Fire history from lacustrine charcoal analyses :

charcoal area or charcoal count?

Presented by Cécile Remy (PhD)
to Wildland Fire Canada 2014, October 7, Halifax

Other authors: Benjamin Andrieux, Christelle Hély, Yves Bergeron, Martin P. Girardin, Pierre Grondin, Martin Lavoie, Adam A. Ali.

Context

Climate

Global Warming

Photo: Cécile Remy

Fires

Adapted from Canadian Forest Service

Vegetation

Context

Climate

Global Warming

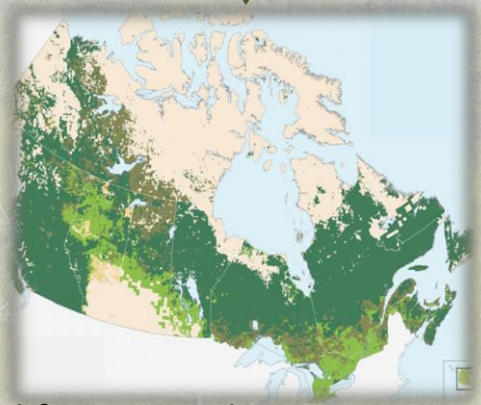
Understanding these interactions in the past

=

paleoecology

Photo: Cécile Remy

Fires



Adapted from Canadian Forest Service

Vegetation

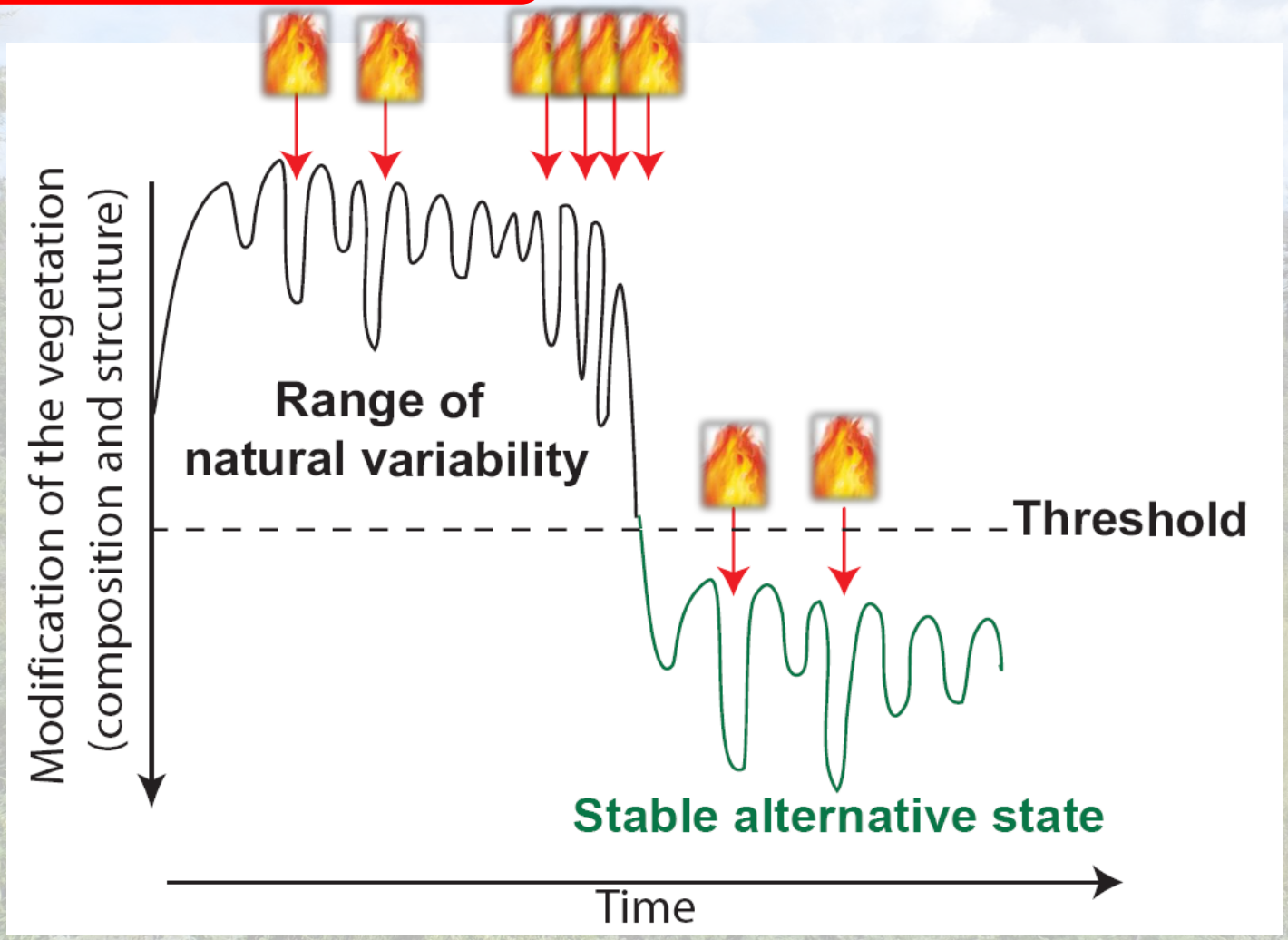
