

Effects of a Severe Windstorm on Fuel Loadings and Biodiversity in Northern Minnesota

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Outline

- What happened?
- Research
- Results & Applicability

What happened?

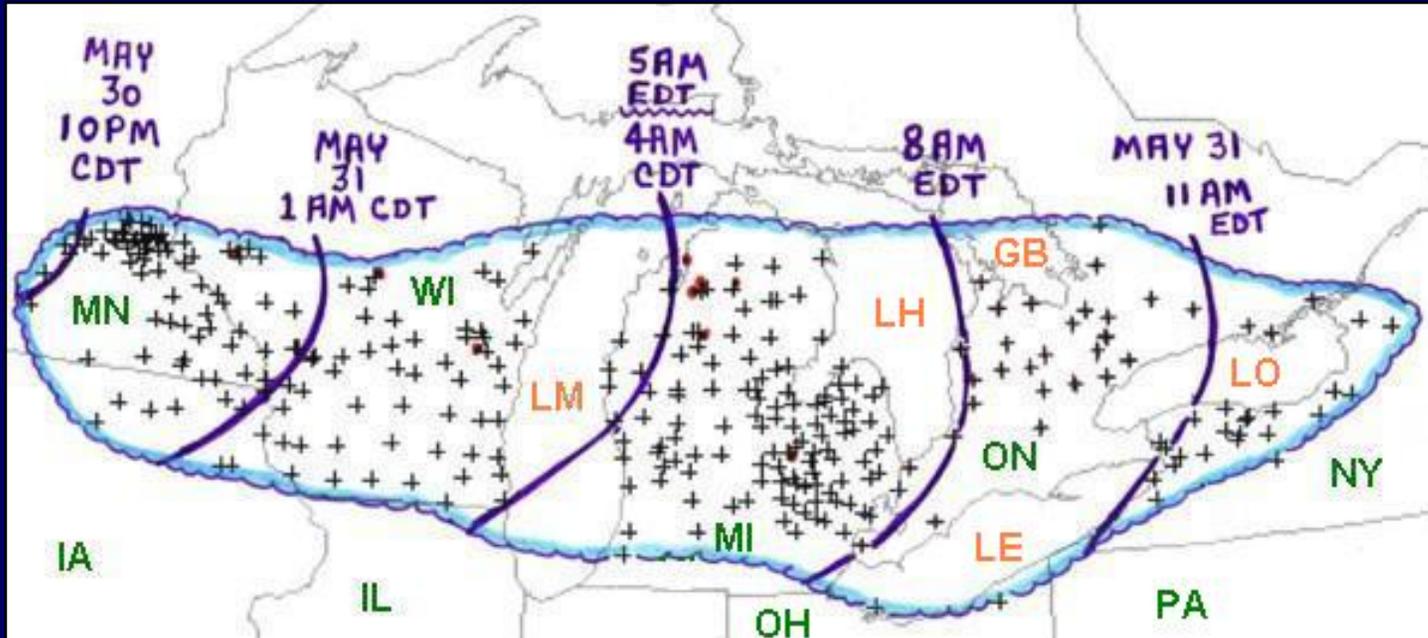


It was a really big storm!



Derecho downburst development

From COMET, 1999, modified from Weisman, 1993.



May 30-31, 1998 Bow echo derecho (6 dead, 190 injured, \$291,000,000 damage).

From: R.H. Johns and J.S. Evans: www.spc.noaa.gov/misc/AbtDerechos

Damage from the July 4, 1999
Super-cell derecho in the
BWCAW



Minneapolis Star tribune

Lo' Down on the Gunflint Blow-Down

- Gunflint was 3% of total area affected
(14,339 ac out of 477,000 ac)
- Federal – 10,558 ac
- State – 1,325 ac
- County – 293 ac
- Private – 1,609 ac

