Comparison of Basal and Aerial Cover for Total Vegetation Cover and Total Ground Cover on Oil & Gas Well Sites in Southwest Wyoming

2013 Joint Conference

2nd Wyoming Reclamation and Restoration Symposium

30th Annual Meeting of the American Society of Mining and Reclamation

Laramie, WY

June 6, 2013

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Purpose

- To compare and evaluate estimates of vegetation and ground cover obtained from the point-line intercept method as recorded by either aerial or basal hits

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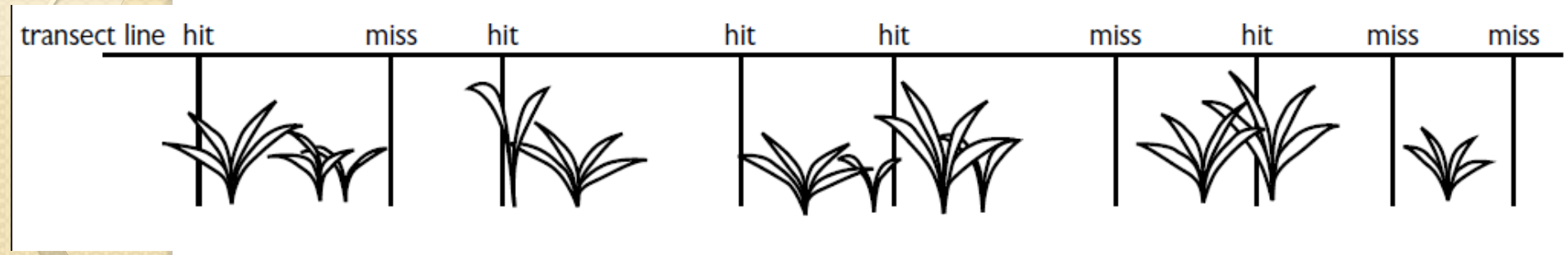
Aerial vs. Basal Cover Definitions

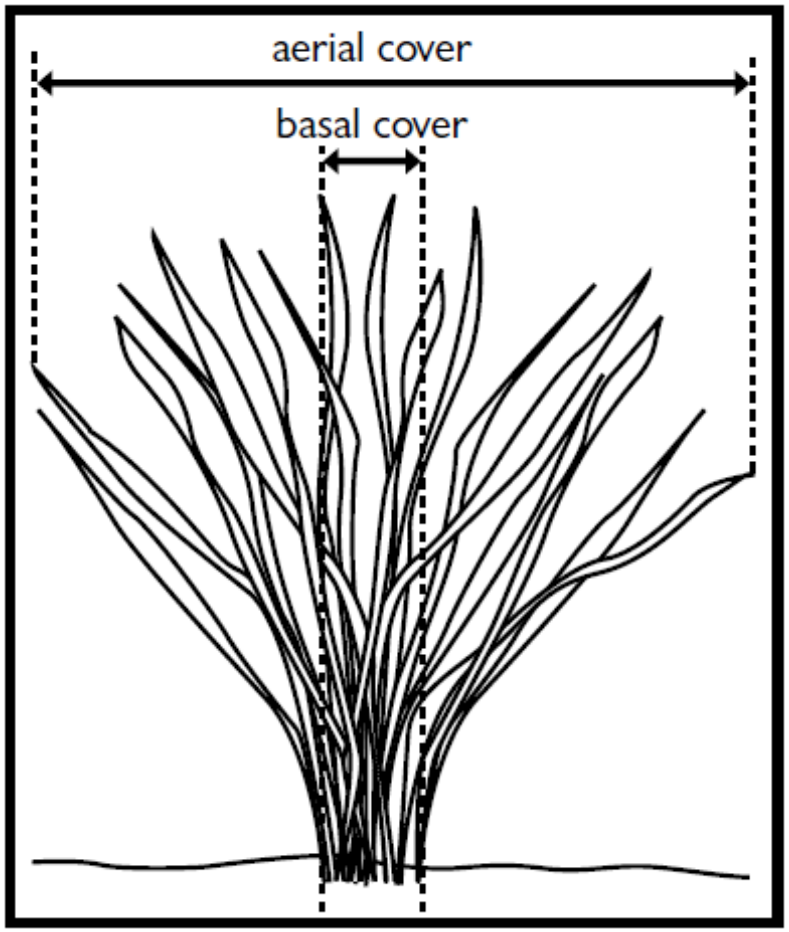
AERIAL COVER

- Defined as the area of ground covered by the vertical projection of the aerial portion of the plants. Small openings within the canopy are excluded. It may exceed 100% (USDA 1999).
- Think of it as, will a rain drop hit the aerial portion of a plant prior to hitting the ground.

