Interactions between a Catastrophic Wind-disturbance Event, Fuel-reduction Activities, and Insects in Northeastern Minnesota

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A LARGE-SCALE WIND-DISTURBANCE EVENT

The July 4th, 1999 Windstorm in the Superior National Forest, Minnesota

FUEL-REDUCTION TREATMENTS

Salvage-logging

Prescribed-burning

ECOLOGICAL CHANGES AFTER THE STORM

Coarse-Woody Debris

Soil Disturbance

ECONOMICALLY IMPORTANT TAXA
SUBCORTICAL INSECTS


Scolytidae


Buprestidae


Cerambycidae


Siricidae


Curculionidae


Cleridae

Bark Beetles
Woodboring Insects
Root-attacking Beetles
Associated Predators

ECOLOGICALLY IMPORTANT TAXA
LITTER-DWELLING BEETLES


Agonum cupripenne (Say)


Sphaeroderus lecontei Dejean

Ground Beetles

RESEARCH OBJECTIVES

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2. To determine the effects of a severe wind disturbance event and fuel-reduction practices and semiochemical treatments on subcortical insects.

3. To assess the colonization patterns of subcortical insects on jack pine trees.

LAND-AREA TREATMENTS

Years 2000-2003


Wind-Disturbed Forest


Undisturbed Forest


Salvaged Forest

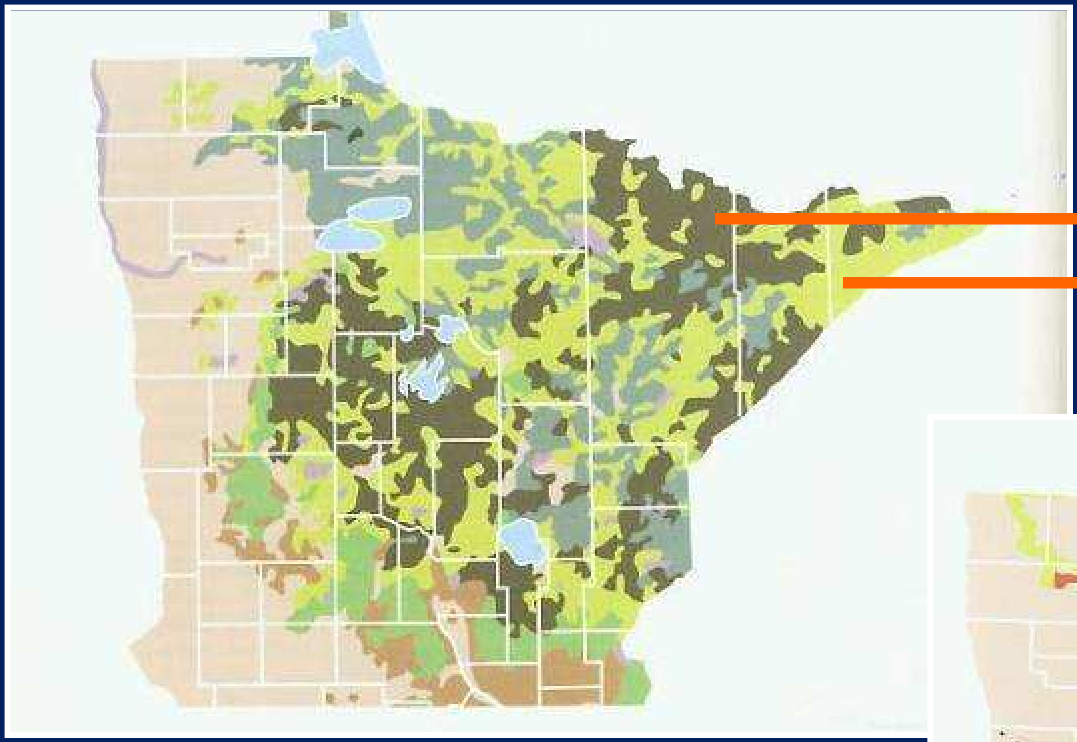

Prescribed-Burned Forest

FOREST COVER-TYPES

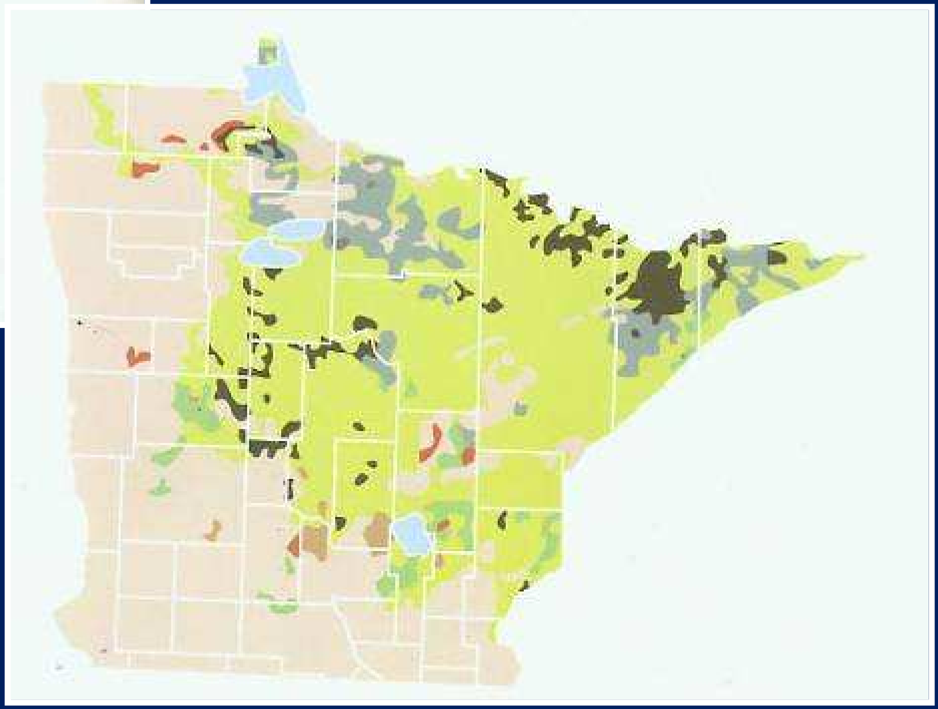
Aspen/Birch

Jack Pine

HISTORIC CHANGES IN FOREST COVER-TYPES



Pre-settlement Vegetation
1800s

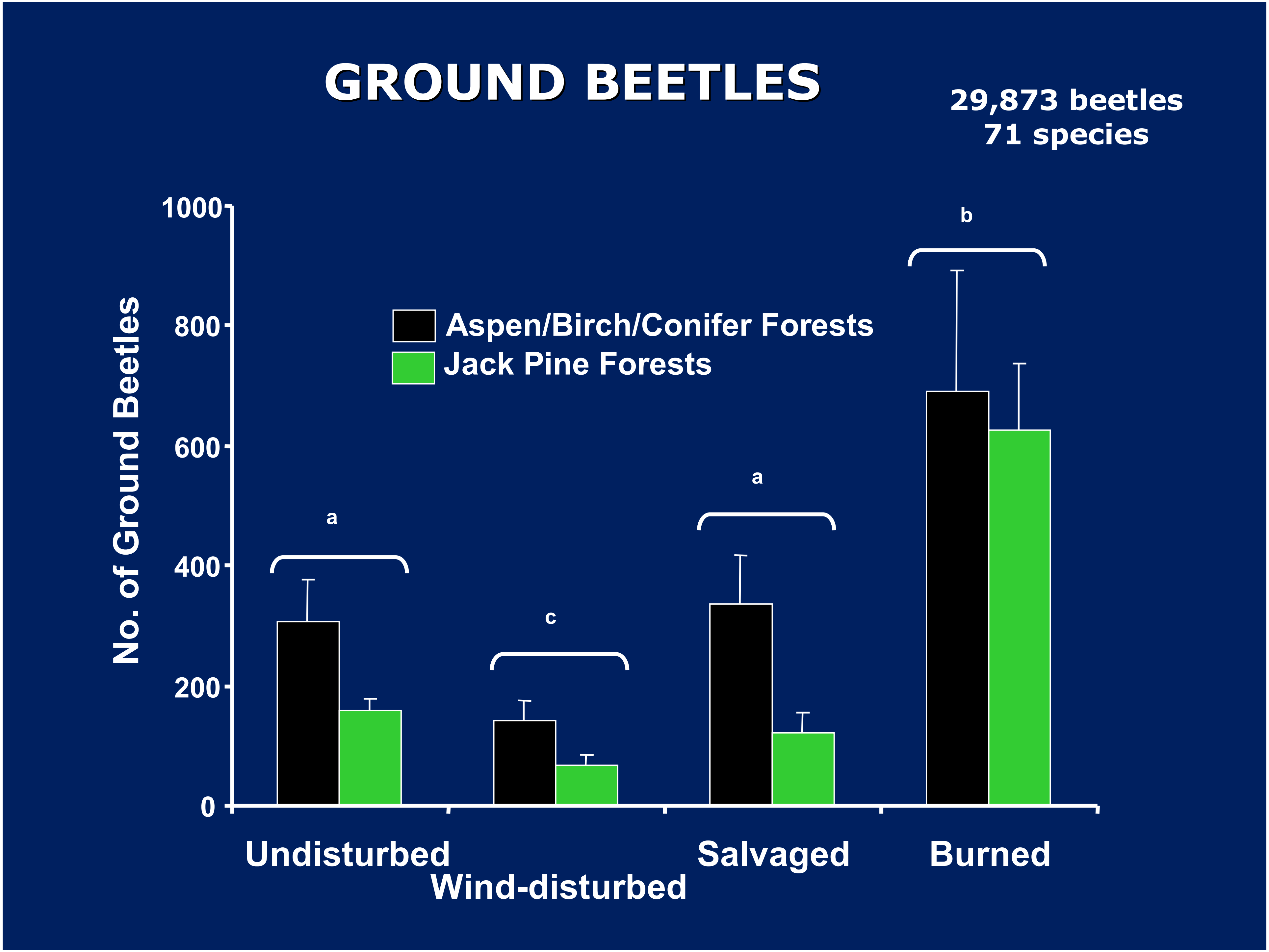


Post-settlement Vegetation
1900s

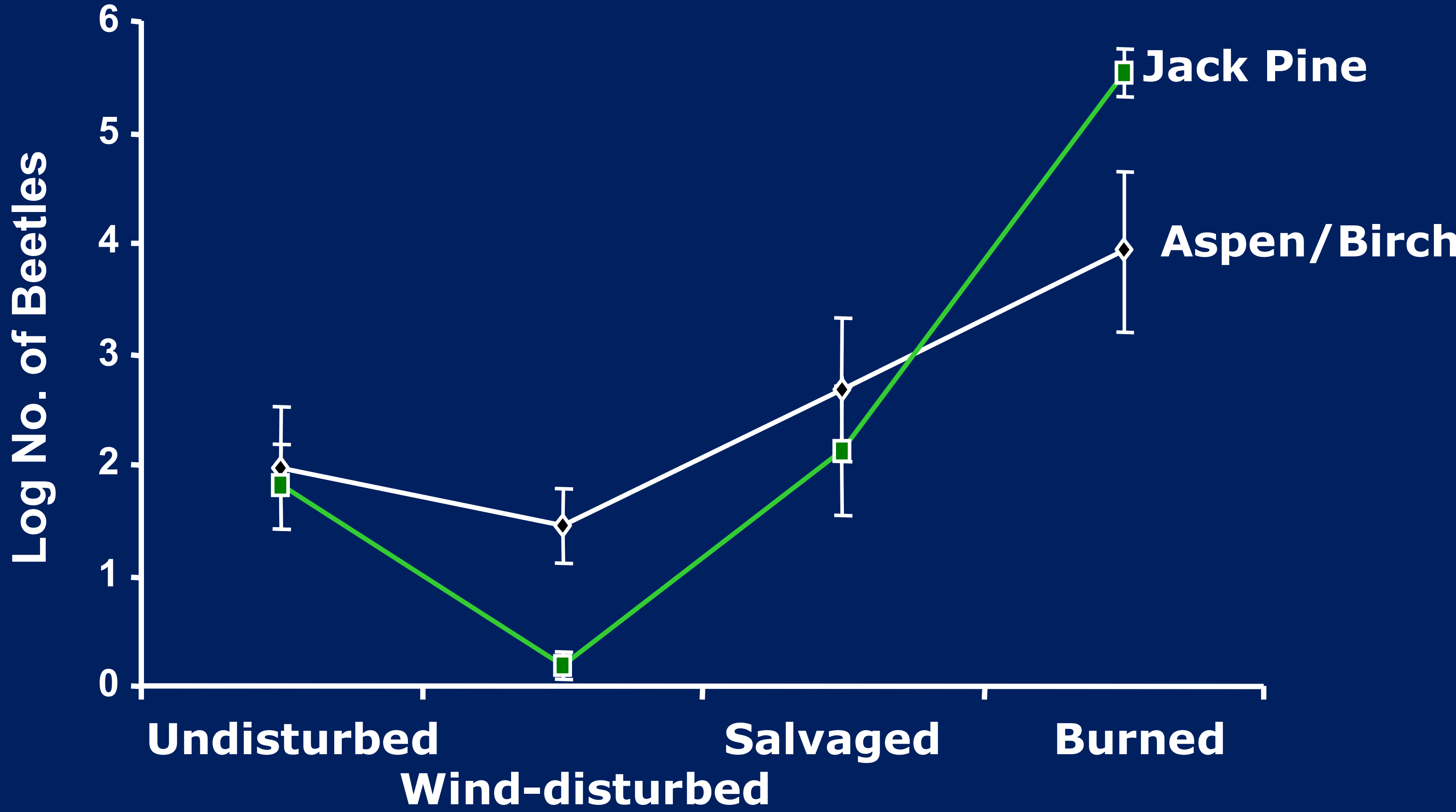
Tester (1995)