Fire reconstructions

Charcoals count

Charcoals area

Fire reconstructions

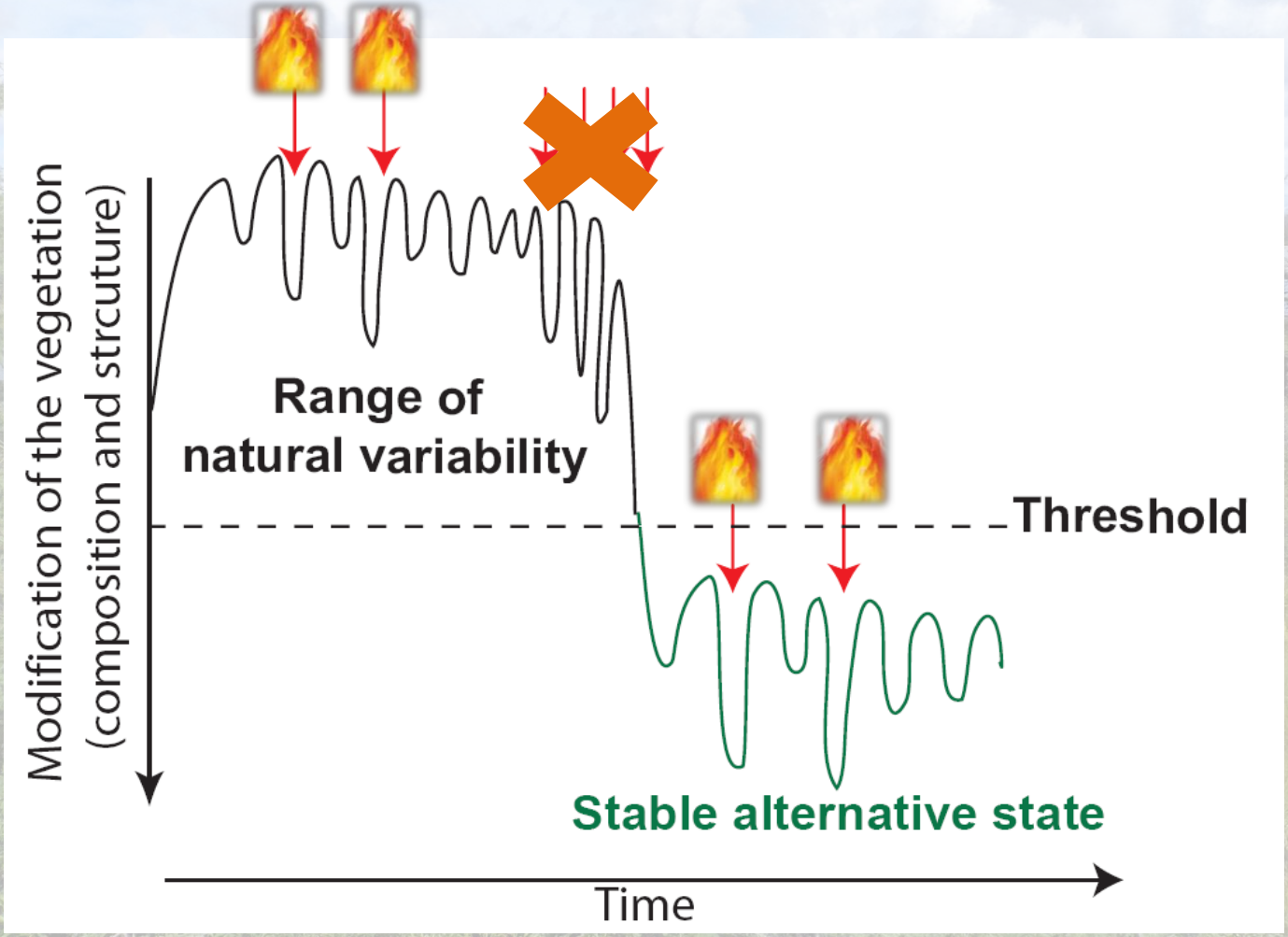
Charcoals count



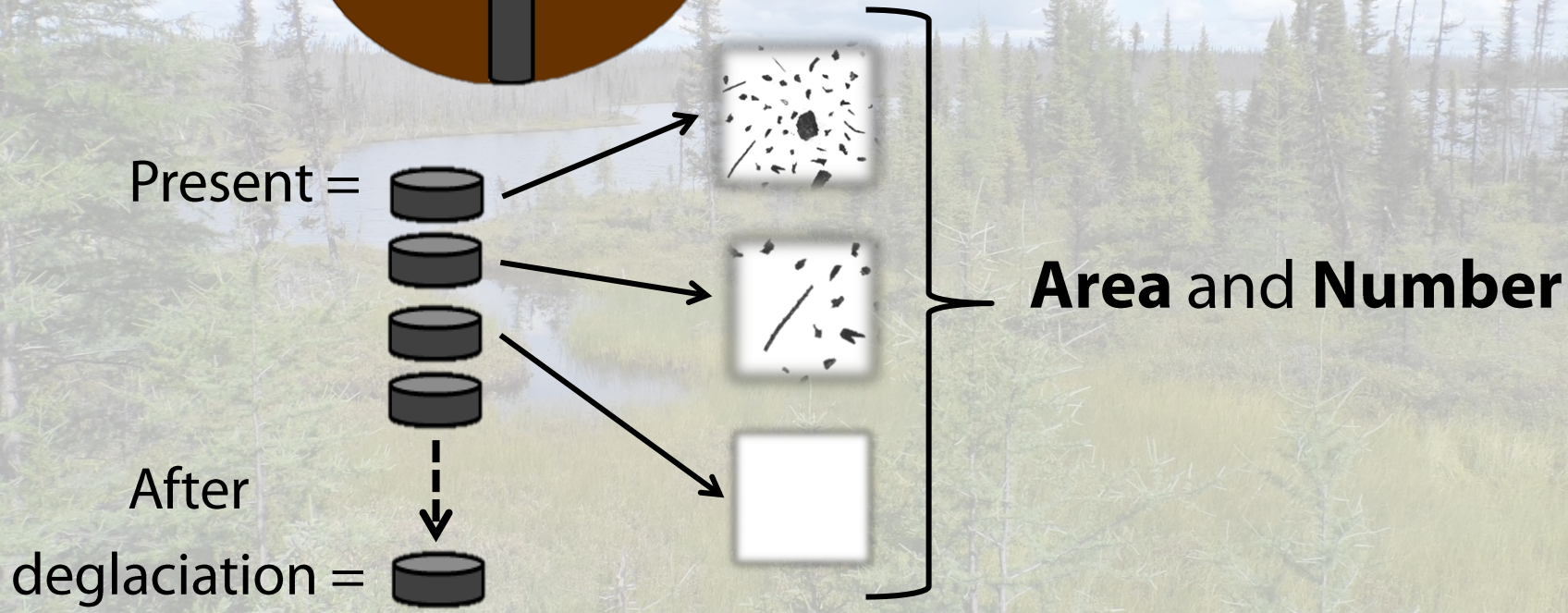
Fire reconstructions

Charcoals count

Charcoals area



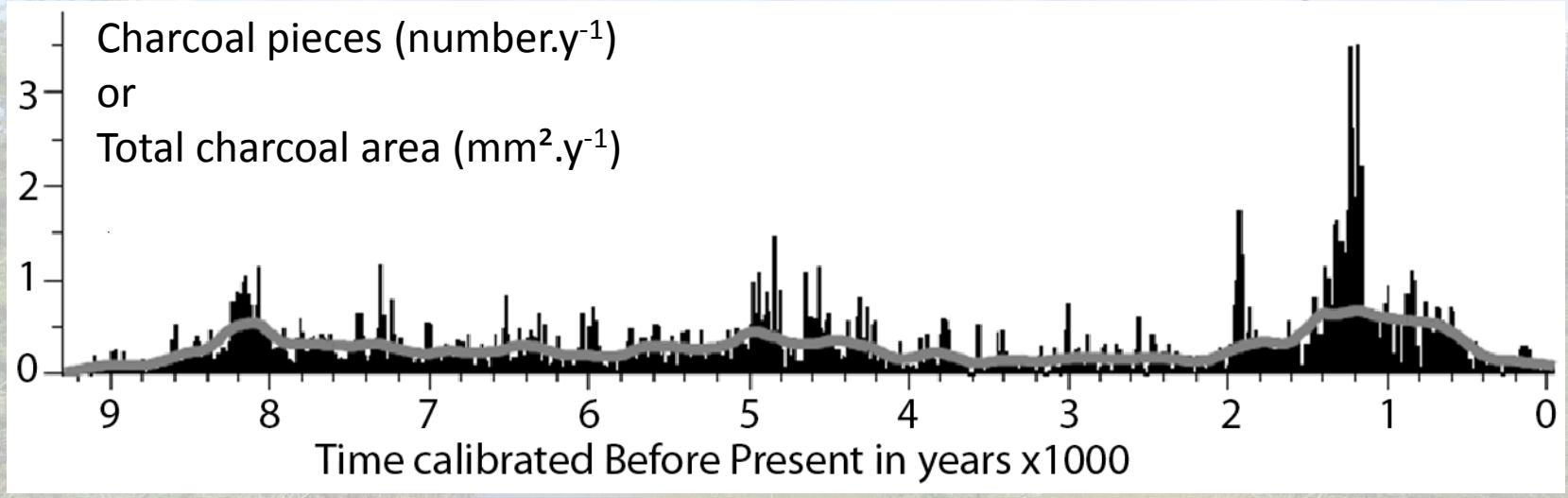
Method



(*Clark J.S. 1988 in Quaternary Research*)

