

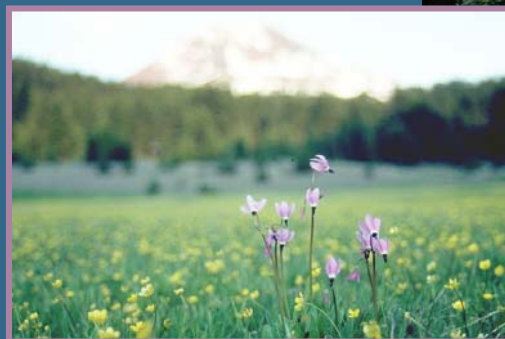
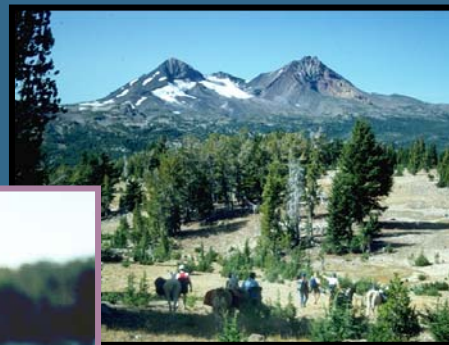
Eagle Cap  
1979-2006



High, medium, & low use sites

## Studies

Three Sisters & Mt.  
Jefferson  
1992 – 2004



Stratified by elevation,  
east/west, & initial impact

## Methods

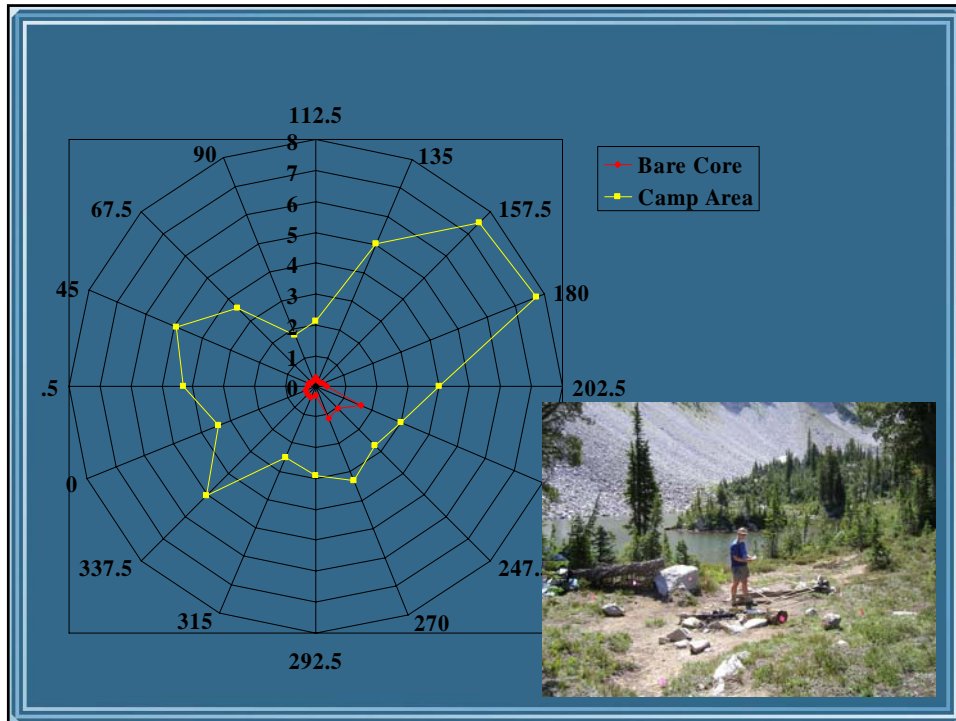
Multiple parameters



## Methods

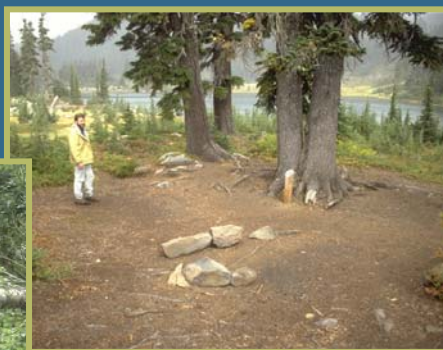
- Radial transect method
- Distance to edge of core and camp





