Using historical literature for ESD Development

Shane A. Green
NRCS Utah

Vegetation Data (Plant Communities section)

- One major criticism of ESDs is that they are not based on (enough) data
  - More data = better credibility
    - Expertise should be applied to data interpretation (no black boxes, no "data-less" theories)
- Some data is more valuable than other data
  - no data is useless

How to Gauge the Value of Data for ESDs

- What data was collected?
  - What metrics were recorded (production, cover, density, frequency)
    - Which concepts were used? (annual production vs. peak standing crop, foliar vs. canopy cover)
      - What techniques were used (double sampling vs. comparative yield vs. ocular estimates, point vs. linear vs. plot cover techniques)
- Where was the data recorded?
  - Ecological Site identification
  - Soil Identification
  - Geographic Location (coordinates, T, R & Section)
  - Random or deliberate site selection

How to Gauge the Value of Data for ESDs

- Why was the data collected?
  - Monitoring vs. assessment
  - Wildlife / watershed / livestock purpose and focus
  - Ground truth for remote sensing
- When was the data collected?
  - Concepts and techniques change over time
    - i.e. density = cover in old terminology
  - Temporal context
    - i.e. Pre or post-settlement, pre or post-invasive plants, management history

How to Gauge the Value of Data for ESDs

- Who collected the data?
  - Agency or individual reputation or bias

What parts of the ESD can data inform?

- Plant Communities Section
  - Annual production and cover by species
  - State and transition models
  - Plant community structure

				Annual Production in Pounds Per Acre		Foliar Cover Percent	
		ymbol	Scientific Name	Low	High	Low	High
3 -Secondary Shrubs				40	80		
	black sagebrush	ARNO4	*Artemisia nova*	8	24		
	spiny hopsage	GRSP	*Gravia spinosa*	8	24		
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	8	24		
	winterfat	KRLA2	*Krascheninnikovia lanata*	8	24		
	plains pricklypear	OPPO	*Opuntia polyacantha*	8	24		
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	8	24		
	Nuttall's horsebrush	TENU2	*Tetradymia nuttallii*	8	24		

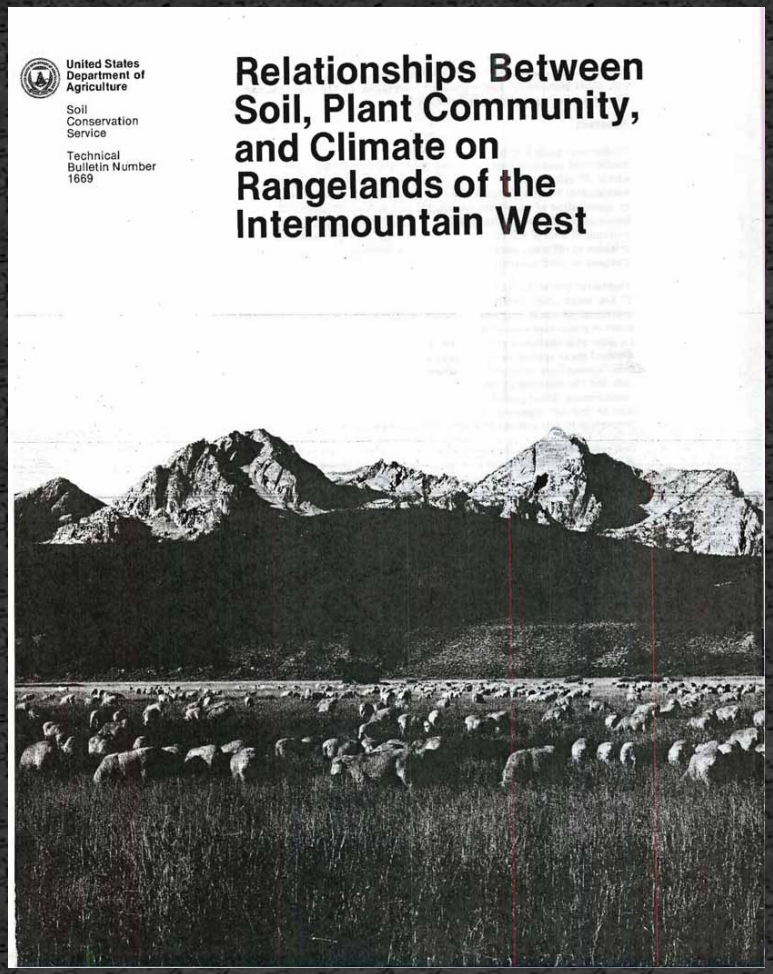
Annual Production by Plant Type:

	Annual Production (lbs/AC)		
Plant Type	Low	Representative Value	High
Grass/Grasslike	203	349	450
Forb	45	78	100
Shrub/Vine	203	349	450

Where to get data for ESDs

- Range Sites – they were based on some data
  - Old dusty files need to be examined and organized
- Historical data
  - Journals and accounts, survey notes
- Partner agencies
  - Division of Wildlife, BIA, BLM, USFS, Universities
- NRCS sources
  - Field offices, NRI

Examples – Range Sites



Passey, H. B., Vern K. Hugie, E. W. Williams, and D. E. Ball. 1982. Relationships between soil, plant community, and climate on rangelands of the Intermountain West. U.S. Department of Agriculture, Technical Bulletin No. 1669.

Abstract

Studies were made to determine the range of soil, climate, and vegetation characteristics consistently associated under natural conditions. Eighty-five study sites were selected within 32 relict areas in northern Utah, southern Idaho, northeastern Nevada, and west-central Wyoming. Studies were confined to climax plant communities characterized by associations of sagebrush, bluebunch wheatgrass, Sandberg bluegrass, and Idaho fescue and by Entisol, Aridisol, and Mollisol soil orders. Soil subgroups provided the most meaningful level of soil classification for correlation with broad plant associations. The presence of different species or subspecies of sagebrush provided the most meaningful grouping of plant communities.

Vegetation production and composition data were recorded for 10 consecutive years on 17 key study sites. Annual and periodic fluctuations in total production and yield of individual species in response to climatic variations were analyzed. Year-to-year differences in production were greater on sites with deeper soils and higher precipitation than on sites with shallower soils and lower precipitation. Fluctuations in production of individual plant species were inconsistent and erratic. Growing conditions favorable to some species were unfavorable to others. Production was positively related to precipitation, but the relationship was too broad to be of practical interpretive value for range management. Broad positive correlations also were observed between total annual production and soil organic-matter content, soil nitrogen content, amount of plant litter, percentage of soil covered by plants, and basal area of plants.

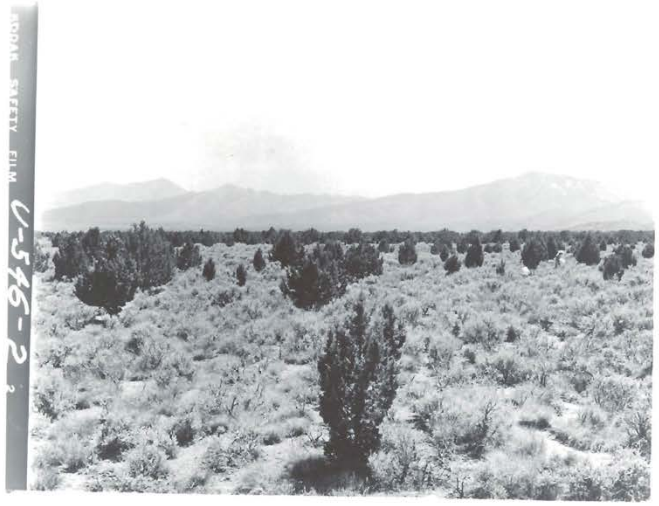
Soil properties modify the effects of climate on plant communities; likewise, variations in weather conditions modify or mask the effects of specific soil properties on plant growth and distribution. Nevertheless, climax plant communities protected from abnormal disturbance serve as valuable benchmarks for soil survey interpretations on rangeland. Effects of soil, plant, and climate relationships on relict areas may be used to approximate productive potential of other areas of the same or similar soils.

