

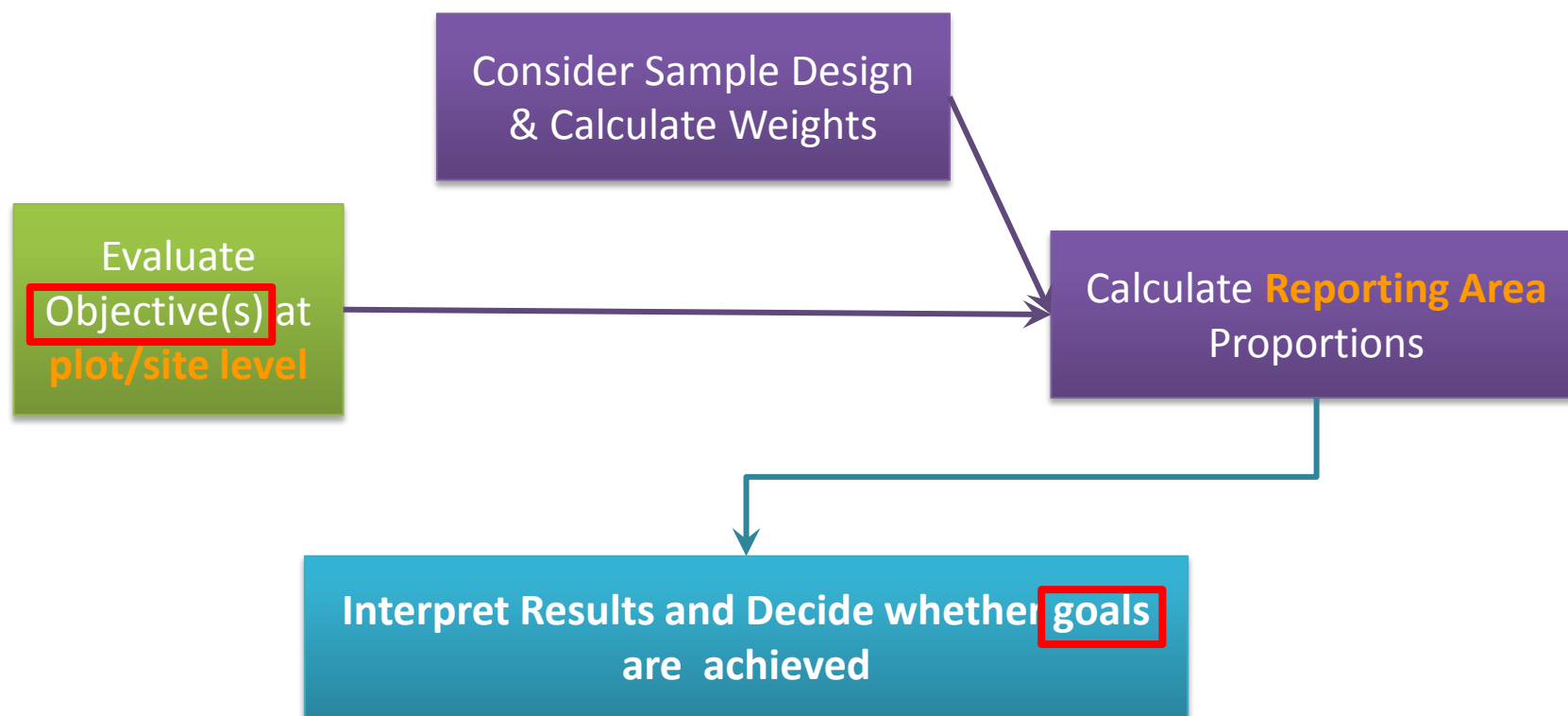
From Information to Action: Applying Data to Inform Management



AIM Project Leads Training
2016

So you collected AIM data... what now??

All of the information you need is captured in the project's
Monitoring Design Worksheet



Evaluating Monitoring Objectives

- Was the monitoring objective met?
 - o Important to make good, quantitative objectives
 - o Management questions vs. Monitoring objectives

Management question: maintain stream channel form and function within natural ranges of local physiographic conditions

Monitoring objective: Determine whether bank stability is greater than or equal to 75% for 80% of perennial Wadeable streams in the planning area with 95% confidence.

- Benchmark: average bank stability $\geq 75\%$
- Required Proportion: 80% of stream km



In-Class Exercise: Question 4

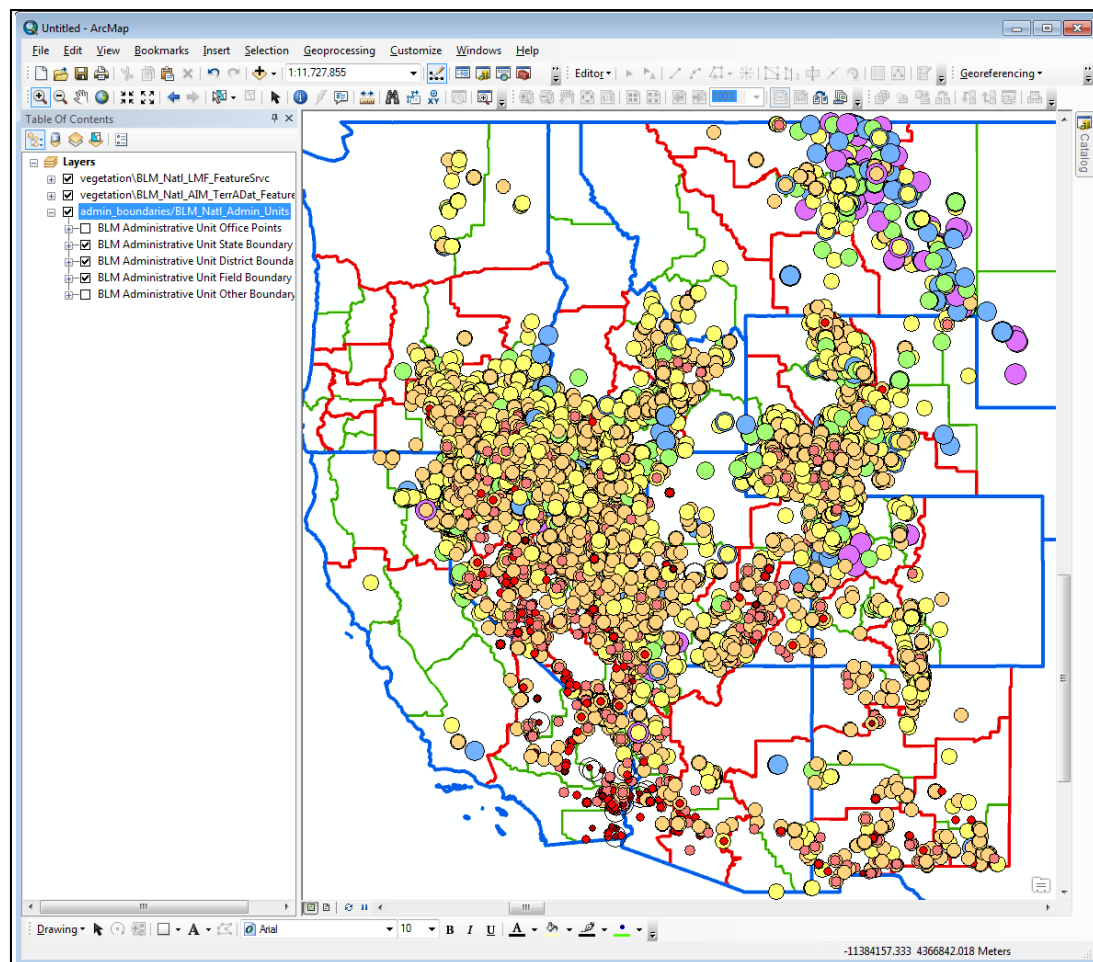
Step 1: Evaluate whether the benchmark was met or not for each objective at each monitoring site

- Simple “meeting” or “not meeting”
- Rating “suitable”, “marginal”, “unsuitable” (i.e., GRSG)
- “Significant”, “Moderate”, or “Minimal” departure



In-Class Exercise: Question 4

Data you'll need to do analysis:



TerrADat +
LMF +
AquADat

In-Class Exercise: Question 4

- Abbreviated data from AIM databases have already been downloaded
- Objectives have been laid out (see formula below)
- Benchmarks are provided in the tables
- Other GIS layers were used to gather information (i.e., weights, etc.)

Study area + Indicator + Benchmark + Proportion +
Confidence Level + Time Period



In-Class Exercise: Question 4

Step 1: Evaluate whether the benchmark was met or not for each objective at each monitoring site

- Simple “meeting” or “not meeting”
- Rating “suitable”, “marginal”, “unsuitable” (i.e., GRSB)
- “Significant”, “Moderate”, or “Minimal” departure

Study area + Indicator + Benchmark + Proportion +
Confidence Level + Time Period

Have your benchmarks at each site been met?



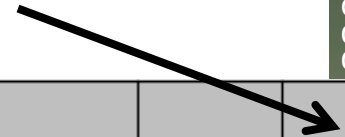
ES&R Objectives

- Objective 1: Total plant cover is within the appropriate range for the associated Ecological Site (see bullet points below) across 70% of the aerially seeded areas with 80% confidence.
 - Ecological Site 1: 60% cover
 - Ecological Site 2: 30% cover.
- Objective 2: Maintain soil stability equal to or greater than 4 across 70% of the aerially seeded areas with 80% confidence.

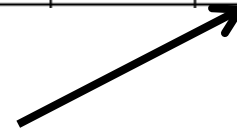


ES&R Example

1 meeting
10 not meeting



PlotID	Ecological Site	DateVisited	Weight (acres)	Mgmt History/ Design	TotalFoliar Cover_FH	Benchmark	Benchmark 1 Met?	SoilStability_ All	Benchmark	Benchmark 2 Met?
KNT15-A3-HOL-13	1	5/26/2015 0:00	1000	A	76.7	60	Yes	2.9	4	No
T15-A1-HOL-13	1	7/7/2015 0:00	1000	A	90.0	60	Yes	3.7	4	No
T15-A2-HOL-13	1	5/27/2015 0:00	1000	A	74.0	60	Yes	3.4	4	No
T15-A3-HOL-13	1	5/27/2015 0:00	1000	A	70.0	60	Yes	2.2	4	No
T5-A2-HOL-13	1	7/10/2015 0:00	1000	A	58.7	60	No	1.3	4	No
T5-A3-HOL-13	1	7/29/2015 0:00	1000	A	58.0	60	No	3.0	4	No
TD-BASCO-HOL-13	2	6/16/2015 0:00	2000	A	86.7	30	Yes	2.1	4	No
TD-HORSECREEK-HOL-13	2	8/11/2015 0:00	2000	A	34.0	30	Yes	3.0	4	No
TPD-CHINA-HOL-13	2	6/10/2015 0:00	2000	A	76.0	30	Yes	2.3	4	No
T5-A1-HOL-13	2	7/10/2015 0:00	2000	A	35.3	30	Yes	4.2	4	Yes
T9-A1-HOL-13	2	5/28/2015 0:00	2000	A	42.0	30	Yes	2.4	4	No
C5-A1-HOL-13	1	6/16/2015 0:00	5500	B	66.7	60	Yes	2.8	4	No
C9-A1-HOL-13	1	6/9/2015 0:00	5500	B	49.3	60	No	2.3	4	No
HA-1	1	5/27/2015 0:00	5500	B	56.0	60	No	3.9	4	No
HA-2	2	5/28/2015 0:00	5500	B	66.7	30	Yes	4.1	4	Yes
HC_9	2	6/16/2015 0:00	5500	B	49.3	30	Yes	1.6	4	No



