

A horizontal decorative band with a complex, multi-colored pattern of geometric and organic shapes, including spirals and zig-zags, in shades of blue, red, and yellow.

Update on the Use of Biological Controls at McDonald Project

Mine Design Operations and Closure Conference 2011

Sonya Rosenthal, PE., Newmont Mining Corporation

John Gorocho, Sand Dollar Resources

May 2011

Presentation Outline

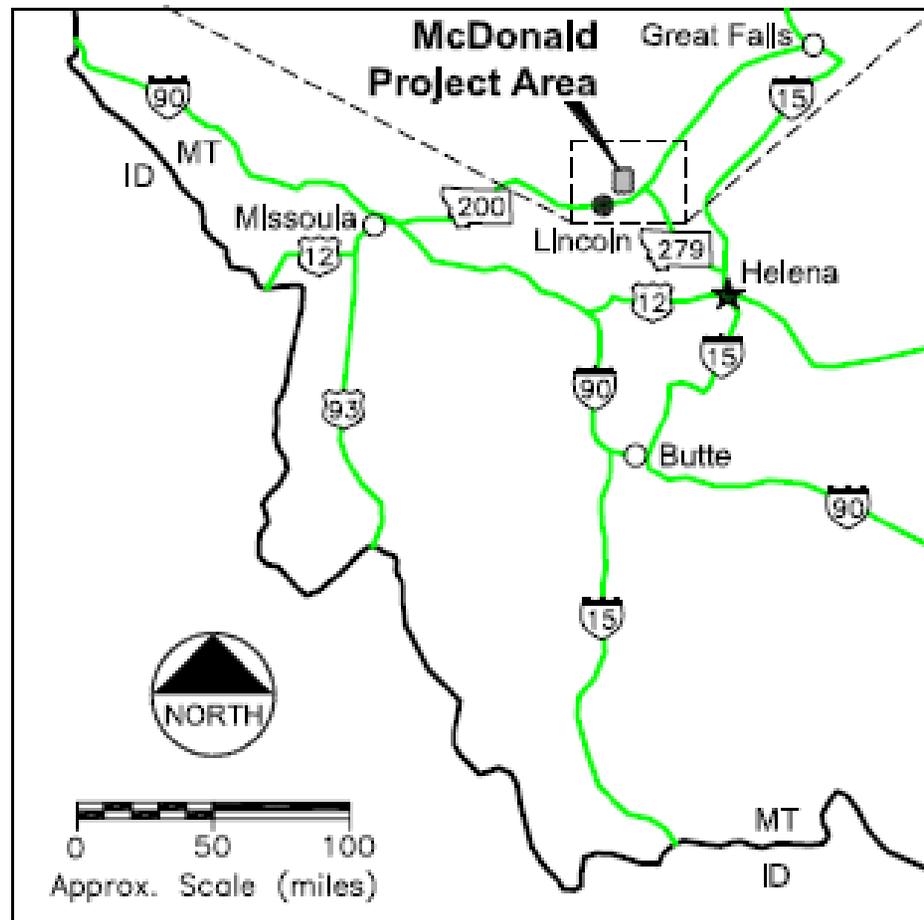
- Background
- Project Site
- Specific Knapweed Situation
- Site Biological Agents Utilized
- 2009 Review
- 2010 Collection and Augmentation
- 2010 Release Site Monitoring
- 2010 Season Summary and Observations
- 2011 Pilot Program
- Successful Program Descriptions
- Newmont 2011 Pilot Program Objectives

Biologic Controls Background

The first biological programs in the United States and Canada were initiated in the 1960's with the importation of two seed head flies from Eurasia. Through further research and biological and genetic testing of biological agents eight seed head feeders and five root borers have been released and are established in the Western States. Potential bio-control insects undergo strict testing for a period of 5 to 10 years by the United States Department of Agriculture APHIS Department to ensure host specificity of introduced insects.

Specifically , insects targeted for release on our project site were introduced in the USA in 1988 (*Cyphocleonus achates*) and during 1991 (*Larinus minutus*).