BASAL COVER

- The area of ground surface occupied by the basal portion of the plant. (USDA 1999).
- For trend comparisons basal cover is generally considered the most stable. (USDA 1999).





The above graphic shows:

- Aerial cover would be 5/9 or 55%.
- Basal cover would be 0/9 or 0%.

- Graphics were obtained from Field Techniques for Measuring Vegetation BLM Technical Reference 1730-1

Methodology: Point-Line Intercept

- Sampling data was collected in mid-June each year
- Each 50-meter transect represents a single sample point.
  - The two transects per well were than averaged together.
- Percent cover measurements were taken from point-intercepts at 0.5-meter intervals along a 50-meter transect using a laser pointer.
- Each point-intercept represented 1% towards cover measurements.
- Percent cover measurements will recordaerial "first-hit" and basal cover (at the ground surface) point-intercepts by live foliar vegetation species, litter, rock, or bare ground. Litter includes all organic material that is dead (does not include standing dead vegetation from this year's growth).

Data Collection

- Aerial and Basal cover were collected on the same 30 wells sites over a 3 year period (2009, 2010, and 2011). Collected data by:
  - Total Vegetation Cover
  - Total Ground Cover
  - Total Bare Ground Cover
  - Total Vegetation Cover by Lifeform

Location

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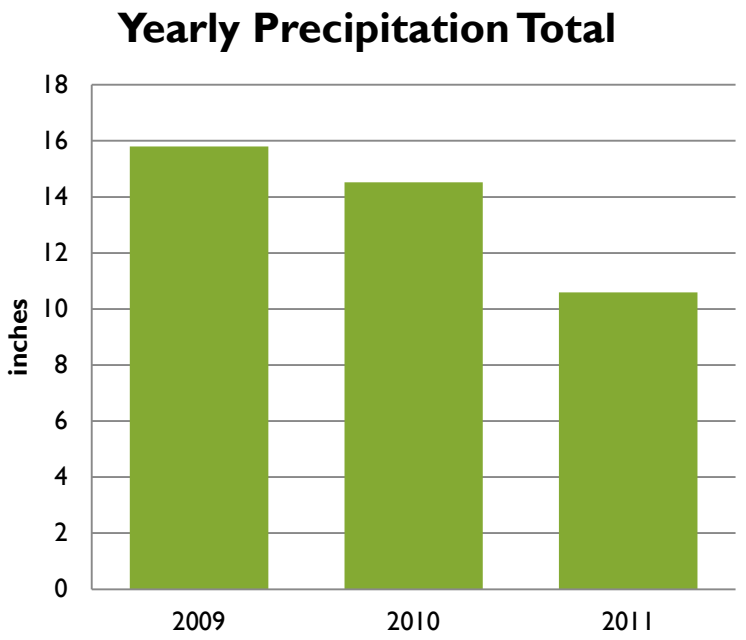
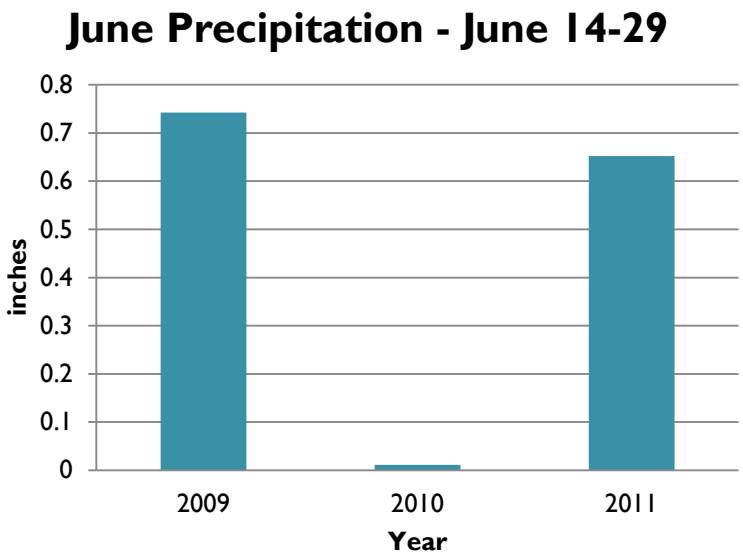
Some factors impacting vegetation reclamation cover