9 meeting
2 not meeting



Grazing Permit Renewal Objectives

Terrestrial Objective:

- Invasive species cover is within the appropriate range for the ecological site (see below bullet points) for 80% of the allotment across 5 years, with 90% confidence.
 - Claypan: <5% invasive species cover
 - Loamy 6-12": <10% invasive species cover

Aquatic Objective:

- % fine sediment is within the 90th percentile of regional reference conditions (see below bullet points) for 90% of the allotment over 10 years, with 90% confidence.
 - Northern Basin & Range:
 - Minimal departure: <52.2% fines
 - Moderate departure: >52.2 and <69.5
 - Significant departure: >69.5% fines
 - Central Basin & Range:
 - Minimal departure: <56.4% fines
 - Moderate departure: >56.4 and <74.5
 - Significant departure: >74.5% fines



Grazing Permit Renewal Example

PlotID	Stratum	Ecogroup	Sample Date	Weight	Indicator	Indicator value	Benchmark	Condition class
T1	Basin Big Sage-Greasewood	Loamy Slope 6-12"	9/13/2013	1250	Invasive annual grasses	5	<10%	Meeting
T2	Low Sage	Loamy Slope 6-12"	9/13/2013	1200	Invasive annual grasses	6	<10%	Meeting
T5	Mountain Big Sagebrush and Shrub	Loamy Slope 6-12"	9/16/2013	3000	Invasive annual grasses	9	<10%	Meeting
T8	Basin Big Sage-Greasewood	Claypan	8/28/2015	4 meeting 6 not meeting	Invasive annual grasses	3	<5%	Meeting
T3	Wyoming Big Sage	Loamy Slope 6-12"	5/25/2015		Invasive annual grasses	38	<10%	Not meeting
T4	Wyoming Big Sage	Loamy Slope 6-12"	6/26/2014		Invasive annual grasses	11	<10%	Not meeting
T6	Mountain Big Sagebrush and Shrub	Claypan	9/17/2013	3000	Invasive annual grasses	8	<5%	Not meeting
T7	Mountain Big Sagebrush and Shrub	Claypan	8/6/2014	3000	Invasive annual grasses	27	<5%	Not meeting
T9	Mountain Big Sagebrush and Shrub	Claypan	5/6/2015	3000	Invasive annual grasses	42	<5%	Not meeting
T10	Mountain Big Sagebrush and Shrub	Claypan	6/26/2014	3000	Invasive annual grasses	9	<5%	Not meeting
A1	Small stream (1st and 2nd order)	Northern Basin & Range	7/12/2015	14	% Fine sediment	38.6	Min. Dep.: <52.2	Minimal departure
A2	Large stream (3rd and 4th order)	Northern Basin & Range	7/14/2015	10	% Fine sediment	45.2		Minimal departure
A3	Small stream (1st and 2nd order)	Northern Basin & Range	6/25/2014	14	% Fine sediment	57.3		Moderate departure
A4	River (5th order +)	Northern Basin & Range	7/12/2015	14	% Fine sediment	22.7	Mod. Dep.: 52.2-69.5	Minimal departure
A5	Small stream (1st and 2nd order)	Northern Basin & Range	7/14/2015	10	% Fine sediment	49.9	Sign. Dep.: >69.5	Minimal departure
A6	River (5th order +)	Northern Basin & Range	6/25/2014	14	% Fine sediment	62.8		Moderate departure
A7	Large stream (3rd and 4th order)	Northern Basin & Range	6/25/2014	14	% Fine sediment	38.7		Minimal departure
A8	Small stream (1st and 2nd order)	Central Basin & Range	9/1/2014	14	% Fine sediment	72.1	Min. Dep.: <56.4	Moderate departure
A9	Large stream (3rd and 4th order)	Central Basin & Range	8/25/2013	10	% Fine sediment	42.7	Mod. Dep.: 56.4-74.5	Minimal departure
A10	Small stream (1st and 2nd order)	Central Basin & Range	7/15/2013	14	% Fine sediment	76.9	Sign. Dep.: >74.5	Significant departure

6 minimal departure

3 moderate departure

1 significant departure

GRSG Objectives

Nesting Objectives:

- Objective 1: Sagebrush cover is between 15 and 25% for arid sites.
- Objective 2: Sagebrush height is between 30 and 80 cm for arid sites.
- Objective 3: Overall nesting habitat suitability must be rated as “suitable” or “marginal” for at least 80% of the seasonal habitat (rating already determined by wildlife biologist) with 80% confidence after 5 years.

Summer Objectives:

- Objective 1: Sagebrush cover is between 10 and 25% for arid sites.
- Objective 2: Sagebrush height is between 40 and 80 cm for arid sites.
- Objective 3: Overall summer habitat suitability must be rated as “suitable” or “marginal” for at least 80% of the seasonal habitat (rating already determined by wildlife biologist) with 80% confidence after 5 years



Site-Scale GRSG Example

Plot ID	DRG	Seasonal Habitat	Weight (acres)	Drought Condition	Sage Cover	Sage Cover	Sage Hgt	Sage Hgt	Per G Cover	Per F Cover	Per G&F Cover	Per G Hgt	Per F Hgt	Sage Shape	# of Pref Forbs	Overall Rating
D3	1	Nesting	300	Severe	34.7	M	64.1	S	S	M		S	M	S	S	S
D5	1	Nesting	300	Severe	34	M	37.5	S	U	U		U	U	M	M	U
S1	1	Nesting	300	Severe	1.3	U	6.5	U	S	M		U	U	U	M	U
S3	1	Nesting	300	Severe	28	M	42.7	S	S	S		S	M	M	M	S
T1	1	Nesting	300	Severe	12	M	11.7	U	S	M		U	U	M	U	U
T2	2	Nesting	500	Severe	12.7	M	18.5	U	S	M		U	M	U	U	U
T3	2	Nesting	500	Severe	12.7	M	23.7	M	S	M		M	S	M	S	M
A33	2	Nesting	500	Mid-range	20	S	28.6	M	S	M		S	M	S	M	S
A34	2	Nesting	500	Mid-range	41.3	M	41.3	S	S	M		S	M	M	S	S
CS1	2	Nesting	500	Severe	21.3	S	25.5	M	U	M		M	M	S	M	M
CS2	3	Nesting	2000	Severe	32	M	22.1	M	M	M		S	S	M	M	M
D4	3	Nesting	2000	Severe	20	S	21.9	M	S	S		M	S	S	M	S
ER1	3	Nesting	2000	Severe	41.3	M	27.6	M	S	M		M	S	M	S	M
A35	3	Nesting	2000	Mid-range	30	M	49.4	S	S	S		S	S	M	S	S
A36	3	Nesting	2000	Mid-range	32	M	33.8	S	S	S		M	S	S	M	S
BB3	1	Summer	1500	Mid-range	16.7	S	41.2	S			S				M	S
BB6	1	Summer	1500	Mid-range	26.7	M	51.3	S			S				S	S
BC10	1	Summer	1500	Mid-range	12.7	S	115	M			S				S	S
DG6	1	Summer	1500	Severe	18.7	S	23.4	M			M				S	S
ER2	1	Summer	1500	Severe	9.3	M	17.4	U			M				M	M
FS3	2	Summer	1000	Severe	9.3	M	28.1	M			S				S	S
FS4	2	Summer	1000	Severe	12.7	S	23.2	M			S				M	S
SR2	2	Summer	1000	Mid-range	13.3	S	28.3	M			S				S	S
SR3	3	Summer	3500	Mid-range	16.7	S	21.8	M			S				S	S
SR4	3	Summer	3500	Mid-range	38.7	M	29	M			S				S	S
BB1	3	Summer	3500	Mid-range	0.7	U	10.7	U			S				M	U
BB2	3	Summer	3500	Mid-range	11.3	S	34.5	M			U				U	U
BB7	3	Summer	3500	Mid-range	0	U	4.8	U			U				U	U
FS1	3	Summer	3500	Severe	21.3	S	63.7	S			S				S	S
SR1	3	Summer	3500	Mid-range	42.7	M	23	M			M				S	M

3 Suitable
11 Marginal
1 Unsuitable

8 Suitable
5 Marginal
2 Unsuitable



Site-Scale GRSG Example

Plot ID	DRG	Seasonal Habitat	Weight (acres)	Drought Condition	Sage Cover	Sage Cover	Sage Hgt	Sage Hgt	Per G Cover	Per F Cover	Per G&F Cover	Per G Hgt	Per F Hgt	Sage Shape	# of Pre Forbs	Overall Rating
D3	1	Nesting	300	Severe	34.7	M	64.1	S	S	M		S	M	S	S	S
D5	1	Nesting	300	Severe	34	M	37.5	S	U	U		U	U	M	M	U
S1	1	Nesting	300	Severe	1.3	U	6.5	U	S	M		U	U	U	M	U
S3	1	Nesting	300	Severe	28	M	42.7	S	S	S		S	M	M	M	S
T1	1	Nesting	300	Severe	12	M	11.7	U	S	M		U	U	M	U	U
T2	2	Nesting	500	Severe	12.7	M	18.5	U	S	M		U	M	U	U	U
T3	2	Nesting	500	Severe	12.7	M	23.7	M	S	M		M	S	M	S	M
A33	2	Nesting	500	Mid-range	20	S	28.6	M	S	M		S	M	S	M	S
A34	2	Nesting	500	Mid-range	41.3	M	41.3	S	S	M		S	M	M	S	S
CS1	2	Nesting	500	Severe	21.3	S	25.5	M	U	M		M	M	S	M	M
CS2	3	Nesting	2000	Severe	32	M	22.1	M	M	M		S	S	M	M	M
D4	3	Nesting	2000	Severe	20	S	21.9	M	S	S		M	S	S	M	S
ER1	3	Nesting	2000	Severe	41.3	M	27.6	M	S	M		M	S	M	S	M
A35	3	Nesting	2000	Mid-range	30	M	49.4	S	S	S		S	S	M	S	S
A36	3	Nesting	2000	Mid-range	32	M	33.8	S	S	S		M	S	S	M	S
BB3	1	Summer	1500	Mid-range	16.7	S	41.2	S			S				M	S
BB6	1	Summer	1500	Mid-range	26.7	M	51.3	S			S				S	S
BC10	1	Summer	1500	Mid-range	12.7	S	115	M			S				S	S
DG6	1	Summer	1500	Severe	18.7	S	23.4	M			M				S	S
ER2	1	Summer	1500	Severe	9.3	M	17.4	U			M				M	M
FS3	2	Summer	1000	Severe	9.3	M	28.1	M			S				S	S
FS4	2	Summer	1000	Severe	12.7	S	23.2	M			S				M	S
SR2	2	Summer	1000	Mid-range	13.3	S	28.3	M			S				S	S
SR3	3	Summer	3500	Mid-range	16.7	S	21.8	M			S				S	S
SR4	3	Summer	3500	Mid-range	38.7	M	29	M			S				S	S
BB1	3	Summer	3500	Mid-range	0.7	U	10.7	U			S				M	U
BB2	3	Summer	3500	Mid-range	11.3	S	34.5	M			U				U	U
BB7	3	Summer	3500	Mid-range	0	U	4.8	U			U				U	U
FS1	3	Summer	3500	Severe	21.3	S	63.7	S			S				S	S
SR1	3	Summer	3500	Mid-range	42.7	M	23	M			M				S	M