Overview of Experimental Design

- A two factor ANOVA design
- Coverttype
- Fuel reduction treatment



Aspen-Birch-Conifer Undisturbed



Jack Pine Undisturbed





Aspen-Birch-Conifer Unsalvaged



Jack Pine Unsalvaged





Aspen-Birch-Conifer Salvage



Jack Pine Salvage





Aspen-Birch-Conifer Mechanical Pile





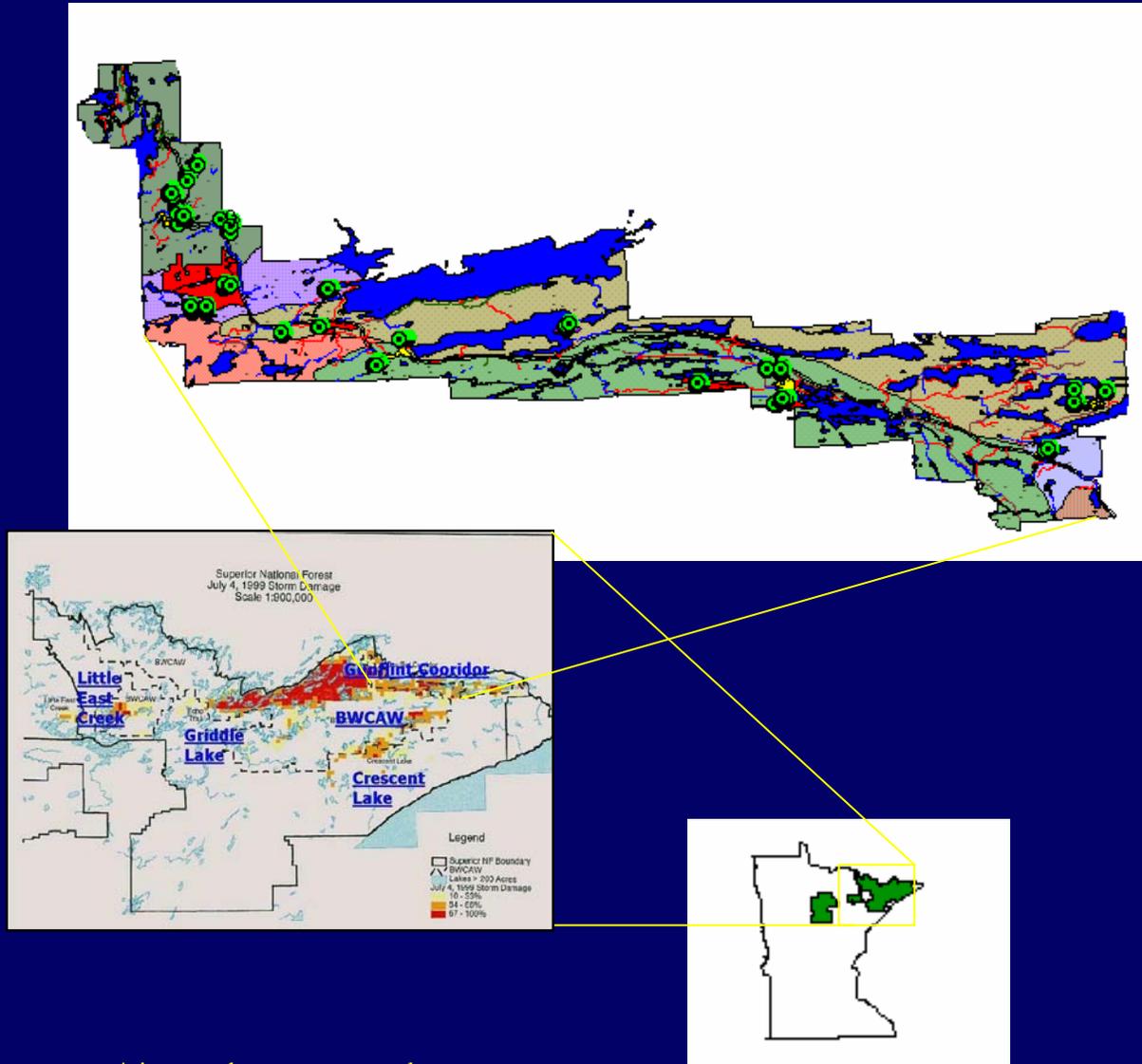
