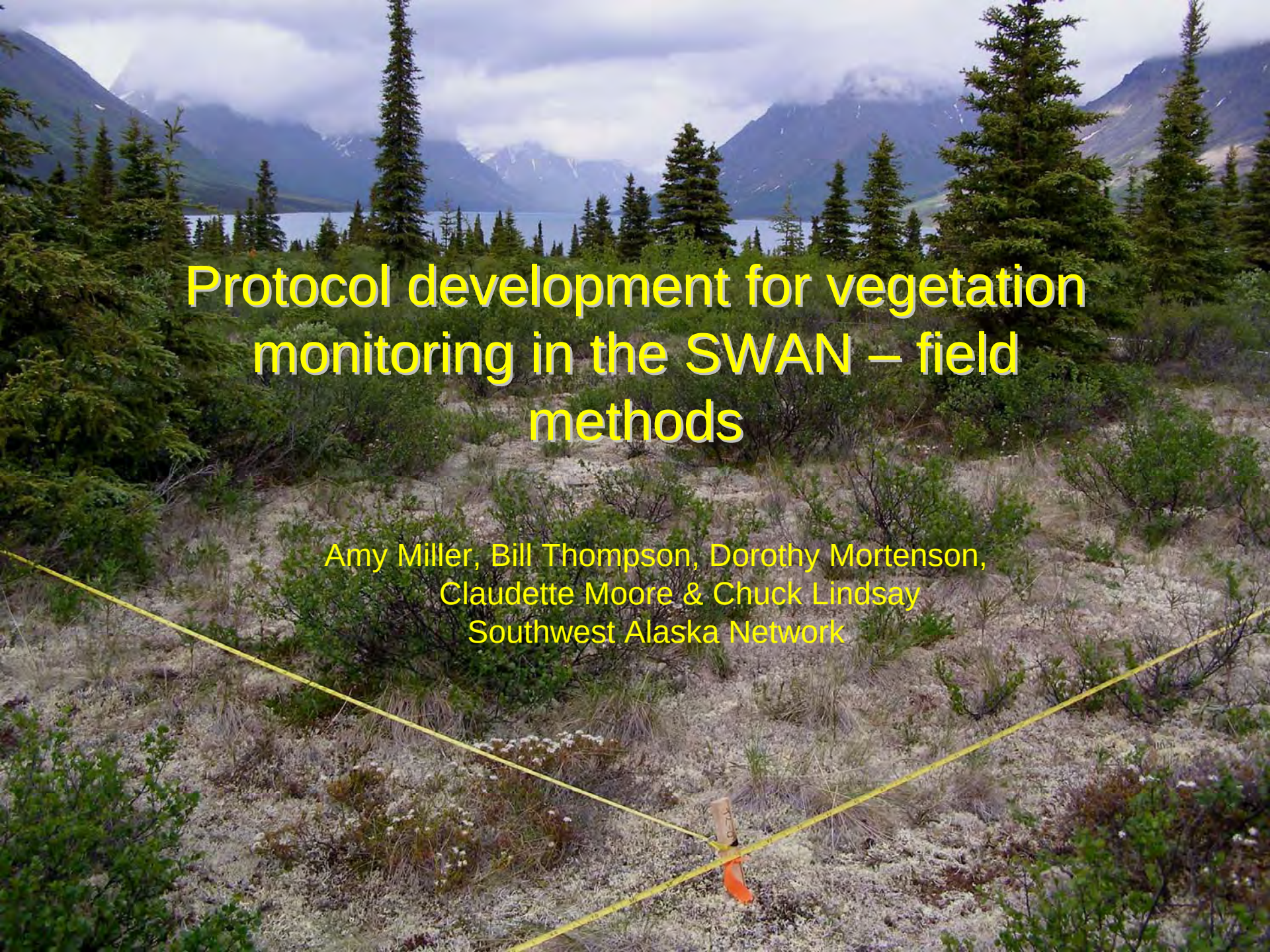


Protocol development for vegetation monitoring in the SWAN – field methods

Amy Miller, Bill Thompson, Dorothy Mortenson,
Claudette Moore & Chuck Lindsay
Southwest Alaska Network

Background

What aspects of vegetation change are of interest to management?