6 Suitable
6 Marginal
3 Unsuitable

3 Suitable
9 Marginal
3 Unsuitable



But we're not done

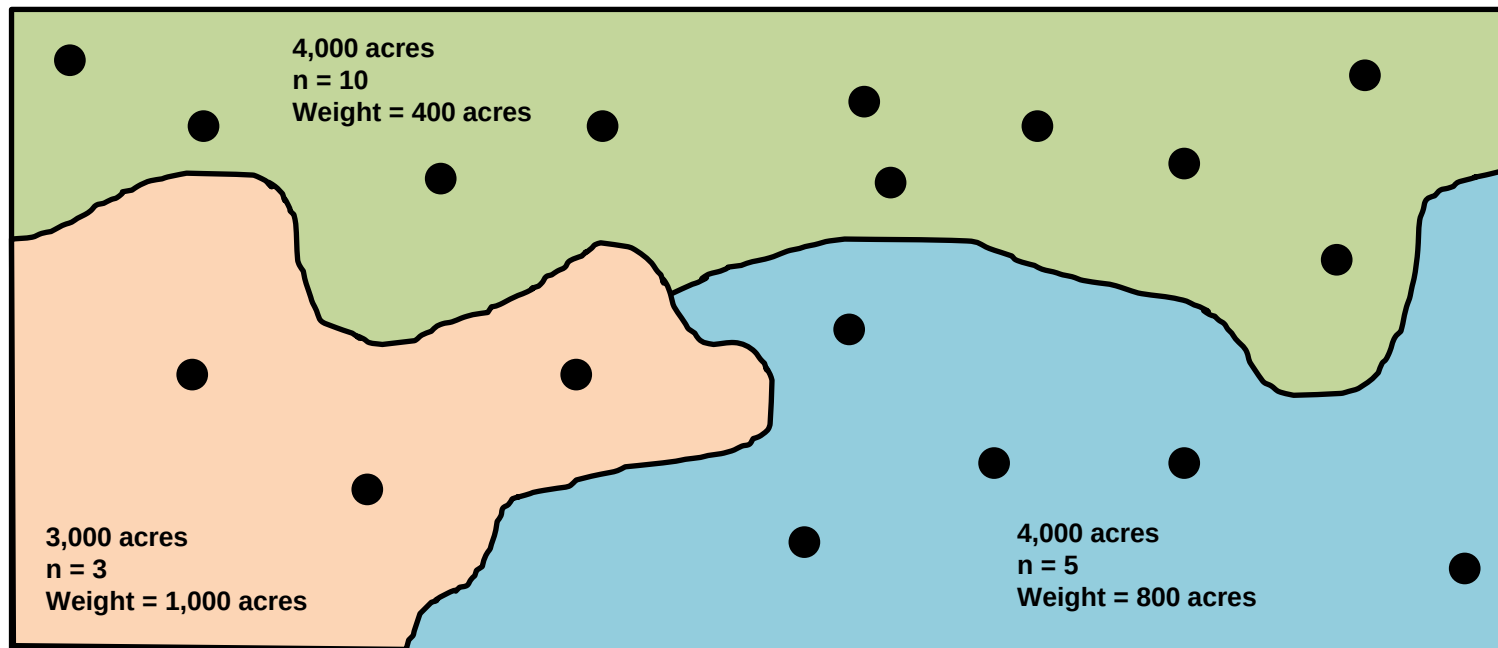
Now that you've evaluated whether your benchmarks have or have not been met...

What proportion of your reporting area is meeting/not meeting your objective?



Concept of weighting

- What does each plot/site represent?
 - o x amount of stream kilometers
 - o x amount of acres
- Lower number of points within an area means each point has a larger weight (i.e., represents a larger area)



Why use weighting in analysis?

- Goes back to sample design – you selected points to sample that should be representative of a larger area
- Concerns: Certain areas might be over- or under-represented



Why use weighting in analysis?

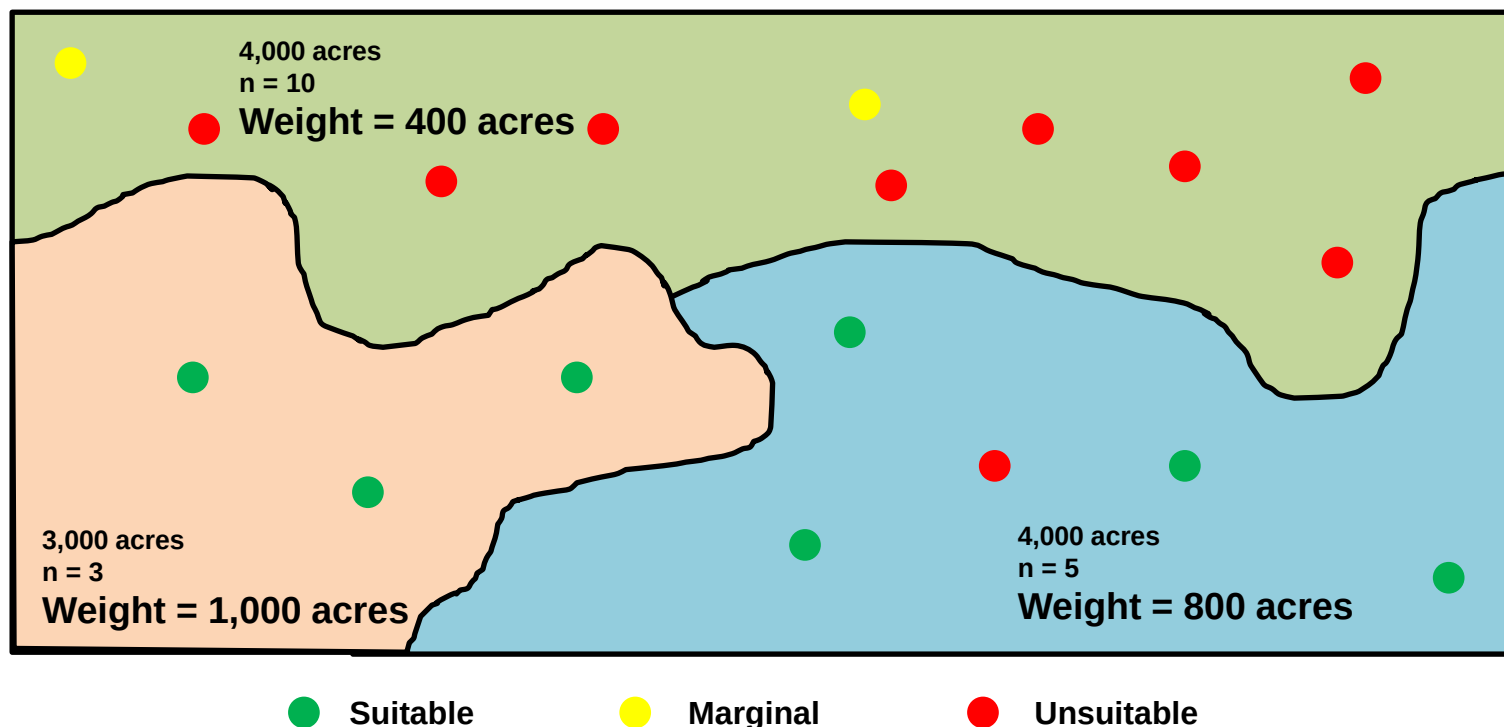
For example:

You want to know who people are voting for in an upcoming election. As it stands, 18-40 year olds make up around 35% of the population while 65+ year olds represent about 15% of the population.

If you only call land lines, you might be biasing your data by excluding a younger generation who only have cell phones. When your results come in, it turns out that of the population you sampled, 70% were 65 years or older while only 20% were between the ages of 18 and 40. This means that the 65+ year olds are over-represented, while the 18-40 year olds are under-represented.



Easier to think about spatially...



Total acreage = **11,000 acres**

Acreage that is suitable: $3 \times 1,000 + 4 \times 800 = 6,200$

Proportion of acreage that is suitable: $6,200 / 11,000 = 0.563$ or **56.3%**

56.3% of your reporting unit is considered “suitable”

Interpreting the information

What do you do with the 56.3% of the reporting unit being suitable?

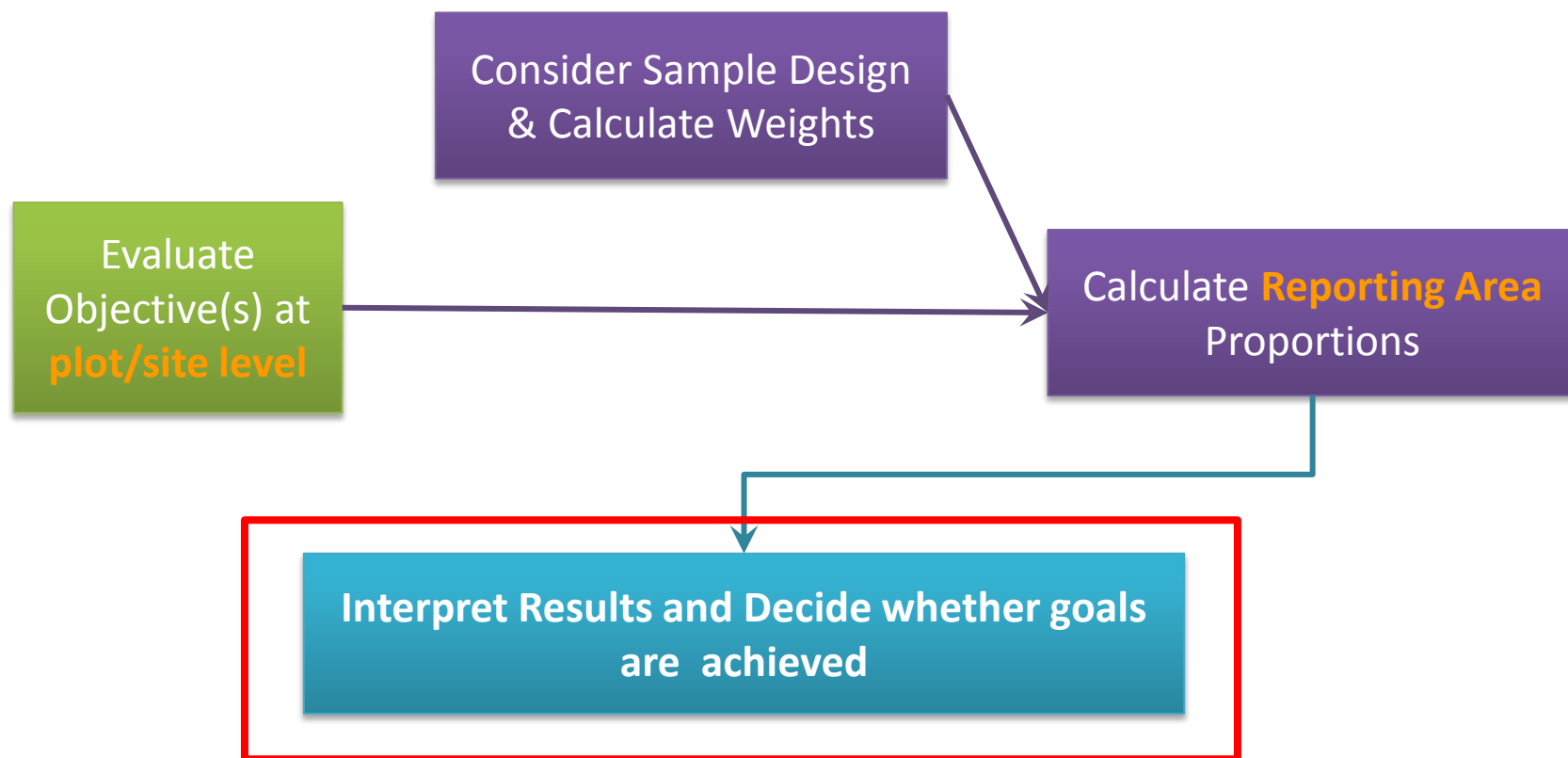
Again, important to have quantitative monitoring objectives:

Study area + Indicator + Benchmark + Proportion +
Confidence level + Time Period

If the monitoring objective for this example was “Suitability must be rated as ‘suitable’ for at least 70% of the field office over 5 years with 80% confidence”, you would NOT have met this objective.