Aspen-Birch-Conifer Prescribed Burn



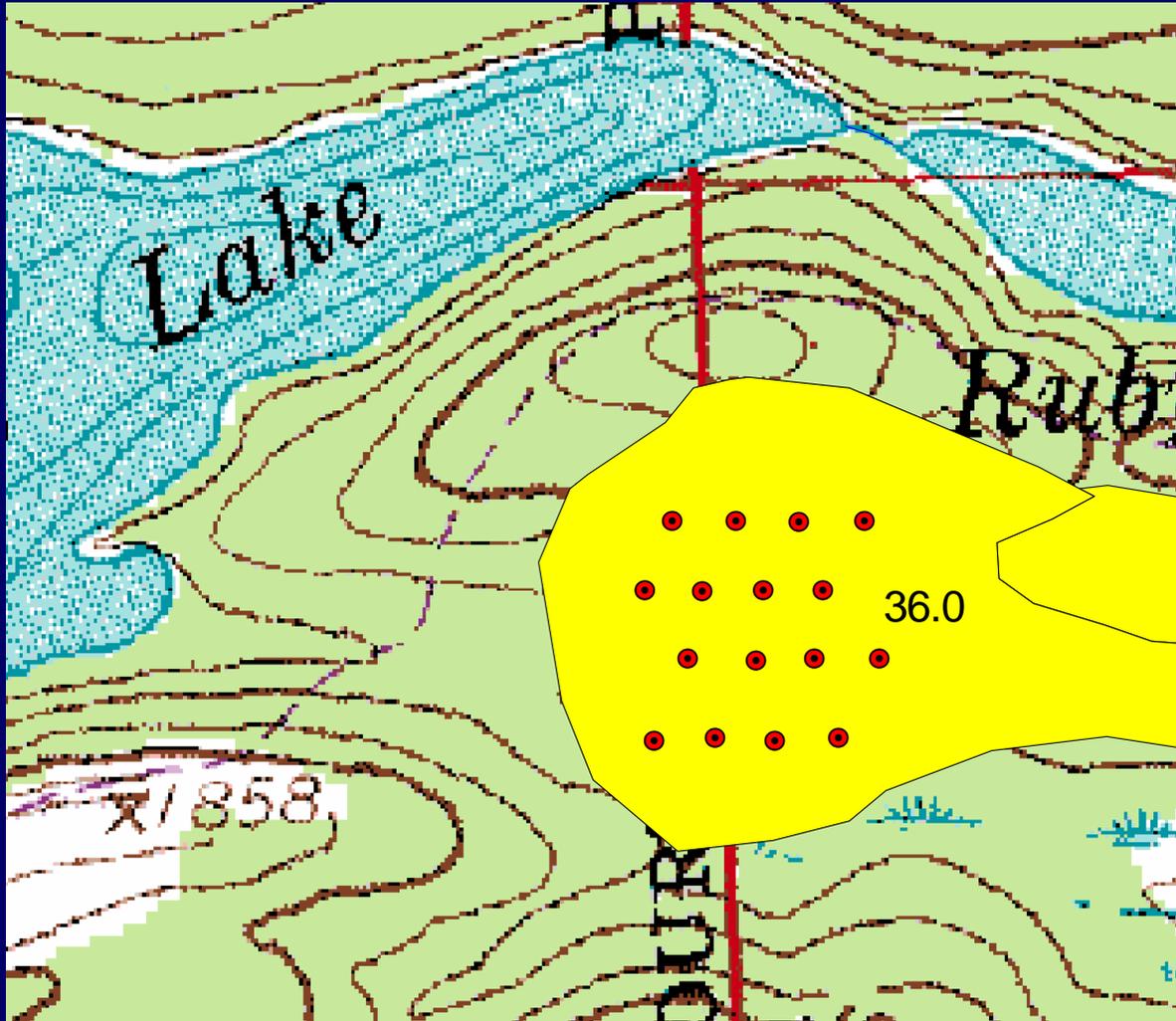
Research

- Framework, field crews, summer housing --
Chippewa National Forest
- Fuel reduction research –
Joint Fire Sciences Program
- Research on shrub community dynamics --
Chippewa National Forest
- Research on the insects --
Forest Health Monitoring Program

