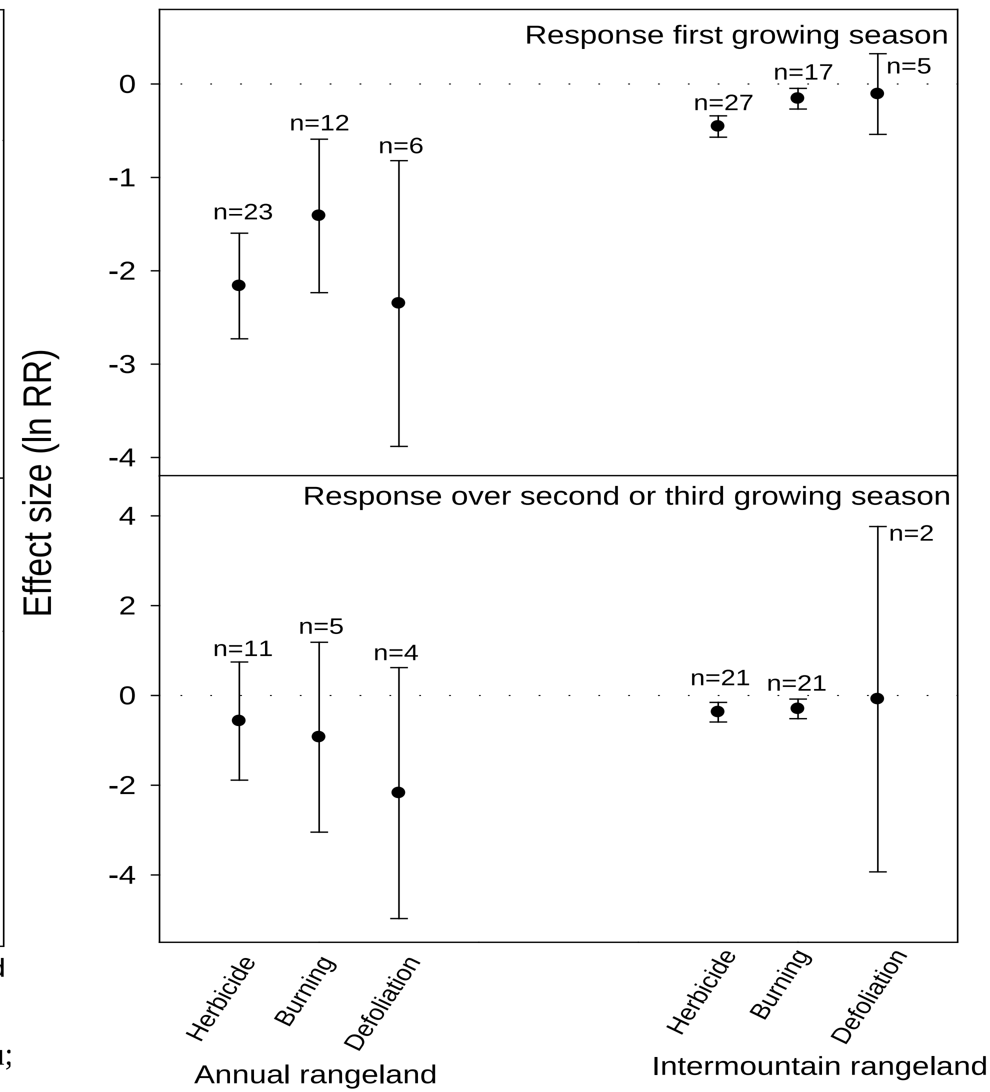
- Grass species
- Plant identification problems
- Controlling grass species in a rangeland is a challenge
- No county cost share program for medusahead like there is for yellow starthistle
- Cattle movement between summer and fall pastures

Plan of action:

- Weed management workshops
  - Control methods and plant identification
  - Improve early detection of new invasions
- Demonstration plots showcasing different medusahead control methods
  - Milestone
  - Fire
  - High intensity grazing
  - Host field days on the site
- Participating in large scale studies
- Compare effects of follow-up treatments

Effectiveness of medusahead control efforts





Contact Elise Gornish for more information: egornish@ucdavis.edu;
530-754-8766

Invasion resistance of natives vs. naturalized exotic communities: interactions with precipitation, N deposition and clipping season

Joanne Heraty (jmheraty@ucdavis.edu)

Valerie Eviner (veviner@ucdavis.edu)

Carolyn Malmstrom (Michigan State University, carolynm@msu.edu)

Kevin Rice (kjrice@ucdavis.edu)

Eviner lab website: http://www.plantsciences.ucdavis.edu/plantsciences_faculty/eviner

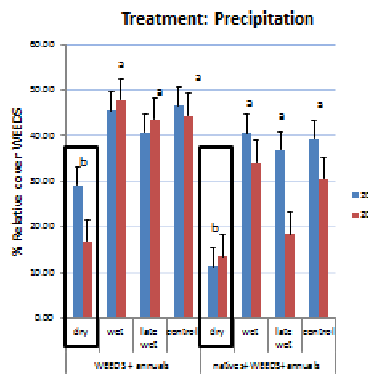
QUESTION: How do we manage noxious weeds by understanding how **climate, timing of grazing,** and **N deposition** benefit desirable grass species while reducing invasive species cover?

STUDY SITE: Controlled grassland experiment in Davis, CA. Established 2007.
2.25 m² plots with 1-m buffers. 10 treatment replicates.

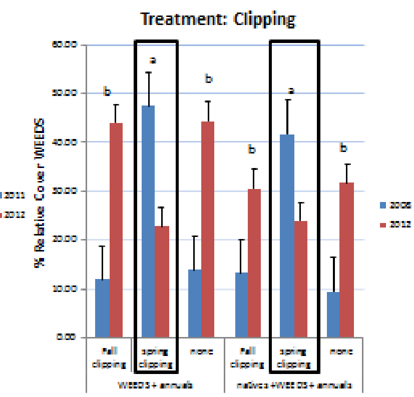
TREATMENTS:

- **Community type:** monocultures, mixtures of exotic naturalized annuals, invasive noxious weeds, natives
- **Climate**: Dry, wet, late wet, control (normal annual rainfall for location)
- **Grazing**: Fall clipping, spring clipping, none
- **Fertilizing**: High fertilization, none

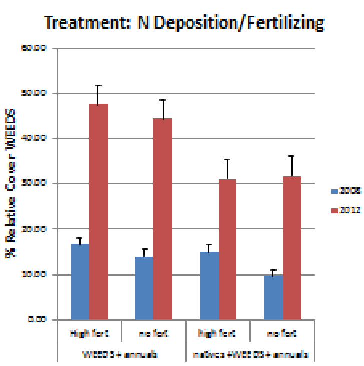
Composition: $p < 0.0001$
Precipitation: $p < 0.0001$
Time: $P = 0.0477$



Clipping*Time: $p < 0.0001$
Time: $p < 0.0001$
Clipping: $p < 0.0001$



Time: $p < 0.0001$
Composition: $p < 0.0001$
Time*composition: $P = 0.0013$



Effects of precipitation, grazing, N Deposition on reducing Medusa/Goatgrass cover:

*In both community types, dry conditions support reduced weed cover.

*Spring clipping significantly reduces weed cover in both community types over time.

*Fall clipping and no clipping increases % cover of weeds in both community types over time.

*No significant correlation between fertilization treatment on increase or decrease in weed cover.

In the works

Ecosystem Services Data

Controlling for invasive grasses has tradeoffs

Noxious weeds:

- Decrease spring forage availability in naturalized areas
- Decrease spring forage availability and soil N availability in native areas
- Increases water holding capacity in native areas
- Decreases soil compaction in native areas

Community mixtures with natives are able to suppress invaders over time.