Closing the loop



Decide whether goals are achieved

You collected all your data, evaluated it, and decided whether or not objectives were met.

But ultimately, we need to know whether or not goals were achieved (e.g., were land health standards met).

For example (using multiple lines of evidence):

Soils Land Health Standard:

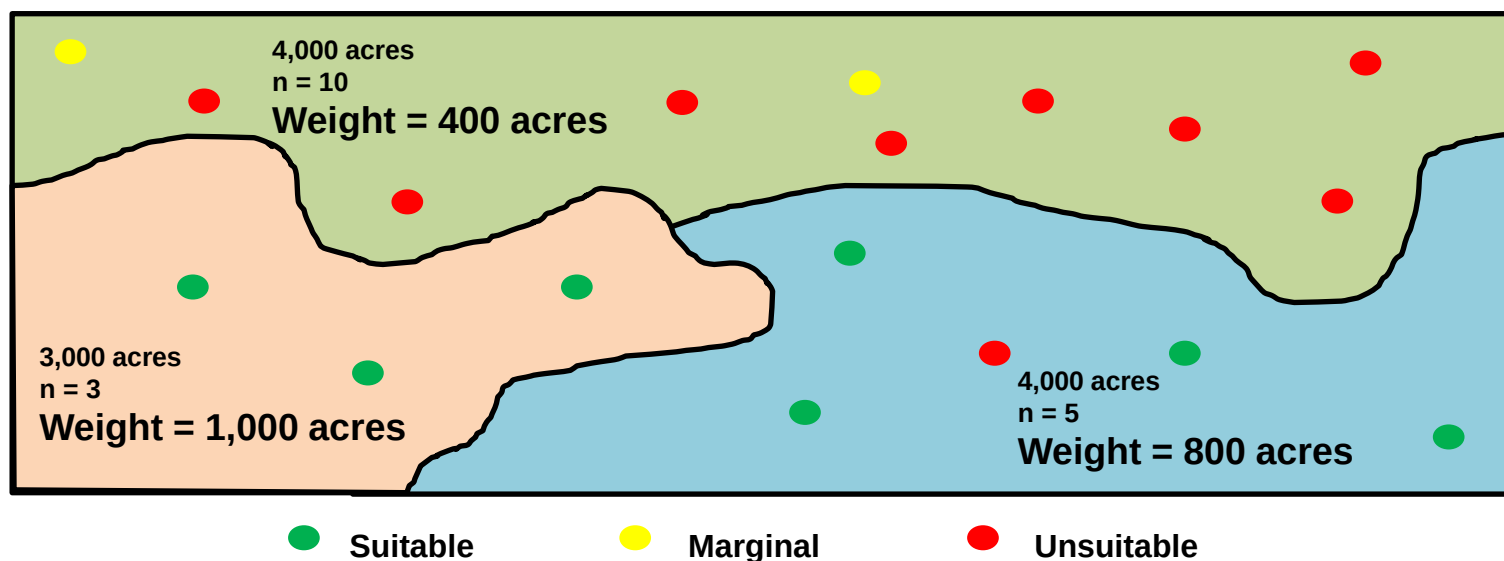
- *Soil stability objective is **met** with 85% of the landscape achieving the benchmark*
- *Canopy gap objective **not met** with only 60% of the landscape achieving the benchmark*

Was the landscape meeting the Soils Land Health Standard?



In-Class Exercise: Question 4

Step 2: Using the weights for each site, calculate the proportion of your reporting unit meeting your objective.



Total acreage = **11,000 acres**

Acreage that is suitable: $3 \times 1,000 + 4 \times 800 = 6,200$

Proportion of acreage that is suitable: $6,200 / 11,000 = 0.563$ or **56.3%**

What graphics would you use to show your results?

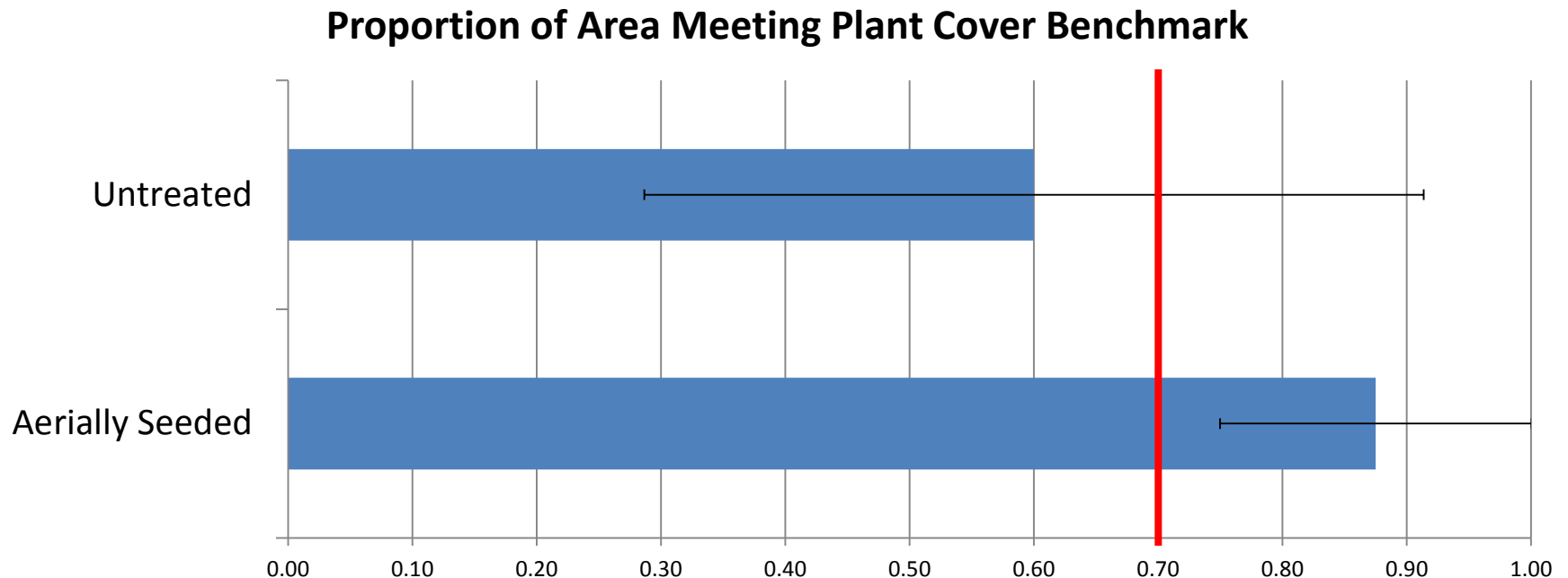


Objective 1: Total plant cover is within the appropriate range for the associated Ecological Site (see bullet points below) across 70% of the aerially seeded areas with 80% confidence.

Ecological Site 1: 60% cover

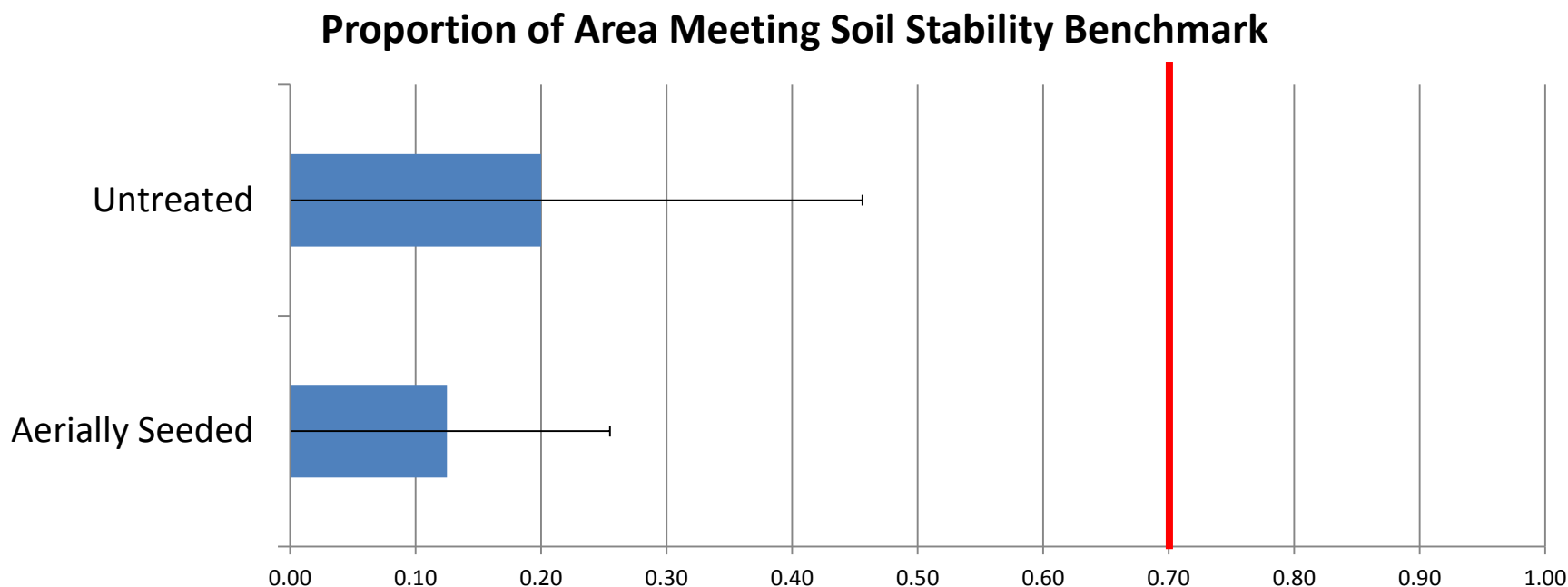
Ecological Site 2: 30% cover.

Proportion of aerially seeded and untreated areas in the allotment meeting Objective 1 (total foliar cover):



Objective 2: Maintain soil stability equal to or greater than 4 across 70% of the aerially seeded areas with 80% confidence.