H.B. Passey and Vern K. Hugie

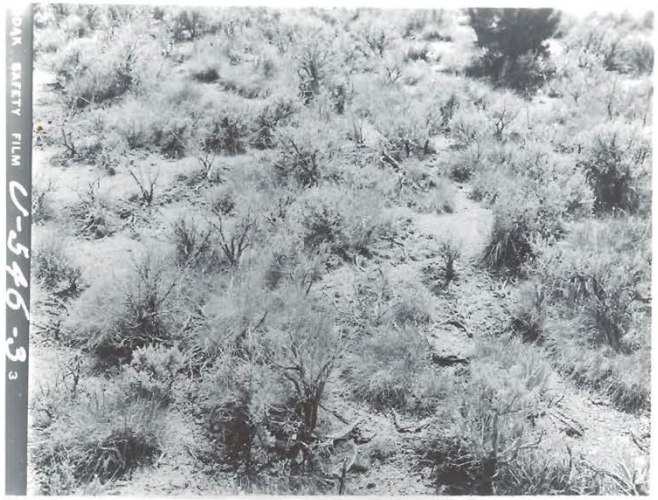
SCS Plant/Soil Relationships Team

Some Plant-Soil Relationships on an Ungrazed Range Area of Southeastern Idaho
H. B. Passey and V. K. Hugie, *Journal of Range Management*,
Vol. 16, No. 3 (May, 1963), pp. 113-118

The data presented will be useful in the technical description of range sites represented by the relicts and, through interpolation and extrapolation of these data, the place of sagebrush in potential native plant communities may be approximated for range sites not represented by suitable relict areas.



General View of Vegetation

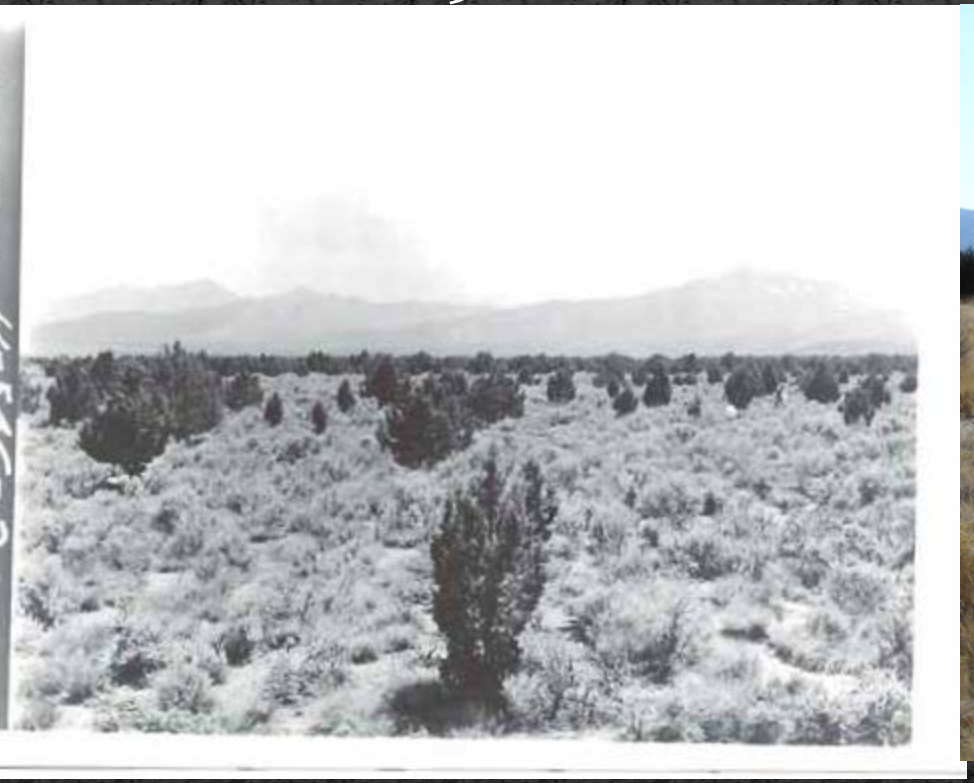


Close Up of Vegetation

Plot 1-60 Upland Gravelly Loam

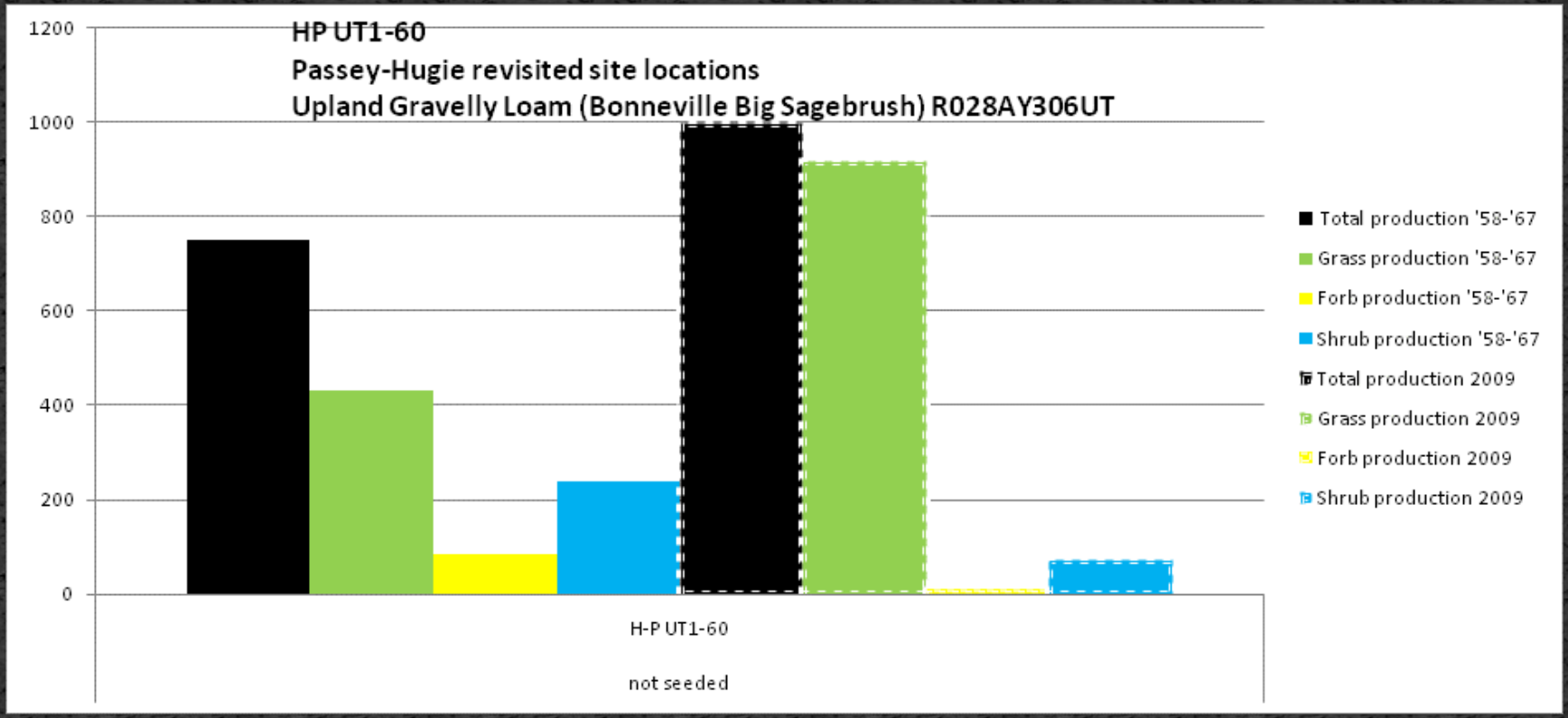
"The inventory location has burned within the last few years, removing most of the native shrub species and releasing the Bluebunch wheatgrass. Broom snakeweed has increased in spots as expected following a wildfire."