PITFALL TRAP
Ground Beetles

Six Pitfall Traps/Plot

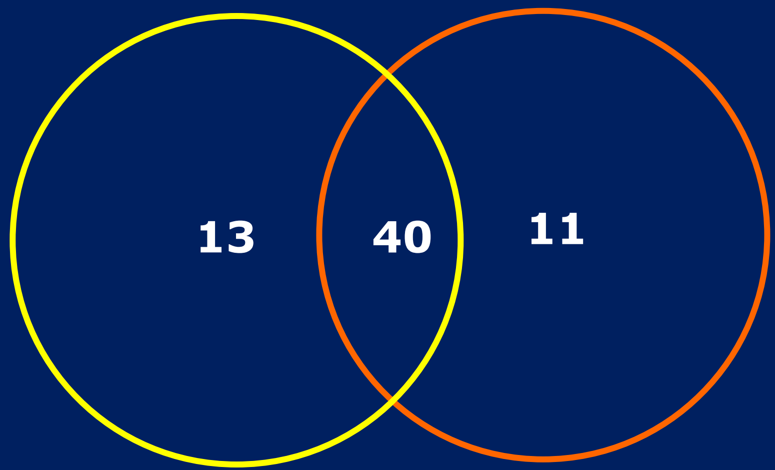

GROUND BEETLES
29,873 beetles
71 species
No. of Ground Beetles
1000
800
600
400
200
0
Aspen/Birch/Conifer Forests
Jack Pine Forests
a
c
a
b
Undisturbed
Wind-disturbed
Salvaged
Burned

PTEROSTICHUS MELANARIUS
Exotic Species



GROUND BEETLE SPECIES RICHNESS

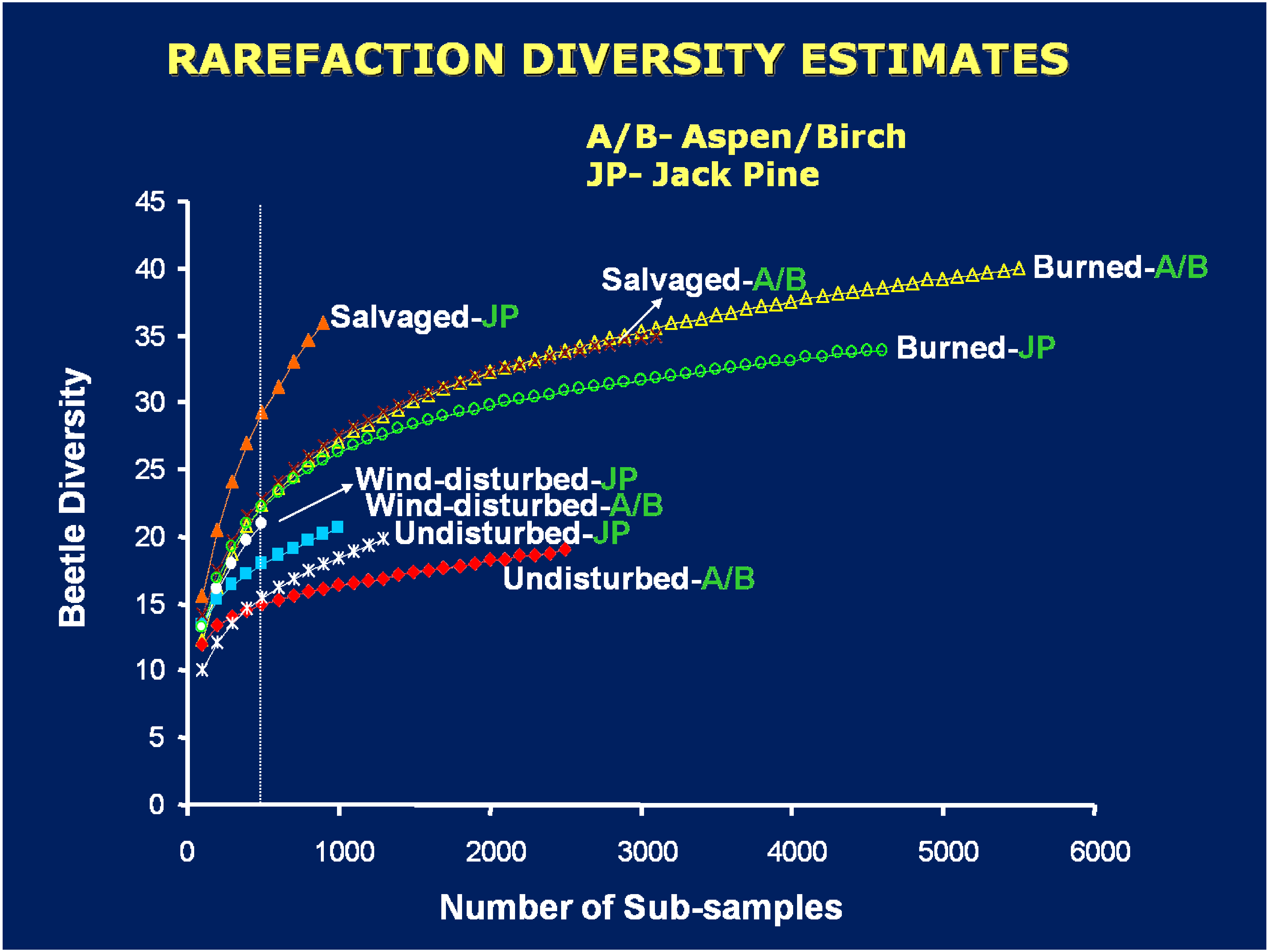
Aspen/Birch/Conifer Cover Type (53)