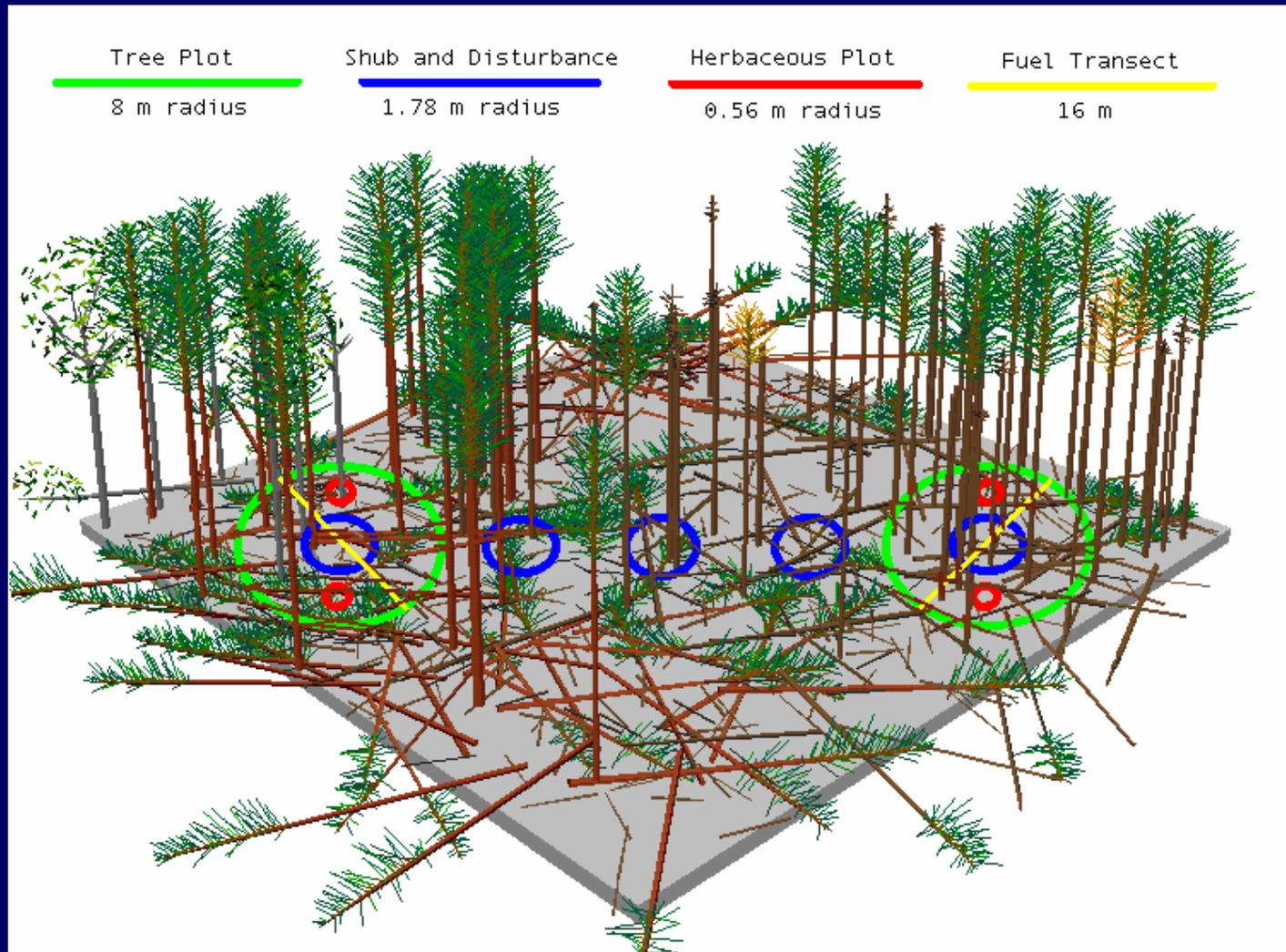
Study Sites in the Superior National Forest