1960



2010

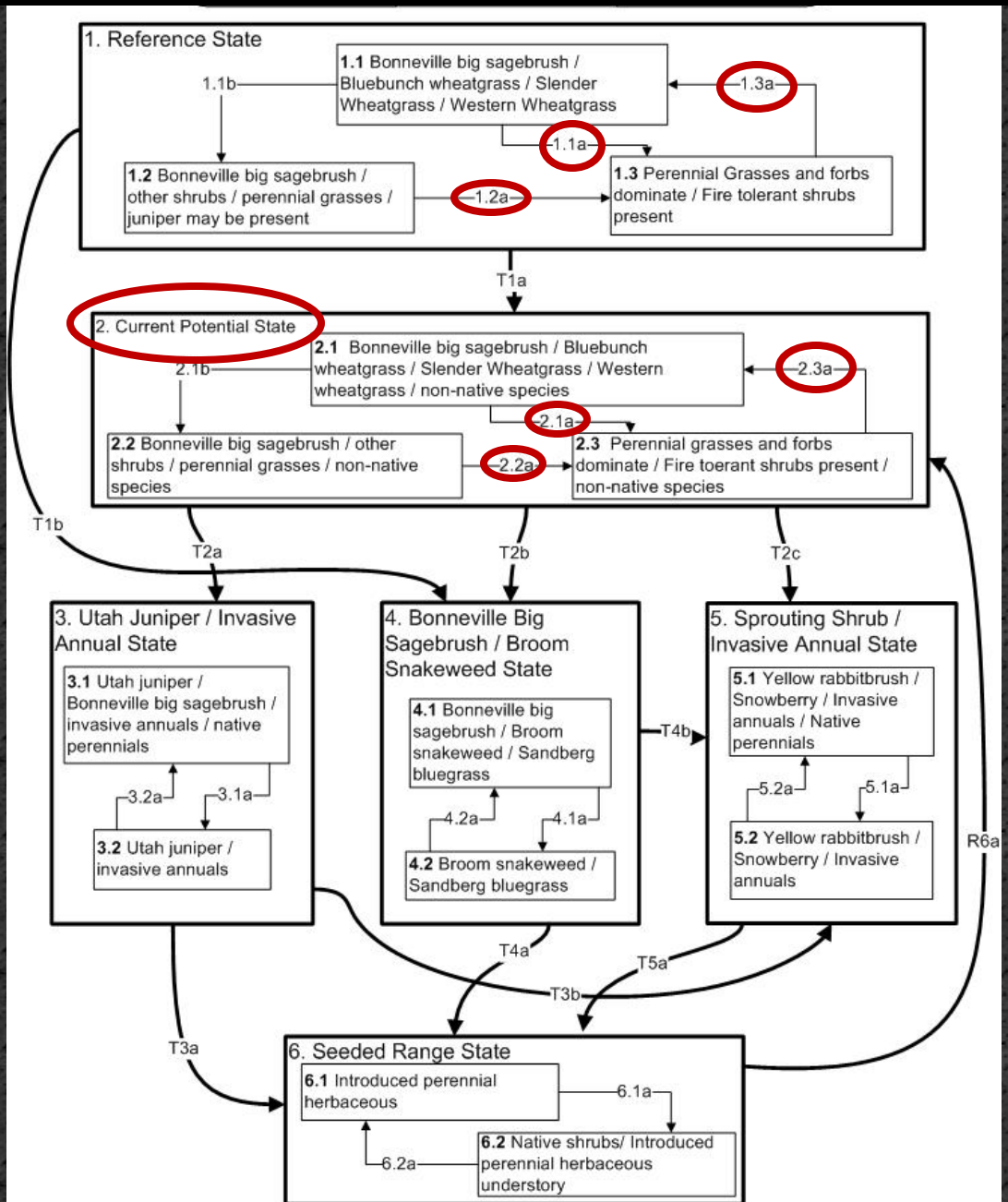
Plot UT1-60 Upland Gravelly Loam



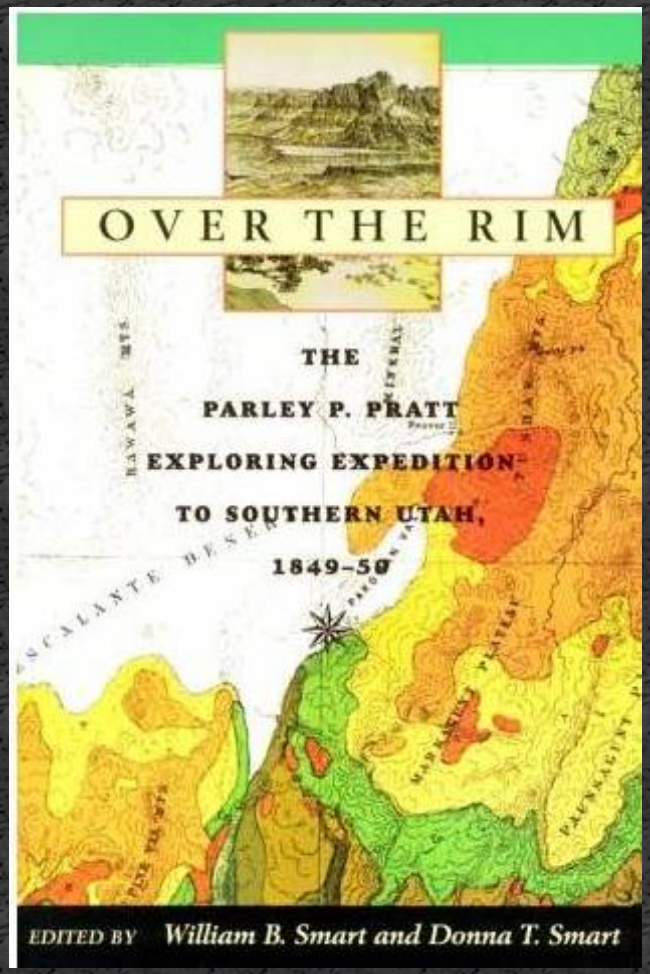
Plot UT1-60 Upland Gravelly Loam

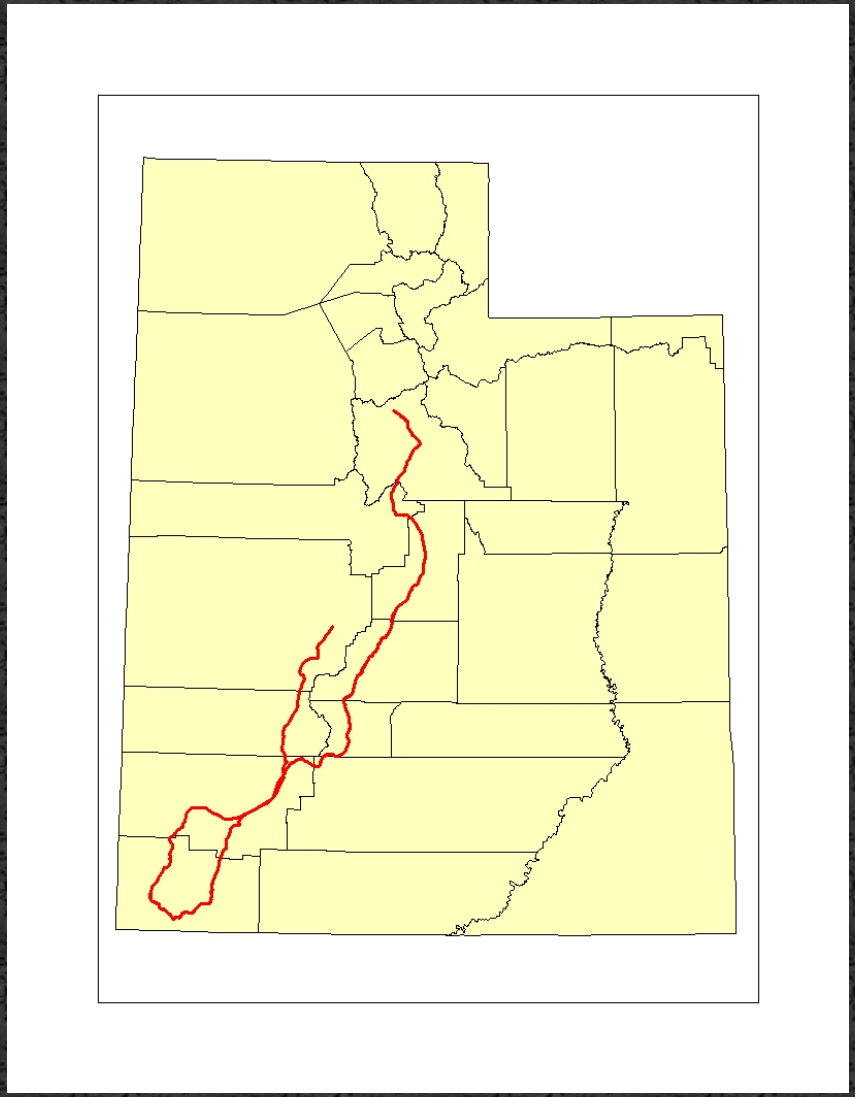
H-P UT1-60									
Species	Symbol	H-P two-year average lbs/ac	H-P two-year average % comp	H-P Two-year Ecological Status	H-P Two-year Forage Value	2009 Inventory in lbs./acre	2009 Inventory in % comp.	2009 Inventory Ecological Status	2009 Inventory Forage Status
Grasses									
Bluebunch wheatgrass	PSSP6	380	51	25	190	790	79	25	395
Nevada bluegrass	PONE	0	0	0	0	25	3	3	13
Sandberg bluegrass	POSE	38	5	5	19	73	7	3	37
Cheatgrass	BRTE	1	0	0	0	4	0	0	0
Bottlebrush squirreltail	ELEL5	1	0	0	0	0	0	0	0
Soft brome	BRHO2	0	0	0	0	0	0	0	0
Thickspike wheatgrass	ELLA3	2	0	0	0	0	0	0	0
Basin wildrye	LECI4	0	0	0	0	0	0	0	0
Needle-and-thread	HECO26	0	0	0	0	0	0	0	0
Indian ricegrass	ACHY	10	2	2	5	21	2	2	11
Bulbous bluegrass	POBU	0	0	0	0	5	0	0	0
Forbs									
Yellow sweetclover	MEOF	0	0	0	0	0	0	0	0
Wavyleaf thistle	CINU	0	0	0	0	0	0	0	0
Arrowleaf balsomroot	BASA3	0	0	0	0	0	0	0	0
Yellow salsify	TRDU	0	0	0	0	0	0	0	0
Longleaf phlox	PHLO2	16	2	2	0	0	0	0	0
Cussion phlox	PHHO	0	0	0	0	1	0	0	0
Browse milkvetch	ASCI2	11	2	2	0	0	0	0	0
NW Indian paintbrush	CAAN7	0	0	0	0	0	0	0	0
American vetch	VIAM	6	1	1	0	0	0	0	0
Foothill deathcamas	ZIPA2	5	1	1	0	0	0	0	0
Tall tumblemustard	SIAL2	0	0	0	0	0	0	0	0
Spurred lupine	LUCA	0	0	0	0	0	0	0	0
Navajo fleabane	ERCOC3	4	0	0	0	0	0	0	0
Longleaf hawksbeard	CRAC2	30	4	3	0	8	1	1	0
Alfalfa	MESA	0	0	0	0	0	0	0	0
Other forbs		10	2	2	0	0	0	0	0
Other annuals		1	0	0	0	0	0	0	0
Shrubs									
Mountain big sagebrush	ARTRW8	124	16	15	0	52	5	15	0
Bitterbrush	PUTR2	0	0	0	0	0	0	0	0
Green rabbitbrush	CHVI8	4	0	0	0	0	0	0	0
Broom snakeweed	GUSA2	3	0	0	0	13	2	2	0
Smooth horsebrush	TECA2	0	0	0	0	0	0	0	0
Rubber rabbitbrush	ERNA10	0	0	0	0	7	1	1	0
Utah juniper	JUOS	106	14	0	0	0	0	0	0
Other woody		0	0	0	0	0	0	0	0
Totals:		**752**	**100**	**58**	**214**	**999**	**100**	**52**	**456**