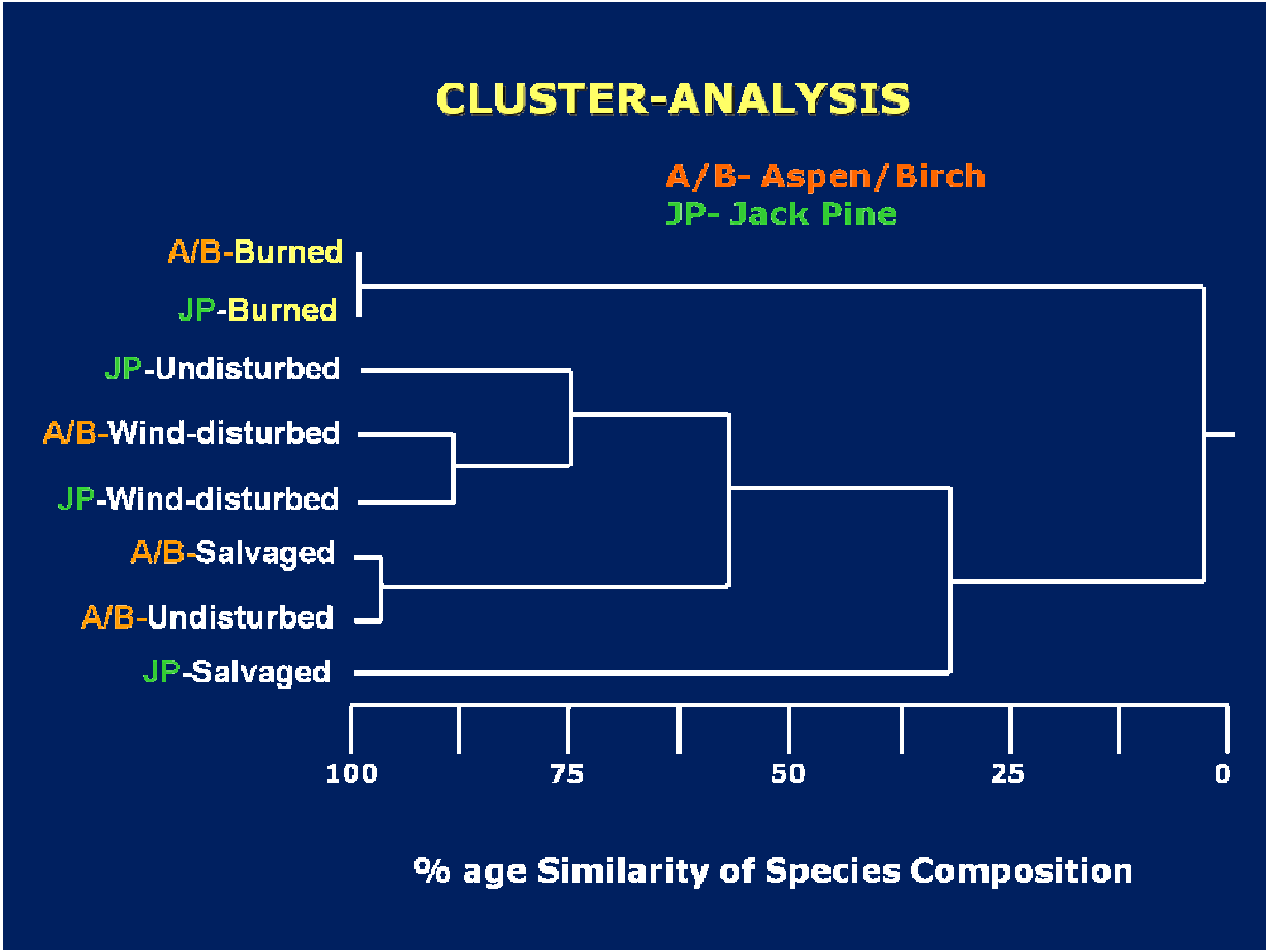


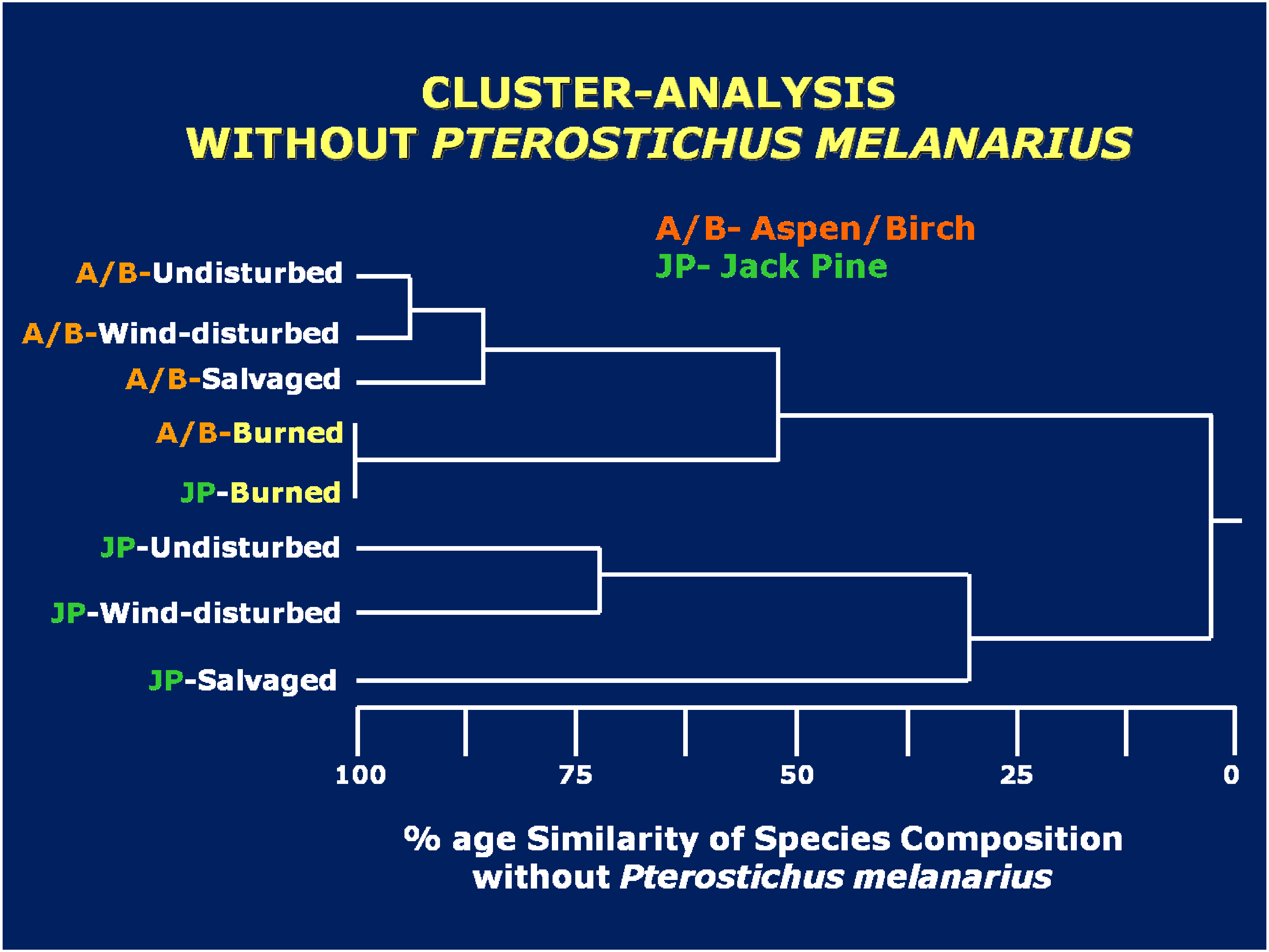
Jack Pine Cover Type (51)

Sphaeroderus n. brevoorti

Myas cyanscenes


RAREFACTION DIVERSITY ESTIMATES
A/B- Aspen/Birch
JP- Jack Pine
Beetle Diversity
Number of Sub-samples
0
5
10
15
20
25
30
35
40
45
0
1000
2000
3000
4000
5000
6000
Salvaged-JP
Salvaged-A/B
Burned-A/B
Burned-JP
Wind-disturbed-JP
Wind-disturbed-A/B
Undisturbed-JP
Undisturbed-A/B