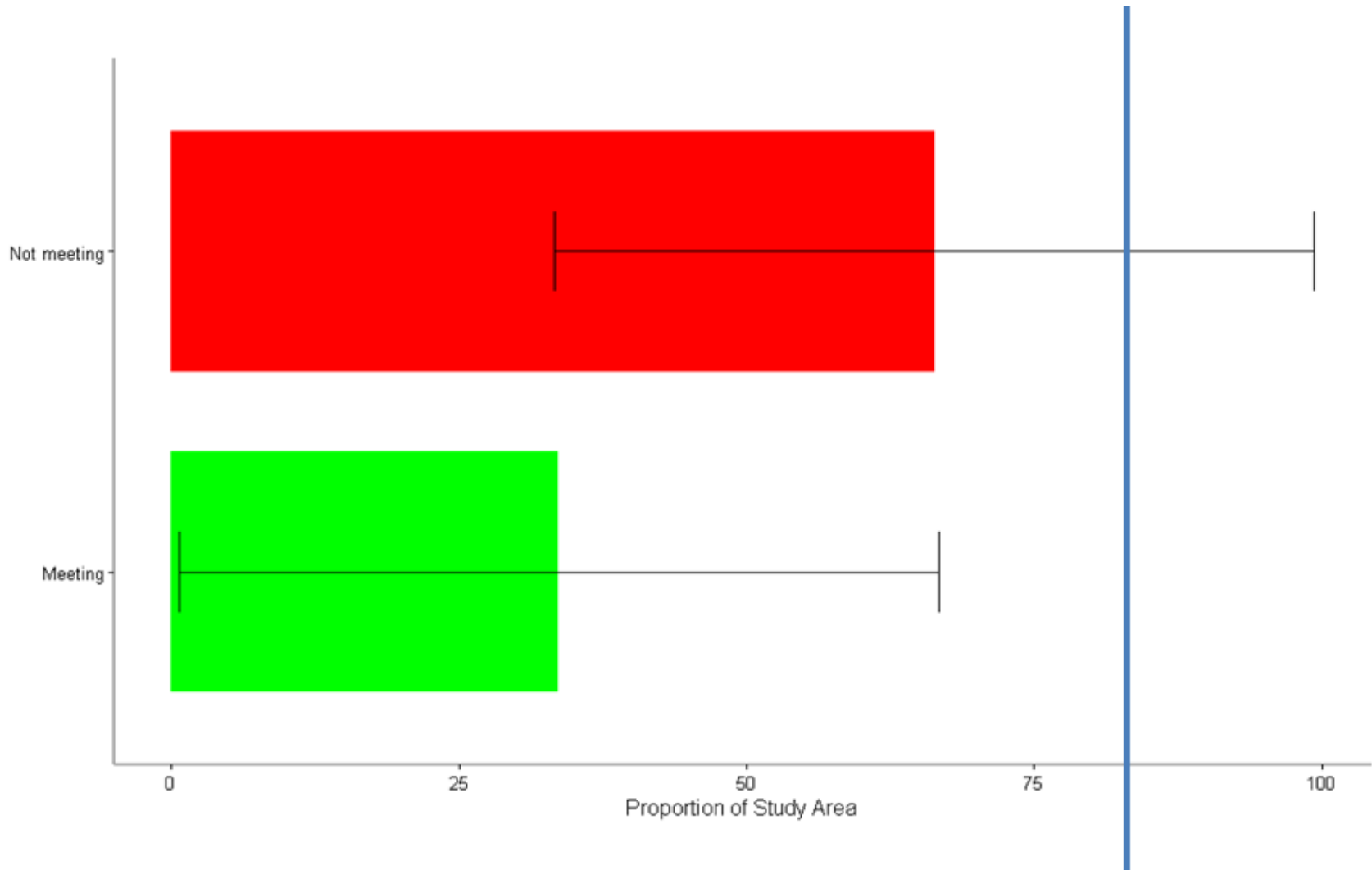
Proportion of aerially seeded and untreated areas in the allotment meeting Objective 2 (soil stability):



Invasive species cover is within the appropriate range for the ecological site for 80% of the allotment across 5 years, with 90% confidence.

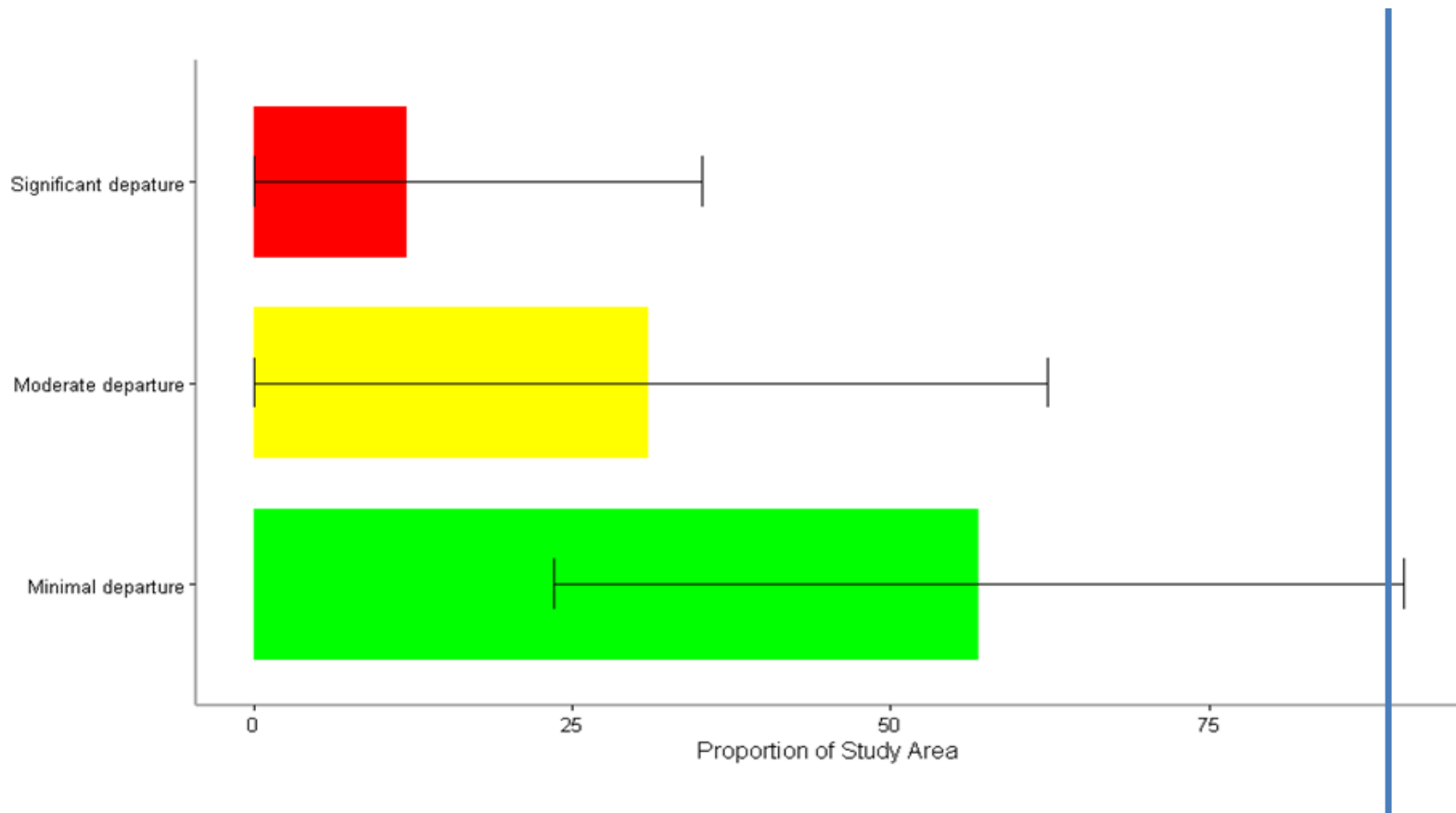
Claypan: <5%

Loamy 6-12": <10%

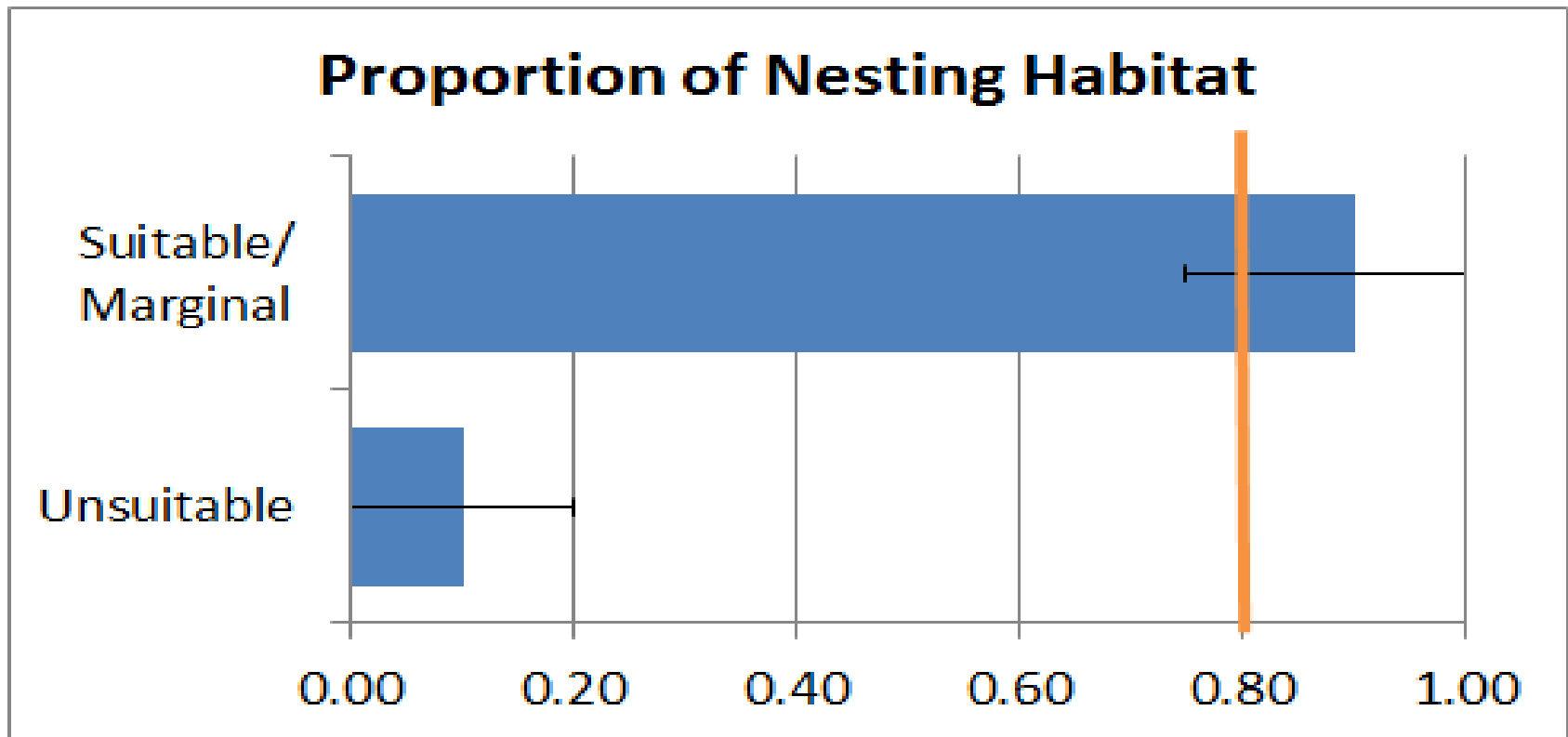


% fine sediment is within regional reference conditions (see below bullet points) for 90% of the allotment over 10 years, with 90% confidence.