## Methods

- Tree damage



## Methods

- Seedling regeneration



## Methods

- Vegetation cover



## Methods

- Vegetation cover – plot establishment



## Methods

- Mineral soil exposure



## Baseline Issues

- Center point



## Baseline Issues

- Islands



## Baseline Issues

- Amorphous sites



## Baseline Issues

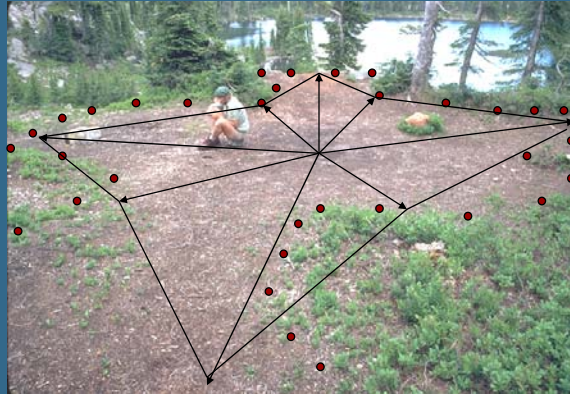
- Amorphous sites





## Baseline Issues

- Amorphous sites



## Baseline Issues

- Where is the edge?



## Baseline Issues

- Where is the edge?



## Baseline Issues

- Where is the edge?



## Baseline Issues

- Precise relocation of quadrats
- Estimating vegetation cover



## Baseline Issues



## Baseline Issues

- What is a damaged tree?
- How far do you look?



## Baseline Issues

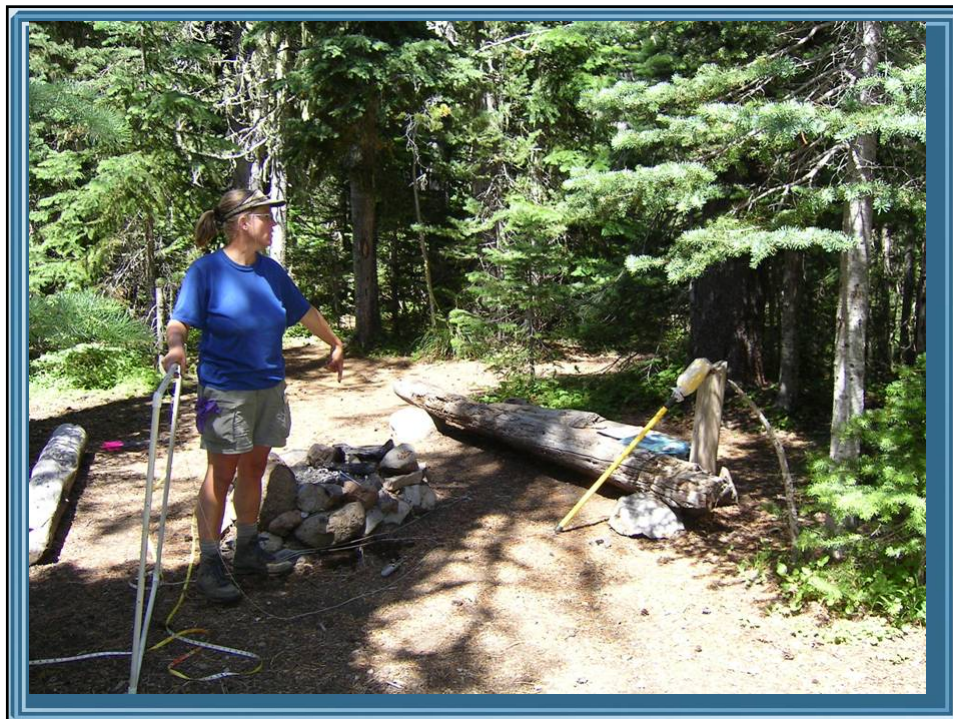
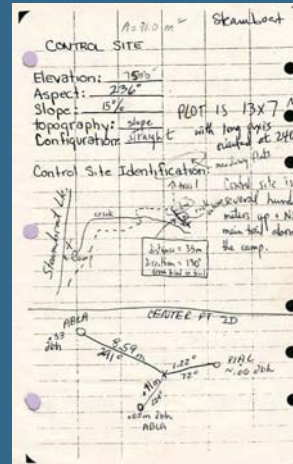
- What is mineral soil?
  - Subalpine soils  $\neq$  montane soils!