Site Layout



Plot Layout Design



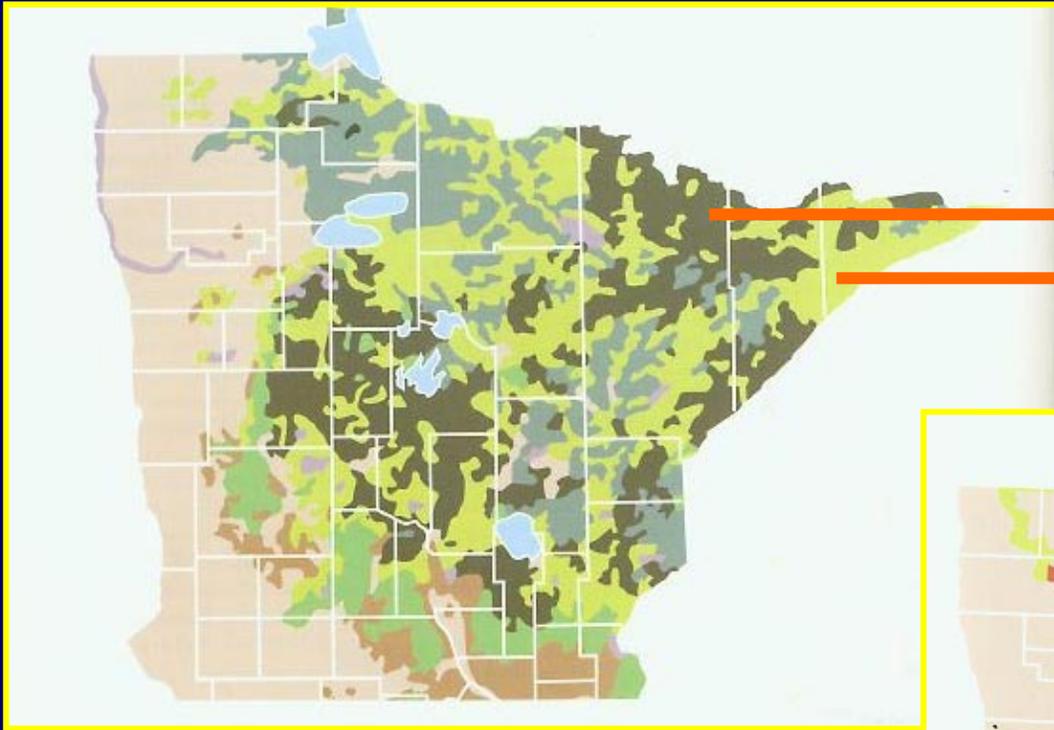
Fuel Reduction Treatment Results Summary

- Salvage harvesting was most successful in reducing total fuel loadings
- Prescribed burns were very effective in reducing fine fuel loadings
- 15 – 20 fuel sampling transects are necessary per location (forest stand) to obtain adequate fuel loading estimates

Shrub Community Results Summary

- No detectable differences in average total aboveground biomass
- Greatest changes in shrub species dominance occurred following salvage logging in both cover types
- A shift from a jack pine cover type to an aspen cover type is likely following salvage logging
- The aspen-birch-conifer cover type appears stable following all fuel reduction treatments