McDonald Project Site



Spotted Knapweed



Knapweed Bio:

- ❖ Originally from Central Asia
- ❖ In USA for over 120 years
- ❖ Reduces forage loss for livestock and wildlife
- ❖ Increases surface water runoff and soil sedimentation
- ❖ Lowers plant diversity
- ❖ Reduces germination of some grasses
- ❖ Noxious weed per Lewis and County Weed Board

Specific Knapweed 'Crop' Situation

- ❑ Large field of high density spotted knapweed
- ❑ Specific seed source could be other than past land disturbance (exploration, ranching, logging, etc.). Sources could be from a combination of wildlife, lease grazing, hunters, carried in the wind, etc.
- ❑ Chemical control not easily accessible for vehicle spraying and requires intensive backpack spraying
- ❑ Twice yearly application of chemical controls (Chaparral). Places additional chemicals in the environment and requires cost / time to apply chemicals
- ❑ Cost benefit of self propagating insects is great compared to cost of chemicals and application of chemicals

Initial Knapweed 'Crop' Situation



Site Biological Agents Utilized

Recommended by “Bio-agent” experts for this project site



Root Boring Weevil
(Cyphocleonus achates)

- ✓ Adults feed on leaves and flower parts
- ✓ Larvae feed on root cortex
- ✓ Adult activity occurs from August to mid-September



'Lesser' Seed Head Weevil
(Larinus minutus)

- ✓ Adults feed on leaves and flower parts
- ✓ Larvae feed on seeds in the flower head
- ✓ Adult activity occurs from late June to late August

2009 Season Review

- ❑ Four release sites nominated
- ❑ 1,333 root boring weevils released at one site
- ❑ Weevils acquired from:
 - Augusta High School bio-agent program
 - USDA – APHIS, Helena and Corvallis
- ❑ Unable to acquire ‘lesser’ seed head weevil due to coordination complications
- ❑ Visual monitoring till end of season

2010 Collection and Augmentation

- ❑ Due to Fall 2009 sub-zero temperatures, insect mortality seemed inevitable, so additional root boring weevils were introduced to supplement the existing colony
- ❑ Both species of bio-agents were collected during the 2010 season
- ❑ 2,220 seed head weevils were collected at a site near Jefferson City selected by USDA-APHIS (Helena)
 - ❑ June 30th collection carried out by Newmont and USDA-APHIS. Sweep nets were used for collection with contents deposited into pillow cases for transport to the USDA-APHIS office
 - ❑ Seed head weevils were sorted both by manual and mechanical aspirators and unwanted insects (ants, spiders and grasshoppers) were removed. The weevils were counted, using a graduated cylinder, packaged and placed in a cooler for same-day release

2010 Collection and Augmentation Cont'd

- ❑ 885 root boring weevils were collected on August 18th at the same site near Jefferson City
 - ❑ Collection was accomplished by the Newmont contract crew and USDA – APHIS technicians. The weevils were individually plucked off knapweed plants, placed in cardboard containers and transported in coolers to the project release sites

- ❑ 414 additional root boring weevils were received at the latter part of the season
 - ❑ Provided from Augusta High School insectary and Lewis and Clark Extension Service.