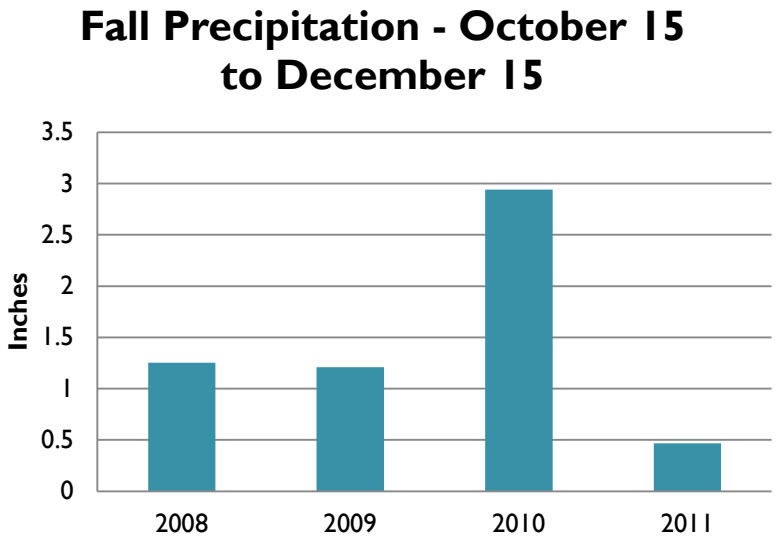
- Climatic patterns for 2009, 2010, and 2011
  - Changes in vigor (annual biomass production)
  - Changes in number of plants (mortality and recruitment)
- Amount of weed spraying
- Ecological Site Descriptions
- Changes over the growing season- samples were conducted in mid-June of each year.

CLIMATE

- The study area historically receives less than 10 inches of precipitation per year
- 2009 and 2011 had wetter Junes than 2010
- 2010 and 2011 had less annual precipitation than 2009
- 2010 had high fall precipitation







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Mean Summary for 2009, 2010, and 2011

	Basal Cover	Aerial Cover	*Difference (Aerial - Basal)
Total Ground Cover	44.02	46.17	2.15
Total Vegetation	20.79	23.89	3.10
Bare Ground	55.98	53.77	-2.21
Annual Grasses	0.10	0.15	0.05
Perennial Grasses	10.51	13.34	2.83
Annual Forbs	8.90	9.13	0.23
Perennial Forbs	0.02	0.02	0.00
Sub-Shrubs	1.13	1.14	0.01
Full Shrubs	0.11	0.12	0.01

*Calculated the overall means over the three years and then subtracted any differences of Aerial – Basal.