Charcoal peaks

Selecting local fires events (charcoal peaks)



(*Clark J.S. 1988 in Quaternary Research* ,
Carcaillet C. et al. 2001 in The Holocene,
Higuera P.E. et al. 2007 in Quaternary Science Reviews)

Peaks of total charcoal area

Area

x_1 x_2 1 fire event

x_1 x_2 1 fire event

- **1 charcoal ≠ 1 fire event**

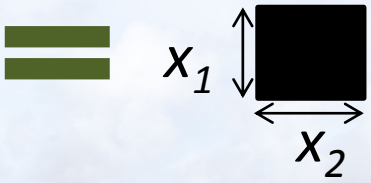
Peaks of charcoal number

Number

1 fire event

0 fire event

Area



1 fire event

1 fire event

- **Fragmentation**
- **Regional contribution**

- **1 charcoal ≠ 1 fire event**

(Oris F. et al. in press in Geophysical Research Letters,
Asselin H. and Payette S. 2005 in Review of Palaeobotany and Palynology,
Patterson III W. A. et al.1987 in Quaternary Science Reviews,
Lynch J. A. et al. 2004 in Can. J. For. Res.)

Area *versus* Number

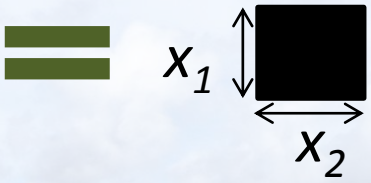
Number

1 fire event

0 fire event

- **Fragmentation**
- **Regional contribution**

Area



1 fire event

1 fire event

- **1 charcoal ≠ 1 fire event**
-

Should we use:

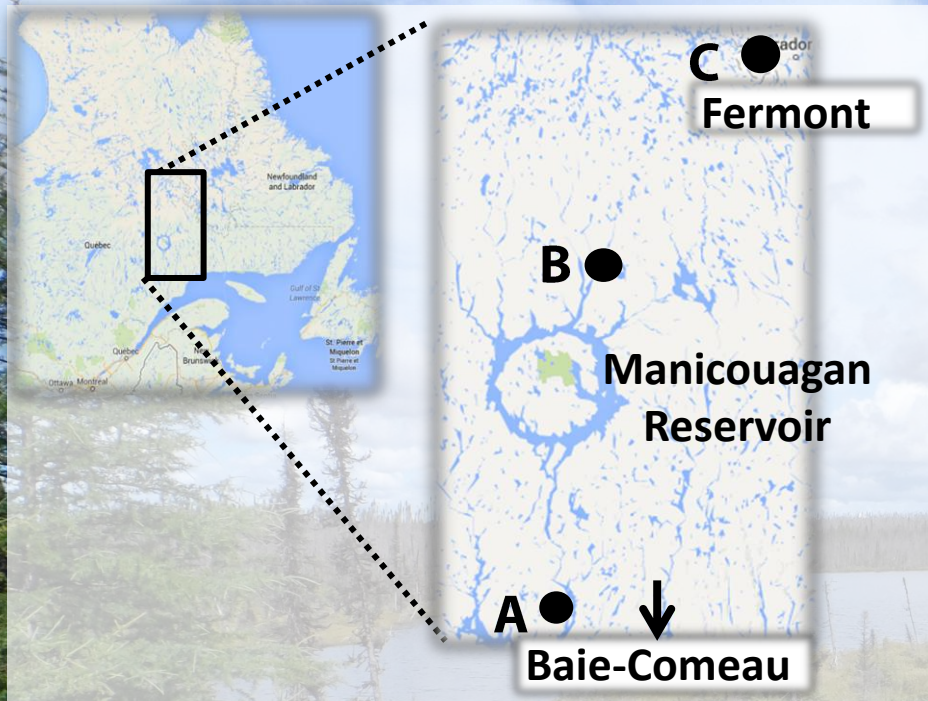
Area or Number?

Area *versus* Number

"Comparisons between records using these charcoal quantification methods can be done without misleading interpretations related to methodology."