Funding sources:
USDA NRI Weedy and Invasive Species Program, Kearny Foundation of Soil Science, Packard funding to UC Agriculture Sustainability Institute, Hatch funding.

Research made possible by:
Past and present members of the Eviner lab group, research collaborators Carolyn Malmstrom (Michigan State University) and Kevin Rice (University of California Davis).

EXOTIC NATURALIZED ANNUALS: [Avena fatua, Bromus hordeaceus, Festuca perennis, Trifolium subteranneum]

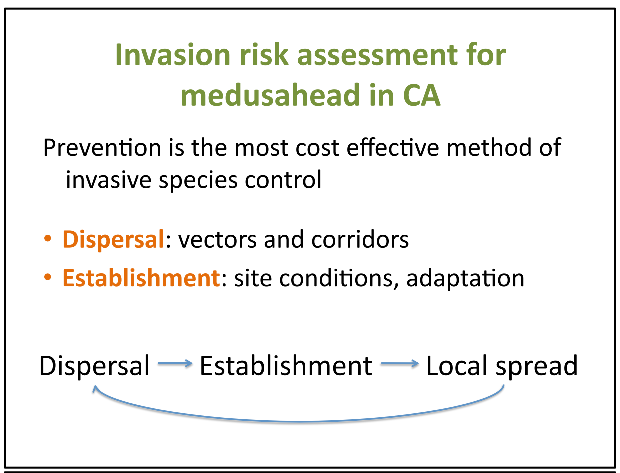
NATIVES: [Acmispon americanus, Bromus carinatus, Elymus glaucus, Elymus triticoides, Festuca microstachys, Stipa pulchra]

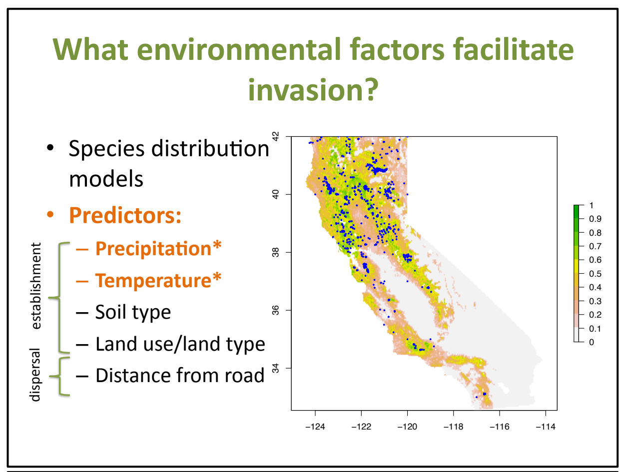
INVASIVE NOXIOUS WEEDS: [Aegilops triuncialis, Elymus caput-medusae]

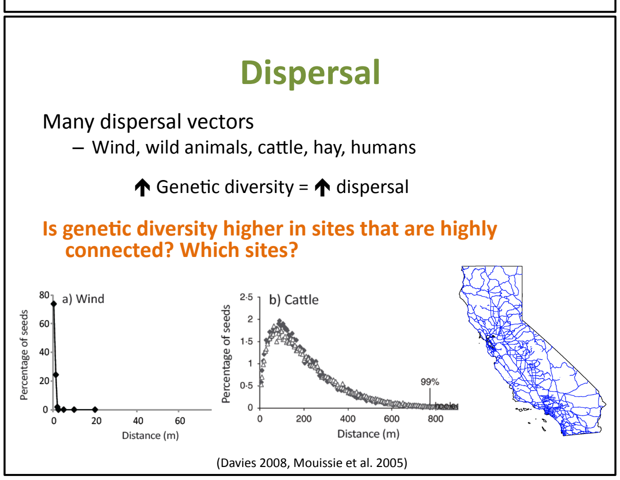
Invasion risk assessment for medusahead in CA:
Incorporating dispersal vectors and adaptation into predictions of spread

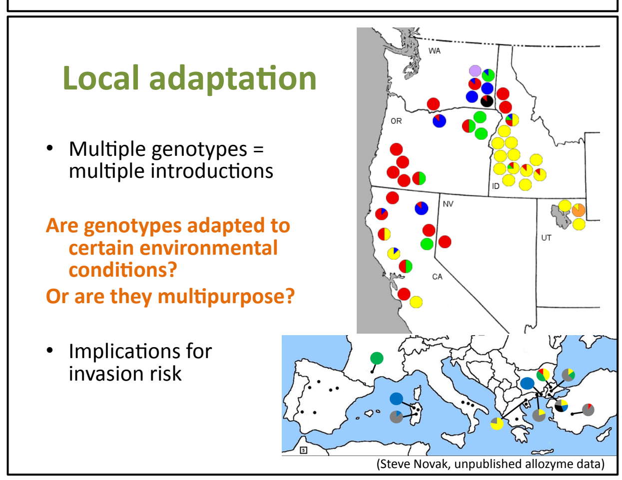
Emily C. Farrer
USDA Postdoctoral Fellow
Advisors: Katharine Suding, George Roderick
Department of Environmental Science, Policy & Management
University of California, Berkeley
Email: ecfarrer@berkeley.edu
Webpage: http://emilyfarrer.wordpress.com

The ability to predict where medusahead is likely to invade next is important for informing management decisions. Understanding the factors that promote invasion allows us to identify vectors that we might be able to control. I am combining species distribution modeling with population genetics to understand and predict medusahead invasion in California. Distribution modeling results indicate that precipitation and temperature dictate where medusahead has invaded statewide. I will use a genetics approach to test whether landscape connectivity through movement of cattle, infested hay, and humans increases medusahead dispersal. I will also test whether different medusahead genotypes are specialized to particular environmental conditions. I will then integrate dispersal and local adaptation information with distribution modeling to create detailed maps of invasion risk.





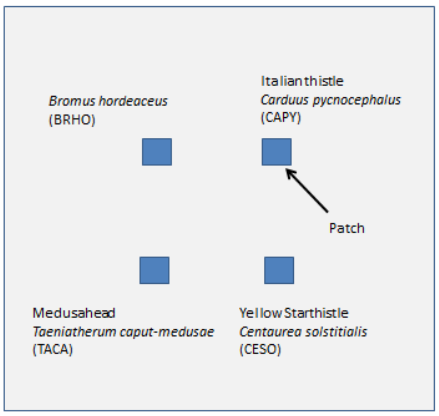


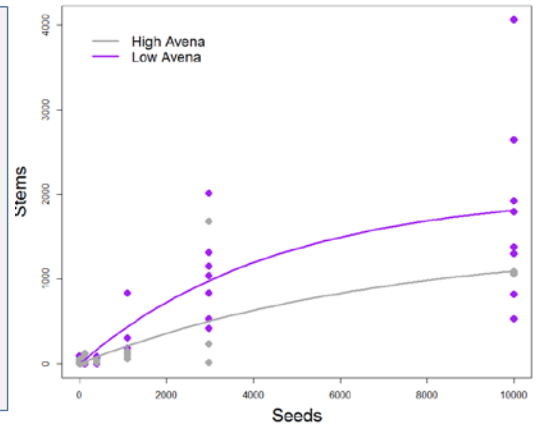


Managing weed threshold dynamics

Erica Spotswood
Postdoc - Katharine Suding lab
Department of Environmental Science, Policy and Management
UC Berkeley
espots@berkeley.edu

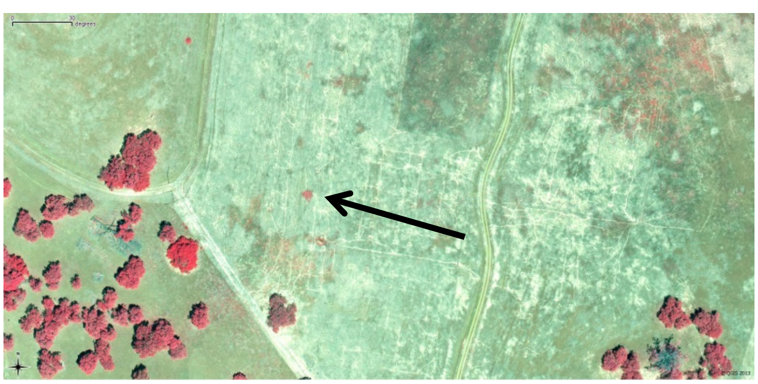
Identifying thresholds and density dependence using seed addition experiment





Seeds added to 20 x 20 meter plots of four species at 9 densities in October 2012. Experiment is monitoring recruitment in the first year, and spatial spread in subsequent three years. We predict that livestock mediated dispersal of Medusahead will accelerate the rate of spread in grazed plots compared to ungrazed plots. Medusahead recruitment saturated at lower densities in patches with high cover of Wild Oats. Soft chess and Italian thistle showed evidence of establishment limitation, while Medusahead and Yellow Starthistle showed seed limitation.