- Forest health/forest mortality
- Wildlife habitat
- Exotic species
- Subsistence resources
- Visitor experience/wilderness

At what scale?

- Landscape-level (area, connectivity)
- Community-level (species composition, structure)

Monitoring vegetation composition & structure: a tiered approach

I. Extensive – long-term, landscape-level changes

Remote sensing

Aerial surveys

II. Intensive – shorter-term, community-level change

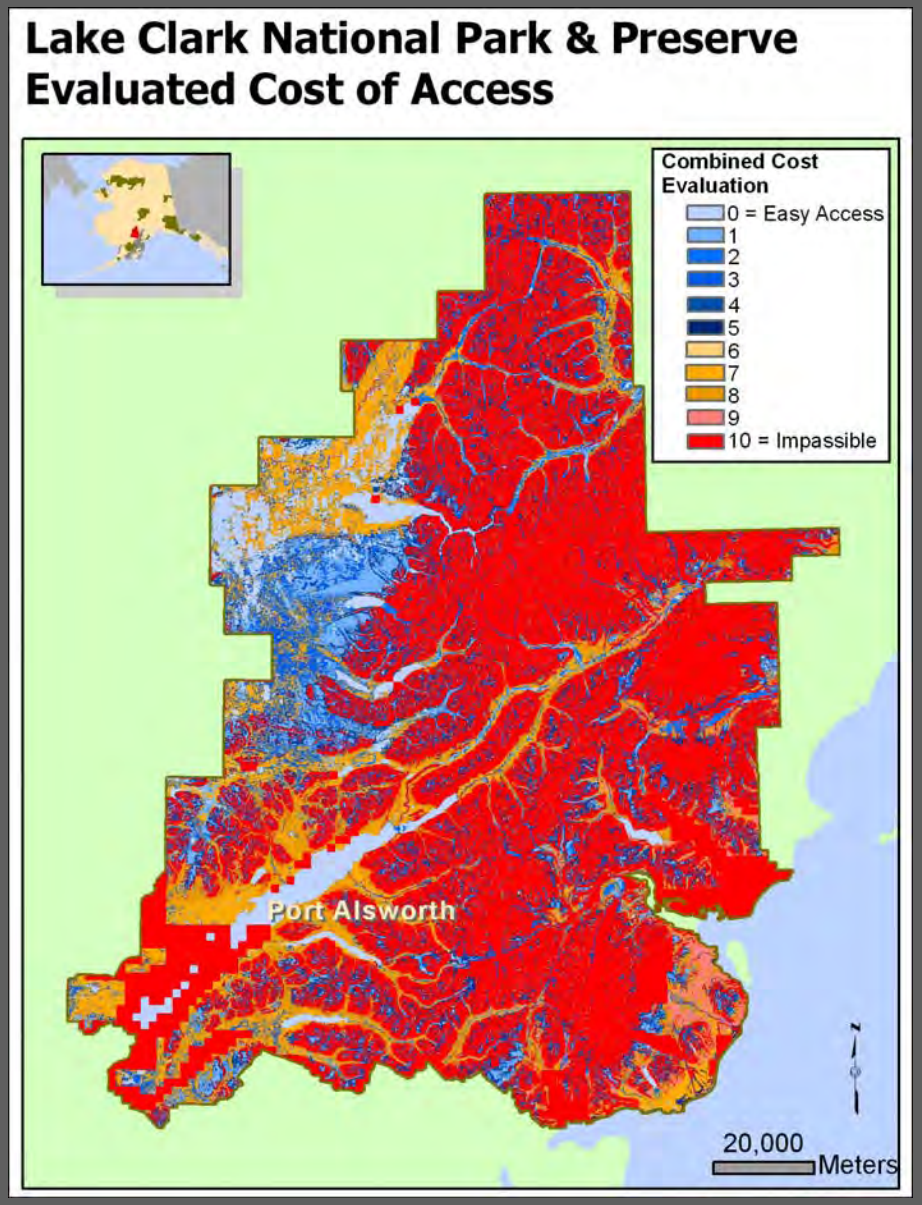
Ground-based monitoring

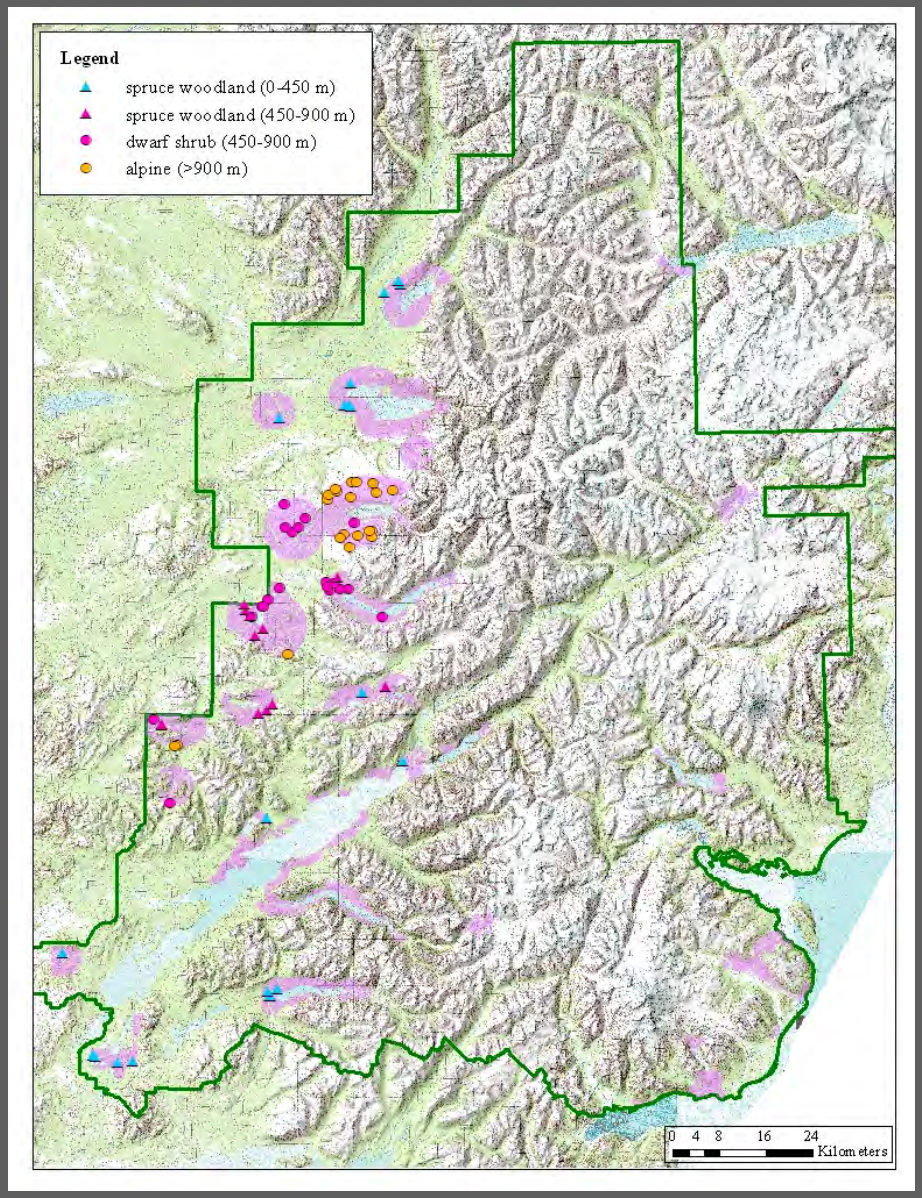
Keeping it manageable: imposing constraints on ground-based monitoring

- Accessible
- Broadly-distributed
- Late-successional
- Responsive to environmental drivers
- Ecological or cultural value

Monitoring Design

Development of access layers





Evaluation of spatial arrays of sampling points

Percentage of samples in 1000 simulation runs in which the lower 90% confidence limit (CL) of the estimated change rate from 50 GRTS samples (*n*) of single plots equaled and/or exceeded a specified change (= minimum detectable change) in three landcover classes occurring in various frequencies for true changes of 20% and 50% during 2 time periods within accessible areas in 4 strata of LACL (see Table 1 for stratum descriptions).