What parts of the ESD can data inform?



Examples – Historical Journals

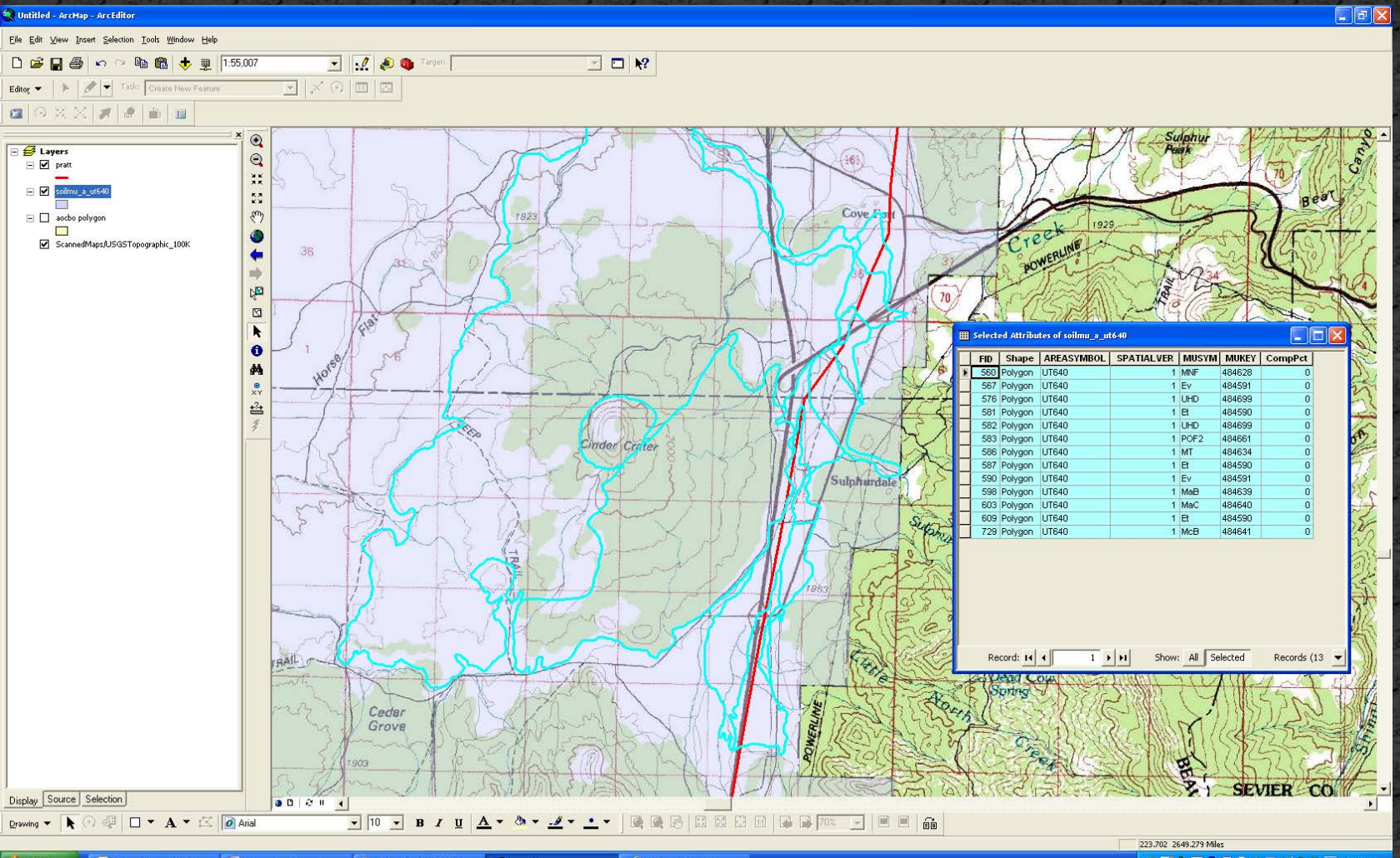




P.P. Pratt Expedition – 1849-1850

151 observations tied to an ecological site.

12 did not match the soil/site correlation. 92% match with historical record and correlated ESD.



P.P. Pratt Expedition – January 16th 1850 entry

- Campbell: "Pass down thro a bottom of beautiful wheat grass 4&5 inches above the snow"
- Haight: "Came over a sage plain 5 miles to *(Cove)* Creek

Upland loam (Mountain big sagebrush)

