Sahara Mustard Control Strategies

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Annual Weeds are Difficult to Manage

Examples of Widespread Mojave Exotic Annual Weeds

- **Red Brome, *bromus madritensis (rubens)***
- ***Schismus barbatus***
- Rabbitsfoot grass, *polypogon monospeliensis*
- London Rocket, *Sisymbrium irio*
- Tumble Mustard, *Sisymbrium altissimum*
- Russian Thistle, *Salsola paulsenii*,
- Flixweed/Tansy Mustard, *Descurainia sophia*
- Five-hook Bassia, *Bassia hyssopifolia*

Why Annuals are a Challenge

- Germination conditions are variable, difficult to predict, populations vary from yr to yr, precip dependent
- Short treatment window, short time for management reaction
- High seed production
- Multiple generations w/in 1 yr
- Usually long term seed viability
- High densities in “good yrs”, but almost always present, some seed production

Is there Hope for Annual Weed Control?

- Past management has occurred in site specific areas, site- led approach, intensively managed/agricultural areas
- YES?-Yellow Starthistle, Central, CA
- Sahara Mustard: Unknown? We have a lot to learn

Current & Potential Control Methods on BRTO

- Mechanical Extraction: Handpulling, hoeing with hand tools
- Chemical: Post emergent, pre-emergent, spot, broadcast applications
- Flaming
- Steam/hot foam
- Biological Control? Grazers
- Cultural: Roadside Maintenance, construction decontamination, livestock grazing, need BMP’s

Seed Bank Management

- It’s all about seeds!
- Controls should be designed around stopping seed production
- Supplemental watering
  - Stimulate germination
  - Followed by pre-planned treatment
- Pre-emergent herbicides

Extraction

- **Hand pulling/Hoeing**
  - **Most common method utilized**
  - **Libby Powell, UNLV at Lake Mead control areas, effective, minimal plants the following yr**
  - **Selective**
  - **Ergonomics/ Occupational Health**
  - **Soil Disturbance**
  - **Prior to seed, after- bag, short window**

Handpulling at Joshua Tree NP

Extraction Continued

- Be thorough, get all of them- Matt Brooks, USGS, Johnson Valley, CA, thinning may increase seed production from remaining plants
- Labor intensive, isolated areas
- Multiple treatments per site/monitoring

Herbicides

- >25 Labeled for wild mustards (Larry Jensen, Helena Chemical Company)
- Sulfonylureas
  - Telar, Escort, Cimarron Extra, low rates ½ to 1oz/acre
- Imidazolinones
  - Plateau, Habitat
- Hexazinone, (Velpar)

Other Herbicides that may work

- 2,4-D (Weedar 64)
- Triclopyr (Garlon)
- Glyphosate (Round-up)
- (pers com, Joe DiTomaso, UC Davis)

Agricultural Industry

- Velpar (hexazinone) 1-2 pints/acre. alfalfa fields (dormant) to control flixweed and tansy mustard (winter annuals), personal com George Beck, CSU Coop-Extension
- Canola Production in Canada: personal comm Neel Harker, Canada Dept Ag
  - Canola Crop 95% *Brassica napus, 5% Brassica rapa*
  - Genetically modified crops resistent to herbicides

Herbicide Selectivity

- Post emergent: apply to plant parts/leaves,
- Selective herbicides
  - Broadleaves (dicots) (2,4-D's)
  - Grasses (monocots)
- Non-selective broad spectrum (round-up)
- Rates and timing of application affect selectivity as well (dormant plants<less uptake)
- Application method (spot vs broadcast)

Post Emergent Applied Herbicides for Sahara Mustard

- Disturbed areas: Roadsides/bare-ground: broadcast, non-selective
- “Natural Areas” creosote overstory: selective broadcast or spot treatments

Broadcast Applications

- Truck booms, spray mounts
- ATV's
- Aerial (planes, helicopters)
- Large scale
- More acres treated
- Less expensive/acre, residual
- Less soil disturbance

Spot Treatments

- **Selectivity more guaranteed**
- **Herbicide applied to target only**
- **Backpack sprayer**
- **ATV tank w/ spray wand**
- **Small scale**
- **Repeated treatments**
- **Soil disturbance from trampling**

