THE EFFECTS OF INTENSIVE FOREST BIOMASS REMOVAL ON STREAM ENVIRONMENTALS & BIOTIC ASSEMBLAGES

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VALUE DOCTORAL PROGRAM

Introduction

- Intensive forest biomass removal for use in bio-energy production.
- Involves removal of all or most of the logging residues (i.e. branches, twigs, fine woody debris, treetops and stumps).
- Biomass left on site replenish the soil nutrients and act as a substrate for biota.
- This practice of removing logging residues (LRR) has its *pros* (i.e. CO_2 neutral) and *cons* (i.e. environ damage).

Rationale for the study

- 3 million m^3 of LR collected in 2006, but the target is 13 million m^3 by 2015 (Finnish MAF 2006).
- Despite this 4-fold increase there has been virtually NO impact studies on stream ecosystem.
- Ultimately, this study will try to contribute to the discourse about balancing climate change mitigation (i.e. CO_2 neutral), energy policy (i.e. bio-energy) and biodiversity conservation.

Collection

Collection and bundling

At Roadside storage

At the power plant


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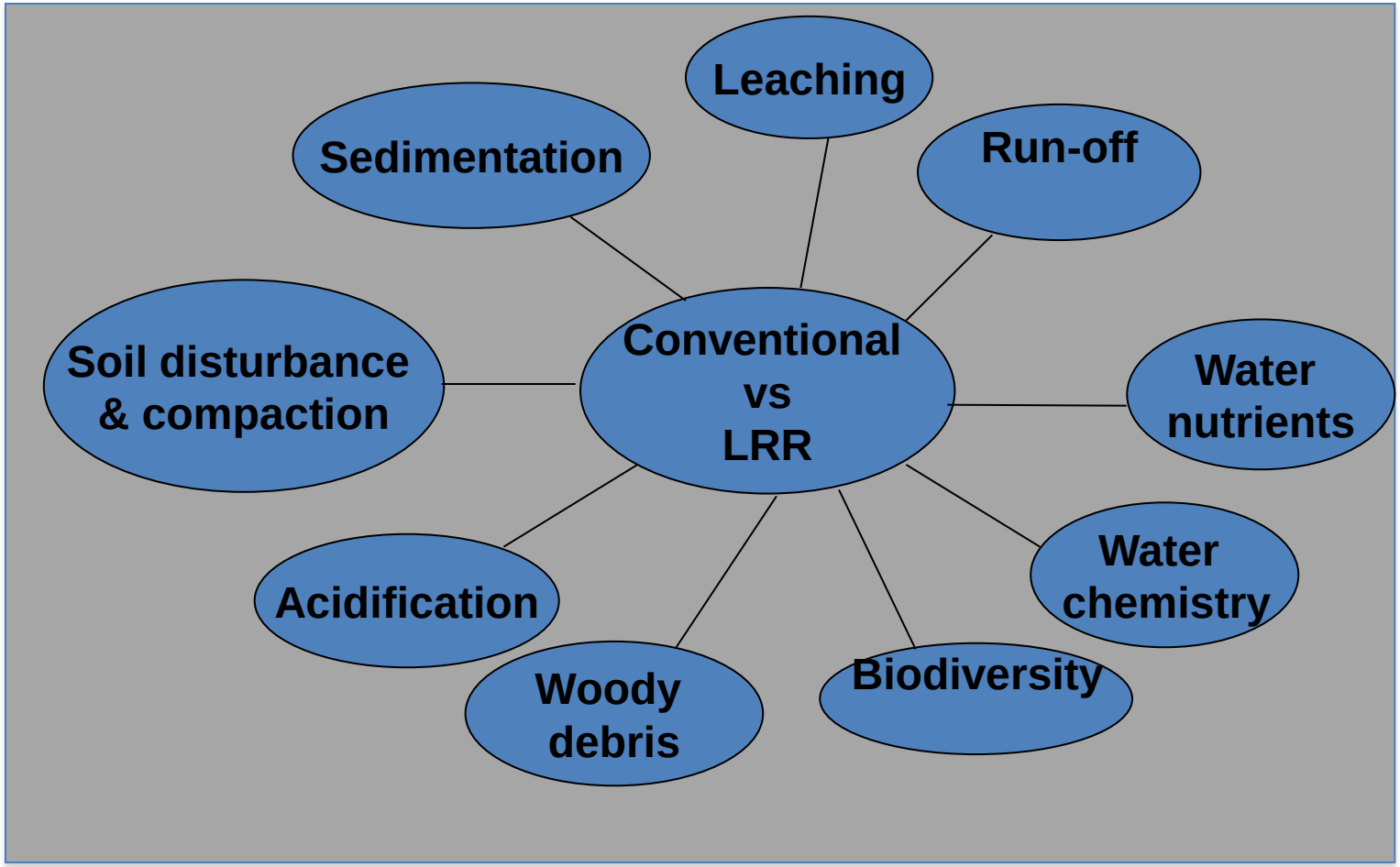
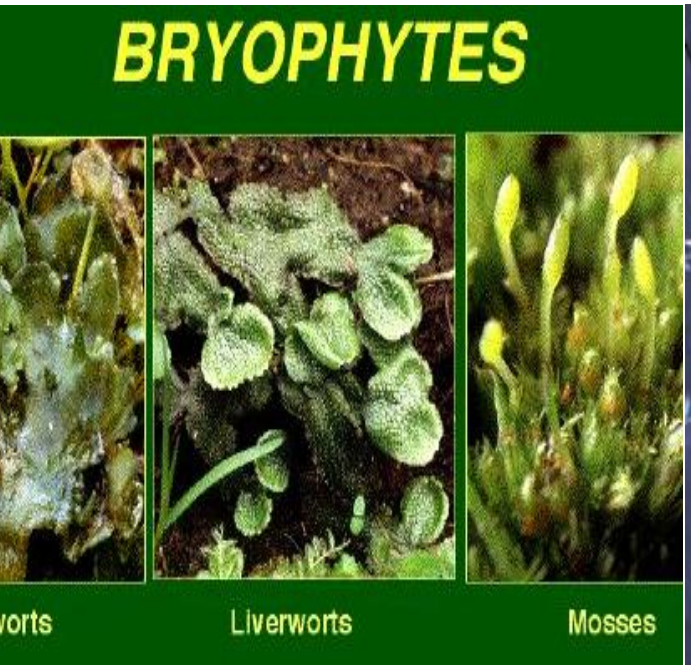
Aquatic processes likely to be effected by the LRR