CLUSTER-ANALYSIS
A/B- Aspen/Birch
JP- Jack Pine
A/B-Burned
JP-Burned
JP-Undisturbed
A/B-Wind-disturbed
JP-Wind-disturbed
A/B-Salvaged
A/B-Undisturbed
JP-Salvaged
100
75
50
25
0
% age Similarity of Species Composition


CLUSTER-ANALYSIS
WITHOUT PTEROSTICHUS MELANARIUS
A/B- Aspen/Birch
JP- Jack Pine
A/B-Undisturbed
A/B-Wind-disturbed
A/B-Salvaged
A/B-Burned
JP-Burned
JP-Undisturbed
JP-Wind-disturbed
JP-Salvaged
100
75
50
25
0
% age Similarity of Species Composition
without Pterostichus melanarius

LINDGREN FUNNEL TRAP
Bark and woodboring Insects

Eleven traps per plot

SEMIOCHEMICAL TREATMENTS FOR FUNNEL TRAPS

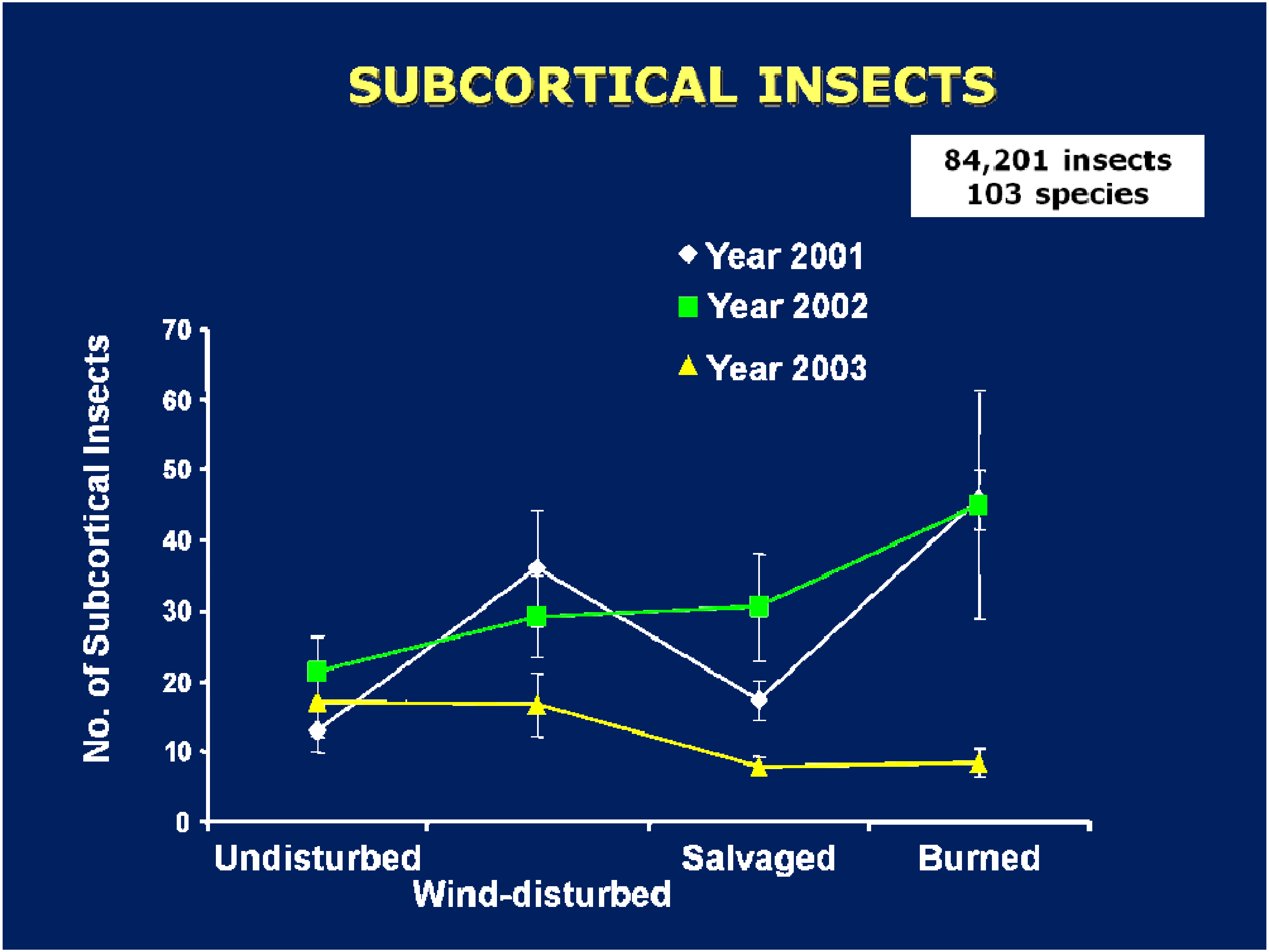
(A) Scolytidae

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

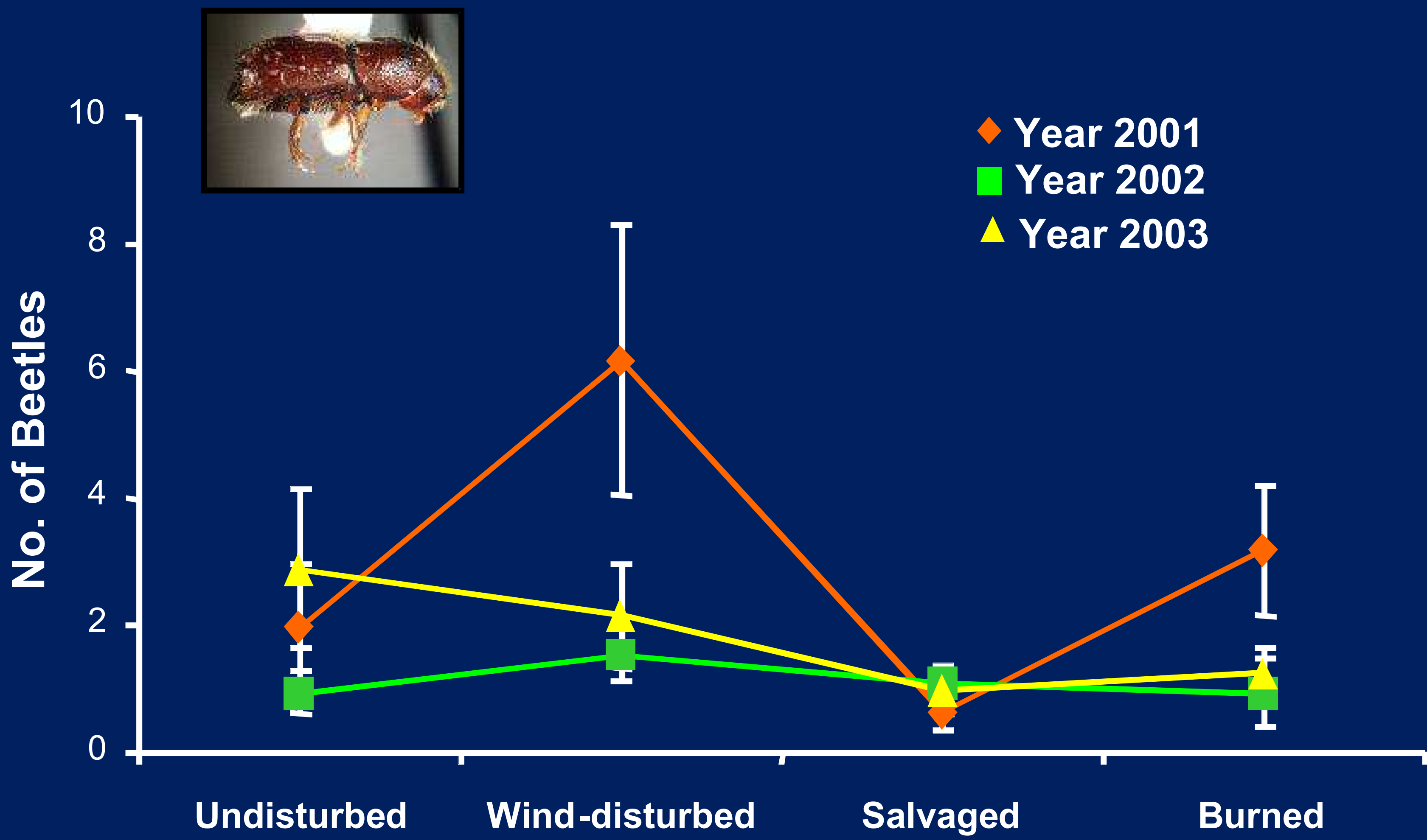
(B) Wood-boring Beetles

Beetle Species	Baits
Buprestidae	Ethanol, (−)-α-pinene
Cerambycidae	Ethanol, (−)-α-pinene

(C) Blank Trap (control)

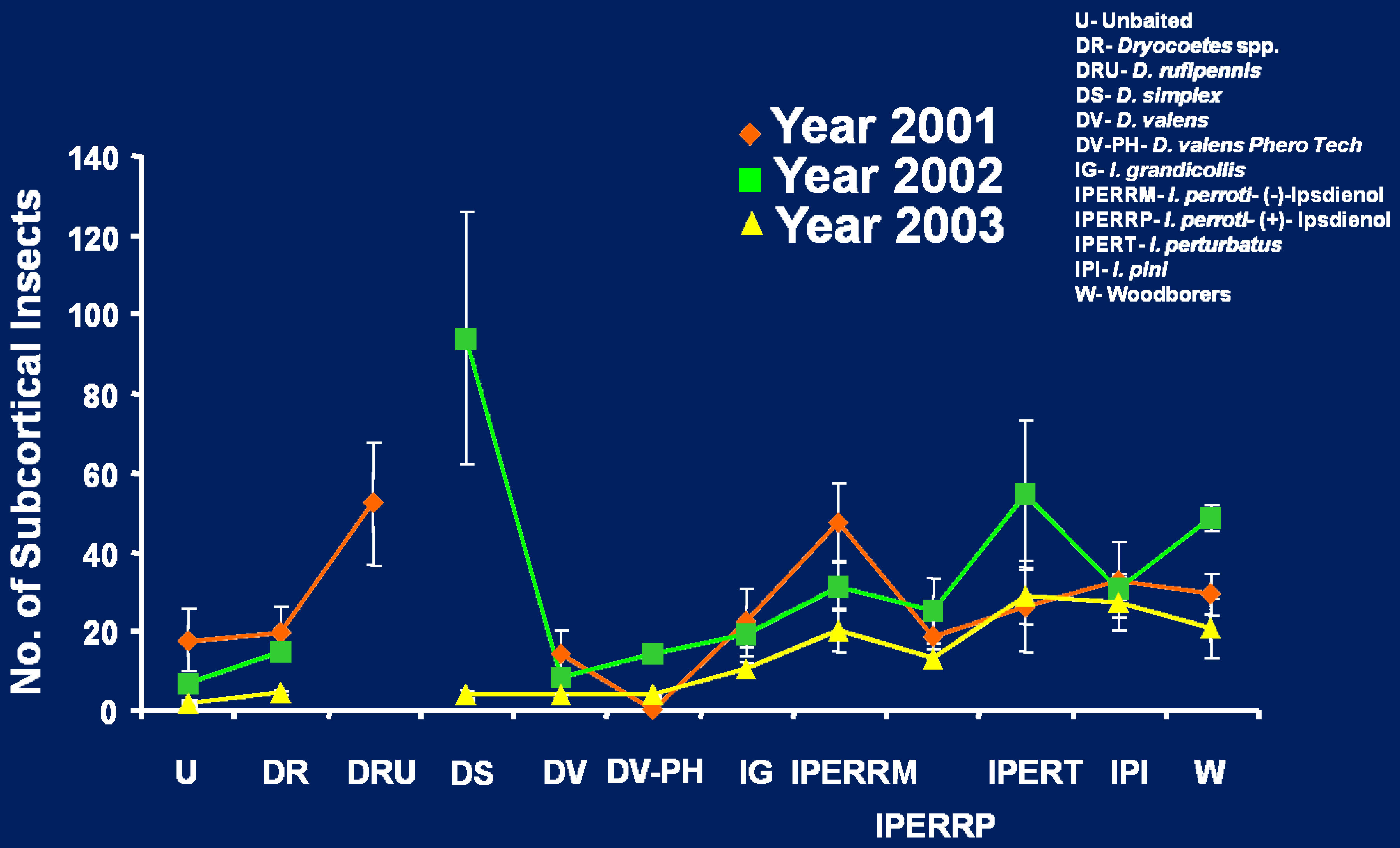

SUBCORTICAL INSECTS
84,201 insects
103 species
Year 2001
Year 2002
Year 2003
No. of Subcortical Insects
0
10
20
30
40
50
60
70
Undisturbed
Wind-disturbed
Salvaged
Burned