%Freq	Stratum (m)	Landcover class	True change	>0%[b]	≥2.5%	≥5%	≥10%	≥15%	≥20%
7	**>950**	**sparsely vegetated**	**20%**	12%	0.1%	0%	0%	0%	0%
			50%	57%	6%	1%	0%	0%	0%
25	**>950**	**dwarf shrub**	**20%**	79% (*n*=49)	24%	5%	1%	0%	0%
			50%	80% **(*n*=23)**	79% (*n*=32)	61%	20%	3%	1%
43	**>950**	**prostrate shrub**	**20%**	80% (*n*=33)	67%	20%	1%	0.3%	0%
			50%	80% **(*n*=12)**	79% **(*n*=17)**	79% **(*n*=23)**	79% (*n*=43)	38%	13%

Simulations indicated that if sampling across all vegetation classes, we would be able to detect a trend only in the <u>most common vegetation classes</u> (e.g., frequency ≥40%), and only if the <u>change was of a large magnitude</u> (e.g., ≥50%).

Selection of broadly-distributed vegetation types

Elevation Zone	LACL	KATM	KEFJ
Low (0-450 m)	White spruce woodland	White spruce woodland	Coastal Sitka spruce
Mid (450-900 m)	White spruce woodland	White spruce woodland	-
Mid (450-900 m)	Low/dwarf shrub tundra	Low/dwarf shrub tundra	-
High (> 900 m)	Alpine - dwarf shrub tundra	Alpine - dwarf shrub tundra	Alpine - dwarf shrub tundra

- Number of types sampled constrained by sample size
- Targeted sampling for uncommon & sensitive vegetation types

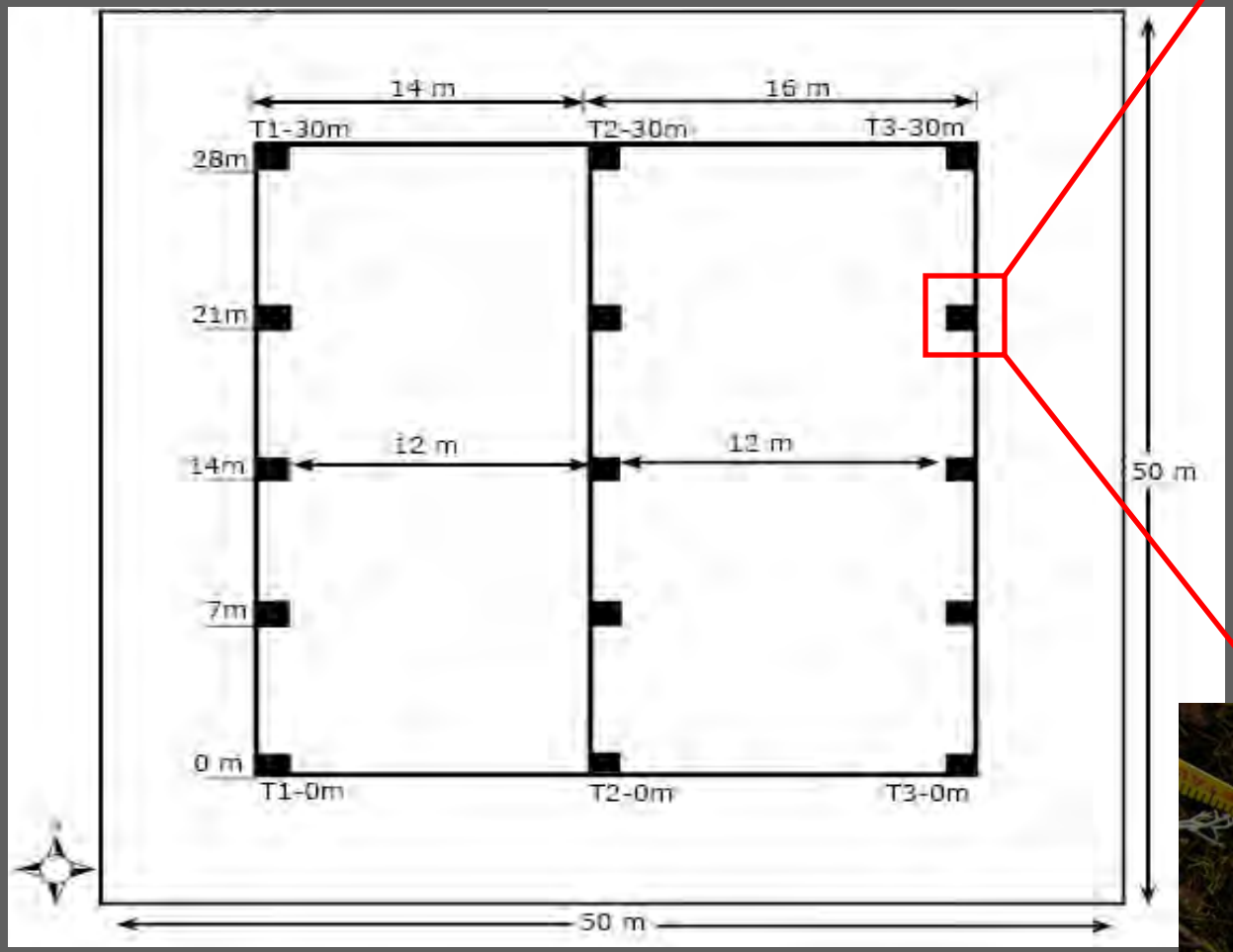
Pilot data collection to estimate variance