- Mosaic nature of forestry; only small patches are harvested at any one time thus creating a mosaic of different age classes

Key questions

- What are the effects of LRR on stream organisms (MI, chironomids, diatoms, bryophytes and plants).



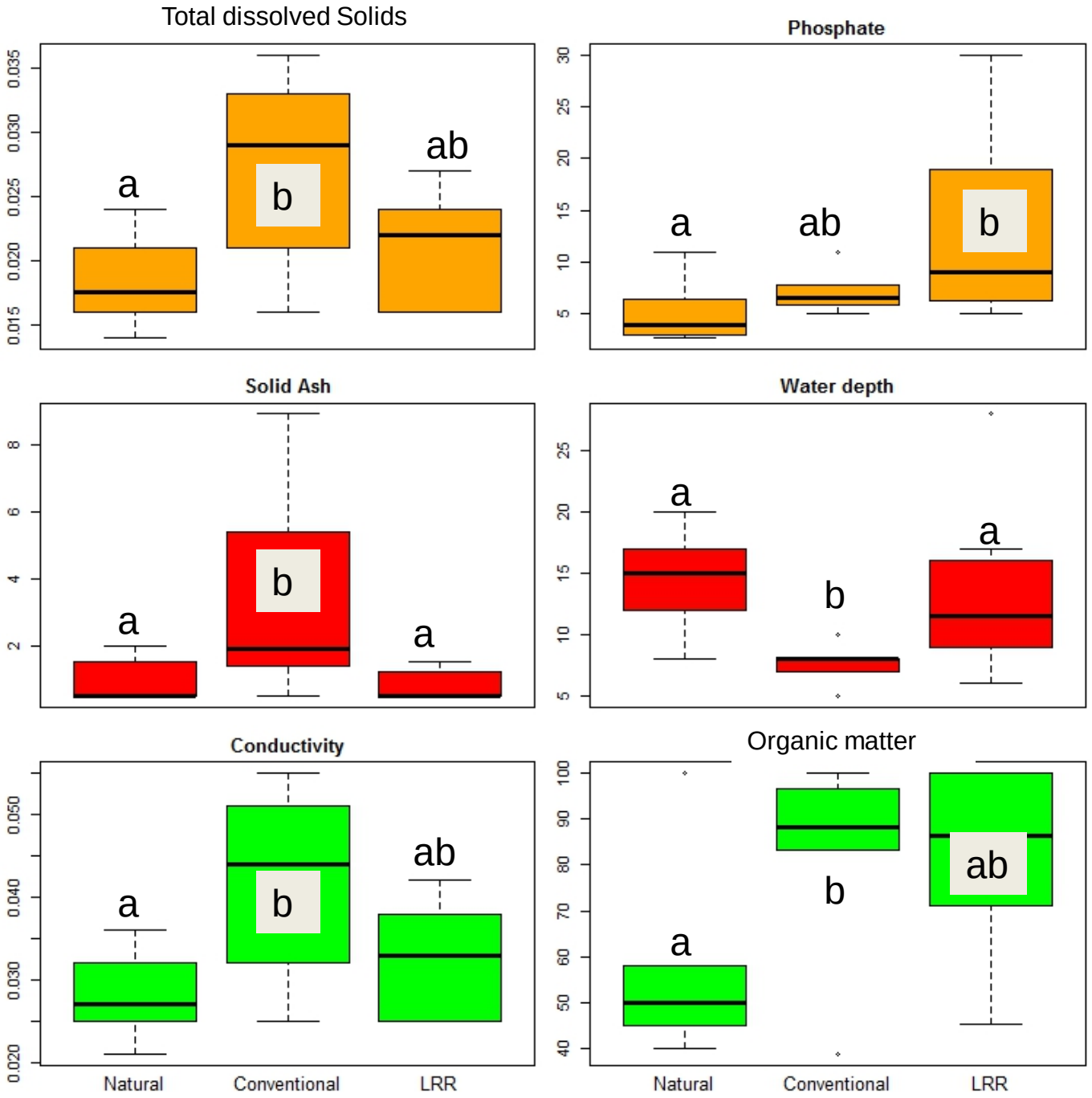
- Specifically, 1) what is difference in biodiversity?
  2) what is difference in environmentals?

