Changes in Quaking Aspen (*Populus tremuloides*) habitats in the Owyhee Mountains, Idaho

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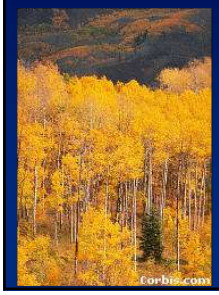


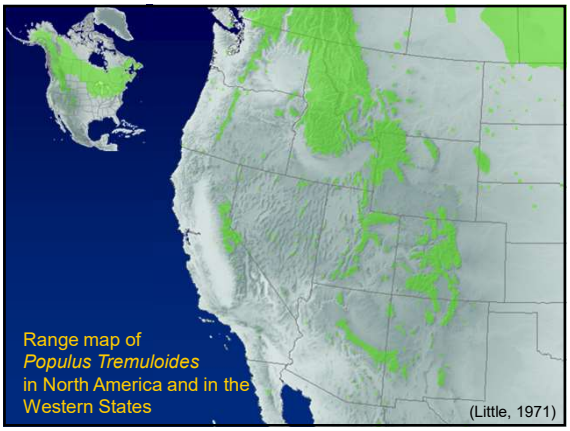
Aspen in the West: Distribution
Ecology
Disturbance regimes
Stressors

Central Questions: Is there evidence that aspen has been or is being lost in the Owyhee Mountains, Idaho?

Aspen in the western US are declining, with a 50-96% decrease in the last 100 years

Area	Current	Historical	Decline
	Acres	*Acres*	*percent*
Colorado	1,110,764	2,188,003	49
Utah	1,427,973	2,930,684	51
New Mexico	140,227	1,141,677	88
Wyoming	203,965	436,460	53
Arizona	29,009	720,880	96
Idaho	621,520	1,609,547	61
Montana	211,046	590,674	64

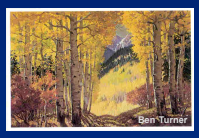
(Bartos 2000)



Range map of *Populus Tremuloides* in North America and in the Western States (Little, 1971)

Implications of Declining Aspen

- Keystone species – Indicator of ecosystem health and function (Campbell and Bartos 2001)
- Decrease in species richness and biodiversity (Bartos and Campbell 1998; Kay 1997; Stohlgren et al.1997)
- Decrease in forage quantity and quality (Bartos and Campbell 1998 ; Mueggler, 1988)
- Altered hydrologic functions (DeByle 1985)
- Recreation and aesthetic value (McCool 2001)



Ecology of Aspen

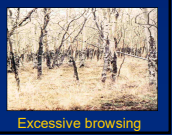
- Aspen is a shade intolerant seral species that is commonly replaced by conifers in the absence of a disturbance
- Aspen is a clonal species that reproduce primarily via vegetative suckering (Bartos 2001)
- Individual trees are short-lived (100-150 year) but aspen clones are long-lived (>1000 years) (Kay 1997)
- Require a disturbance to disrupt the hormonal balance that prevents suckering (Bancroft 1989)

Why is aspen declining?

- Infrequent fires due to fire suppression – aging clones (Bartos 2001)
- Conifer dominance within aspen stands (Bartos and Campbell 1998)
- Excessive browsing by wildlife or livestock (Kaye et al. 2005)
- Disease
- Climate change


Infrequent fires


Conifer dominance


Excessive browsing

Successional sequence in aspen /conifer stands


After fire


Young stand


Mature stand


Aging stand


Conifer dominance


Conversion to conifer

Aspen decline vs. Aspen die-off

Decline
- Observed over the past 60-70 years
- Likely caused by less frequent fires
- Conifer dominance

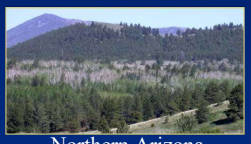
Die-off
- Mature stems begin to die
- Lack of regeneration
- Root system dies
- Observed within the past ~10 years

Bartos, SRM conference 2007

Aspen Summit, Salt Lake City, Utah. December 2006


Utah


Yellowstone NP

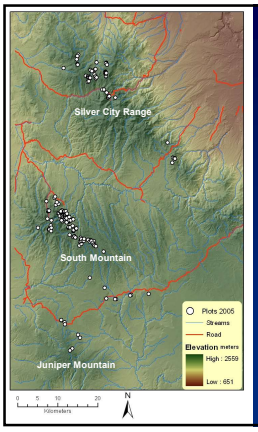

Northern Arizona

Central Questions: Is there evidence that aspen has been or is being lost in the Owyhee Mountains, Idaho?