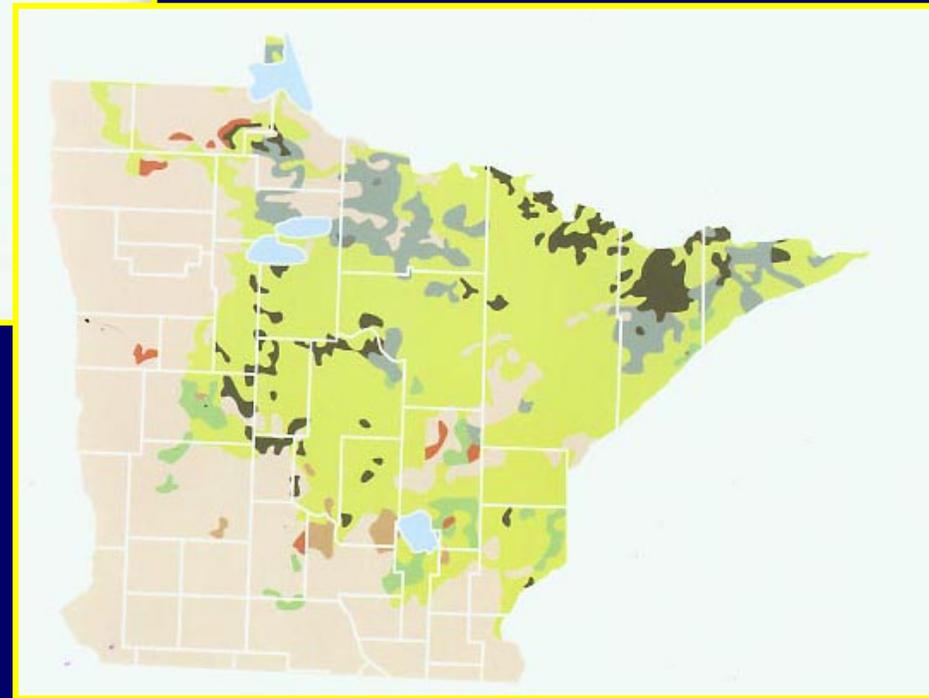
CHANGES IN FOREST COVER-TYPES



Pine Stands

Aspen Stands

Pre-settlement Vegetation



Post-settlement Vegetation



Scaphinotus species



Pterostichus melanarius

Summary of Ground Beetle Results

- Aspen/birch/conifer had greater trap catches while jack pine forests had greater species diversity.
- Some species were caught exclusively in each cover type.
- A number of species were caught in greater numbers in the undisturbed than wind-disturbed forests.
- Species diversity was greater in the wind-disturbed than undisturbed forests.
- *Pterostichus melanarius* was caught in greatest numbers in the jack pine burned forests.
- Salvaged and burned forests had the greatest trap catches, species richness and diversity, and most unique assemblages



SEMIOCHEMICAL TREATMENTS FOR FUNNEL TRAPS

(A) Scolytidae

Beetle Species

Baits

<i>Ips grandicollis</i>	(-)-ipsenol, (-)- α -pinene
<i>Ips perroti</i>	(-)-ipsenol, (-)-ipsdienol
<i>Ips perroti</i>	(-)-ipsenol, (+)-ipsdienol
<i>Ips perturbatus</i>	(-)-ipsenol, (+)-ipsdienol, (-)- <i>cis</i> -verbenol
<i>Ips pini</i>	(+/-)-ipsdienol, lanierone
<i>D. rufipennis</i>	(+/-)-frontalin, (-)- α -pinene, methylcyclohexanol
<i>D. simplex</i>	(+/-)-seudenol, (-)- α -pinene
<i>D. valens</i>	(+)- α -pinene, (-)- β -pinene
<i>D. valens</i>	(+)- α -pinene, (-)- β -pinene, 3-carene
<i>Dryocoetes</i> spp.	(+/-)- <i>exo</i> -brevicomin, (-)- α -pinene
<i>Dryocoetes</i> spp.	(+/-)- <i>endo</i> -brevicomin

(B) Wood-boring Beetles

Beetle Species

Baits

Buprestidae	Ethanol, (-)- α -pinene
Cerambycidae	Ethanol, (-)- α -pinene

(C) Blank Trap (control)

Summary of Subcortical Insects Results

- **Trap catches of some of the abundant subcortical insects were greater in wind-disturbed and burned areas two years after the storm (2001).**
- **Trap catches declined thereafter (in 2003).**
- **Wind-disturbance event and burning increased species richness and diversity on the landscape.**
- **Species composition of the salvaged and burned forests were distinct.**
- **Semiochemicals were effective tools to monitor subcortical insect biodiversity.**
- **Responses of insects to semiochemicals varied strongly with the year of sampling and land-area treatments.**