Study set-up

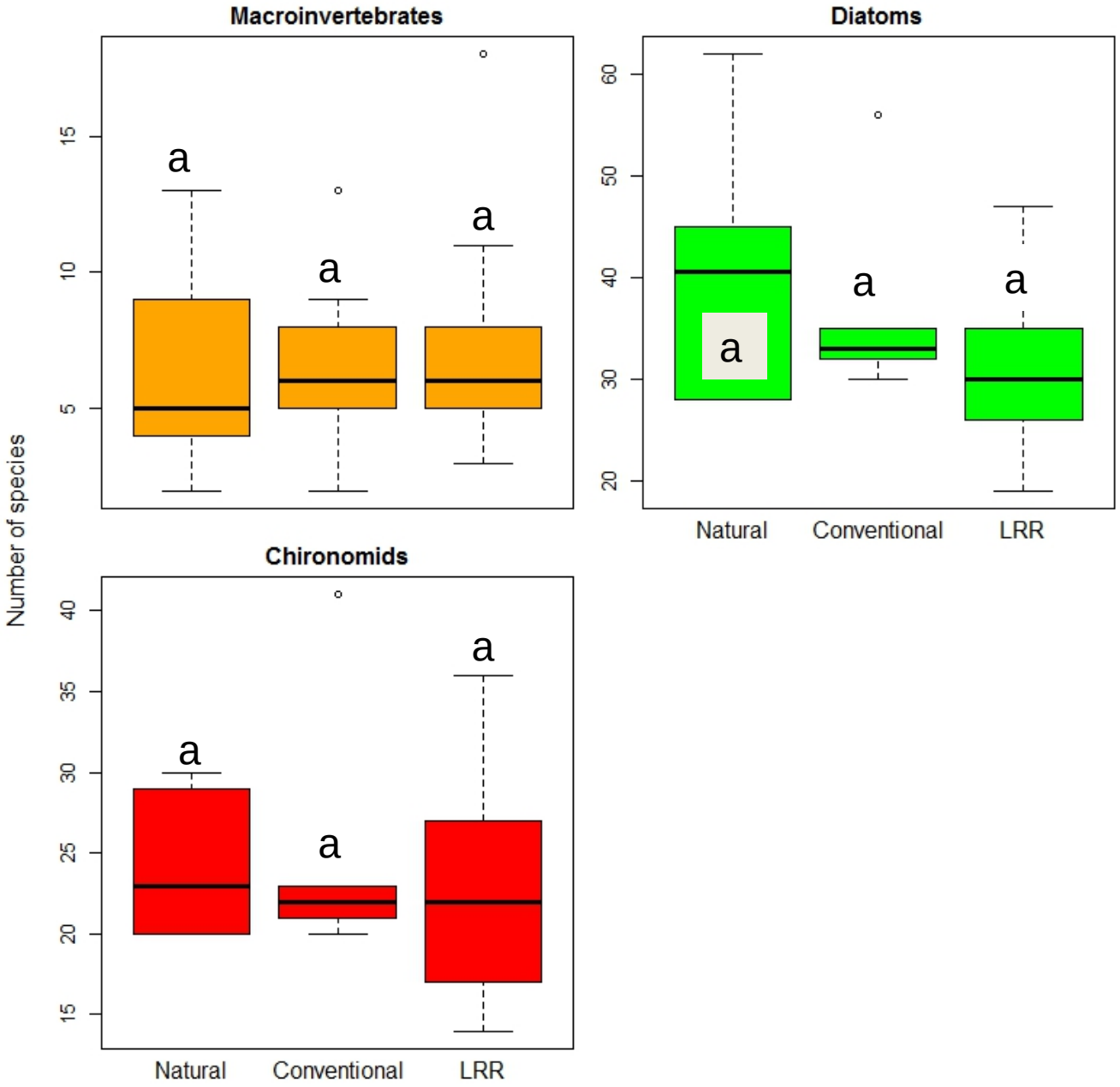
- 1) No LRR, no conventional logging = natural
  2) No LRR, only conventional logging = conventional
  3) LRR present(both stumps & residues) = LRR