- Is bare ground natural?

## Monitoring issues

- Finding your spikes
  - Disappearing bearing trees



## Monitoring issues

- Finding your spikes
  - Disappearing spikes
  - Magnetic rocks



## Monitoring issues

- Reading other people's minds – is change real?



DIRECTION	1 <sup>st</sup> GREEN PLANT	DISTANCE (M)			LONG
		UNTRAMPLED	TRAMPLED	UNTRAMPLED	
0	N	9.67	9.67	✓	
22.5	NNE	12.33	12.33	✓	
45	NE	7.12	8.70	✓	
67.5	ENE	6.65	7.45	✓	
90	E	9.22	8.22	✓	
112.5	ESE	7.80	7.80	✓	
135	SE	7.52	7.52	✓	
157.5	SSE	7.20	7.75	✓	
180	S	5.65	6.30	✓	
202.5	SSW	4.80	5.28	✓	
225	SW	5.54	5.54	✓	
247.5	WSW	6.85	6.85	✓	
270	W	9.78	9.78	✓	
292.5	WNW	9.85	10.85	✓	
315	NW	9.70	9.92	✓	
337.5	NNW	9.52	9.52	✓	
		6.0'	8.34'	Measure	

SITE REASSESSMENT				
Site #	1 <sup>st</sup> plant	App	Camp edge	Comments
0	8.7	Carex	11.5	Somewhat arbitrary
22.5	7.4	Carex	12.3	in use trail
45	4.2	Tirop	14.0	Major disturbance past edge of site
67.5	3.55	mf. Jun	19.1	Somewhat arb. in use trail. Thought to show the deer
90	4.8	Carex	12.4	x use trail
112.5	6.6	Carex	12.4	here requests beyond edge
135	9.05	Carex	9.0	
157.5	4.3	Carex	13.2	
180	5.3	Carex	13.3	Intense branch that pt. back area toward beyond edge
202.5	4.4	Carex	14.0	At log. Arb edge det. not at edge of log
225	5.9	poft	12.1	At log. Very beyond log. branch probably dead, too dense to see
247.5	6.6	Erpe	11.8	at log
270	8.9	Erpe	13.4	at log. Point stick beyond edge
292.5	9.2	Veronica	12.0	
315	6.9	Erpe	14.6	in use trail
337.5	10.1	Usc	14.5	obvious edge

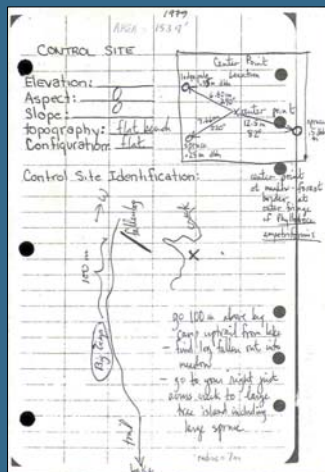


180	5.3	carex	13.3	1st log, branch that pt. of
202.5	7.4	carex	11.0	2nd log, area, branch beyond edge
225	5.9	popl	12.1	At log, 1st edge of log
247.5	6.6	Espe	11.8	At log, very beyond log
270	8.9	Espe	13.4	at log, recent stick beyond



## Monitoring issues

Finding the control...



...what seems obvious now



## Monitoring Issues

- Even if you do find the control...