2010 Collection and Augmentation

Collecting bio-agents



2010 Collection and Augmentation

Sorting and Separating Bio-agents

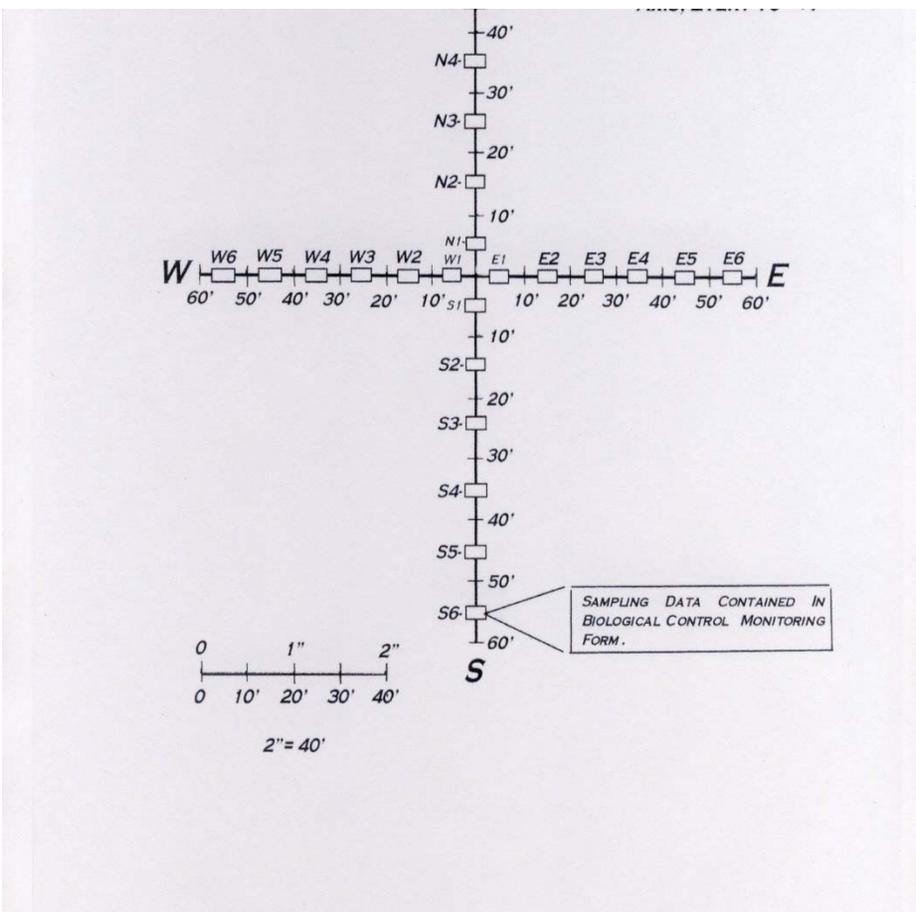


2010 Release Site Monitoring

- ❑ Inspect the survival of the root boring weevil over the winter
- ❑ Monitor the root boring weevil and measure its impact on the knapweed
 - Set up four 60' transects for each release site
 - Measure within a 1'x2' area zone
 - ✓ # adults
 - ✓ Condition of knapweed
 - ✓ Number of knapweed plants
 - ✓ Number of forbs, grasses, shrubs, etc
 - ✓ Aim to monitor twice in July for seed head weevil and twice in August/September for root boring weevil
 - ✓ Keep photographic record of each release site

2010 Release Site Monitoring

Monitoring Template and Transect



Monitoring Template Used



On-site Transect and Quadrant

2010 Monitoring Results

Micro Plot BRS-1 is the 2009 release site of *Cyphocleonus achates*,
 Micro Plots BRS-2 and BRS-3 are the 2010 release sites of *Larinus minutus*

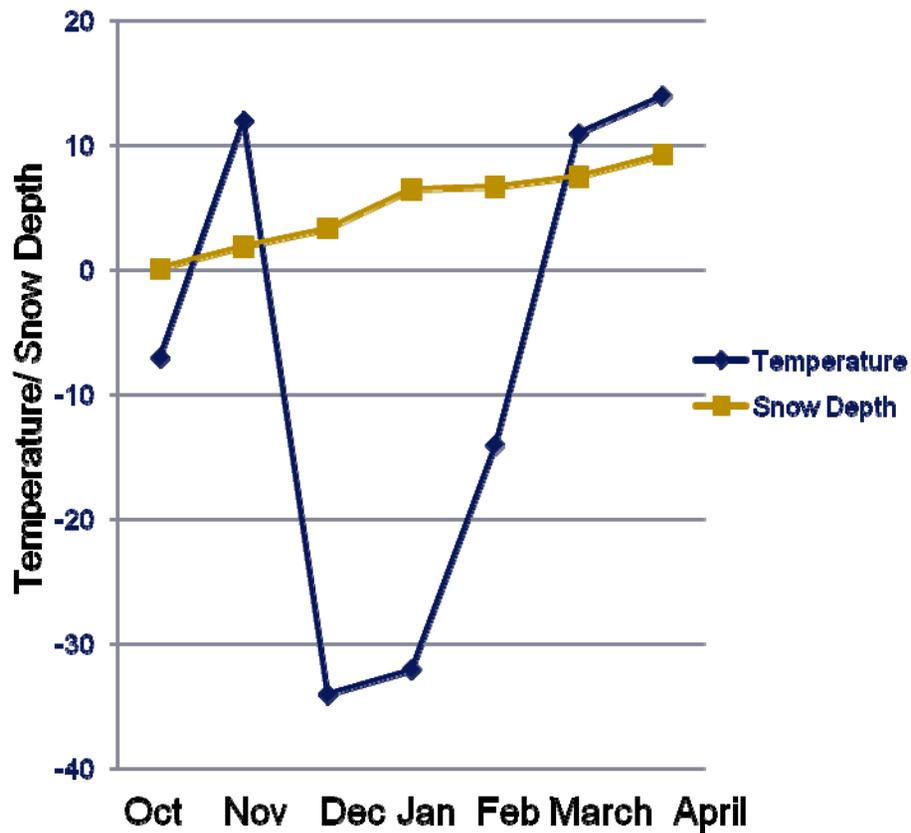
Micro Plot BRS-1						
August 26 2010						
	Bio-Species	Qty	Grasses	Forbs	Shrubs	Knapweed
	<i>Cyphocleonus a</i>	8	135	46	0	163
	<i>Larinus m</i>	29				
Micro Plot BRS-1						
September 14 2010						
	<i>Cyphocleonus a</i>	9	135	46	0	163
	<i>Larinus m</i>	1				
Micro Plot BRS-2						
August 11 2010						
	<i>Cyphocleonus a</i>	0	92	45	1	164
	<i>Larinus m</i>	22				
Micro Plot BRS-3						
August 11 2010						
	<i>Cyphocleonus a</i>	0	107	56	3	102
	<i>Larinus m</i>	48				