(*Ali A.A. et al. 2009 in Quaternary Research*)

Fire reconstructions



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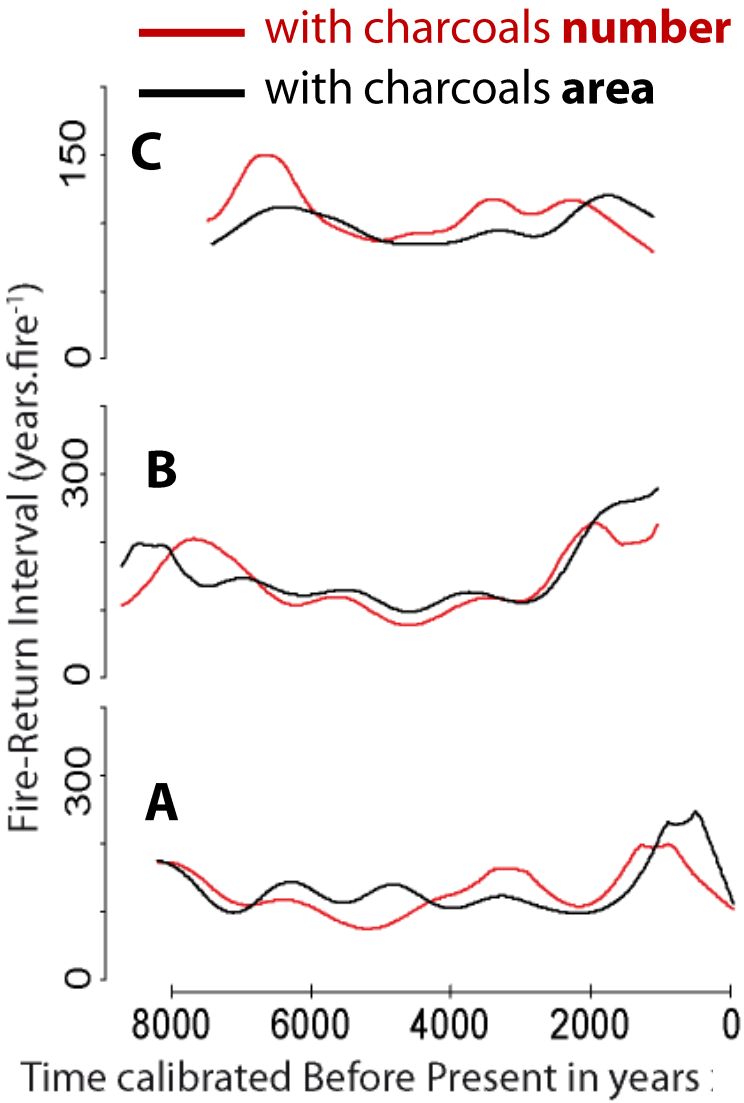

(*Higuera P.E. et al. 2007 in Quaternary Science Reviews*)

Recent Improvements

With charcoal number:

Gavin D.G. et al. 2006 in Ecology, Higuera P.E. et al. 2011 in Int. J. Wildland Fire

Method to select independent fire events

(charcoal peaks not included in another one)

Recent Improvements

Two possibilities of fire history reconstructions:

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With charcoal area:

Finsinger W. et al. 2014 in The Holocene

Method to select fire events statistically the most robust

(charcoal peaks with total area significantly greater than expected by chance)