Pre-emergent Herbicide Application

- Herbicides that remain active in the soil
- Soil residual
- Rates and timing can effect selectivity
- Can be applied prior to germination
- Seeds germinate then seedling mortality occurs from herbicide uptake
- Larger treatment window (big advantage)
- Pro-active instead of re-active
- Long term control, one application, no repeat

Flaming

- Effective for annual plants (seedlings?)
- Alternative to herbicides
- Less soil disturbance than extraction
- Selective/Spot treatments
- Labor intensive
- Comparative to spot herbicide
- Soil trampling
- Need data on BRTO

Flaming Continued

- Easier to train and use than herbicides
- Use in low wildfire severity conditions
- Optimal in rain
- Slower than spraying
- Multiple treatments/site
- Ken Moore, Wildlands Restoration Team, Cal-IPC 2004 Proceedings
- CAL-IPC News Article “Think Heat”, Spring 2004
- McGill University Ecological Agricultural Projects

Hot Steam/Foam Treatment

- Post emergent application
- Roadside, accessible areas only
- Need a lot of water, equipment
- Non-herbicide alternative
- Unknown effects on soil microbes
- Need more consideration, more information on applicability

Biological Control

- **Insects: Selective predators? Unlikely many mustards not all bad and to Canola crops?**
- **Mega- Grazers: goats, sheep, cows**
  - **Probably more negative effects in "natural" areas, notorious for spreading weeds, widespread trampling, desirable plants**
  - **Disturbed areas/roadsides: traffic hazards**

  -Intensive expensive mgt/repeat

Cultural Practices

- **Roadside Grading with Heavy Equipment**
  - **Timing is critical**
  - **Prior to seed development**
  - **No grading during seed cast-then were spreading and contaminating equipment**
  - **All grading disturbs soil-more weeds**

Revegetation

- **Seeding w/ desirable species**
  - **Native winter annuals**
  - **Fill the BRTO niche/ competition**
  - **Once species is found then collect seed and increase for commercial growers distribution**
  - **May have potential in “natural areas”**
  - **Roadside areas, if grading continues then weeds will thrive**

Revegetation Continued

- **Need more studies**
- **What species**
- **May be effective in combination with control methods**
- **Expensive upfront costs**
- **Seeding success in Mojave is very ??**
- **Seeding Impacts on other native biota?**

Monitoring of Treatments

- **Pre-treatments:**
  - **Photograph**
  - **Vegetation Cover estimates (estimates/plots)**
- **GPS/GIS/map treatment sites**
- **Document treatment activities (labor/methods)**
- **Develop a post treatment monitoring Schedule**

Example Post Treatment Monitoring Schedule

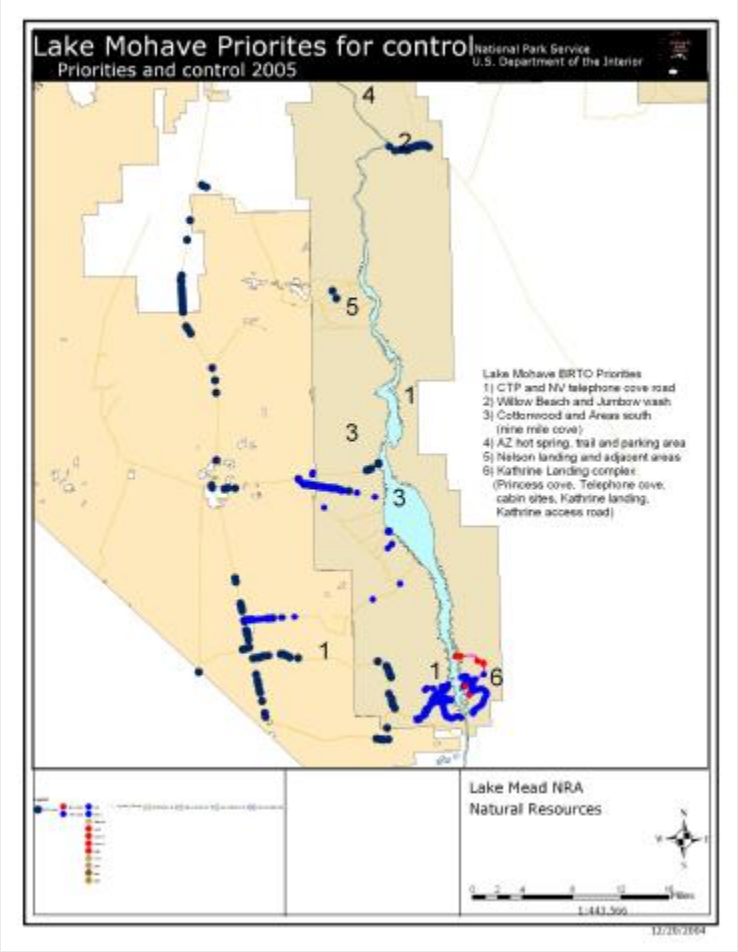
- **1-2 Weeks: record immediate post treatment results**
- **1, 2, and 3 month post treatment (BRTO recruitment and other plant response)**
- **Multi-year post treatment**
  - **Critical to determine seed bank response and long term effectiveness**