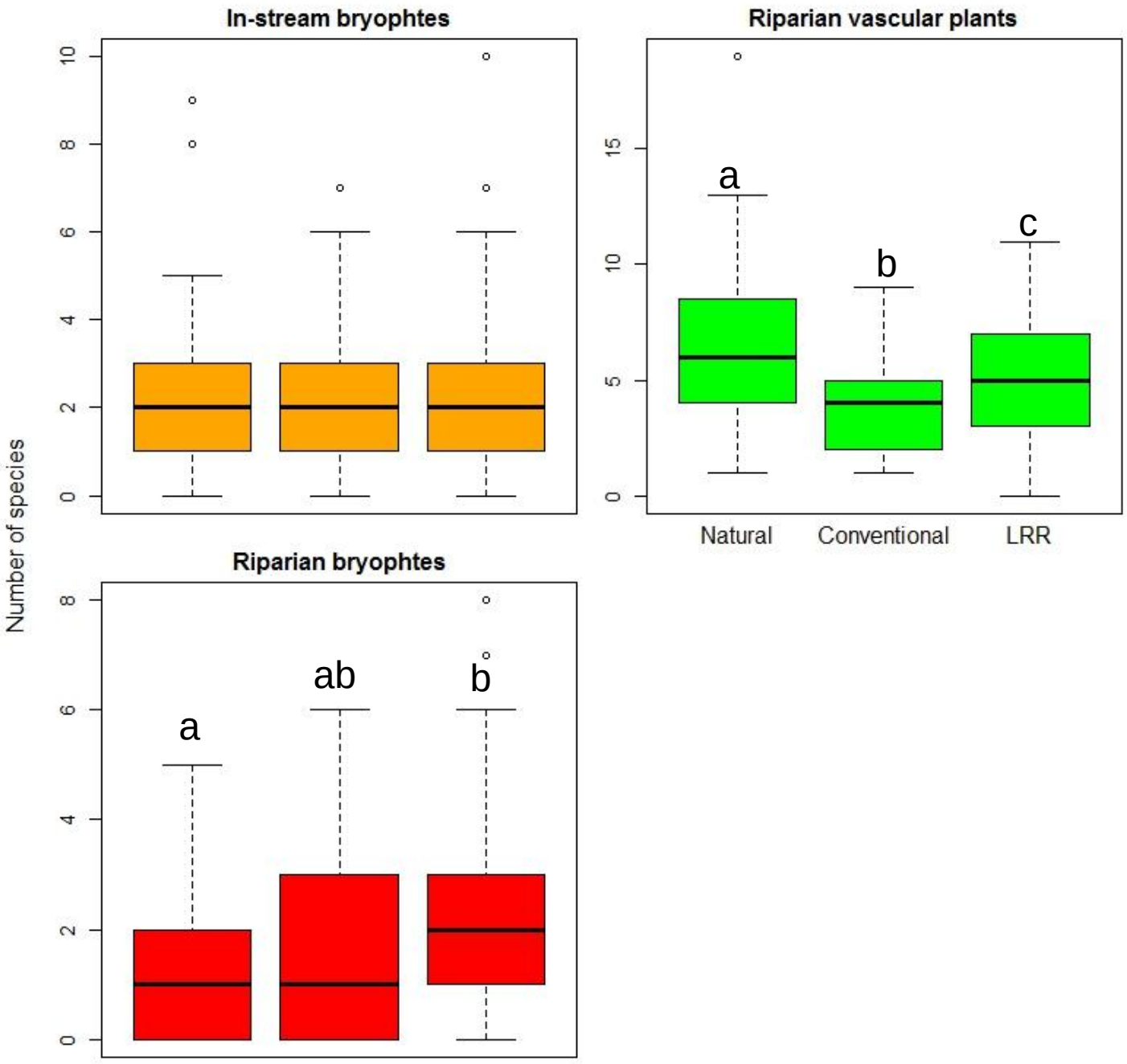
- Each treatment had a minimum of 6 sites.
- Each site was independent (i.e. one treatment in each stream).
- Sampling took place in central Finland, around Jyväskylä.