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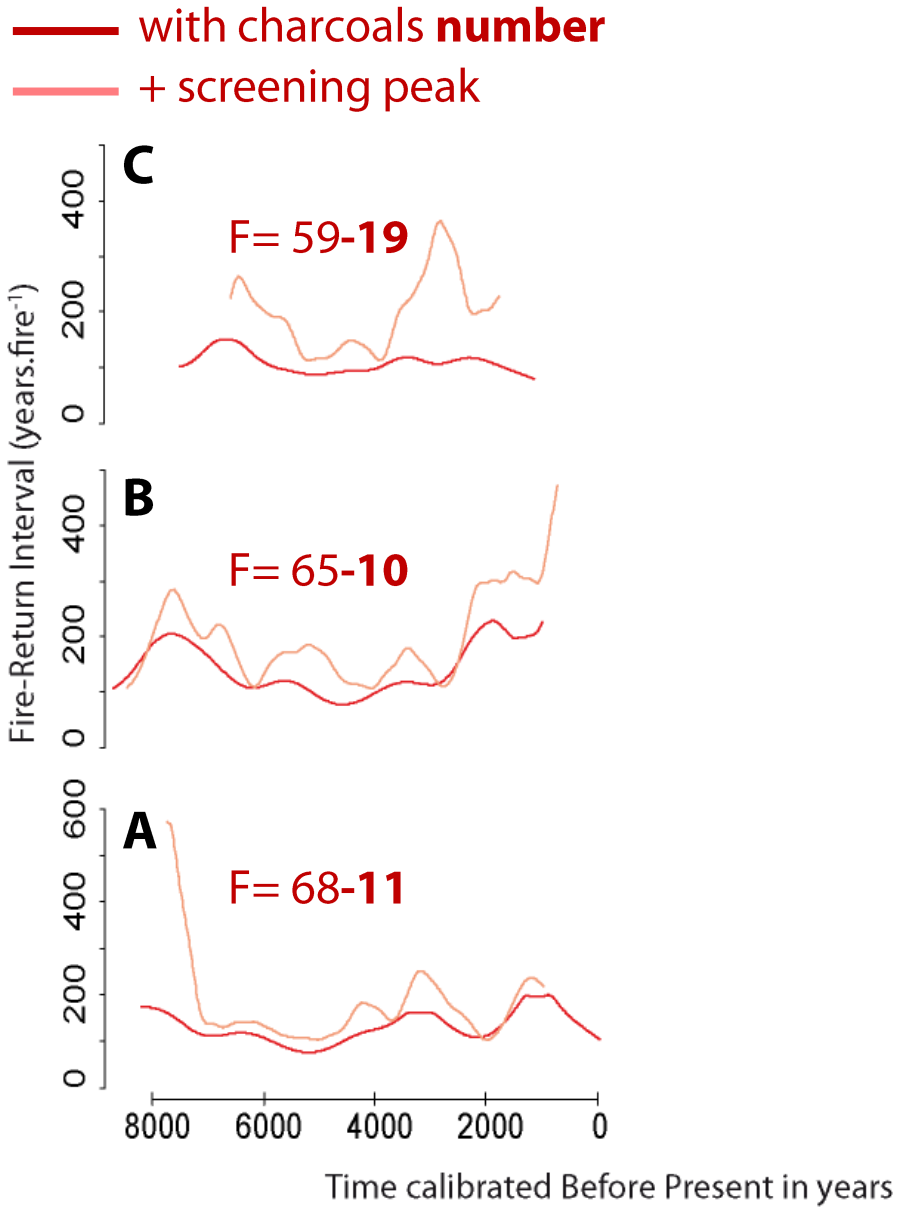
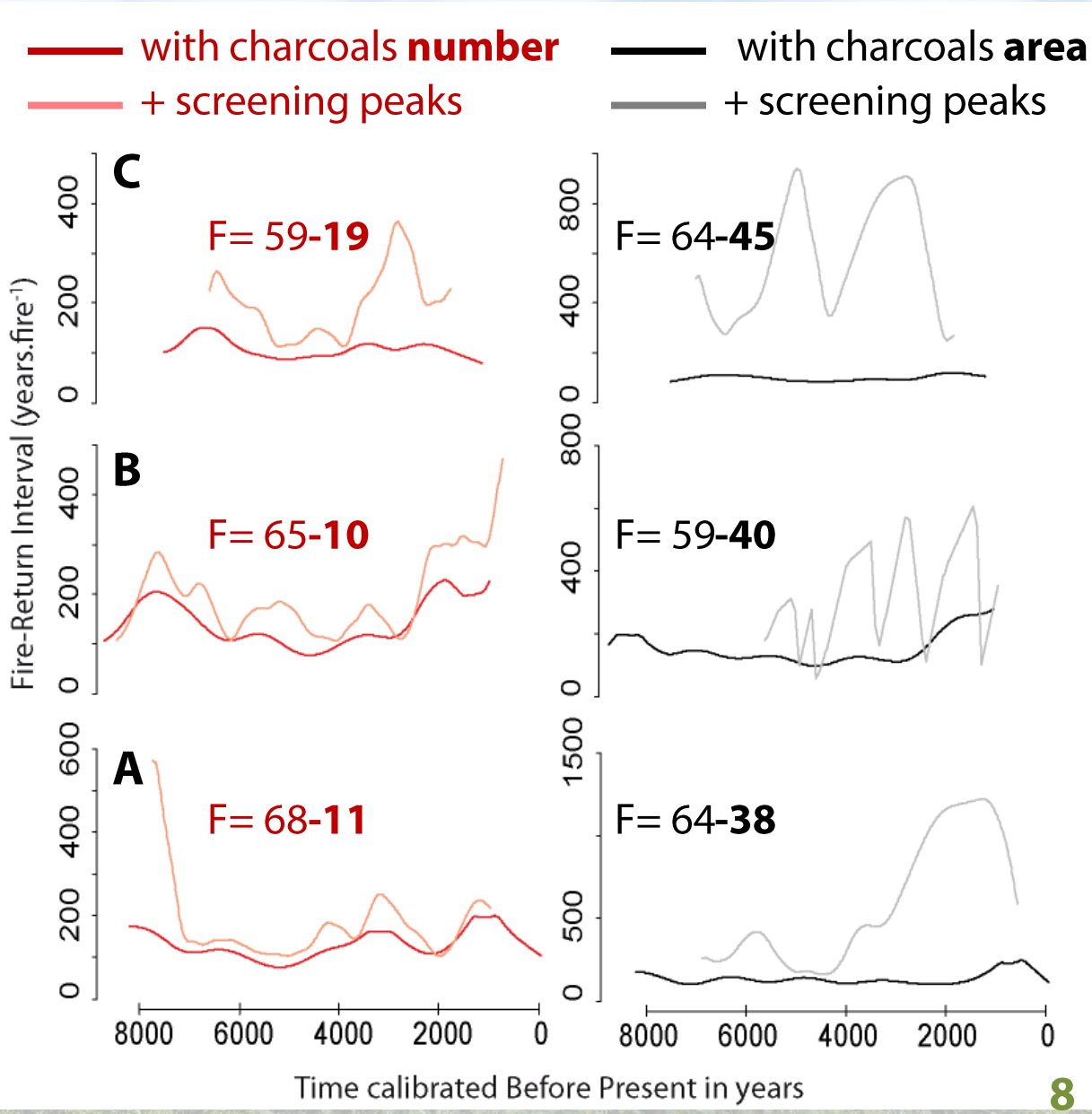
Should we use: Area or Number?