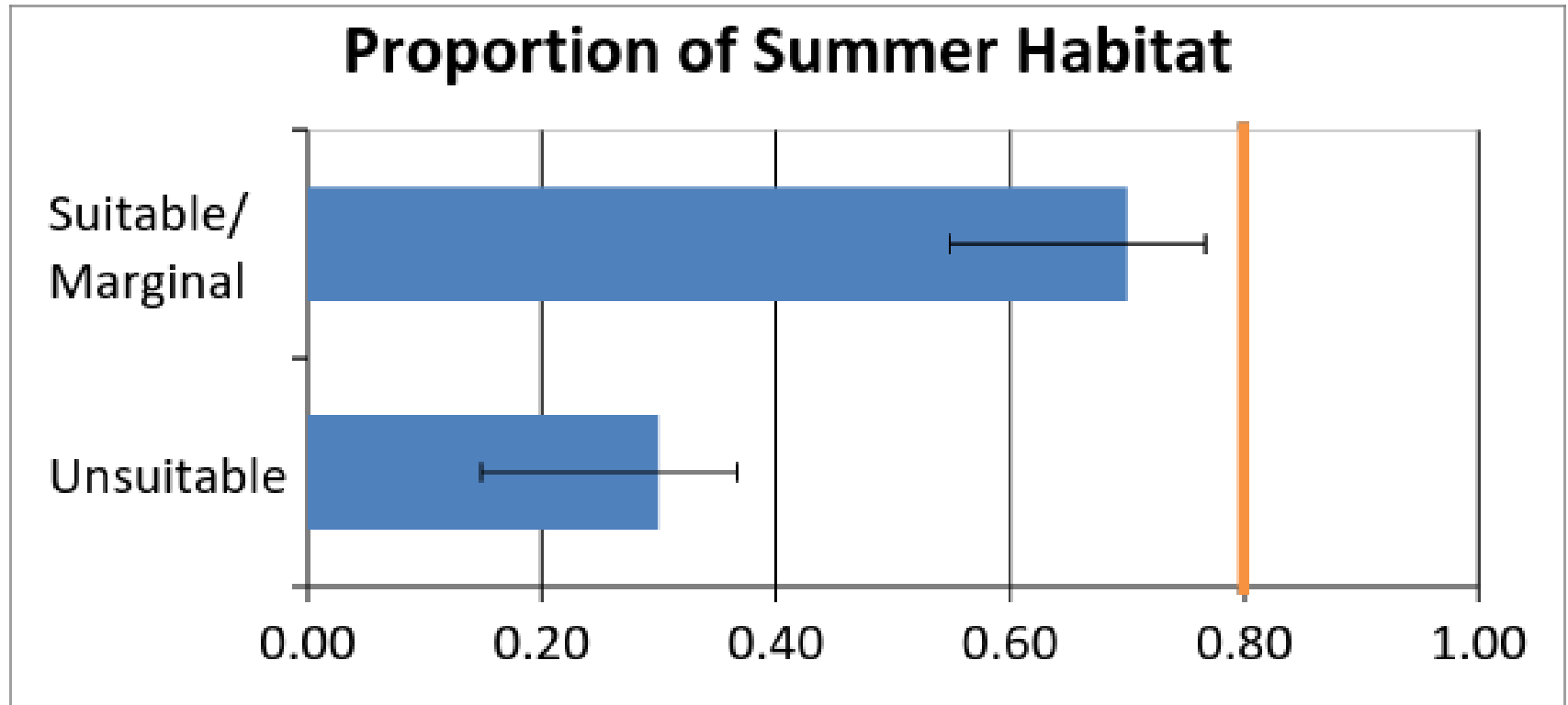
Significant departure: >74.5% fines



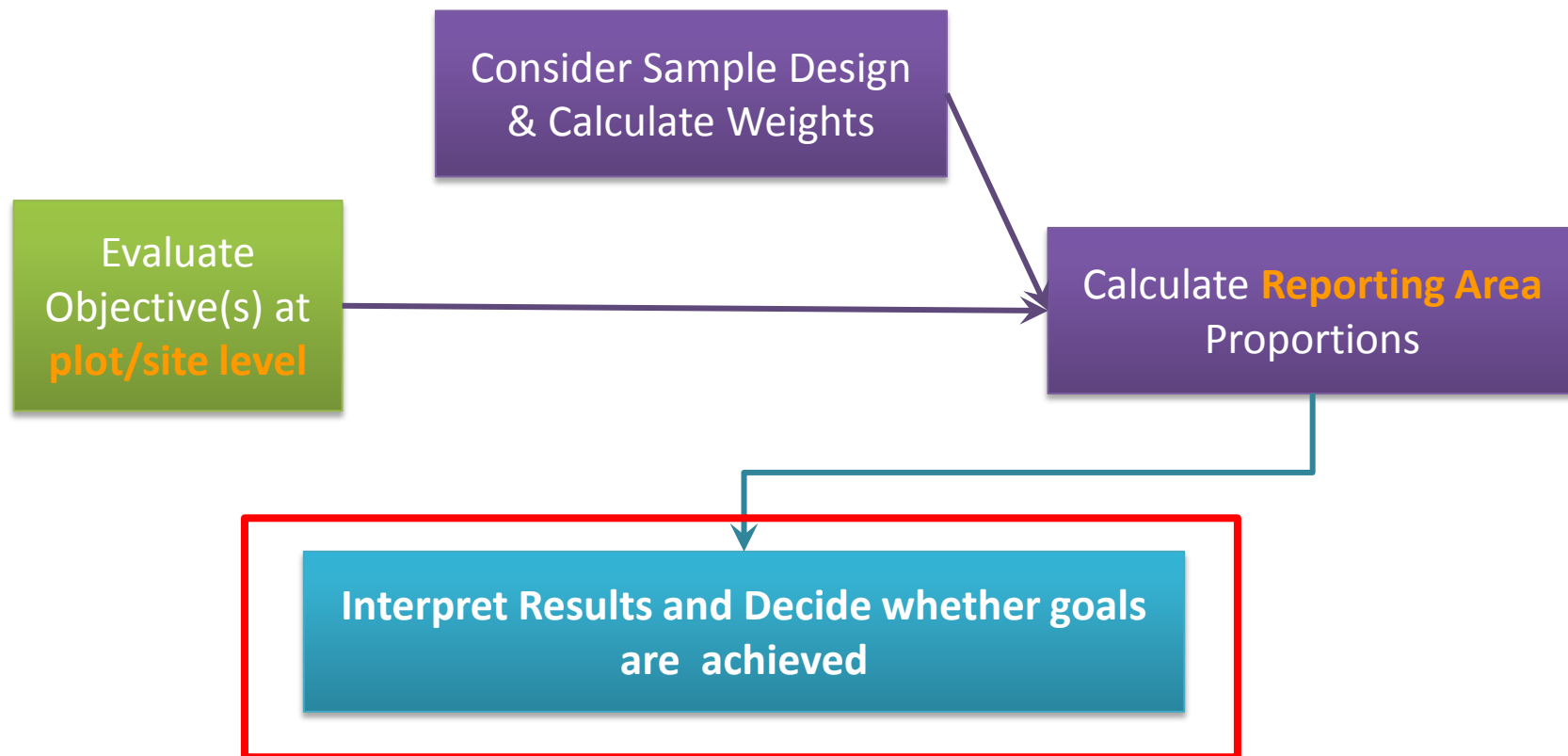
Proportion of nesting habitat within the Elko District Office rated as “suitable” or “marginal” (meeting Objective 3) or “unsuitable” (not meeting Objective 3).



Proportion of summer habitat within the Elko District Office rated as “suitable” or “marginal” (meeting Objective 3) or “unsuitable” (not meeting Objective 3).



Closing the loop



Closing the loop – ES&R

Objective 1 (plant cover) met
Objective 2 (soil stability) not met

1. Did the treatments meet your objectives?
2. What was the impact of the fire on land health of these allotments?
3. Can we release the grazing closure on the fire?
4. What would be next steps?



Closing the loop – Grazing Permit Renewal

Terrestrial Objective (invasive species) not met
Aquatic Objective (% fine sediment) met

1. Are we meeting/making progress towards Land Health Standards?
2. If not, where are we not meeting LHS and for what standard?
3. What would be the next steps?



Closing the loop – Greater Sage-Grouse

Nesting Objective met
Summer Objective not met

1. Is the seasonal habitat suitable/making progress towards suitable for greater sage-grouse?
2. If the habitat is not suitable, where are sites located that are not meeting the overall habitat suitability?
3. Are there particular seasonal habitat indicators that are limiting an area in its ability to produce suitable seasonal habitat?