Remote identification of Medusahead and Goatgrass



We conducted an aerial flyover of Campbell pastures in May, 2013 to identify patches of Medusahead and Goatgrass when color contrast was at a maximum compared to other vegetation. Near infared image shows contrast between dry grass and green vegetation. Note patch of Goatgrass.

Stakeholder-Prescribed Adaptive Grazing Management Experiment

UC Sierra Foothill Research and Extension Center

- **Ranchers, range managers, and conservation professionals.**
- **Prescribe goals and management strategies (treatments).**
- **Implement, adapt, and monitor with stakeholder input.**

Project Partners

UC SFREC Adaptive Management Advisors

Ranchers & Ranch Managers
Audubon California
Beale Air Force Base
CA Department of Fish and Wildlife
Center for Natural Lands Management
City of Fairfield
Contra Costa Water District
Defenders of Wildlife
Department of Fish & Game
East Bay Municipal Utility District
East Bay Regional Parks
Environmental Consultants
Hedgerow Farms
Natural Resource Conservation Service
Nevada Irrigation District
Placer Land Trust
Point Reyes National Park
PRBO Conservation Science
San Francisco Public Utilities Commission
The Nature Conservancy
UC Cooperative Extension
UC Davis Natural Reserve System
US Fish & Wildlife Service
US Forest Service

Stakeholder Workshops

Request to Stakeholder Advisory Groups

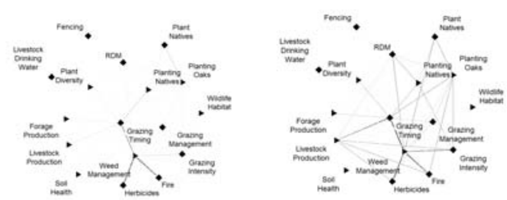
8 pastures, 1200 acres

1) Primary natural resource and agricultural goals.
2) Potential challenges and opportunities for goals.
3) Adaptive management strategies to achieve goals.

Conversation Dynamics and Belief Change: Adaptive Rangeland Management by Diverse Stakeholder Groups

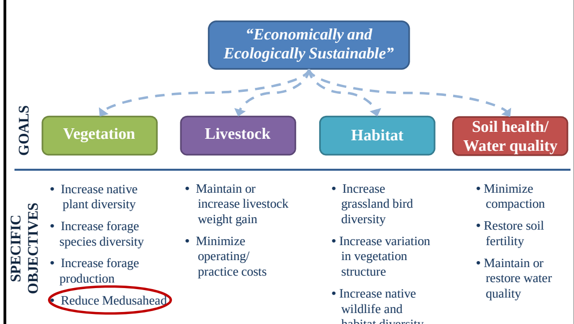
L. Jasny, M. Lubell, L. Roche, and K. Tate

Relating Goals to Methods: Mixed-Group Discussions



Before Discussion *After Discussion*

Stakeholder Goals and Objectives



Stakeholder Prescribed Adaptive Grazing Experiment – Year 1

Grazing Treatments

T1 Season-Long
Oak - 27 steers; Grassland - 45 steers

T2 Fall/Spring grazing
Oak - 63 steers; Grassland - 85 steers

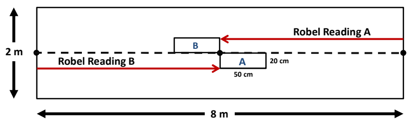
T3 Fall/Spring, targeted
Oak - 65 steers; Grassland - 82 steers

T4 Winter
Oak - 65 steers; Grassland - 82 steers

Adaptively implemented and monitored with stakeholder participation

Monitoring Ecosystem Service Responses to Prescribed Grazing Treatments

Goal	Indicator	Frequency Measured
Livestock & Forage	Steer weight gains (ADG)	Seasonal & Annual
	Available forage (lbs/ac)	Seasonal & Annual
Plant Cover, Diversity	Cover and frequency of weeds, good forage species (grasses vs. forbs), richness	Seasonal & Annual
Habitat Diversity	Ground bird hiding cover (in)	Seasonal & Annual
Soil and Water Quality	Cattle fecal – nutrient distribution	Seasonal & Annual



Grassland Pastures

T1 45 stockers (Start= 635 lbs; End= 935 lbs)

T2 85 stockers (Start= 641 lbs; End= 848 lbs)

T3 82 stockers (Start= 638 lbs; End= 851 lbs)

Treatment	Average Daily Gain (lbs/day)	
	Dec-Feb	Mar-May
Season-Long (T1)	0.4	2.9
Fall/Spring (T2)	0.05	2.8
Fall/Spring Targeted (T3)	0.04	1.8

Oak Pastures

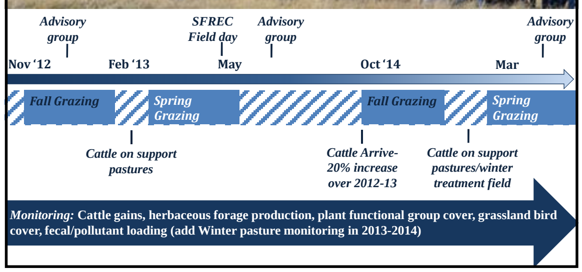
T1 27 stockers (Start= 614 lbs; End= 951 lbs)

T2 63 stockers (Start= 593 lbs; End= 952 lbs)

T3 65 stockers (Start= 585 lbs; End= 958 lbs)

Treatment	Average Daily Gain (lbs/day)	
	Dec-Feb	Mar-May
Season-Long (T1)	1.5	2.4
Fall/Spring (T2)	0.6	3.6
Fall/Spring Targeted (T3)	0.5	3.5

Timeline



Joe DiTomaso
jmditomaso@ucdavis.edu

Guy Kyser
gbkyser@ucdavis.edu

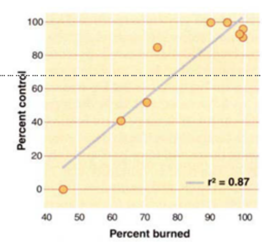
Information on medusahead and barb goatgrass control can be found at **wric.ucdavis.edu**

http://wric.ucdavis.edu/information/crop/natural%20areas/wr_A/Aegilops_cylindrica-triuncialis.pdf

http://anrcatalog.ucdavis.edu/pdf/8315.pdf

http://wric.ucdavis.edu/information/crop/natural%20areas/wr_T/Taeniatherum.pdf

We are also in the process of developing a medusahead management guide which should be available by next year sometime



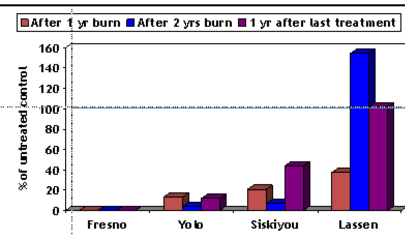
Percent of transect burned in second year plotted against percent barb goatgrass control.