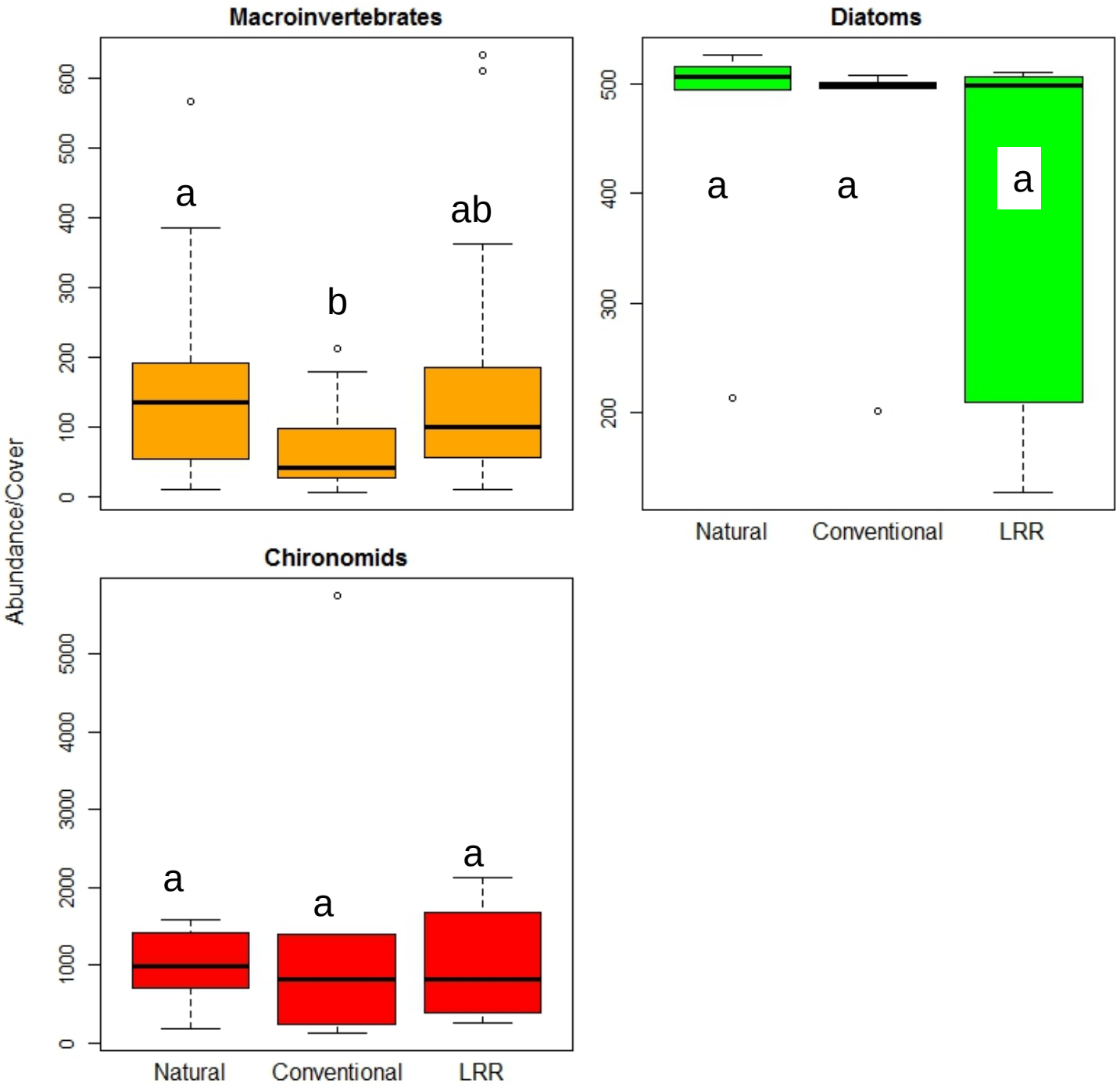
Results: Environmental variables

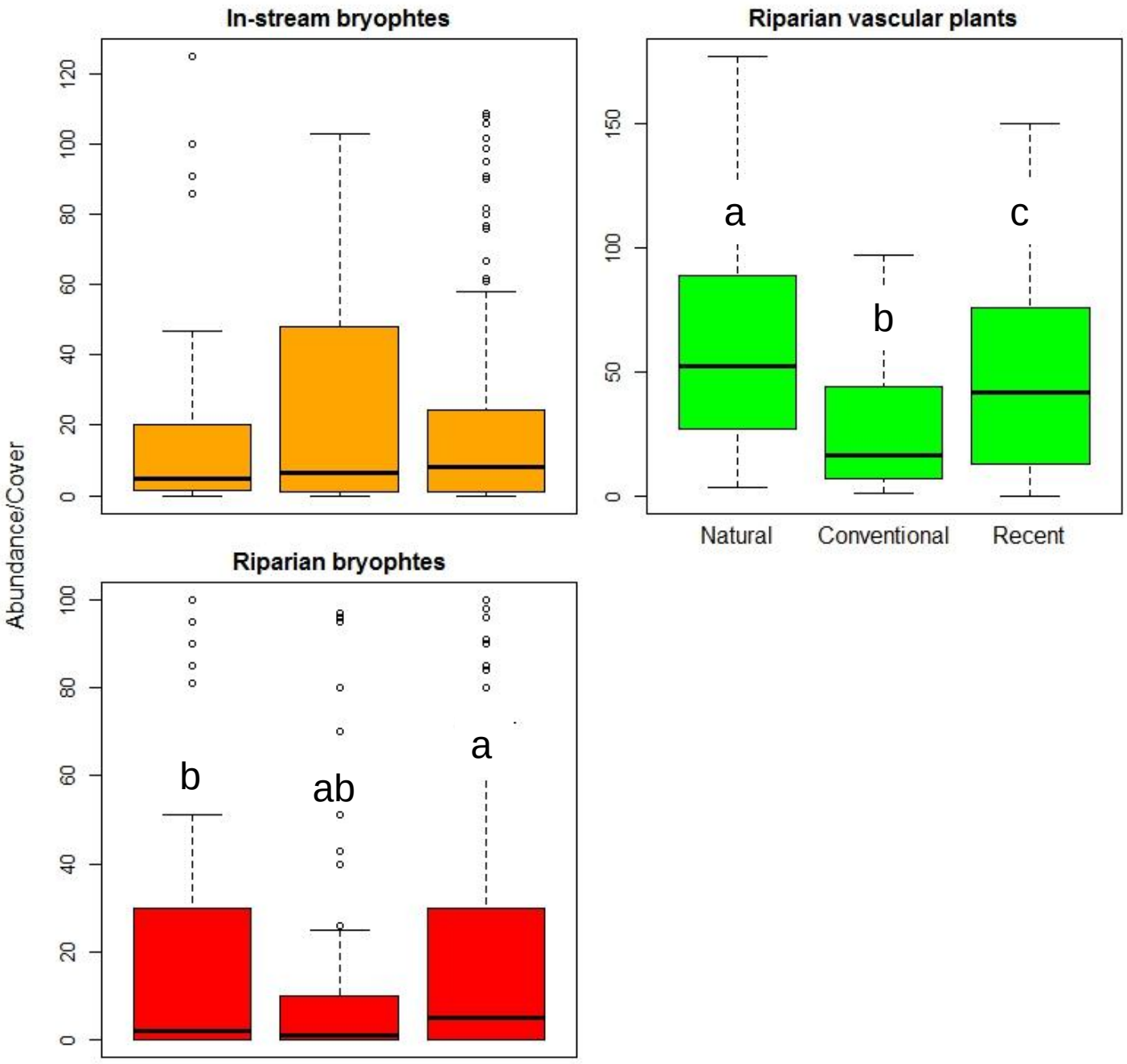

Total dissolved Solids
0.015
0.020
0.025
0.030
0.035
a
b
ab
Phosphate
5
10
15
20
25
30
a
ab
b
Solid Ash
2
4
6
8
a
b
a
Water depth
5
10
15
20
25
a
b
a
Conductivity
0.020
0.030
0.040
0.050
a
b
ab
Organic matter
40
50
60
70
80
90
100
a
b
ab
Natural
Conventional
LRR
Natural
Conventional
LRR

Biotic organisms


Macroinvertebrates
Diatoms
Chironomids
Number of species
a
a
a
a
a
a
a
a
a
5
10
15
20
30
40
50
60
15
20
25
30
35
40
Natural
Conventional
LRR
Natural
Conventional
LRR


In-stream bryophtes
Riparian vascular plants
Riparian bryophtes
Number of species
0
2
4
6
8
10
0
5
10
15
a
b
c
a
ab
b
Natural
Conventional
LRR


Macroinvertebrates
Diatoms
Chironomids
Abundance/Cover
0
100
200
300
400
500
600
200
300
400
500
0
1000
2000
3000
4000
5000
a
b
ab
a
a
a
a
a
a
Natural
Conventional
LRR
Natural
Conventional
LRR


In-stream bryophtes
Riparian vascular plants
Riparian bryophtes
Abundance/Cover
0
20
40
60
80
100
120
0
50
100
150
a
b
c
b
ab
a
Natural
Conventional
Recent

Conclusions

- Conventional logging tends to differ with natural, while LRR is not.
- This pattern appears with both environmental variables (TDS, cond & OM) and biotic organisms (MI).
- Vascular plants showed the strongest response, while diatoms, chironomids & in-stream bryophytes the least.
- R. bryo. LRR had higher diversity than natural, while Conventional was not.

Acknowledgements

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