## Monitoring Issues

- Even if you do find the control...



## What have we learned about sites?



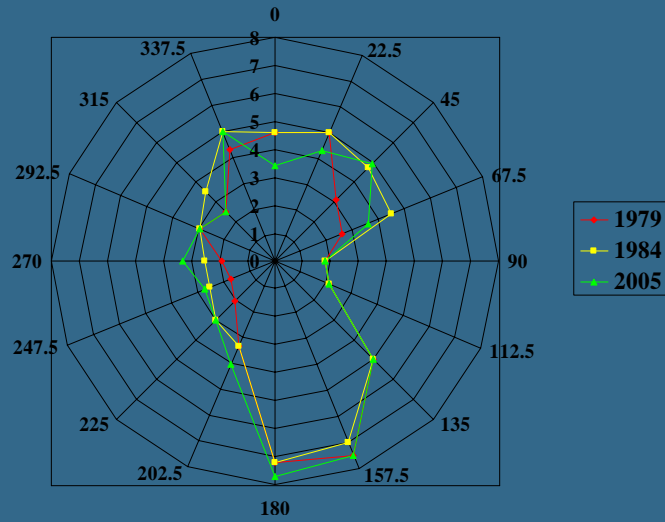
1979

Change can be slow –  
both recovery and  
deterioration

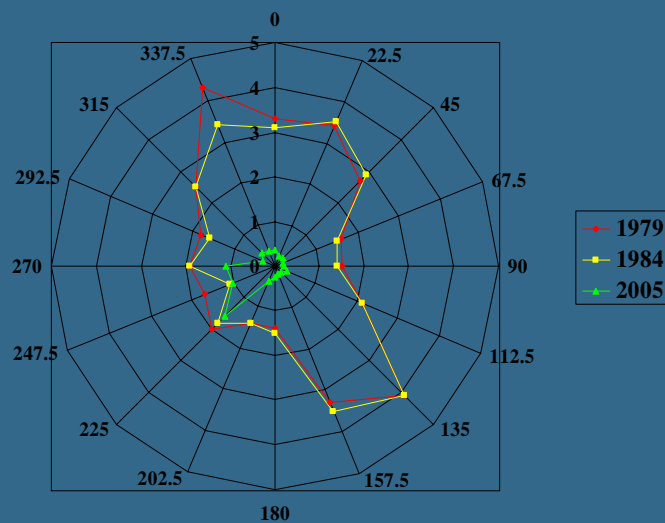


2005

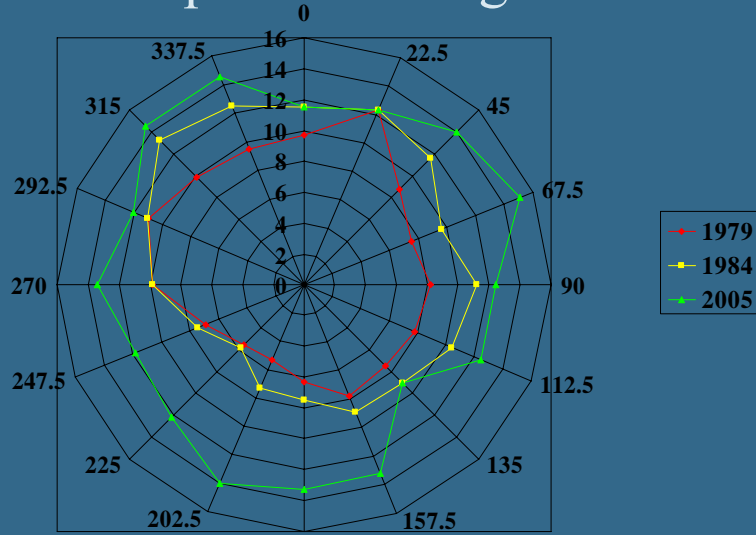
## Change in camp area – Wild Sheep



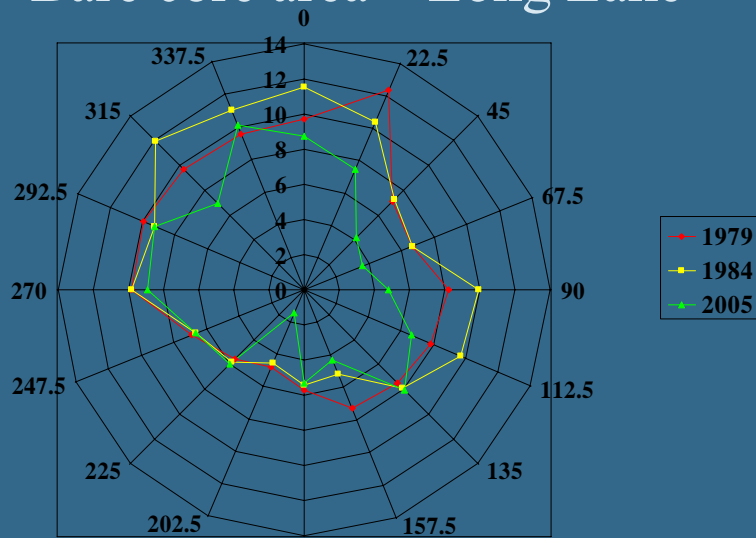
## Change in bare core area – Wild Sheep



## Camp area – Long Lake