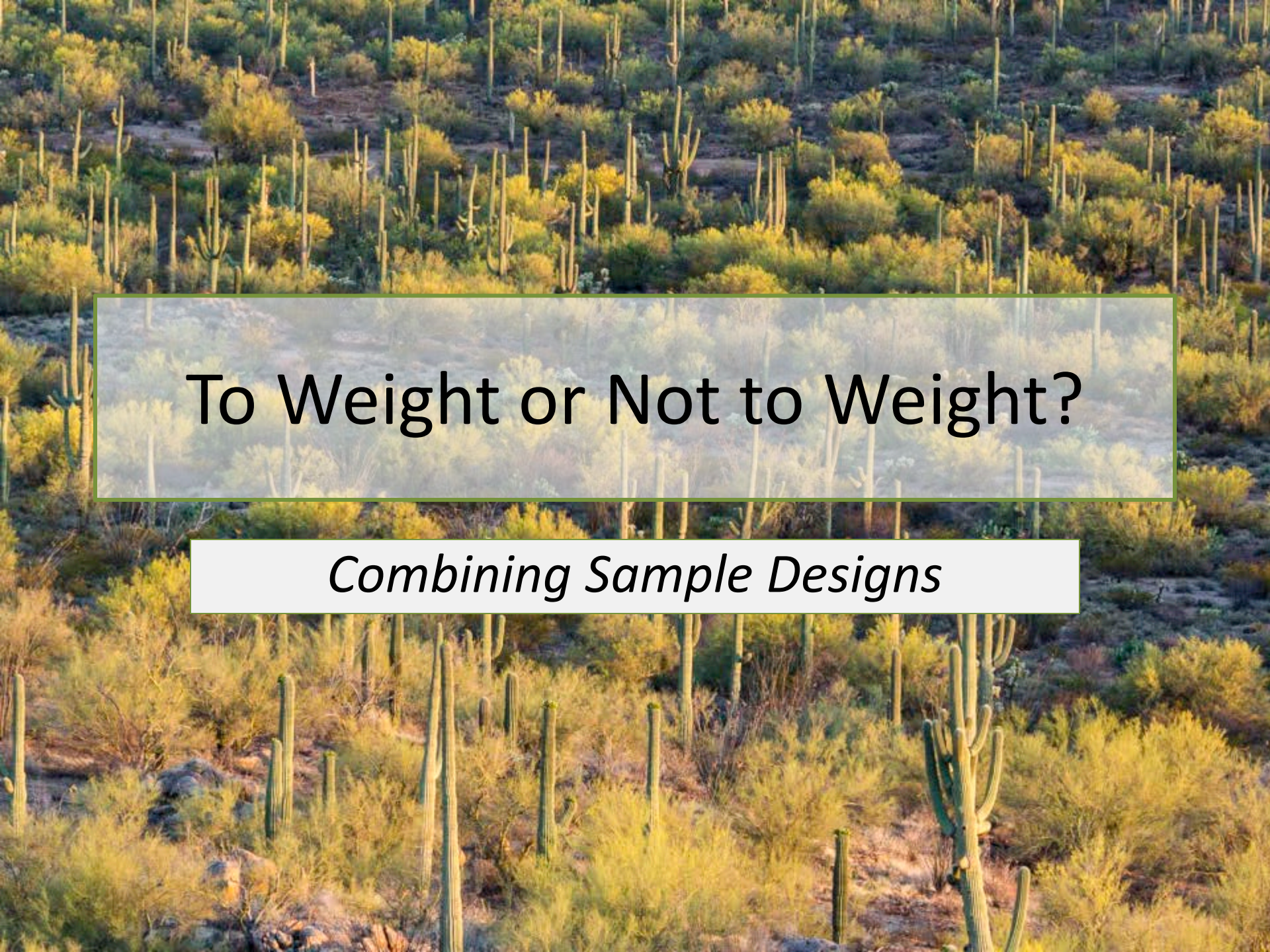
Things to Remember

- Use any and all “good” information
 - Set up multiple objectives to interpret
 - Includes legacy data and any other ancillary data
- Management decisions are completed at the local scale
 - Your job is to interpret results and decide if goals were achieved
 - National AIM team is here to help guide you in setting up objectives/sample design and conducting data analysis



Let's talk more about weights





To Weight or Not to Weight?

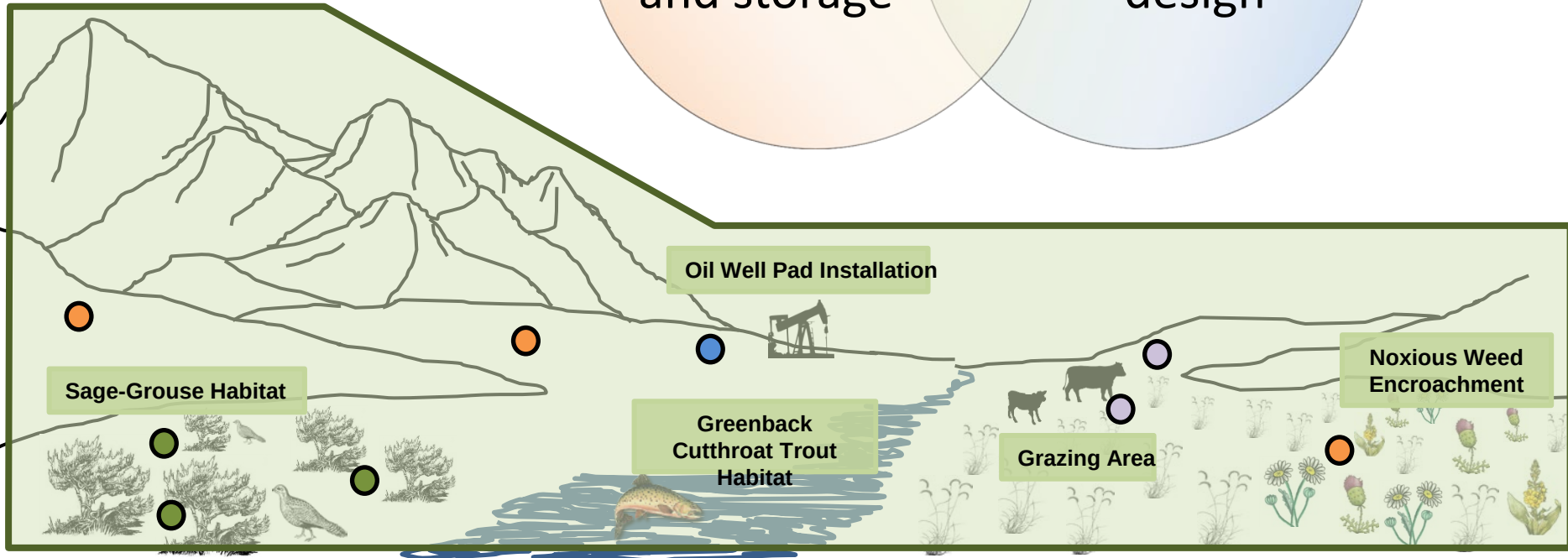
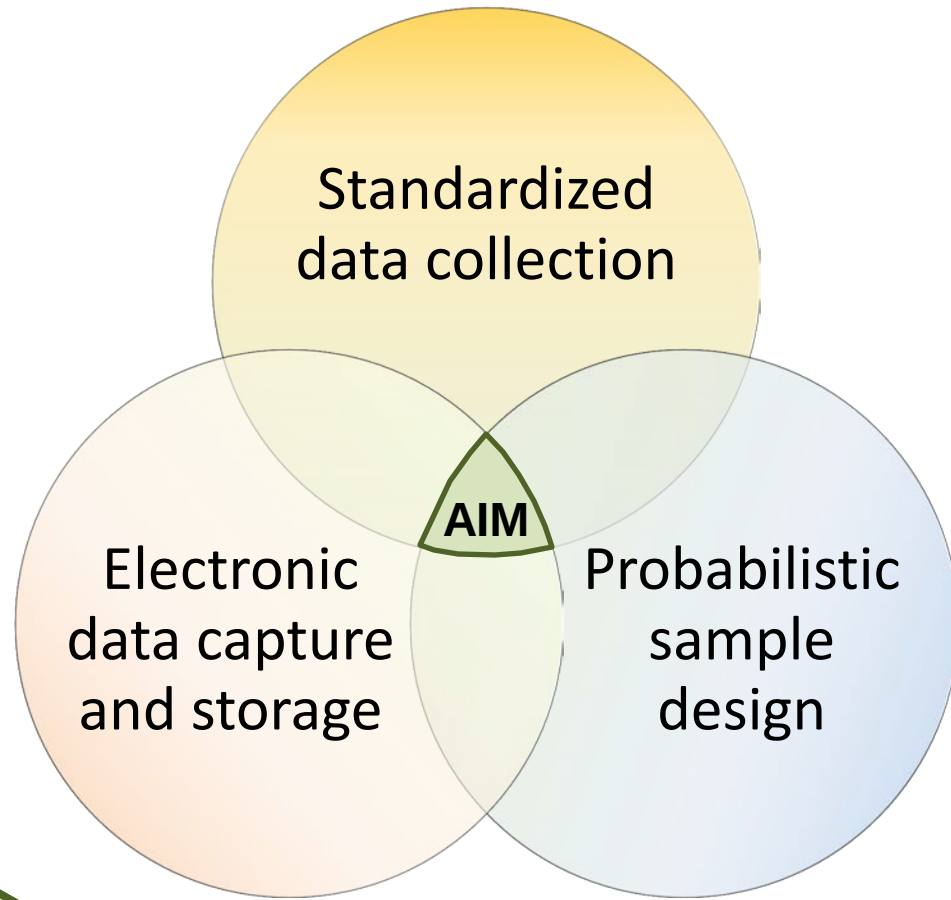
Combining Sample Designs

AIM

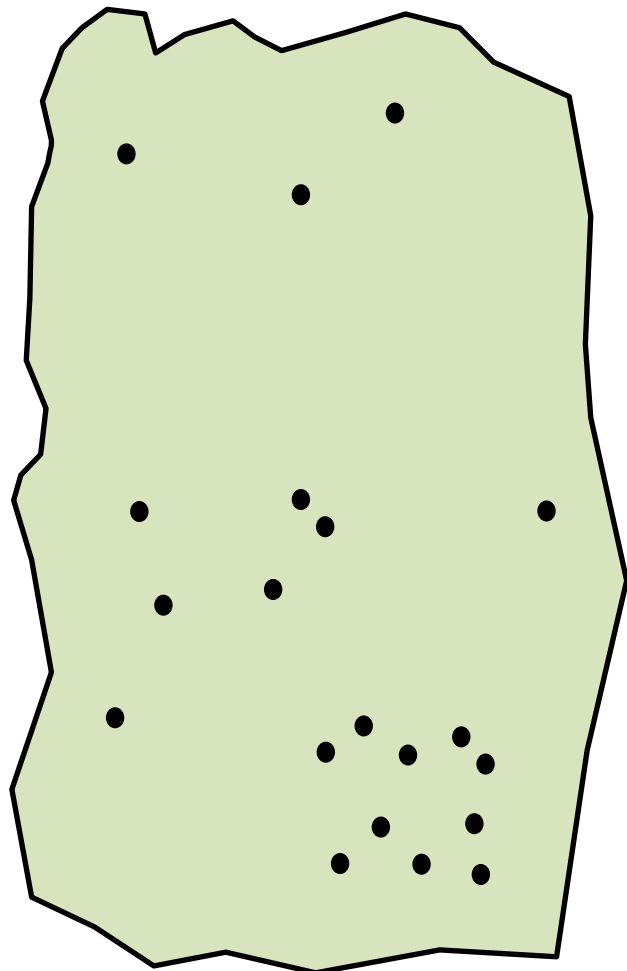
Collect once, use many times

Monitoring Effort

- = Land use plan
- = Sage-grouse habitat
- = Reclamation
- = Grazing
- = Reporting unit



Combining Sample Designs



● = Randomly Selected Monitoring Point

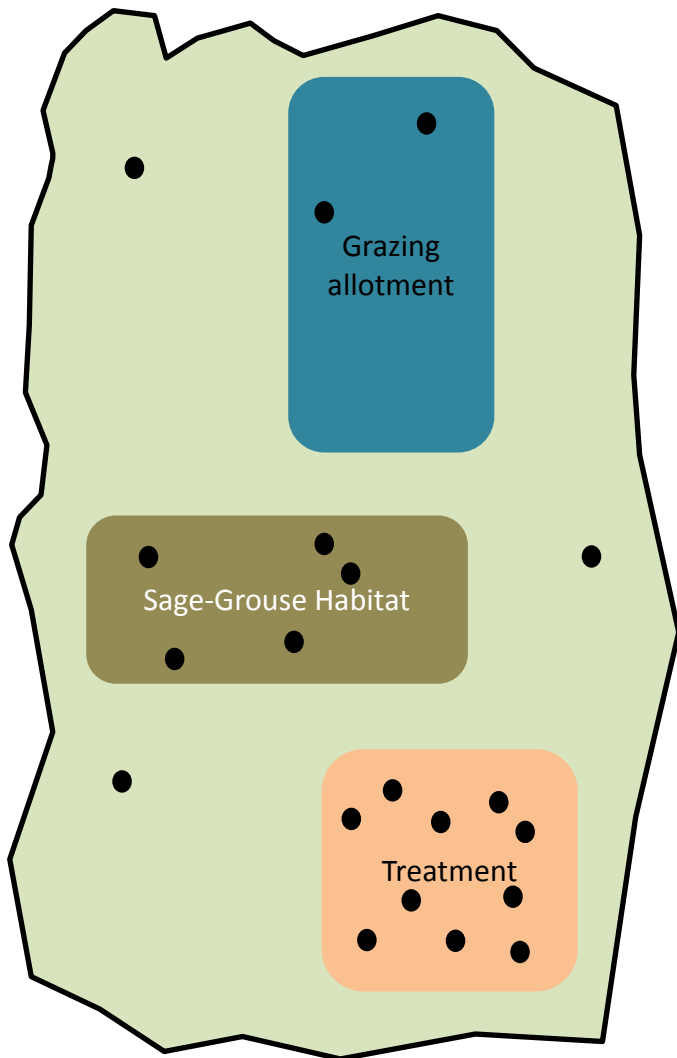
$$\text{Weight} = \frac{\text{area of interest (acres or km)}}{\text{\# of points sampled}}$$

Representative area of an individual monitoring point



1000 acres/20 points= 50 acres/pt

What is a weight?