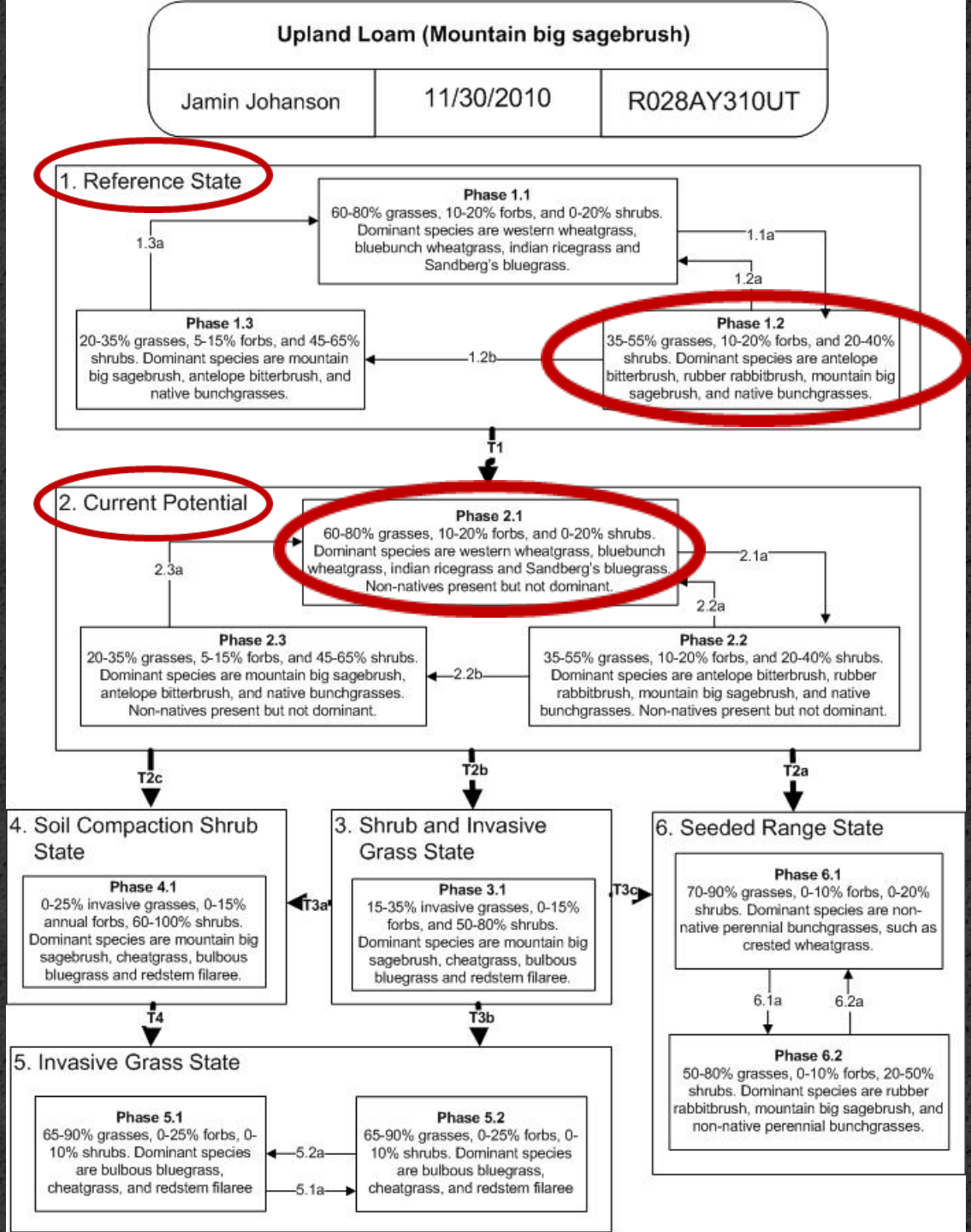
Grass/Grasslike

Group	Group Name	Common Name	Symbol	Scientific Name	Annual Production in Pounds Per Acre Low	Annual Production in Pounds Per Acre High	Foliar Cover Percent Low	Foliar Cover Percent High
0 -Primary Grasses					396	660		
		Indian ricegrass	ACHY	*Achnatherum hymenoides*	120	180		
		squirreltail	ELEL5	*Elymus elymoides*	36	60		
		Sandberg bluegrass	PONE3	*Poa nevadensis(syn)*	60	120		
		bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	180	300		

Shrub/Vine

Group	Group Name	Common Name	Symbol	Scientific Name	Annual Production in Pounds Per Acre Low	Annual Production in Pounds Per Acre High	Foliar Cover Percent Low	Foliar Cover Percent High
0 -Primary Shrubs					156	240		
		mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	120	180		
		antelope bitterbrush	PUTR2	*Purshia tridentata*	36	60		


Campbell: “Pass down thro a bottom of beautiful wheat grass 4&5 inches above the snow”
Haight: “Came over a sage plain 5 miles to (Cove) Creek
Western wheatgrass, Rabbitbrush, Sagebrush,
some invasive annuals


Upland Loam (Mountain big sagebrush)
Jamin Johanson
11/30/2010
R028AY310UT
1. Reference State
Phase 1.1
60-80% grasses, 10-20% forbs, and 0-20% shrubs. Dominant species are western wheatgrass, bluebunch wheatgrass, indian ricegrass and Sandberg's bluegrass.
1.3a
1.1a
1.2a
Phase 1.3
20-35% grasses, 5-15% forbs, and 45-65% shrubs. Dominant species are mountain big sagebrush, antelope bitterbrush, and native bunchgrasses.
1.2b
Phase 1.2
35-55% grasses, 10-20% forbs, and 20-40% shrubs. Dominant species are antelope bitterbrush, rubber rabbitbrush, mountain big sagebrush, and native bunchgrasses.
T1
2. Current Potential
Phase 2.1
60-80% grasses, 10-20% forbs, and 0-20% shrubs. Dominant species are western wheatgrass, bluebunch wheatgrass, indian ricegrass and Sandberg's bluegrass. Non-natives present but not dominant.
2.3a
2.1a
2.2a
Phase 2.3
20-35% grasses, 5-15% forbs, and 45-65% shrubs. Dominant species are mountain big sagebrush, antelope bitterbrush, and native bunchgrasses. Non-natives present but not dominant.
2.2b
Phase 2.2
35-55% grasses, 10-20% forbs, and 20-40% shrubs. Dominant species are antelope bitterbrush, rubber rabbitbrush, mountain big sagebrush, and native bunchgrasses. Non-natives present but not dominant.
T2c
T2b
T2a
4. Soil Compaction Shrub State
Phase 4.1
0-25% invasive grasses, 0-15% annual forbs, 60-100% shrubs. Dominant species are mountain big sagebrush, cheatgrass, bulbous bluegrass and redstem filaree.
T3a
3. Shrub and Invasive Grass State
Phase 3.1
15-35% invasive grasses, 0-15% forbs, and 50-80% shrubs. Dominant species are mountain big sagebrush, cheatgrass, bulbous bluegrass and redstem filaree.
T3c
6. Seeded Range State
Phase 6.1
70-90% grasses, 0-10% forbs, 0-20% shrubs. Dominant species are non-native perennial bunchgrasses, such as crested wheatgrass.
6.1a
6.2a
Phase 6.2
50-80% grasses, 0-10% forbs, 20-50% shrubs. Dominant species are rubber rabbitbrush, mountain big sagebrush, and non-native perennial bunchgrasses.
T4
T3b
5. Invasive Grass State
Phase 5.1
65-90% grasses, 0-25% forbs, 0-10% shrubs. Dominant species are bulbous bluegrass, cheatgrass, and redstem filaree
5.2a
5.1a
Phase 5.2
65-90% grasses, 0-25% forbs, 0-10% shrubs. Dominant species are bulbous bluegrass, cheatgrass, and redstem filaree

Dog Valley – Upland loam (Mountain Big Sagebrush) D28AY310UT

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- Campbell: "Camped in the sage in the hills"
- Haight: "Good Bunch Grass on the Mtns (a)round"

Upland loam (Mountain big sagebrush)