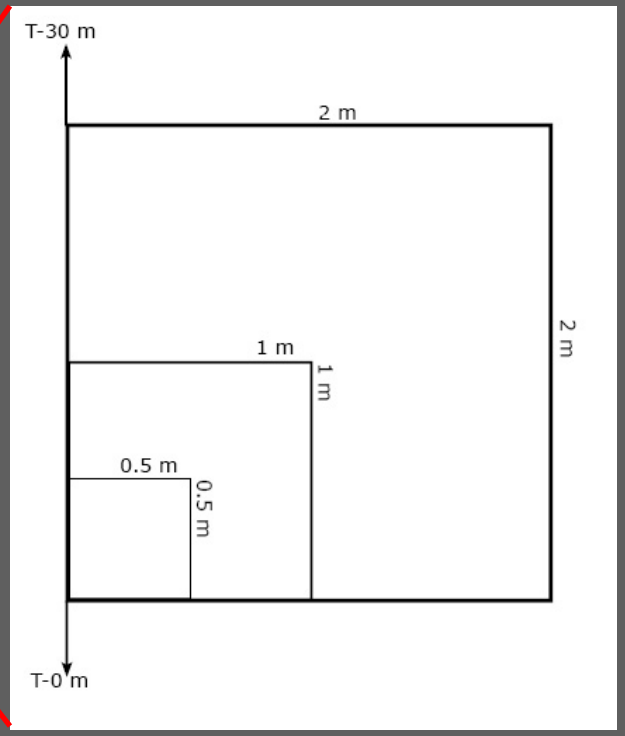
Metrics:

- Species cover by height class
- Species occurrence (frequency)
- Species richness
- Cover by growth form
- Tree seedling density
- Tree & sapling counts by species
- Tree diameter & height by species
- Tree canopy cover
- Tree age
- Fuels
- Soil temperature
- Soil moisture (class)
- Depth to impermeable layer
- Litter depth
- Parent material
- Drainage
- Site characteristics
- Photos – transect & quadrat

15 sites sampled (2007-2008)

Plot layout


14 m
16 m
T1-30m
T2-30m
T3-30m
28m
21m
14m
7m
0 m
12 m
12 m
50 m
T1-0m
T2-0m
T3-0m
50 m