Monitoring Intensity

- Typically about 10% of budget (weeds)
- However 25% may be more appropriate for BRTO b/c so little is known
- More intense monitoring is required for control success to prevent seed production from in year recruitment generations
- And long term/multi-year monitoring commitment to manage seed bank
- That is why mapping and treatment documentation is very important

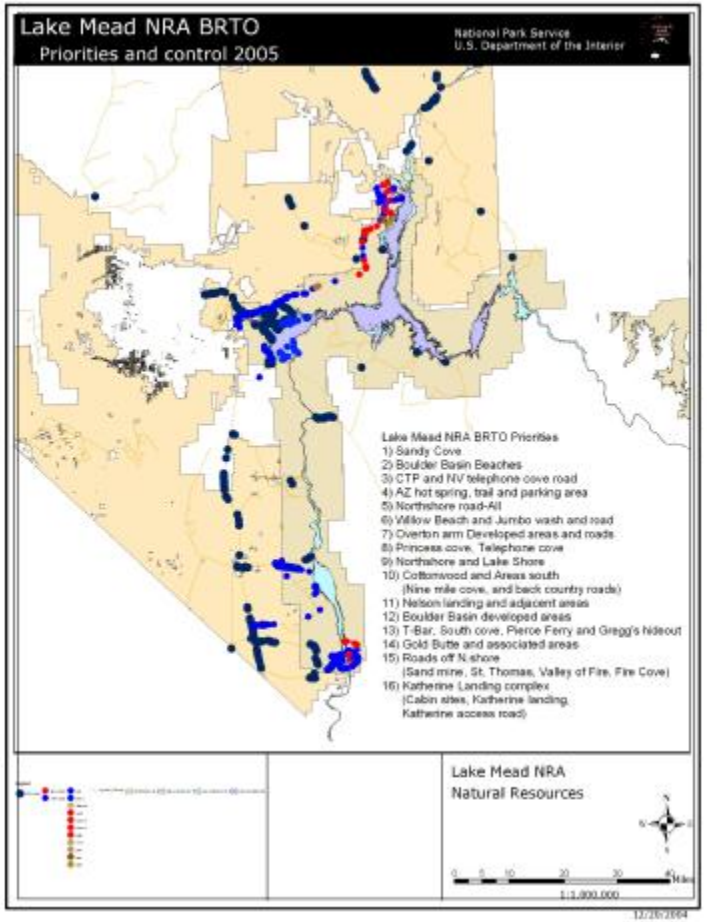
Minimal Strategy

- Control in high priority areas, rare plant/ prime tortoise habitat
- Containment, keep it out of areas it has not currently infested
- Map and maintain mustard free zones



Maximum Strategy

- Implement minimum
- Develop buffers from high priority areas, increase BRTO free zones by mgt
- Implement large scale methods along roadsides/utility corridors
- Manage seed bank



Decontaminate

- **Have crews clean boots, laces, pants seeds are in the soil**
- **Bring equipment and cleaning supplies to project sites for decontamination**
- **Use decontamination BMP's for projects, especially mapping crews**
- **We don't want to be part of the problem, we want to be the solution!**

Thank You

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