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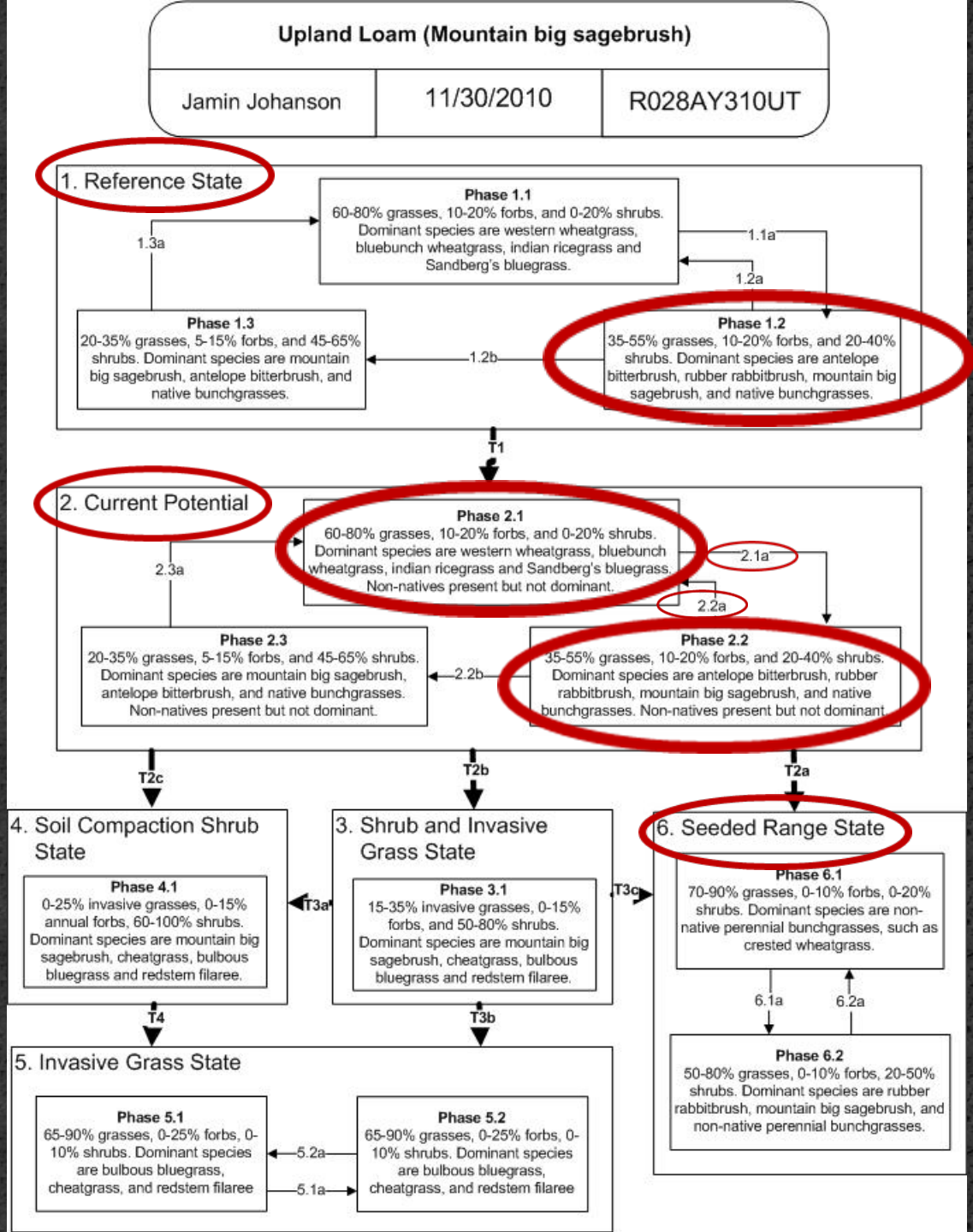
Campbell: “Camped in the sage in the hills”
Haight:“Good Bunch Grass on the Mtns (a)round”
Crested Wheatgrass


Campbell: “Camped in the sage in the hills”
Haight:“Good Bunch Grass on the Mtns (a)round”
Bluebunch Wheatgrass, Rabbitbrush, Utah juniper


Upland Loam (Mountain big sagebrush)
Jamin Johanson
11/30/2010
R028AY310UT
1. Reference State
Phase 1.1
60-80% grasses, 10-20% forbs, and 0-20% shrubs. Dominant species are western wheatgrass, bluebunch wheatgrass, indian ricegrass and Sandberg's bluegrass.
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1.2a
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35-55% grasses, 10-20% forbs, and 20-40% shrubs. Dominant species are antelope bitterbrush, rubber rabbitbrush, mountain big sagebrush, and native bunchgrasses.
1.2b
Phase 1.3
20-35% grasses, 5-15% forbs, and 45-65% shrubs. Dominant species are mountain big sagebrush, antelope bitterbrush, and native bunchgrasses.
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2. Current Potential
Phase 2.1
60-80% grasses, 10-20% forbs, and 0-20% shrubs. Dominant species are western wheatgrass, bluebunch wheatgrass, indian ricegrass and Sandberg's bluegrass. Non-natives present but not dominant.
2.1a
2.2a
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35-55% grasses, 10-20% forbs, and 20-40% shrubs. Dominant species are antelope bitterbrush, rubber rabbitbrush, mountain big sagebrush, and native bunchgrasses. Non-natives present but not dominant.
2.2b
Phase 2.3
20-35% grasses, 5-15% forbs, and 45-65% shrubs. Dominant species are mountain big sagebrush, antelope bitterbrush, and native bunchgrasses. Non-natives present but not dominant.
T2c
T2b
T2a
4. Soil Compaction Shrub State
Phase 4.1
0-25% invasive grasses, 0-15% annual forbs, 60-100% shrubs. Dominant species are mountain big sagebrush, cheatgrass, bulbous bluegrass and redstem filaree.
T3a
3. Shrub and Invasive Grass State
Phase 3.1
15-35% invasive grasses, 0-15% forbs, and 50-80% shrubs. Dominant species are mountain big sagebrush, cheatgrass, bulbous bluegrass and redstem filaree.
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6.1a
6.2a
Phase 6.2
50-80% grasses, 0-10% forbs, 20-50% shrubs. Dominant species are rubber rabbitbrush, mountain big sagebrush, and non-native perennial bunchgrasses.
T4
T3b
5. Invasive Grass State
Phase 5.1
65-90% grasses, 0-25% forbs, 0-10% shrubs. Dominant species are bulbous bluegrass, cheatgrass, and redstem filaree
5.2a
5.1a
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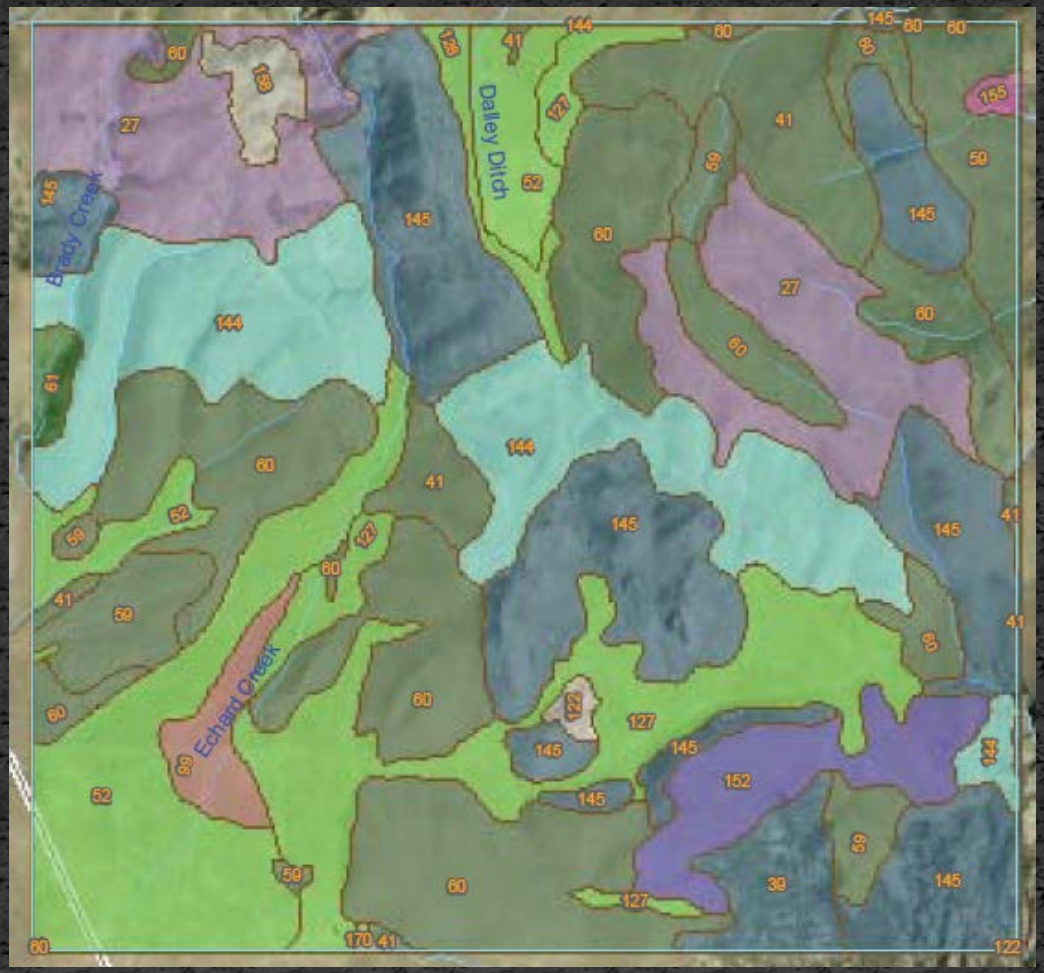
Junipers?