I Where in the Owyhee Mountains can we expect to find aspen?

II What areas are currently occupied by aspen?

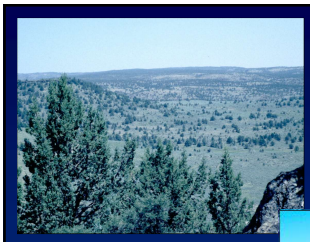
III Is there evidence of remnant aspen stands in areas where aspen is expected but absent according to remote sensing imagery?



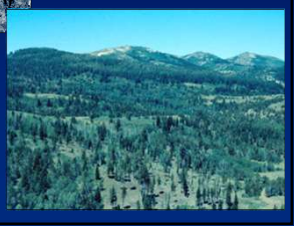
Study area in the Owyhee Mountains in southwestern Idaho

Elevation 1700 – 2550 m
Location 117 W 43N
Precipitation 600-1000 mm
Soils: loamy mixed Pachic Cryoborols

Management: BLM, State, Private



Sagebrush steppe and juniper woodlands at lower elevations (1400-1850 m).



Aspen woodlands with Douglas-fir at higher elevations (1850 – 2200 m)

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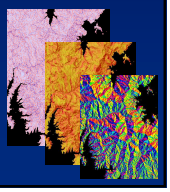
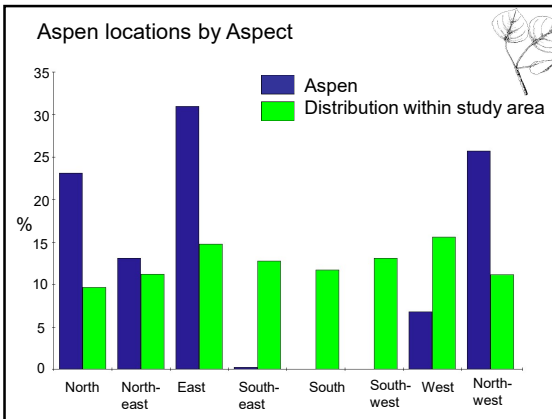
Predicting site potential for aspen

- Select environmental characteristics: elevation, slope, aspect, curvature, solar insolation, soil water-holding capacity (Falkowski et al. 2005, Gustafson et al. 2003, Iverson et al. 1997)
- Test each variable for significance (chi-square test) based on field data
- Compute conditional probabilities for aspen occurrence
- Incorporate the conditional probabilities in Bayes' theorem to compute the probability of occurrence (Aspinall 2000)

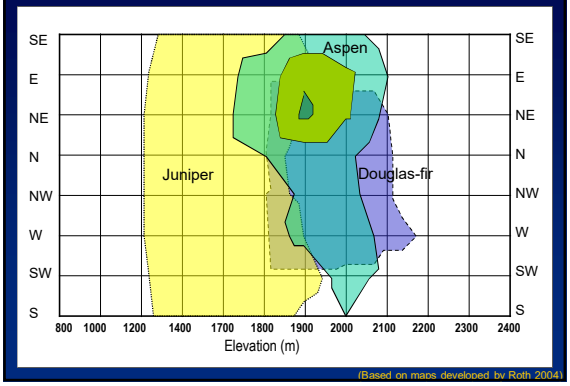
Geographic Information System *ArcGIS*



Aspen locations by Aspect

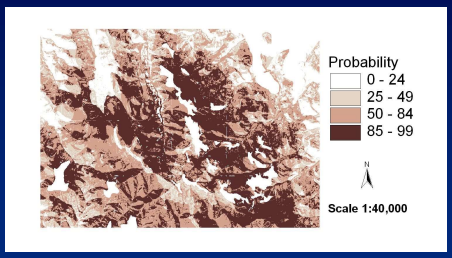


Range for aspen, western juniper and Douglas-fir



(Based on maps developed by Roth 2004)