## Bare core area – Long Lake

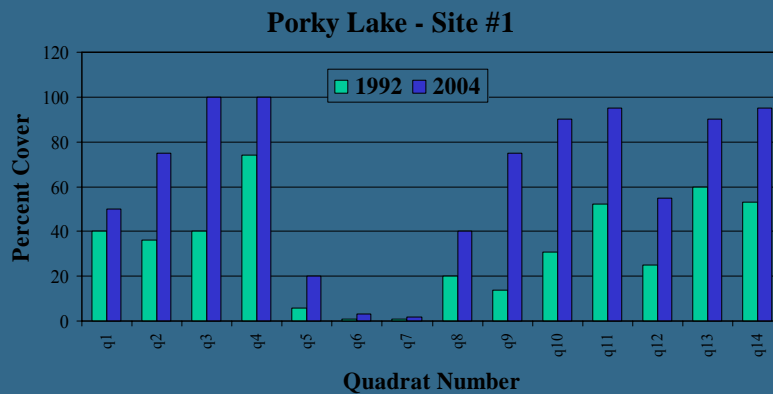




But sometimes change  
can be rapid



## Sometimes change is rapid

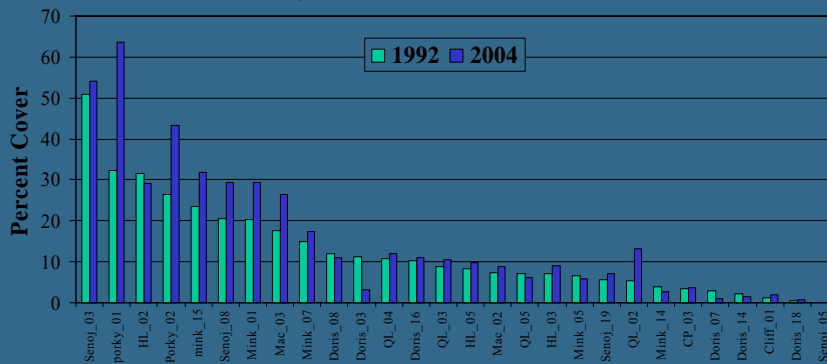


## Lessons about site change from subalpine sites in ECW

- Some impacts plateau quickly
  - Bare core
  - Seedling density
  - Vegetation cover
  - Spp composition
- Other impacts continue to deteriorate
  - Tree root exposure
  - Mineral soil exposure