Dog Valley (a different one) Upland loam (Mountain Big Sagebrush – Indian Ricegrass) R047XB308UT



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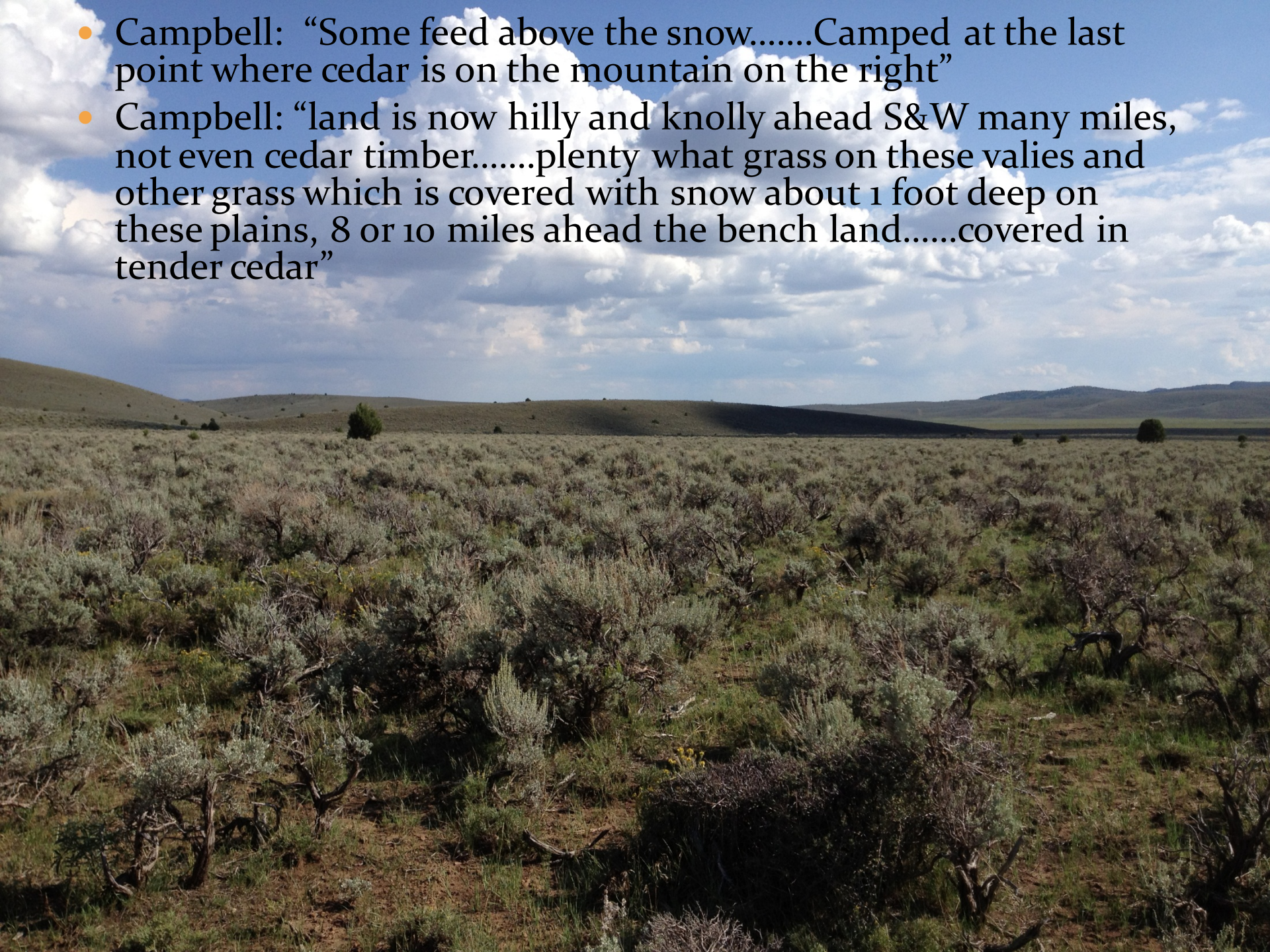
Dog Valley (a different one) Upland loam (Mountain Big Sagebrush – Indian Ricegrass) R047XB308UT

- Campbell: "Some feed above the snow.....Camped at the last point where cedar is on the mountain on the right"
- Campbell: "land is now hilly and knolly ahead S&W many miles, not even cedar timber.....plenty what grass on these valies and other grass which is covered with snow about 1 foot deep on these plains, 8 or 10 miles ahead the bench land.....covered in tender cedar"



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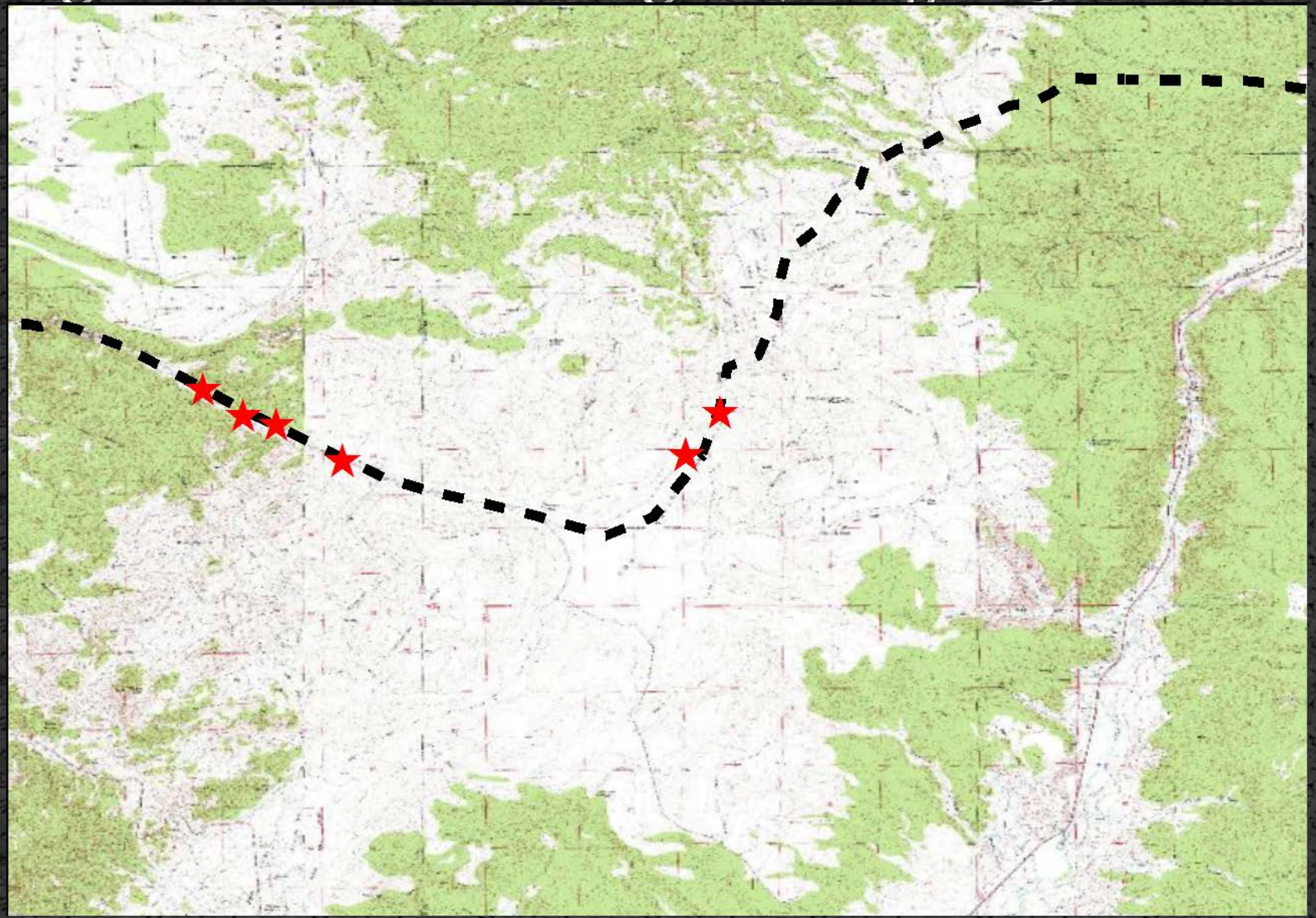
Fremont Canyon - Loamy Bottom R028AY006UT