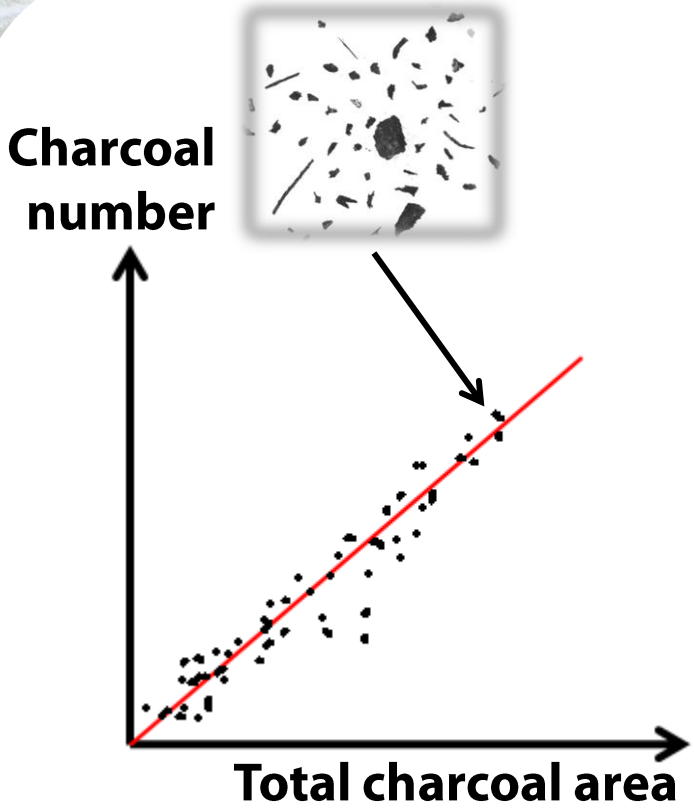
Screening peaks

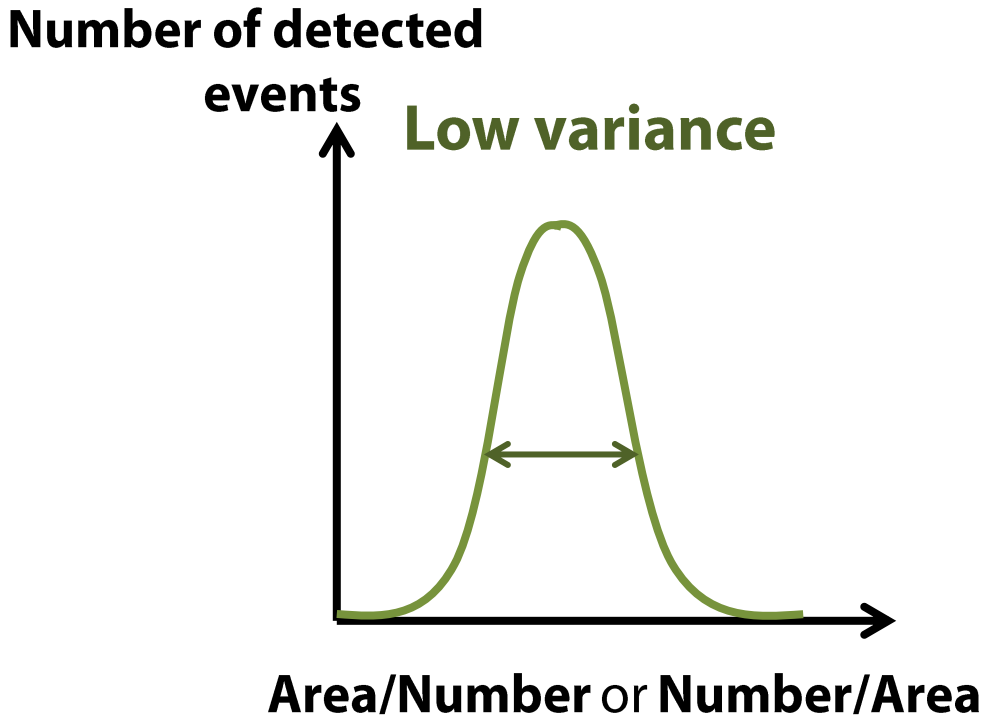


Screening peaks



Charcoals assemblages in peaks