Three years after the burn there was still 85% control (only 5% cover) in the plots that burned twice.

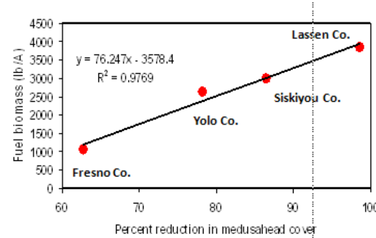
Barb goatgrass

Timing	Chemical	Rate (oz/acre)	Barb goatgrass (% of untreated)	Other annual grasses (% of untreated)
October	aminocyclopyrachlor	8	11.8	467.5
Oct + Jan	aminocyclopyrachlor	4 + 4	0.5	358.8
Oct + Jan	Perspective	4 + 4	2.3	242.4
January	aminocyclopyrachlor	8	12.7	81.8
January	Perspective	8	10.6	142.1
April	aminocyclopyrachlor	8	9.2	133.1
none	none	none	100.0*	100.0*

Medusahead



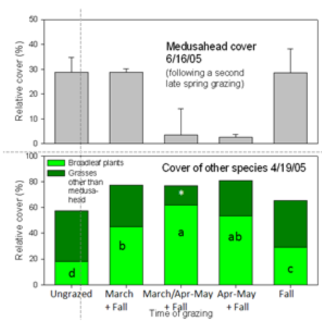
Effect of fuel load on medusahead control one year after burning



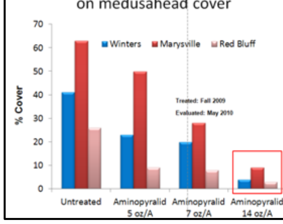
Treatment previous year	% medusahead cover following year
Undisturbed	38
Burned	43
Tilled	18

Reduction in medusahead when thatch is removed by tillage

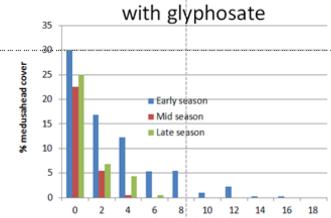
Control of medusahead with grazing



Effect of aminopyralid on medusahead cover



Medusahead control with glyphosate

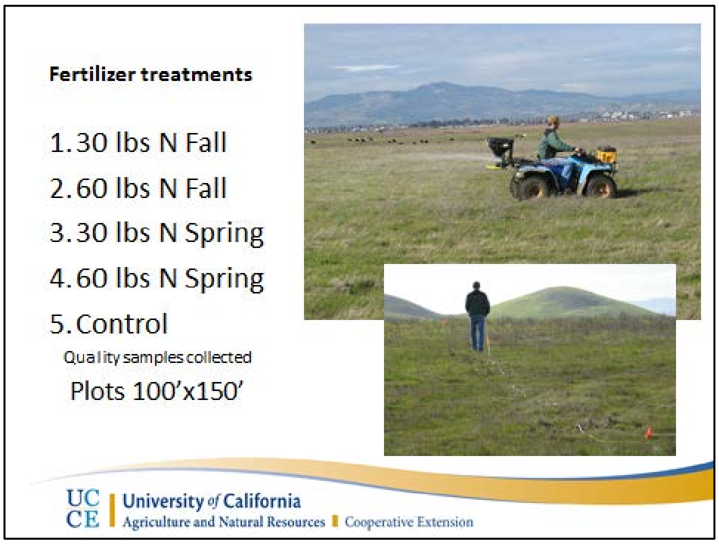


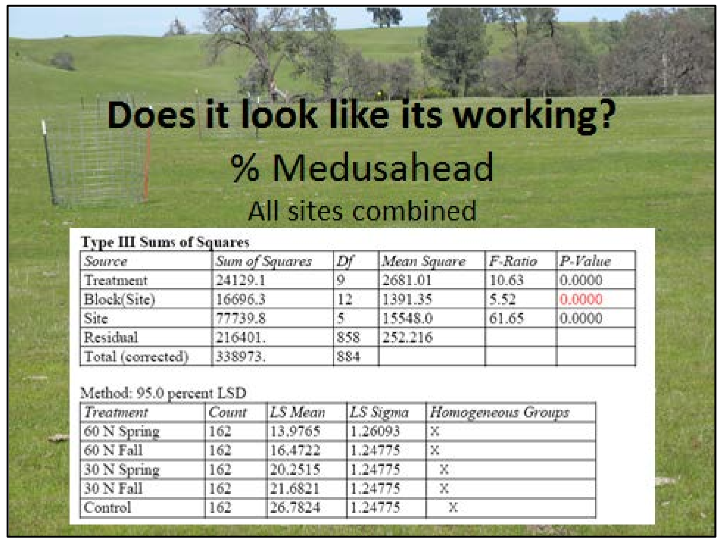
Treatments	% cover
Roundup (glyphosate)	4.4/1.6 **ab**
Landmark (sulfometuron + chlorsulfuron)	0/0 **b**
Matrix (rimsulfuron)	0.05/0.05 **b**
Plateau (imazapic)	0.7/0.5 **b**
Untreated	11.3/3.8 **a**

Controling Medusahead with Nitrogen Fertilizer

A Rustici Range and Cattle Research Endowment funded project.

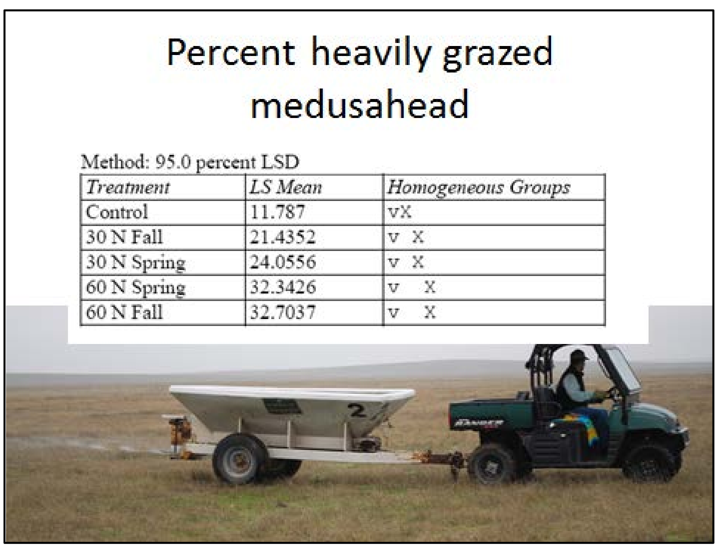
Theresa Becchetti, Josh Davy, Glenn Nader, Sheila Barry, Morgan Doran, Mellissa Merril, Dustin Flavell, Jeremy James, Emilio Laca, and James Bartolome



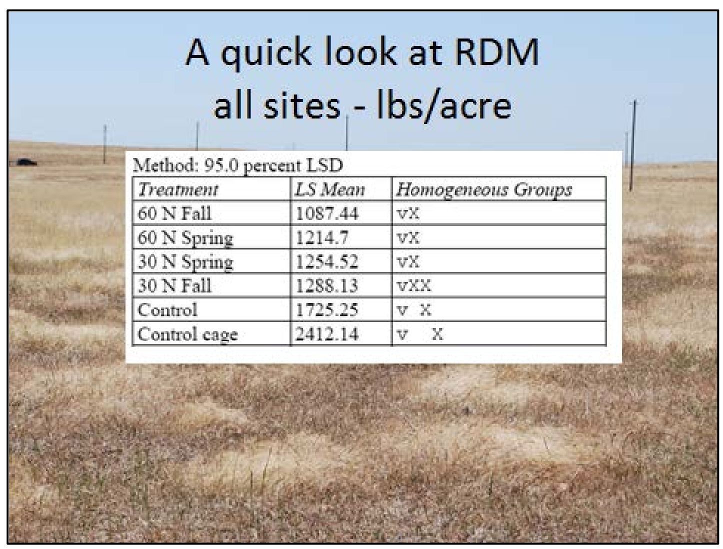


Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Treatment	24129.1	9	2681.01	10.63	0.0000
Block(Site)	16696.3	12	1391.35	5.52	0.0000
Site	77739.8	5	15548.0	61.65	0.0000
Residual	216401.	858	252.216		
Total (corrected)	338973.	884			