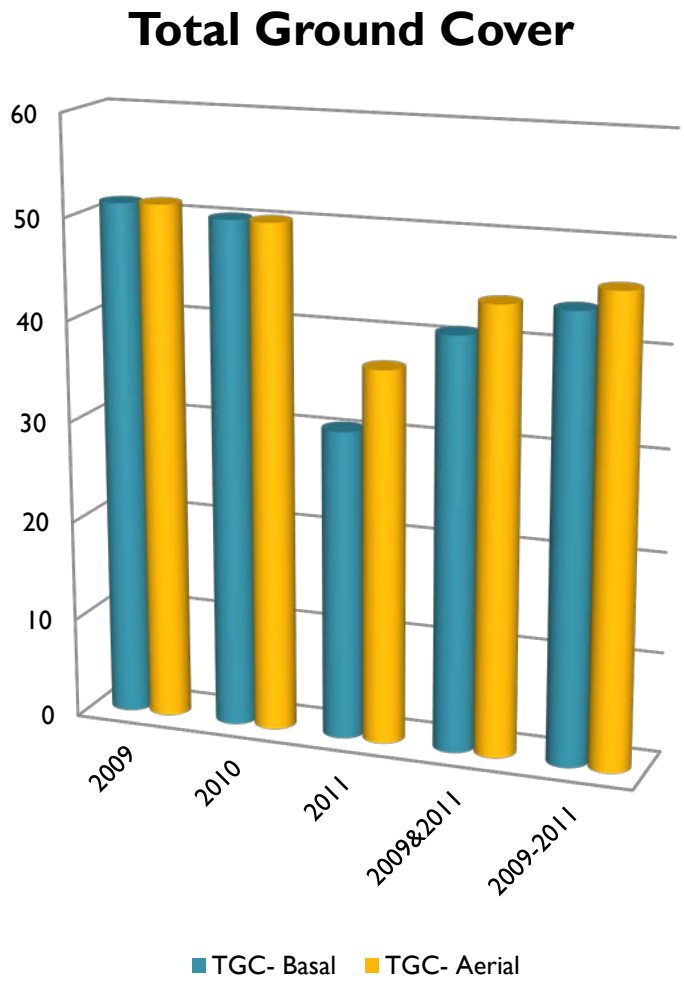
Wilcoxon Signed- Rank Test

- Test is similar to paired t-test if the relationship is not normally distributed
- Type I probability value of 0.05 was used to determine statistically significant differences

Statistical Comparison

- The data showed statistically significant differences in total vegetation cover, total ground cover, and perennial grass cover using the following data combinations only:
  - n= 90 (using a combination of 2009, 2010, and 2011 data)
  - n= 60 (using 2009 and 2011 data sets)
  - n= 30 (using 2011 data set)

Statistical Results for Total Ground Cover



- Compare for the two methods (Aerial vs. Basal) over all observations for the 30 well sites over a 3 year period (n = 90).
- A difference of 2.15% was observed for TGC- Aerial vs TGC- Basal for the entire study (n = 90).
- TGC- Aerial cover 46.17% was 2.15% greater than TGC- Basal cover (44.02%).
- This difference of 2.15% is statistically different from zero at p = 0.05.
- In 2011, a difference of 6.3% is significantly different from zero, where TGC- Aerial is greater than TGC- Basal