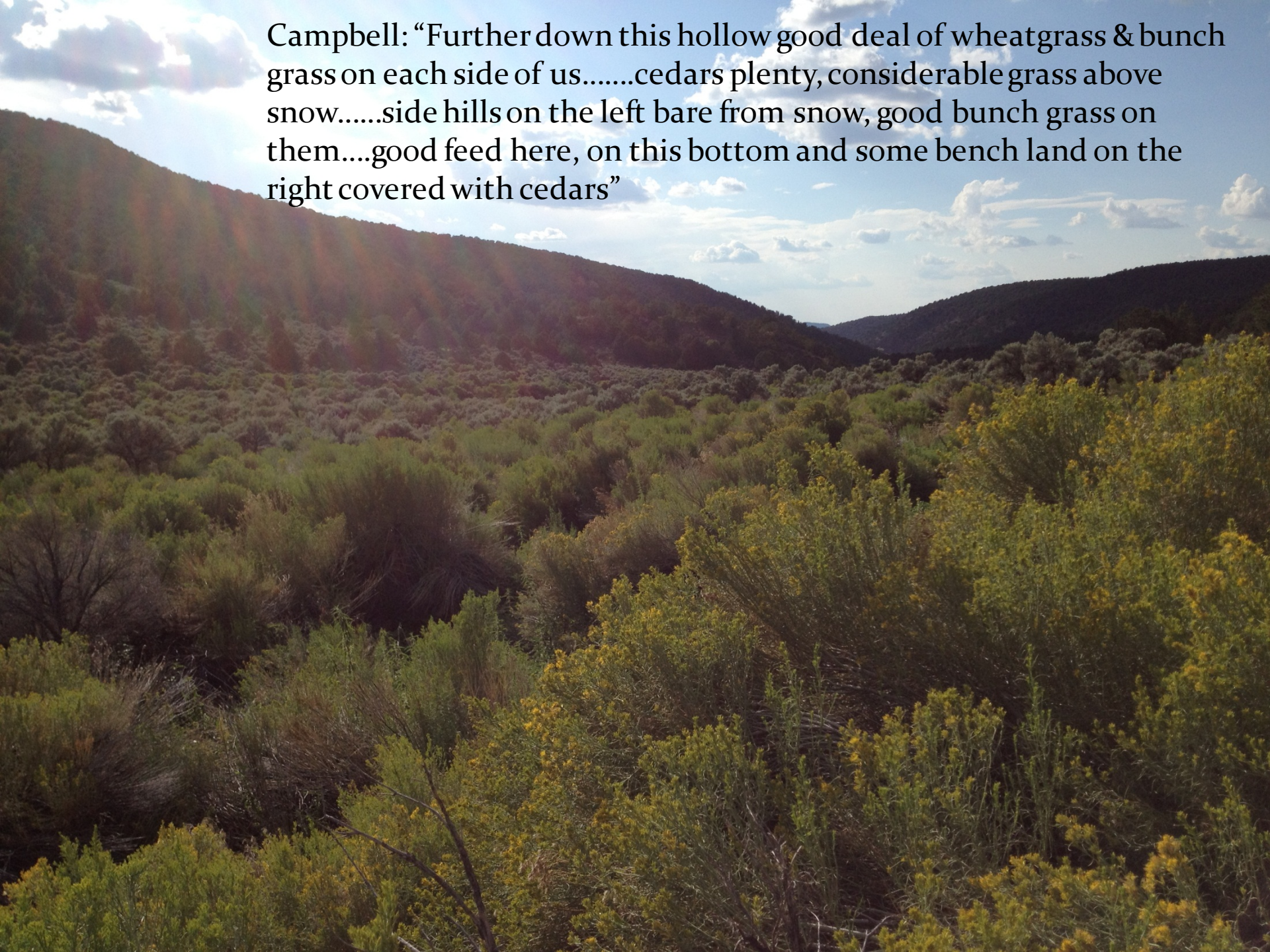
Fremont Canyon Upland loam (Mountain Big Sagebrush – Indian Ricegrass) R047XB308UT



Fremont Canyon Upland loam (Mountain Big Sagebrush – Indian Ricegrass) R047XB308UT

- Campbell: "Further down this hollow good deal of wheatgrass & bunch grass on each side of us.....cedars plenty, considerable grass above snow.....side hills on the left bare from snow, good bunch grass on them....good feed here, on this bottom and some bench land on the right covered with cedars"


Campbell: “Further down this hollow good deal of wheatgrass & bunch grass on each side of us…….cedars plenty, considerable grass above snow……side hills on the left bare from snow, good bunch grass on them….good feed here, on this bottom and some bench land on the right covered with cedars”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State-and-Transition Model
R028AA006UT Loamy Bottom (Basin wildrye)

State 2: Current Potential

Phase 2.1: 85-95% grasses, 5-20% forbs and 0-5% shrubs. Dominant species are Basin wildrye and Western wheatgrass. Non-natives present but not dominant.

2.3 Wildfire (~40-60 yrs) or extended wet period

2.1 Succession without fire or extended wet period

Phase 2.3: 35-50% grasses, 5-15% forbs and 40-50% shrubs. Dominant species are Basin wildrye, Western wheatgras, Basin big sagebrush and Rubber rabbitbrush. Non-natives present but not dominant.

2.2a Extended wet period or fire

2.2b Succession without wet period or fire

Phase 2.2: 35-55% grasses, 5-15% forbs and 20-30% shrubs. Dominant species are Basin wildrye, Western wheatgrass and Rubber rabbitbrush. Non-natives present but not dominant.

T2a: Improper grazing or drought and lack of fire for >50 years

T2b: Seeded range in poor conditions and weed establishment

T2c: Seeded range in good conditions and perennial grass establishment

State 3: Non-sprouting Shrub

Phase 3.1: 20-40% grasses, 0-10% forbs and 45-60% shrubs. **Dominated by Basin big sagebrush. Juniper may be present and perennial grasses show reduced vigor.**

3.2 Proper grazing for extended periods and lack of fire

3.1 Improper grazing or drought and/or fire

Phase 3.2: 20-40% grasses, 0-10% forbs and 45-60% shrubs. Dominated by Basin big sagebrush. Juniper may be present and cheatgrass co-dominates the understory.

T3a: Seeded range in good conditions and perennial grass establishment

T4a: Improper grazing or drought and lack of fire

T3b: Seeded range in poor conditions and weed establishment

T3c: Prolonged improper grazing or drought and/or fire

State 4: Seeded Range

Phase 4.1: This community is 75-95% grass, 5-25% forbs and 0-5% shrubs. Introduced perennial grasses dominate

4.1 Prolonged proper grazing and native establishment

4.2 Seeded range in good conditions and perennial establishment

Phase 4.2: 35-55% grasses, 5-15% forbs, 30-50% shrubs. Basin big sagebrush dominates with native and non-native perennial grasses.

R4: Prolonged proper grazing and favorable conditions

T4b: Seeded range in poor conditions and weed establishment

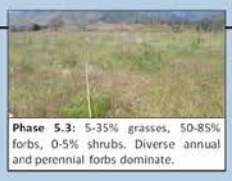
State 5: Invasive species dominated

Phase 5.1: 45-75% annual grass, 5-25% forbs, 20-40% shrubs.. Basin big sagebrush dominates overstory and Cheatgrass dominates understory.

5.1 Fire or shrub removal

Phase 5.2: 65-85% grass, 2-25% forbs, 0-5% shrubs. Cheatgrass and other annual grasses and forbs dominate.

5.3b Weed dominance with out rubber rabbitbrush



Phase 5.3: 5-35% grasses, 50-85% forbs, 0-5% shrubs. Diverse annual and perennial forbs dominate.

5.3b Weed establishment with rubber rabbitbrush

Phase 5.4: 45-60% grasses, 0-10% forbs, 35-60% shrubs. Species diversity is reduced. Rubber rabbitbrush dominates with native perennial and non-native annual grasses.

5.4 Repeated fires, loss of rubber rabbitbrush

More Examples

- NRCS sources
  - Old 417s
  - Conservation Plans
  - Soil/Vegetation relationships team
  - NRI
- BLM sources
  - SVIM Data
  - Ecological Site Inventory Data
  - Monitoring Data
- University sources
  - GAP analysis (ground truth photos and data)

More Examples

- USFS sources
  - TEUI data
  - Monitoring data
- BIA sources
  - Range inventory data
- State Agency sources
  - DWR Big Game Range Trend
- Historical sources
  - Journals
  - Survey notes
  - Photography

How do you find all this data?

- Go to your meetings and make the contacts with partners
- Be aware – browse the lit. cited of interesting papers and follow up on them
- Google
- BLM survey notes web page
- Be a snoop – open the dusty boxes

Summary

- Data is expensive and hard to acquire, therefore all sources of existing data should be exploited before we create new data.
- Even though a data source may not have been collected in a way that would be most useful to us ('correct' techniques and procedures), it still has value.
- Data can inform the mere presence or absence of a species, species dominance, expected amounts (cover and production), and plant community possibilities in the S&TM