2010 Season Summary and Observations

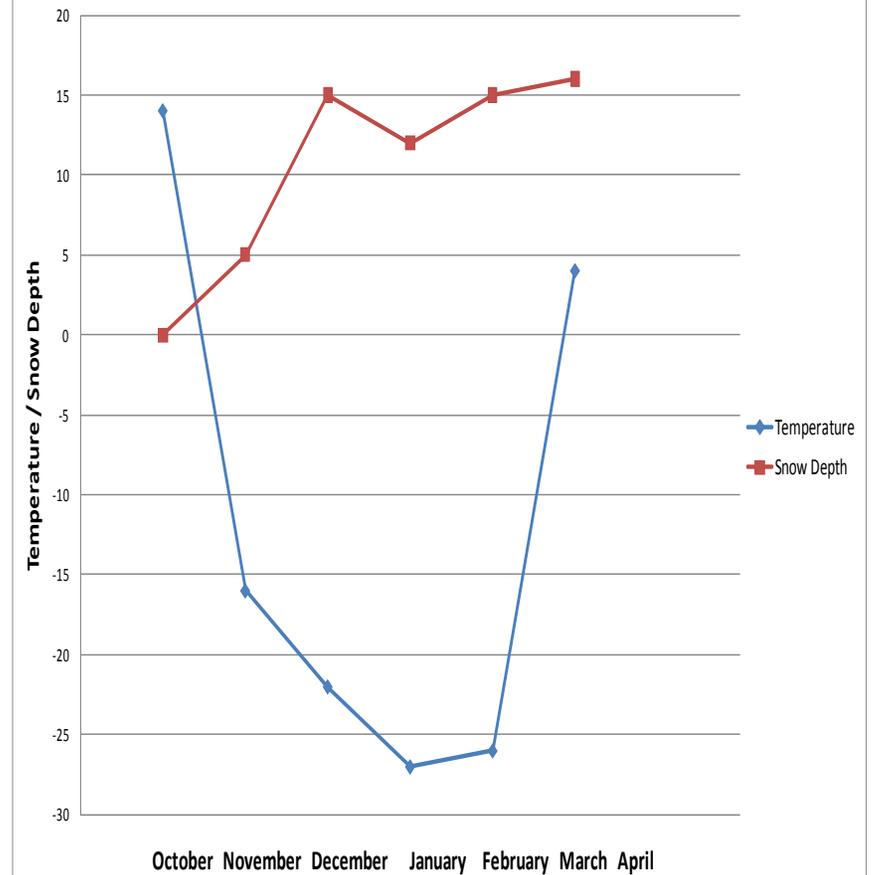
- ❑ Root boring weevil survivability was confirmed with nine insects counted during the first monitoring period and eight in the second monitoring period
- ❑ Observed the rapid dispersal rate of seed head weevils with insects encountered over 600 feet from release sites
- ❑ Seed head weevil appears to be effective in spotted knapweed reduction
- ❑ Monitoring results were included in the Final Reclamation Report and submitted to the appropriate regulatory agencies and stakeholders. The data can be made available to any interested parties or researchers.
- ❑ Anticipated that weevil mortality was experienced from harsh 2009-2010 winter conditions.

2009-2011 Winter Climate Conditions

2009/ 2010 Winter Climatic Conditions



2010/2011 Winter Climatic Conditions



2011 Pilot Program

- Monitor both weevil species twice during respective adult stage
- Determine the survivability of seed head weevil
- Monitor plant species at release sites
- Determine the extent of migration of both species
- Locate other release sites in advance of surplus weevil contributions
- Assist adjoining land holders in implementation of biological programs

Monitoring Biological Control Performance

- Pilot project and information collection to assess the expansion or migration of both types of weevils
- Further research will help to understand if the population is expanding; or if the population will remain the same and just migrate to the food sources
- Plant data collection will confirm noxious weed reduction and type of replacement pioneer vegetation

Newmont 2011 Pilot Program Objectives

Objective #1

Determine the survivability and long term sustainability of a host specific beneficial insect within the reclamation project boundaries.

Objective #2

Reduce dependency of chemical usage and reduce spotted knapweed populations to ecologically acceptable levels and to prevent encroachment into new areas

“The weevils are enjoying knapweed and they need to find new knapweed homes.”



Note the several damaged seed heads from *Larinus minutus* feeding