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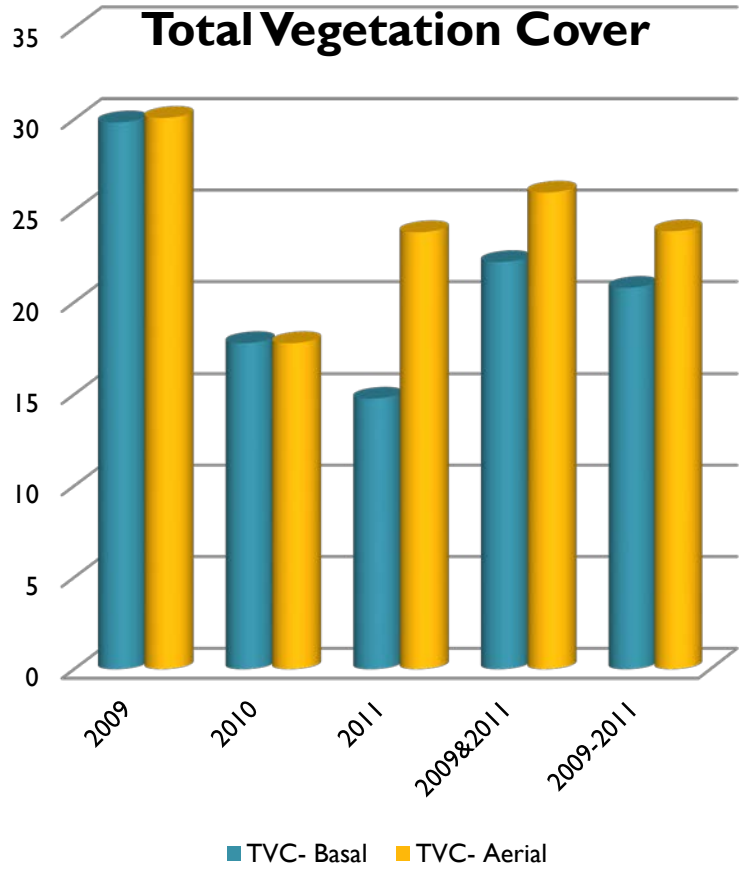
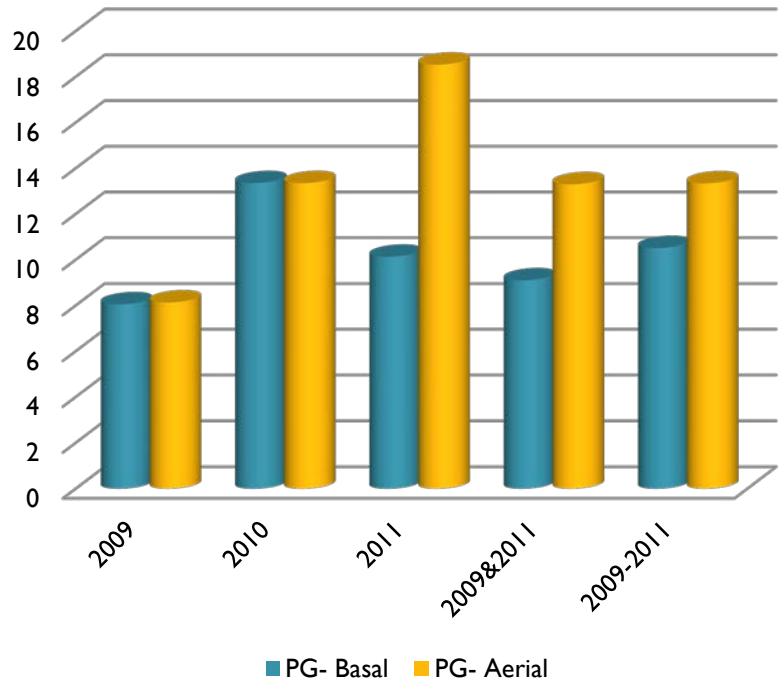
Statistical Results for Total Vegetation Cover

- The TV-Aerial 23.9% was 3.1% greater than TV-Basal (20.8%). This difference is statistically different at p = 0.05.
- Mean difference (3.1%) is significantly different from zero (0.00)
- In 2011, a difference of 9.1% is significantly different from zero, where TV- Aerial is greater than TV- Basal



Statistical Results for Perennial Grasses

- Dominate species included:
  - *Achnatherum hymenoides* (Indiian ricegrass)
  - *Elymus smithii* (western wheatgrass)
  - *Elymus lanceolatus* (thickspike wheatgrass)
  - *Poa secunda* (Sandberg bluegrass)
  - *Elymus elymoides* (bottlebrush squireltail)
  - *Elymus trachycaulus* (slender wheatgrass)



- n = 60 for 2009 and 2011 data sets
- Measurement of perennial grass cover gave a significantly greater cover value (4.2% higher) for aerial measurement compared to that measured by the basal method.

Variable	Count	Mean
Per.grassA	60	13.3
Per.grassB	60	9.1
Difference	60	4.2%

Conclusions

- Estimates of ground cover differ when recorded as aerial hits or basal hits
  - 2009 and 2010 did not a significant difference in values
  - 2011 had a significant difference in values
  - 2009 and 2011 combined had a significant difference in values
  - 2009-2011 had significant difference in values

Conclusions

- These two cover estimates differ within perennial grass cover
  - Follows the same trend as TV and TGC
  - Forbs, shrubs, and annual grasses did not provide enough data to run statistical tests

Recommendations

- Aerial cover shows greater % total ground cover and % total vegetation cover.
- Aerial cover shows a higher % of cover and is more similar to qualitative observations.
- Aerial cover measurements may be more reflective of the cover available to protect the soil surface from rain droplets
- However other research states that basal cover is more consistent over time because it does not fluctuate as much during drought years.

Acknowledgement

- Charles D. Bonham, Ph.D.
  Professor Emeritus, Range Science
  at Colorado State University
- BKS Environmental field crews

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Questions

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