T-30 m
2 m
2 m
1 m
1 m
0.5 m
0.5 m
T-0 m

02.006
2008

Estimated coefficients of variation (CVs) for plot variables

Vegetation class	Species	Mean cover (%)	CV (%)
Dwarf birch	*Arctostaphylos alpina*	1	63
	Betula glandulosa	26	33
(n=5)	*Ledum palustre* ssp. *decumbens*	22	23
	Lichen	34	18
	Moss	31	24
Spruce woodland	*Picea glauca*	5	22
	Betula glandulosa	16	27
(n=4)	*Vaccinium uliginosum*	16	15
	Empetrum nigrum	27	12
	Lichen	38	22
	Moss	38	21

- Species with low cover or variable distributions had high CVs
- Species with high cover and widespread distributions had low CVs
- Interannual variability in species cover ranged from <5% to >70%

Simulations to evaluate sample size & sampling frequency – 1. Panel design

								Year								
Panel	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
1	X					X					X					
2		X					X					X				
3			X					X					X			
4				X					X					X		
5					X					X					X	
6					X	X				X	X				X	X

- Rotating panel: 5-year and 10-year sampling intervals
- Sample size: 6, 8, 12, and 24 plots/panel

Simulations to evaluate sample size & sampling frequency – 2. Simulated CVs

Interval (yr)	Plots/yr	Target CV	<0%	≥ -10%	≥ -20%	≥ -30%
5	**6**	**5**	100	100	100	100
		10	100	100	100	95
		20	100	>99	90	47
		30	92	79	57	24
5	**12**	**5**	100	100	100	100
		10	100	100	100	99
		20	100	100	99	69
		30	99	94	77	39
5	**24**	**5**	100	100	100	100
		10	100	100	100	>99
		20	100	100	>99	87
		30	>99	99	92	57

MDC = 40%

Simulations to evaluate sample size & sampling frequency – 3. Actual CVs

Interval (yr)	Plots/yr	Target CV	<0%	≥ -10%	≥ -20%	≥ -30%
5	6	5	100	100	100	100
		10	100	100	100	95
		20	100	>99	90	47
		30	92	79	57	24
5	12	5	100	100	100	100
		10	100	100	100	99
		20	100	100	99	69
		30	99	94	77	39
5	24	5	100	100	100	100
					100	>99
					>99	87
		30	>99	99	92	57

CVs = 15%-33% for common species
CVs = 18%-24% for lichens, moss

MDC = 40%

Going Operational

Selection of broadly-distributed vegetation types

Elevation Zone	LACL	KATM	KEFJ
Low (0-450 m)	White spruce woodland	White spruce woodland	Coastal Sitka spruce
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= 48 plots = 48 plots = 24 plots

Estimated plots/year = 24-36 in one park (2-3 types)

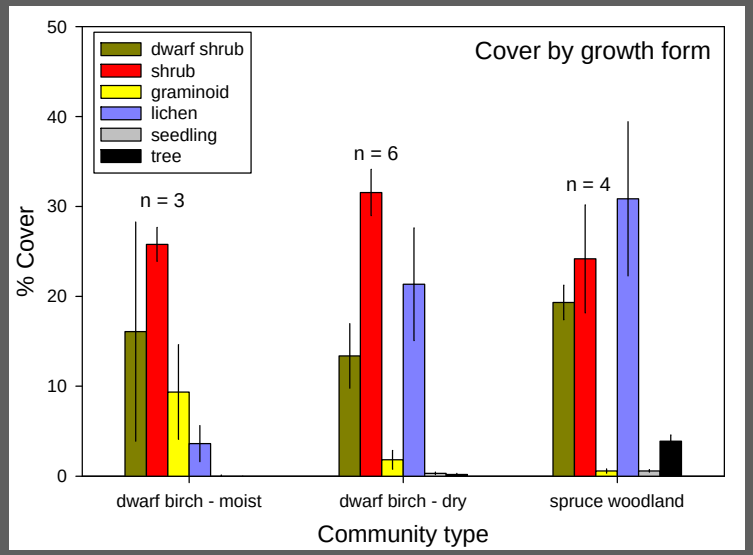
Summer 2009:

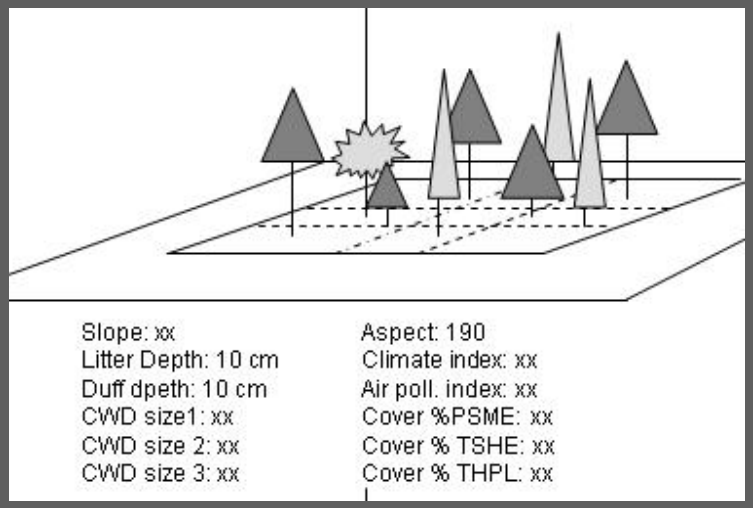
- Pilot monitoring - LACL
- Site reconnaissance – KEFJ

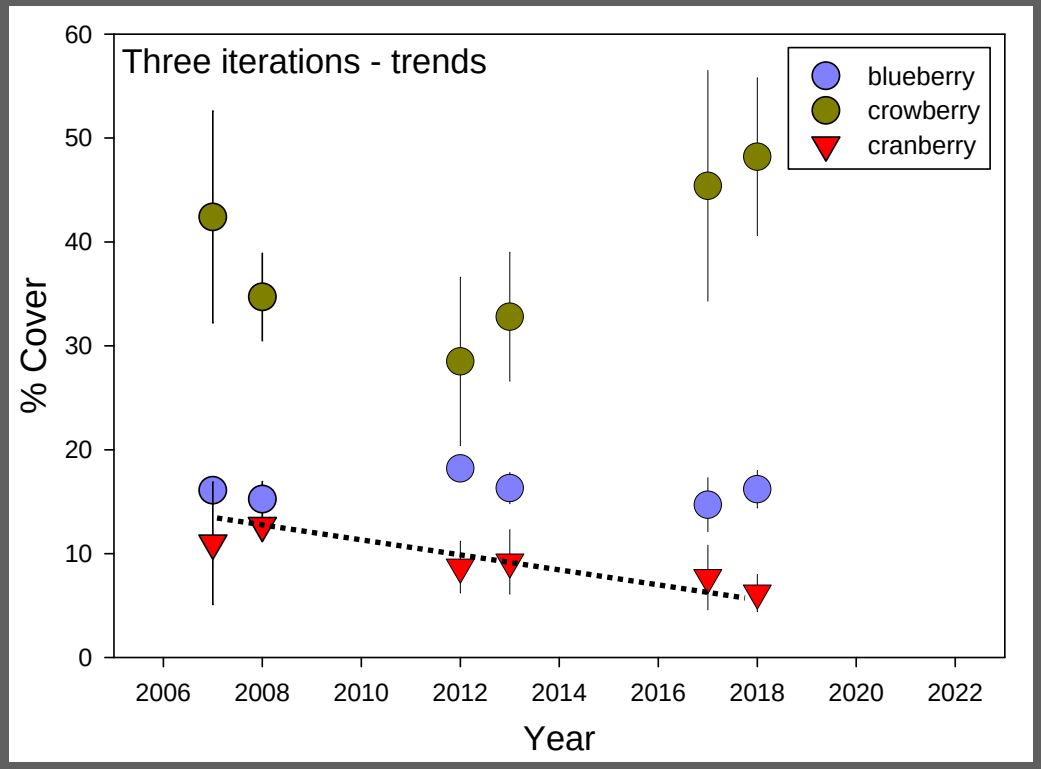
Fall 2009 and beyond:

- Evaluation of FIA data - KEFJ-PWS
- Database development
- Data integration & cross-site analyses

Data exploration: approaches to analysis







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