But, trends may differ in different places

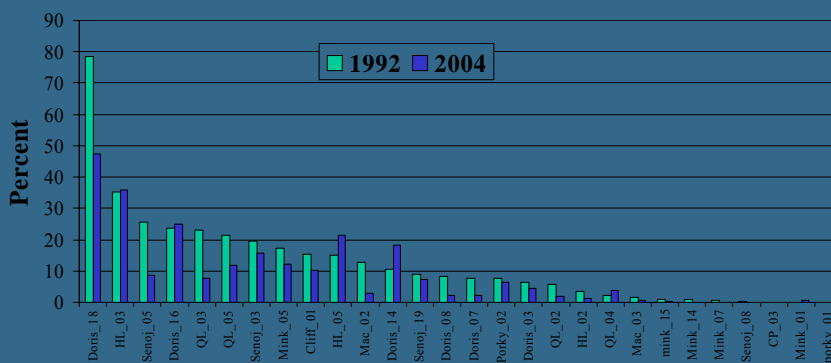
Mean Vegetation - Three Sisters Sites



Eagle Cap, 1979-1990:  
12 sites improved (a little), 7 deteriorated, 1 unchanged

But, trends may differ in different places

Change in Mineral Soil Exposure - TSW



Eagle Cap, 1979-1990:  
3 sites improved, 16 deteriorated, 1 unchanged

## Lessons about monitoring



## Lessons about monitoring

- Make assumptions explicit
  - What is a “tree”?
  - What is a “seedling”?
  - What is “bare core”?
  - Which side of the tape are the quadrats on?
- More important to have a consistent decision rule than to be totally accurate
- A major issue is determining edge of site
  - Variable transect vs. radial transect



## Lessons about monitoring

- Phenology matters
- Perennials vs. annuals?
- Quadrats are the way to go for plants
  - Whose “north” is “north”?
  - Spikes solve this problem

## Lessons about monitoring

- How precise do you need to be?
  - Combine rapid assessment & measurement?
- We measure what is easy to see. Is this necessarily what's important?

## Lessons about monitoring

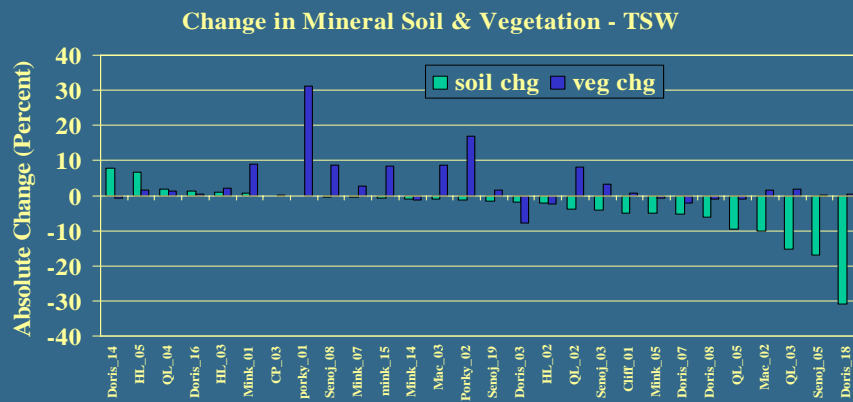
- This approach is not best for tracking deterioration on highly impacted sites
  - E.g., Long Lake
    - 1979 vegetation = 0.2%
    - 1984 vegetation = 1.0%
    - 2005 vegetation = 0.6%
  - Measures occur within original site boundary; changes outside are not tracked
  - Growth of a little veg at center point can totally change measurements

## Trends may differ for different parameters → use multiple measures

### Eagle Cap:

- Mean mineral soil increase over controls:
  - 1979: 24%
  - 1984: 42%
  - 1990: 51%
- Mean vegetation loss on camps:
  - 1979: 87%
  - 1984: 85%
  - 1990: 81%
- **Conclude: vegetation is stable, soil deteriorates**

## Trends may differ for different parameters



- Conclude: soil improved, vegetation was stable or improving, but on different sites

## Last thoughts

- Become proficient in natural history of your area
- Keep good field notes – you won't be around forever
- Beware of confounding factors – e.g., trail reroutes
- Don't expect dramatic improvement without a lot of effort