Treatment	Count	LS Mean	LS Sigma	Homogeneous Groups
60 N Spring	162	13.9765	1.26093	X
60 N Fall	162	16.4722	1.24775	X
30 N Spring	162	20.2515	1.24775	X
30 N Fall	162	21.6821	1.24775	X
Control	162	26.7824	1.24775	X



Treatment	LS Mean	Homogeneous Groups
Control	11.787	vX
30 N Fall	21.4352	v X
30 N Spring	24.0556	v X
60 N Spring	32.3426	v X
60 N Fall	32.7037	v X



Treatment	LS Mean	Homogeneous Groups
60 N Fall	1087.44	vX
60 N Spring	1214.7	vX
30 N Spring	1254.52	vX
30 N Fall	1288.13	vXX
Control	1725.25	v X
Control cage	2412.14	v X

- Data anaylsis is beginning and a paper for the Jornal of Rangeland Ecology and Management is being drafted.
- Wet chemistry is being performed on Medusahead samples.
- A second year of fertilizer is being applied this fall (November 2013) with a split plot design to allow for expression of carryover effect as well as a second year of fertilizer. Forage samples are planned again this year to look at qulaity of Medusahead.

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Making a Difference for California

Seedings to compete with medusahead

For more information on this and other topics visit : http://cetehama.ucdavis.edu/

Seedings to compete with medusahead
funded by the Rustici Range and Cattle Research Endowment

Here's the idea

- Lets eliminate the weed we don't want
- Replace it with something we do want
- Evaluate the forage we replaced
  - Competitive ability to withstand reinvasion
  - Forage production
  - Forage quality
  - Ability to survive

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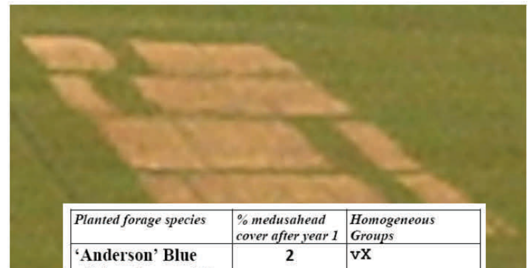
Seeding to compete with medusahead

1. Alturas → seeded differently
2. Likely ↗
3. Palo Cedro
4. Red Bluff
5. Fairfield
6. Farmington
7. Sunol
8. Hopland
9. Parkfield



Planted forage species	*% medusahead cover after year 1*	*Homogeneous Groups*
'Anderson' Blue wildrye (perennial grass)	2	vX
Ryegrass/soft chess (annual grass mix)	3	vX
'Advanced AT' hardinggrass (perennial grass)	3	vX
'Berber' orchardgrass (perennial grass)	3	vX
'Flecha' fescue (perennial grass)	3	vX
'Luna' wheatgrass (perennial grass)	4	vX
Control	27	v X

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Timeline

- **Complete weed control**
  - **Spring 2011, Fall 2012 - glyphosate**
- **Seed competing treatments**
  - **Fall 2012**
- **Allow treatments to fully establish**
  - **No grazing, 2,4-D Spring 2013**
- **Evaluate initial establishment**
  - **Spring 2013**
- Individually evaluate established plants
  - Ongoing

'Fle
fesc

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What we've learned

- 5 of the 9 sites look successful after year 1
  - 1-4 plants per sqft needed, 2+ desired
  - All failures were harrowed
    - Only 1 harrowed site succeeded
    - All drilled plots succeeded
    - Excellent weed control may have lessoned the effects of extremely dry weather
    - A separate research trial is evaluating the success of 16 different planting methods

Average plant counts of the 5 successful sites

Planted forage species	*Plants per square ft at the end of yr 1*	*Homogeneous Groups*
'Advanced AT' hardinggrass	3	vX
'Luna' wheatgrass	5	v X
'Berber' orchardgrass	5	v XX
'Flecha' fescue	6	v X
'Anderson' Blue wildrye	8	v X
Ryegrass/soft chess	12	v X

UC CE | University of California Agriculture and Natural Resources | Cooperative Extension

Cooperative Extension of Tehama County
1754 Walnut Street, Red Bluff, CA 96080
(530) 527-3101
FAX: (530) 527-0917
Email: jdavy@ucdavis.edu
Website: cetehama.ucdavis.edu
Josh Davy, UC Farm Advisor

Rob Wilson
Center Director/Farm Advisor
UC ANR Intermountain Research and Extension Center

2816 Havlina Rd.
Tulelake, CA 96134
530-667-5117
rgwilson@ucanr.edu

Related Medusahead Publications

1. Kyser, G., J. DiTomaso, M. Doran, S. Orloff, R. Wilson, D. Lancaster, D. Lile, and M. Porath. 2007. Control of Medusahead (*Taeniatherum caput-medusae*) and Other Annual Grasses with Imazapic. Weed Technology. Vol. 21:1 66-75

2. Wilson, R. 2009. Medusahead control on Great Basin rangeland with various herbicides. WSWS Progress Report: 23-24

3. Wilson, R. 2009. Seeded perennial grass tolerance to various herbicides used for annual grass control. WSWS Progress Report: 58-59.

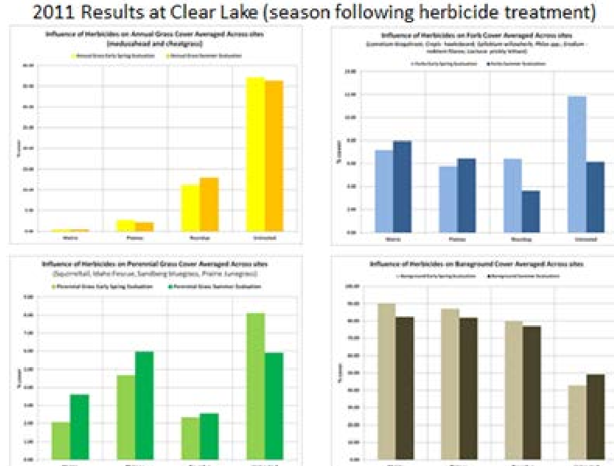
4. Wilson, R. 2009. Established perennial grass tolerance and downy brome control with rimsulfuron and sulfometuron. WSWS Progress Report: 60.

5. Kyser, G.B., R. Wilson, J. Zhang, and J. DiTomaso. 2013. Herbicide-assisted Restoration of Great Basin Sagebrush Steppe Infested with Medusahead and Downy Brome. Rangeland Ecology and Management. 66(5): 588-596

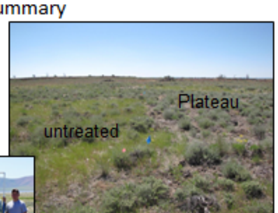
Medusahead and Cheatgrass Management Project at Clearlake National Wildlife Refuge (fall 2010-2013)

- **Manage annual grasses for improved wildlife habitat (sage grouse)**
- **Study was conducted at three sites with differing vegetation types:**
  - Solid stand of medusahead with sporadic perennial grass and forbs
  - Healthy perennial grass stand recently invaded by medusahead
  - Sagebrush overstory & sporadic perennial grass understory invaded by medusahead
- **Annual Grass Control Treatments**
  - Fall 2010 applied Matrix at 4 oz/A + non-ionic surfactant
  - Fall 2010 applied Plateau at 6 fl. oz/A + non-ionic surfactant (not labeled in CA)
  - Spring 2011 applied glyphosate (4L) at 10 fl. oz/A + non-ionic surfactant
  - Untreated Control
- **Revegetation Treatments in each herbicide block**
  - Half of the plots were seeded in late winter (3/10/2012) with a native seed mix containing Low sagebrush, Basin Big sagebrush, squirreltail, Idaho fescue, and Great Basin wildrye
  - Seed was broadcast and broadcast with harrow incorporation

2011 Results at Clear Lake (season following herbicide treatment)

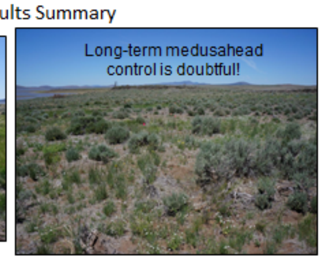


2011 Results Summary



Summary
- Matrix and Plateau provided effective control of all annual grasses 1 year after treatment
- Herbicides suppressed some annual forbs but released some desirable forbs, perennial grasses and sagebrush
- Herbicide treated areas had more bareground!