Ips pini

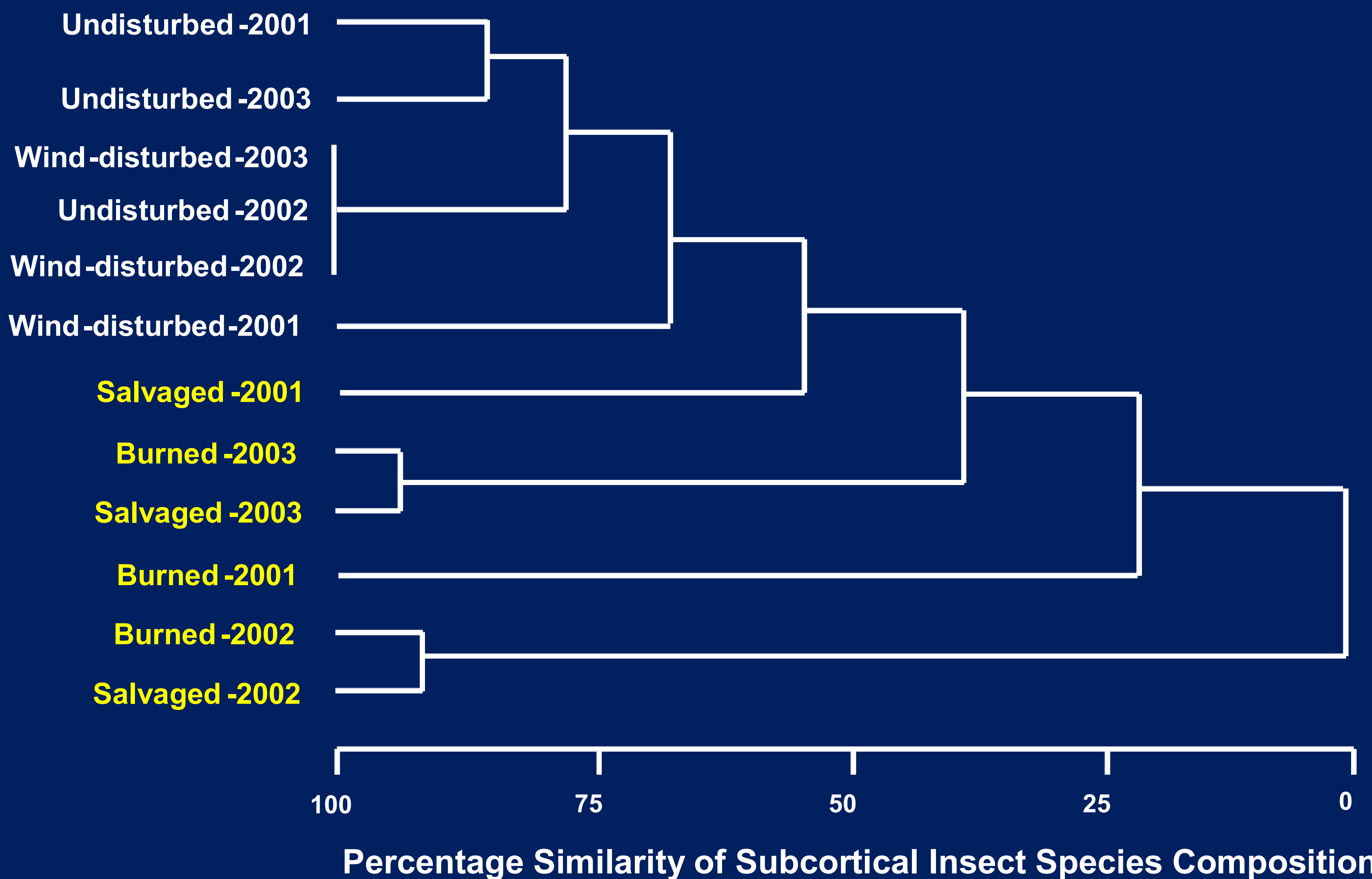


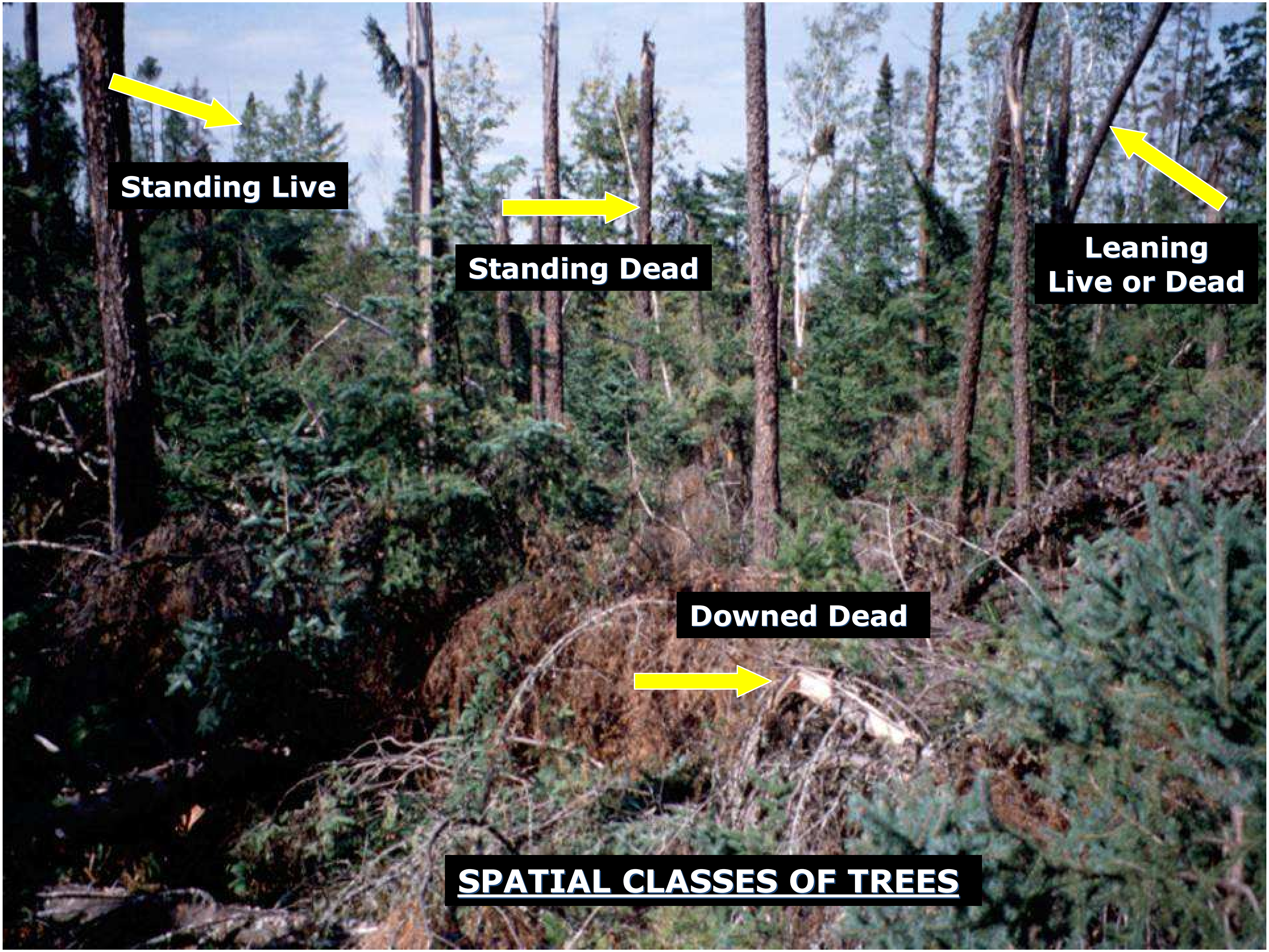
Year 2001
Year 2002
Year 2003
No. of Beetles
0
2
4
6
8
10
Undisturbed
Wind-disturbed
Salvaged
Burned