Probability of aspen occurrence



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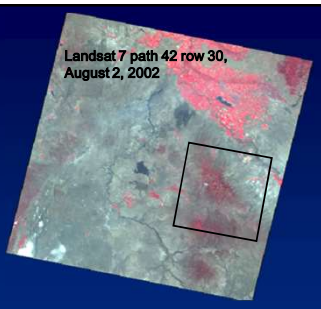
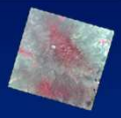
Detecting Aspen

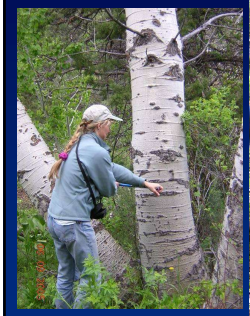


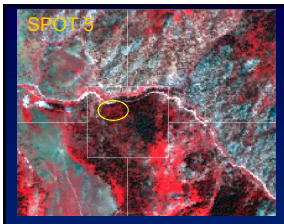
SPOT 5, July 27, 2002

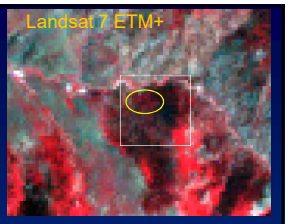


	Landsat 7	SPOT 5
Multispectral image		
Spatial resolution	30 m	10 m
Spectral resolution	0.450 – 2.35	0.50 – 1.75 micrometer
Number of bands	7	4
Extent	180 sq km	60 sq km

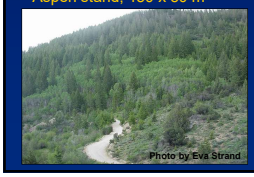
Field data collection

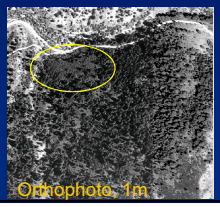




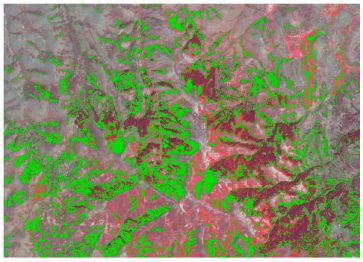


Box 600 x 600 m
Aspen stand, 150 x 50 m





Aspen occurrence



Scale 1:40,000

Accuracy 80%

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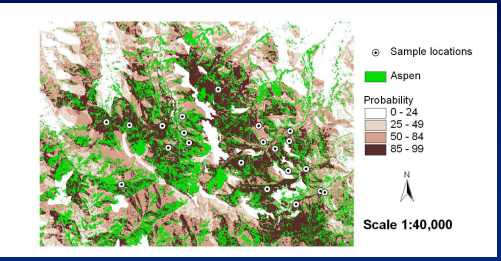
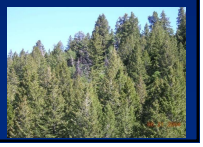
Aspen probability & aspen occurrence



41 sites were sampled

Remnant aspen stands

- Dead standing or downed aspen stems (15 locations)
- Scattered aspen stems with regeneration in forest gaps – evidence of dead aspen stems on the ground (21 locations)
- No evidence that aspen ever existed in the area (5 locations)



Conclusions

- Aspen in the Owyhee Mountains is being replaced by conifer species Douglas-fir and western juniper
- Aspen stands where the conifer encroachment is severe will be permanently converted to conifer stands
- The aspen loss can be estimated to ~60-70%

Further questions

- What is the rate of aspen conversion to conifers?
- What fire interval and size is desirable for maintenance of aspen on the landscape?
- What will the future landscape look like under various management scenarios?

September 2013 – 2 months after the Juni Fire

September 2015 – 2 years after the Juni Fire

September 2015 – 2 years after the Juni Fire

Acknowledgements:

USDI Bureau of Land Management, Boise District

Field Assistance: Ben Smith & Jacob Young

Questions?