2012 Results Summary



Summary
- Perennial grass seedling establishment was low; grass establishment was similar or higher in Matrix and Plateau plots compared to the untreated control; seed incorporation increased grass establishment
- Sagebrush seedling establishment was higher in Matrix and Plateau plots compared to the untreated control
- Medusahead cover increased in all herbicide treatments
- At some sites, perennial forb and sagebrush cover remained elevated in herbicide-treated plots two year after treatment
- Is it possible to prevent medusahead reinvasion long-term??

Testing the Influence of Prescribed Fire Size on Medusahead

Sasha A. Berleman
PhD Student in Scott Stephens Fire Science Lab, collaborating with the Suding Lab
Environmental Sciences, Policy, and Management
University of California, Berkeley
951-719-6835
sberleman@berkeley.edu

While many individuals and agencies use prescribed fire in medusahead management, constraints on prescribed fire use (weather restrictions, costs, etc.) make it critical to determine the *most efficient methods* of fire use for medusahead management. We ask what minimum spatial scale of prescribed fire successfully reverses the threshold processes that allow medusahead to dominate and invade landscapes, and does cattle grazing after prescribed fire influence medusahead dispersal and reinvasion rates.

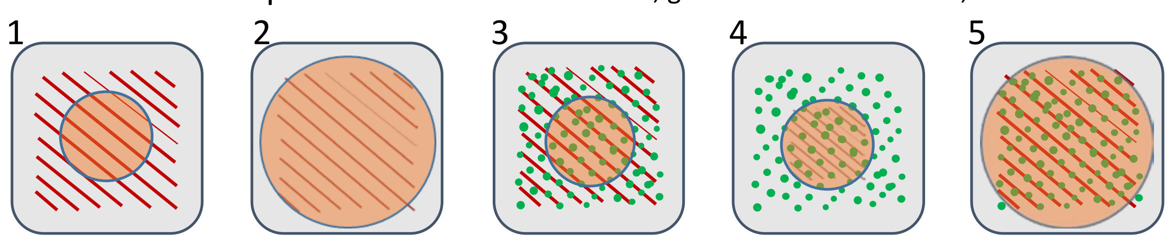
Main Factors Influencing Control Burn Success

1) **Seedbank:** What's present before the burn; what's viable after the burn? What's the proportion of desirable seeds to undesirable seeds? Are there plants that survive the burn such as perennials or opposite timed species?
2) **Dispersal:** What species are present in the edges of the burn? How far do the species around the burn to disperse? How quickly? By what mechanism are they likely to disperse?

These factors are directly linked to medusahead patch size and population density.

<u>All of these factors considered, burn size could likely be a critical component to whether or not a burn is successful in any particular scenario.</u>

Burn Scenario Examples: red lines are medusahead, green dots are seedbank, circles are burns



1) Small burn on invaded pasture with no native seedbank: likely not a successful burn (very quickly reinvaded from edges)
2) Large burn, such as burning an entire pasture: But even if medusahead is mitigated in the burn, what will come back?
3) Small burn within medusahead infested pasture mixed with a desirable seedbank – burn area is likely to become reinfested very quickly
4) Early Detection Rapid Response (ERDD) scenario where burning only to the extent of a small/new medusahead patch might be more beneficial than burning a larger area?
5) Perhaps point can be reached that a particularly large burn in a pasture that has widespread invasion but also desirable species in the seedbank could become an inhibitor to medusahead reinvasion and allow time for more desirable species to recover within the burn area?

Title: Controlling goatgrass with herbicides in a Marin County serpentine grassland
Authors: James W. Bartolome (presenter), Pete Frye, Michele Hammond, Peter Hopkinson, and Mischon Martin

In 2004 *Aegilops triuncialis* (barbed goatgrass) was detected in the Sleepy Hollow, the first indication this invasive annual grass was in Marin county. Sleepy Hollow open space preserve is ungrazed grassland adjacent to a subdivision in Terra Linda. County Park staff initiated a control program in 2005. Burning showed promise for controlling goat grass in the Coast Range grassland type, but low fuels prevent fire use in the numerous included Serpentine grasslands. Since 2005 post-emergent herbicides (glyphosate) have been tried but showed erratic results among sites and years suggesting an interaction of site and weather. Goatgrass continued to spread in Sleepy Hollow. In 2012 Marin County Parks contracted with the UCB Range Ecology Lab to assist with the design and interpretation of different herbicide treatments to improve control. Here we report results after 2 years.

We applied three herbicides (broadcast Poast and Fusilade, selective for annual grasses); and Aquamaster (spot application, non-selective) as treatments within randomized blocks at seven locations (four in serpentine grassland and three in non-serpentine grassland) in March and May 2012. Because of poor results from the May 2012 treatments, we re-treated those plots in November 2012. The March treatments were repeated in 2013. We report results as: 1) number of barbed goatgrass plants live or setting seed at the beginning of June in each of the 5 x 5 m treatment units, excluding a 1 m wide buffer strip; and 2) species cover within the treatment units at beginning of June. Data were analyzed with one-sided t-test ($p<.05$) for number of live goatgrass and with Detrended Correspondence Analysis (DCA) for species cover.

Results and Conclusions: Goatgrass density was significantly lower than controls except for the May 2012 treatments (Fig. 1). Most effective were Poast and Fusilade, which killed all goatgrass in the Fall 2012 treatments. Aquamaster was less effective, but that may have been partly due to the method of spot application. Goatgrass increased notably on controls between 2012 and 2013. DCA showed a strong effect of soil type on species composition, with a secondary effect from the Poast and Fusilade treatments. Those two herbicides greatly reduced annual grasses, including goatgrass, but did not affect serpentine forbs. Italian thistle was commonly a dominant on treated non-serpentine plots. The two annual grass-selective herbicides effectively reduced goatgrass when broadcast in fall and early spring. Serpentine species were unaffected but some undesirable broadleaved species did increase on non-serpentine sites. Continued monitoring and mapping is recommended to guide future applications.