SUBCORTICAL INSECTS

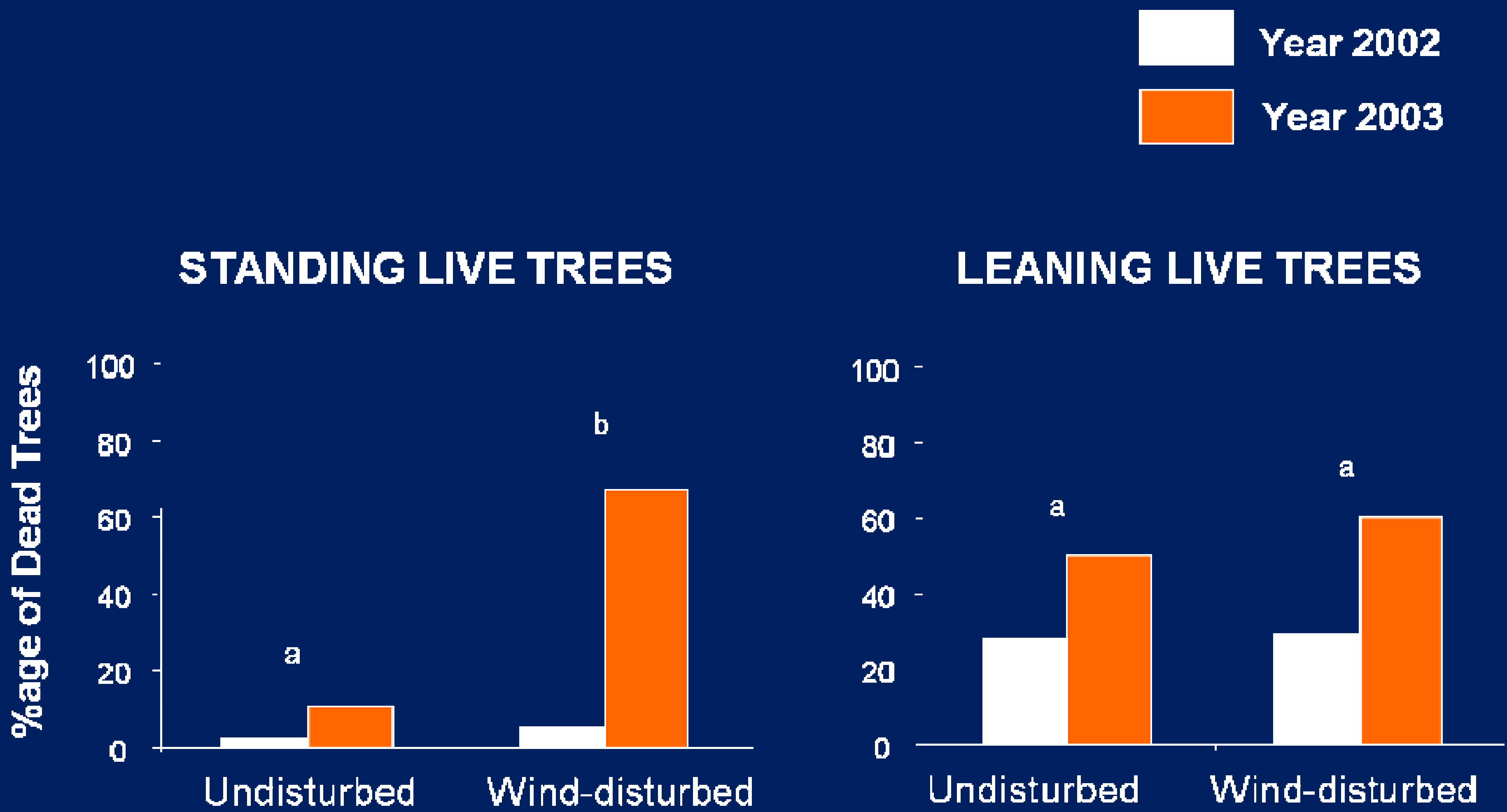


CLUSTER-ANALYSIS OF SUBCORTICAL INSECTS




Standing Live
Standing Dead
Leaning
Live or Dead
Downed Dead
SPATIAL CLASSES OF TREES

TREE MORTALITY



OVIPOSITION SCARS BY WOODBORING BEETLES

Monochamus s. scutellatus (Say)
Monochamus mutator LeConte
Monochamus notatus (Drury)

CONCLUSIONS

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5. A woodboring beetle became primary colonizer of jack pine trees.

6. More than half of the live trees died in wind-disturbed sites.

OVERALL MANAGEMENT GUIDELINES

Did fuel reduction practices affect insect populations and subsequent fire risk? Can prescribed burns and logging be utilized to manage insect fire risk within fire adapted ecosystems?

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Fuel-reduction treatments negatively affect ground beetles, except for fire-adapted species.

Fuel-reduction treatments positively affect subcortical insects for 3-4 years after the windstorm.

Fuel-reduction treatments are not always necessary to control insect epidemics.

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To what degree do insect populations contribute to standing and down fuel loading and subsequent fire risk? How do insects populations influence fire risk in blowdown vs. standing forest?

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Subcortical insects contribute to standing and downed fuel-loading in the wind-disturbed areas that may contribute to increased fire-risk.

FUTURE STUDIES IN SUB-BOREAL FORESTS

- How do impacts of prescribed-fire on insects differ from wildfire?
- What are the mechanisms of responses by forest insects to disturbances?
- Long-term monitoring of these sites to assess faunal recovery and regeneration patterns.

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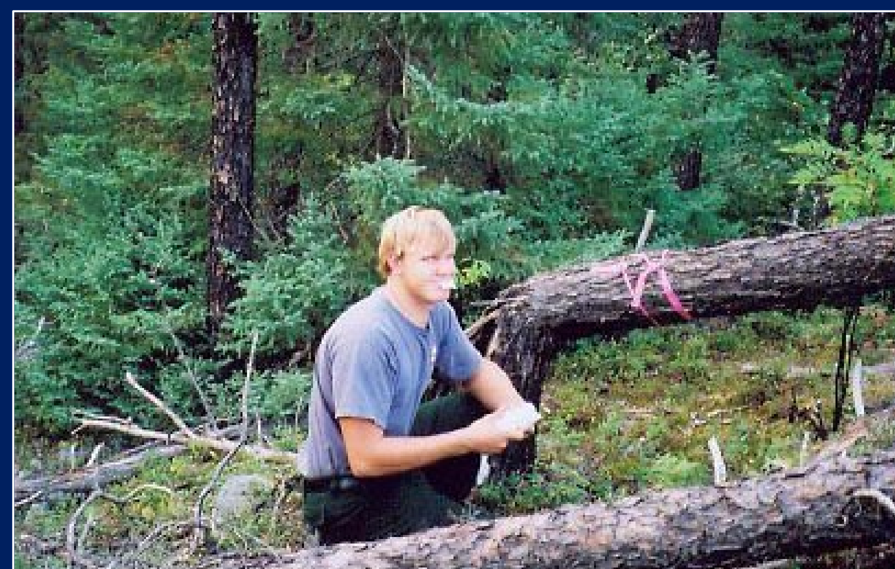

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