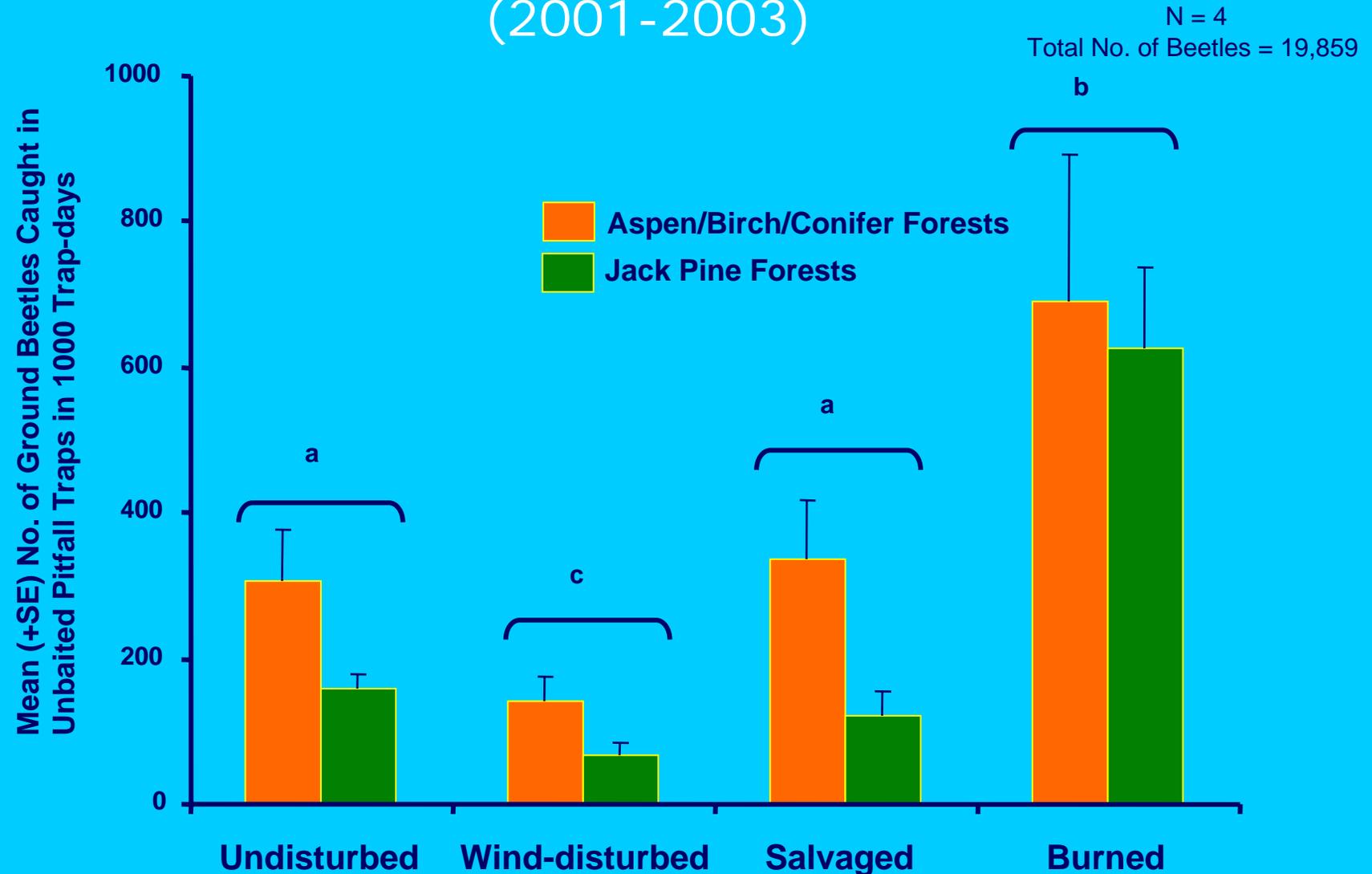
Summary of Subcortical Insects Results

- *Dendroctonus simplex* bait caught the greatest number of insects.
- Most subcortical species were caught using their respective baits.
- *Dendroctonus valens* & *Dryocoetes* spp. baited traps, and unbaited traps had the greatest species diversity.

So, what does all this tell us?

- That depends
- Recall salvage logging appears to foster a shift in forest cover type – from conifer to aspen
- But, prescribed fire seems to promote the presence of an exotic ground beetle

TRAP CATCHES OF ALL GROUND BEETLES (2001-2003)



Three-factor ANOVA: None of the interactions were significant; Forest cover-types ($P < 0.001$); Year ($P > 0.05$); Land-area treatments ($P < 0.001$). REGW pairwise comparison tests, $\alpha = 0.05$.

And,

- In addition to creating a high fire danger situation,
- Doing nothing creates a situation where high populations of insects that are normally not a significant threat become a major problem

Options for Creating & Maintaining a Healthy Forest

- Determine DFC (Desired Future Condition)
- Use thinning and timber harvestings as a tools to shift species composition,
- And promote a forest less prone to windthrow
- Monitor the residual forest