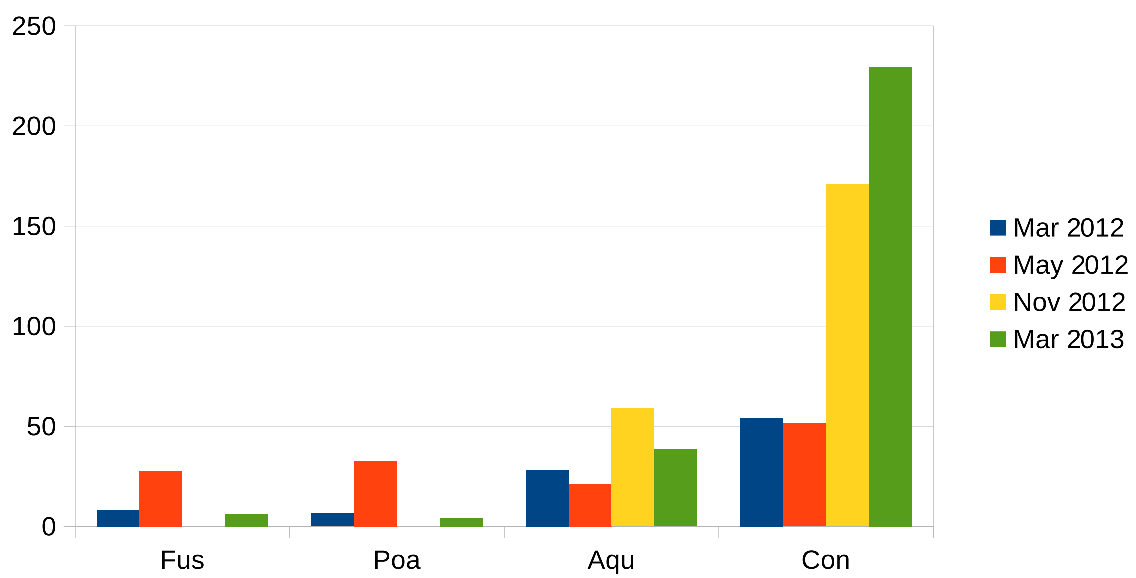
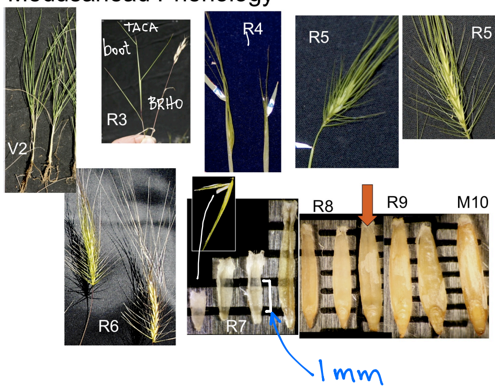


Figure 1. Density of barbed goatgrass individuals counted in May on plots with three herbicide treatments (FUS=Fusilade, POA=Poast, and AGU=Aquamaster) and untreated control. Fusilade and Poast means are significantly different from controls for all means except May 2012 (one sided t-test, $p<.05$). The only significant differences between Aquamaster means and control are for the Nov 2012 and Mar 2013 application dates.

Medusahead must be treated at the most sensitive phenological stage: between boot and anthesis

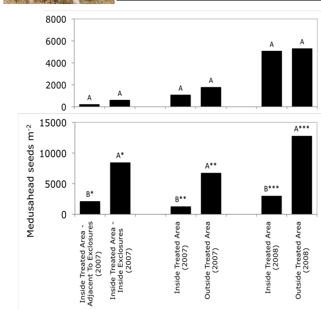
Medusahead Phenology

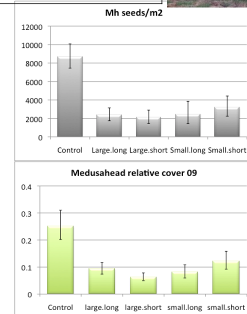


Stage Code	Description
V1	Plant Germinated
V2	Early vegetative, before elongation of internodes
V3 R3	Late vegetative, elongation of internodes and boot stage
R4	From emergence of awns to full emergence of seedhead
R5	From fully emerged seedhead to opening of florets. Anthesis. Visible anthers.
R6	Anthesis to closure of florets. Beginning of kernel formation.
R7	Kernel elongation inside floret until it reaches full length.
R8	Seeds in milk stage. Kernels occupy full length of palea.
R9	Seeds in dough stage.
M10	All seeds in seedhead are mature and hard. Plants are not dead yet. There is some red, brown and green in the seedheads. Glume veins are dark.
D11	Tiller is dead and dry. Color is uniform, sandy yellowish but not grey. Seeds shatter.
L12	Grey plant remains obviously from the previous season.

Grazing with sheep or cattle controls medusahead when applied at the right time, duration and stocking density

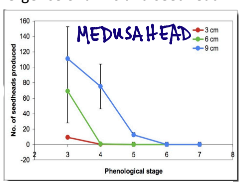
Livestock	County	Start	End	AU/ac	AUM/ac	Reduction in TACA seed
Sheep	Yolo	10-Apr	24-Apr	0.4-1.6	1.2-2.4	80%
Cattle	Glenn	21-Apr	12-May	1.0-2.0	0.7-1.0	75%



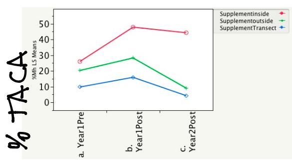


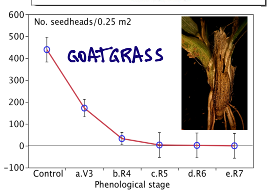
http://mysare.sare.org/mySARE/ProjectReport.aspx?do=viewRept&pn=SW06-038&y=2010&t=1

Medusahead and barb goatgrass are susceptible to mowing after R4: emergence of awns and seedhead



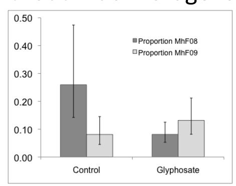
Palatable supplement tubs can be used to attract animals to graze medusahead patches



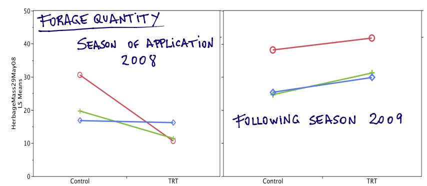


Effect of mowing on medusahead cover at the Dunninga Hills, California. The foreground band at the bottom shows a control area. The middle band shows the area mowed in 2007. Top band shows area recently mowed in 2008. Photo taken in May 2008.

Glyphosate can be used as the agent to kill medusahead at the right stage without much forage loss



Spray with 16 oz/ac in 1% solution between R4 and R7 (~ early May)



Emilio A. Laca
Plant Sciences MS1
One Shields Ave.
Davis, CA 95616
ealaca@ucdavis.edu
(530) 754-4083

Morgan P. Doran, John Harper, Stephanie Larson, Sheila Barry, Josh Davy, Theresa Becchetti, Royce Larsen, Larry C. Forero, Roger Ingram, UCCE Farm Advisors

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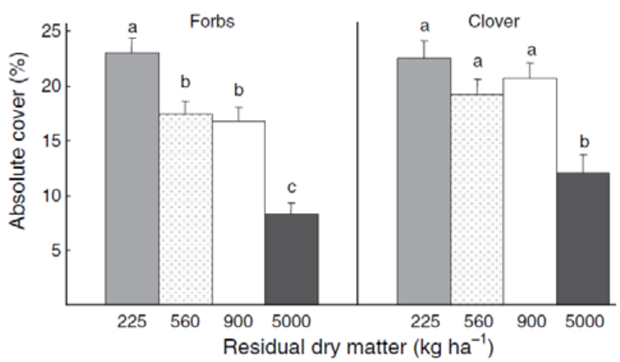
Research supported by:
Western SARE
UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources

Medusahead and Residual Dry Matter (RDM)

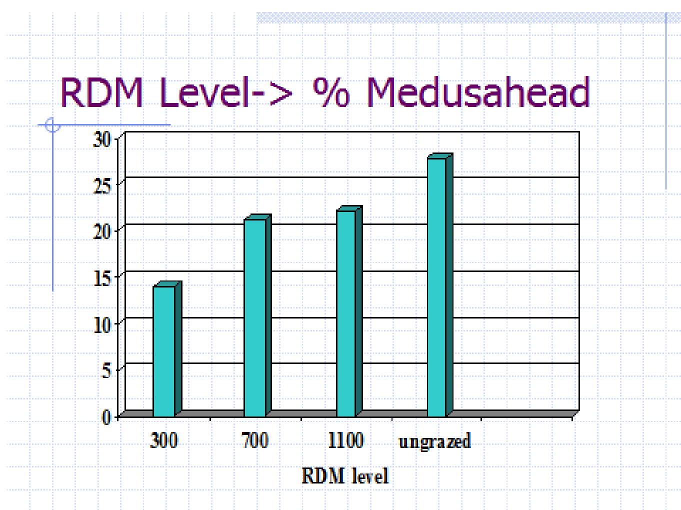
Role of thatch or RDM in Medusahead

Disking, burning, grazing and other methods of managing thatch, litter or RDM have all demonstrated a decrease in medusahead cover for 3-5 years. The reason for that could be its seedling germination process. Young et. al. 1999 observed medusahead seeds (technically more complex than a simple seed, a type of fruit known as a caryopsis) can germinate suspended in litter without the callus end of the seed in contact with a moisture supplying substrate. Not only can they do this once, but repeated germination from adventitious buds can occur if the initial root dries before seedling establishment is obtained.