● = Randomly Selected Monitoring Point

Representative area of an individual monitoring point

$$\text{Weight} = \frac{\text{area of interest (acres or km)}}{\text{\# of points sampled}}$$



100 acres/10 points= 10 acres/pt



200 acres/5 points= 40 acres/pt



200 acres/2 points= 100 acres/pt

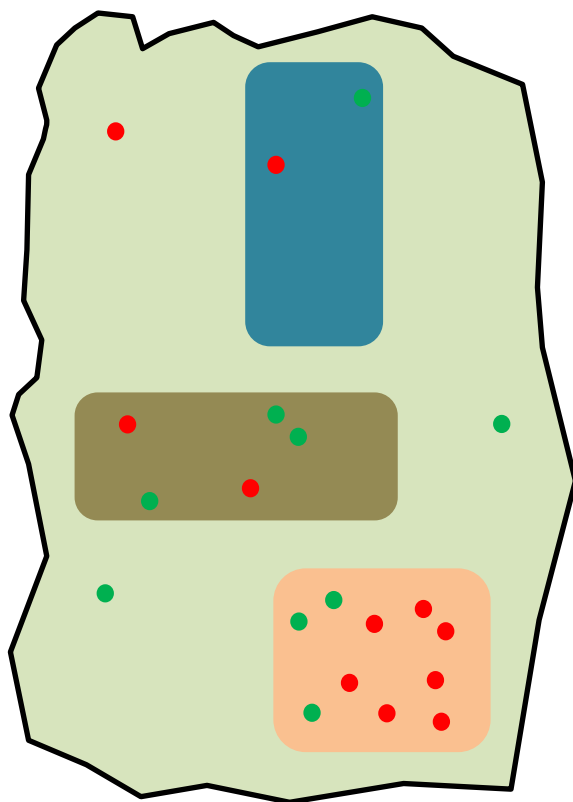


1000 acres/20 points= 50 acres/pt



500 acres/3 points= 166.7 acres/pt

Effects of weights: Equal weights

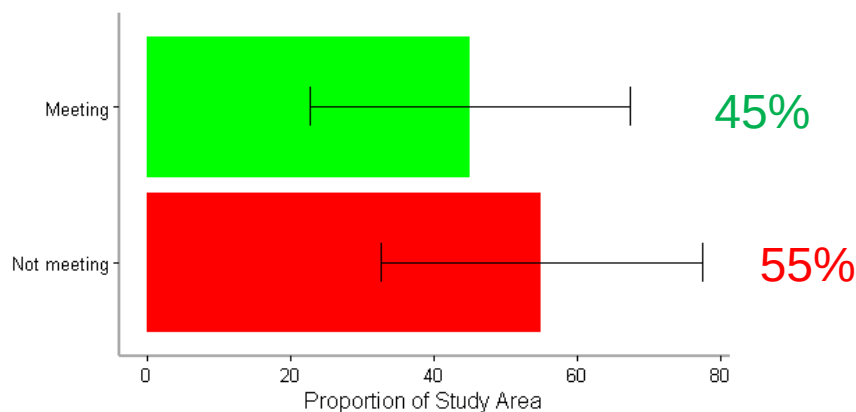


● = Meeting benchmark
● = Not meeting benchmark

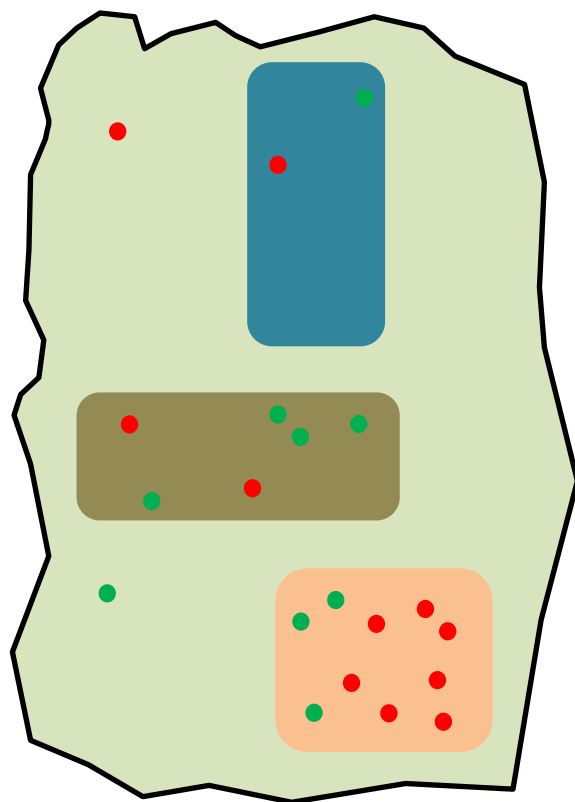
1 plot = 50 acres

● 9 plots = 450 acres

● 11 plots = 550 acres

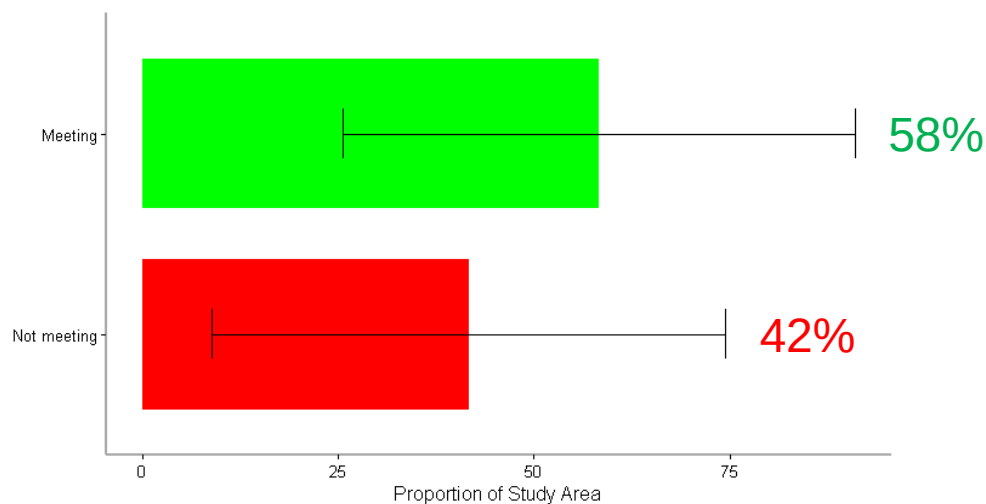


Effects of weights: Unequal weights



● = Meeting benchmark
● = Not meeting benchmark

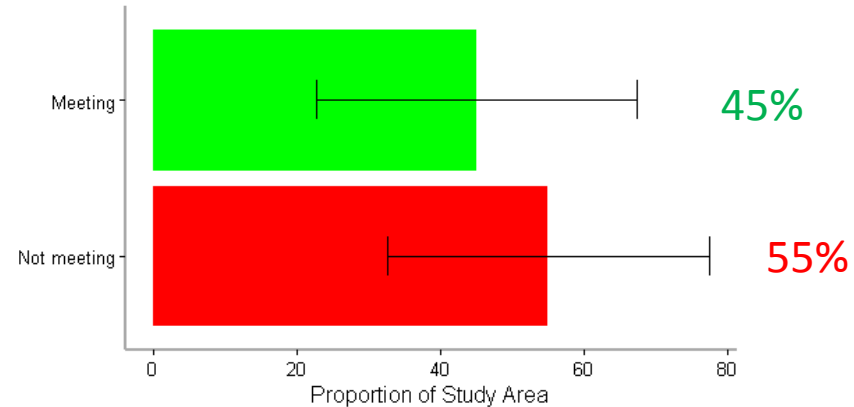
Orange	● 3 plots = 30 acres	● 7 plots = 70 acres	
Brown	● 3 plots = 120 acres	● 2 plots = 80 acres	= 583 acres
Blue	● 1 plot = 100 acres	● 1 plot = 100 acres	= 417 acres
Light Green	● 2 plot = 333 acres	● 1 plots = 167 acres	



Objective: *50% of the landscape is meeting the benchmark*

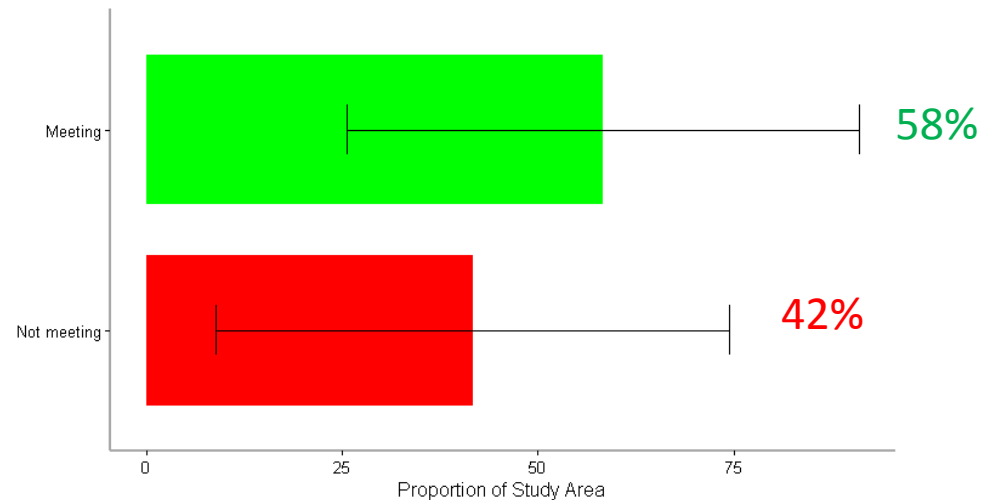
Equal Weights

Conclusion: Monitoring objective is not met



Unequal Weights

Conclusion: Monitoring objective is met



Questions to ask before combining designs

- What is the target population for the reporting unit and each design?
- When were these data collected?
 - Climate variability between years?
 - Management variability between years?
- Are the following assumptions true across all designs?
 - Plot locations are random
 - Missing data are missing at random
 - Non-response is random



Questions to ask before assigning weights

- What are the differences in target populations between designs?
 - Similar target population → equal weights
 - Disparate target population → unequal weights or don't combine designs at all
- How does sample density vary between designs and across the landscape?
 - Equal density → equal weights
 - Disparate density → unequal weights



Answering these questions

- ✓ Project design worksheets
 - ✓ Visual inspection in GIS
 - ✓ Management and climate records
 - ✓ *Consult with the NOC, Jornada, and USU*
- *Document your analysis decisions!*

Other Questions?