Five years of experimental manipulation at SFREC of residual dry matter (RDM) on three slope classes (shallow, intermediate, and steep) and two slope aspects (southeast and northeast) showed significant site and treatment effects on plant composition and productivity. RDM did impact plant species occurance. Plant species diversity was lowest with the highest level of RDM, which represented grazing removal. Clovers and forbs prefered lower RDM.



While the highest RDM treatment were often dominated by medusahead .



Bartolome, J.W., R. D. Jackson, A.D.K. Betts, J. M. Connors, G.A Nader and K. W. Tate. 2007. Effects of residual dry matter on net primary production and plant functional groups in California annual grasslands. Grass and Forage Sci., 62, 445-45.

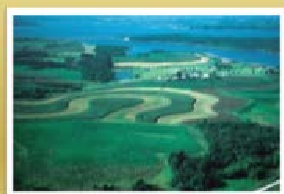
Young, James, Charles Clements and Glenn Nader. 1999. Medusahead and Clay: The Rarity of Perennial Seedling Establishment. Rangelends, 21(6) pg. 19-23.

Alan Bower – USDA – NRCS Northern California Area Rangeland Management Specialist
Red Bluff, CA
alan.bower@ca.usda.gov
530-527-2667 ext. 105

Conservation Planning

- Focus on private landowners
- **Create conservation plans for landowners, using our expertise – to meet landowner's goals and objective**
- Create such plans by focusing on SWAPAH.

S – soil
W – water
A – air
P – plants
A – animals
H - humans



Assess conditions and plan to improve the quality of all of these

Conservation plans consists of practices (overarching and specific)

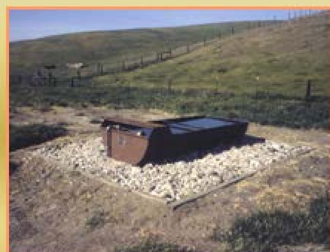
NRCS categorizes conservation practices as three types: Key, Accelerating and Facilitating.

1. Key practice
   -The most important practice(s) that pertain to a specific type of management system
   -The practice(s) which have the greatest potential to effect long term sustainability of the resource base
2. Accelerating Practices - used to directly improve resource conditions when changes in management cannot achieve the resource management goals
3. Facilitating Practice - practices to enhance the ability to properly manage the land under the existing land use, management will improve as a result of implementation.

Examples of some accelerating practices on grazed lands: *Range Planting, Brush Management, Prescribed Burning, Herbaceous Weed Control*
Examples of some facilitating practices on grazed lands: *Fence, Watering Facility, Pipeline, Spring Development*

Facilitating

Offsite water



fencing

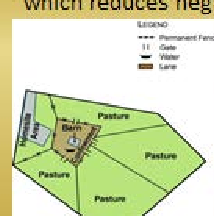
Accelerating

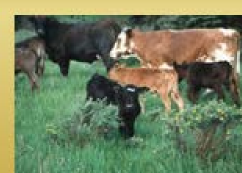
*Herbaceous Weed Control

Mowing, Biological, Chemical

Tied together with post "practice" management e.g.-Prescribed Grazing

The term Prescribed Grazing applies to a technical standard for management of grazed land, the prescription is for grazing which reduces negative effects while enhancing positive ones.



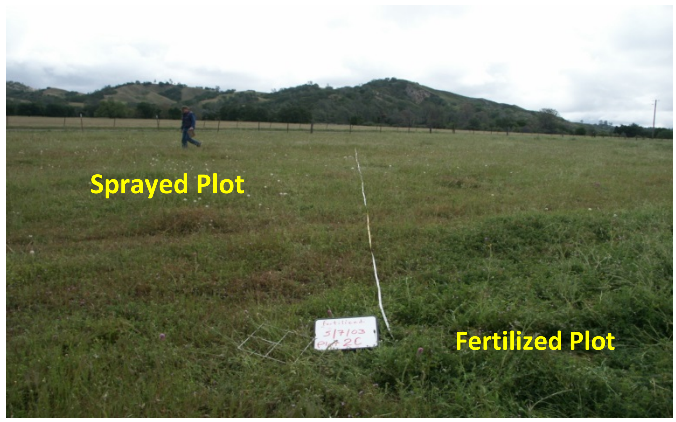


In the case of weeds – Medusahead & Barb Goatgrass – targeted grazing

Medusahead Control - Experimental Scale to Ranch Scale

Royce Larsen UCCE
Karl Striby NRCS

A small demonstration was set up to compare three kinds of treatments that had already been studied. The treatments included: burning, spraying with glyphosate and fertilization and grazing. The purpose was to determine a treatment that could be expanded for that particular ranch and used in conjunction with EQIP (Environmental Quality Incentive Program) cost sharing to determine if control of Mh on a larger than experimental plot scale was feasible.



It was burned in the fall of 2002. The fire escaped and burned all the treatments. Since all plots burned, treatment results were obscured. However, areas that were fertilized exhibited high production of bur clover the next growing season, spring of 2003. It was thought that "fertilization and grazing" was a more effective treatment than spraying or burning for this site.

An EQIP project to control Mh by fertilizing 350 acres with 16-20-0 fertilizer, and using grazing as a means to reduce Mh, was initialized.

- Results: Very productive year, because of both high rainfall and fertilization. A small part of the area fertilized showed very good control of Mh. The rest showed poor control of Mh.
- Conclusion: Too large of an area to get high density of grazing at the right time for Mh control. This is a concern of going from experimental plot scale to ranch scale.

The rancher's comments were: He would not do it again.
Two reasons:

1) Fertilization is cost prohibitive, even with EQIP
2) It's a roll of the dice. No guarantee that the timing of the rain will be correct, so that the fertilizer can be used by forbs and other grasses for maximum efficiency in controlling Mh.

Audubon CALIFORNIA

fact sheet

October 2013

Bobcat Ranch

Our goal for the Bobcat Ranch is to become a research/outreach/education hub for economically feasible conservation practices and rangeland improvements on working lands to enhance the overall productivity and habitat for wildlife species.

Outreach/Education

- Workshops
- Ranch tours
- College classes
- Volunteer groups

Research

- Collaborate on projects- UCD, CS, UCCE, Dow AgriSciences

Where to start

- Road sides
- Develop water sources
- Livestock distribution

Tool Box

- Grazing
- Prescribed burns
- Herbicide application
- Infrastructure

Burrowing Owl by Jolie Gordan

Carissa Koopmann Rivers
ckoopmann@audubon.org
530-795-4116 office
ca.audubon.org/bobcat-ranch

Justin Wages
justin@placerlandtrust.org
Information on medusahead and barb goatgrass control can be found at **PlacerLandTrust.org**

http://www.placerlandtrust.org/dropbox/PLT%20Property%20Maps/2009%20Doty%20Ravine%20Upland%20Report%20FINAL%2012.11.09.pdf

Grazing vs. Non-grazing cover surveys 2008-2009