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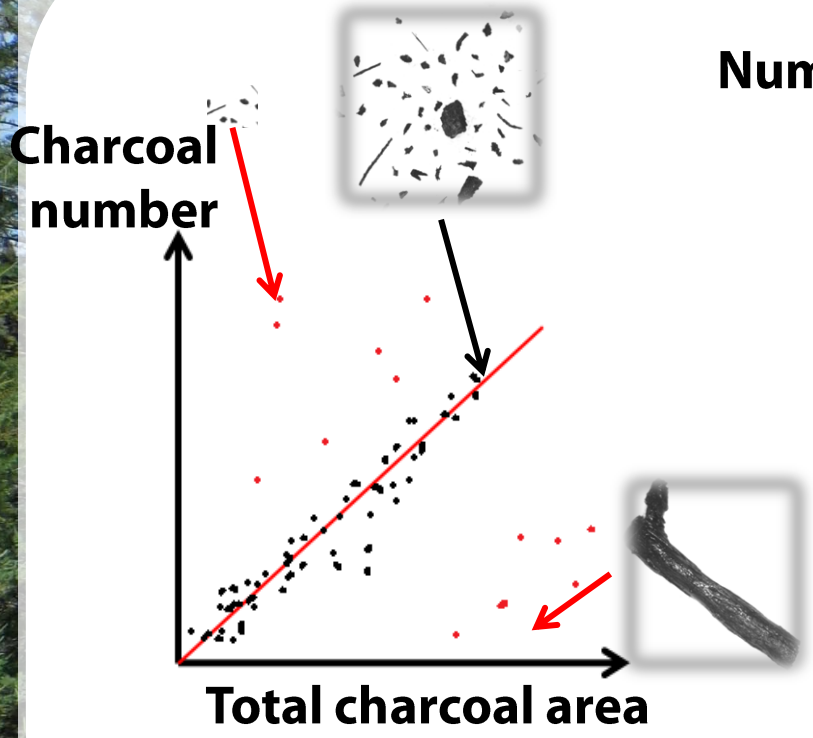

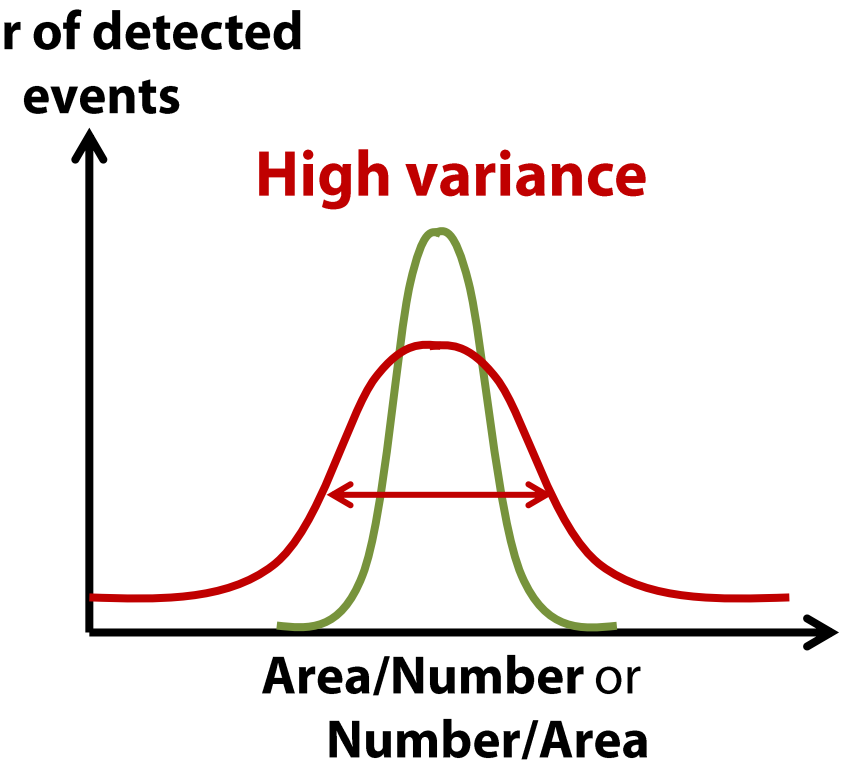

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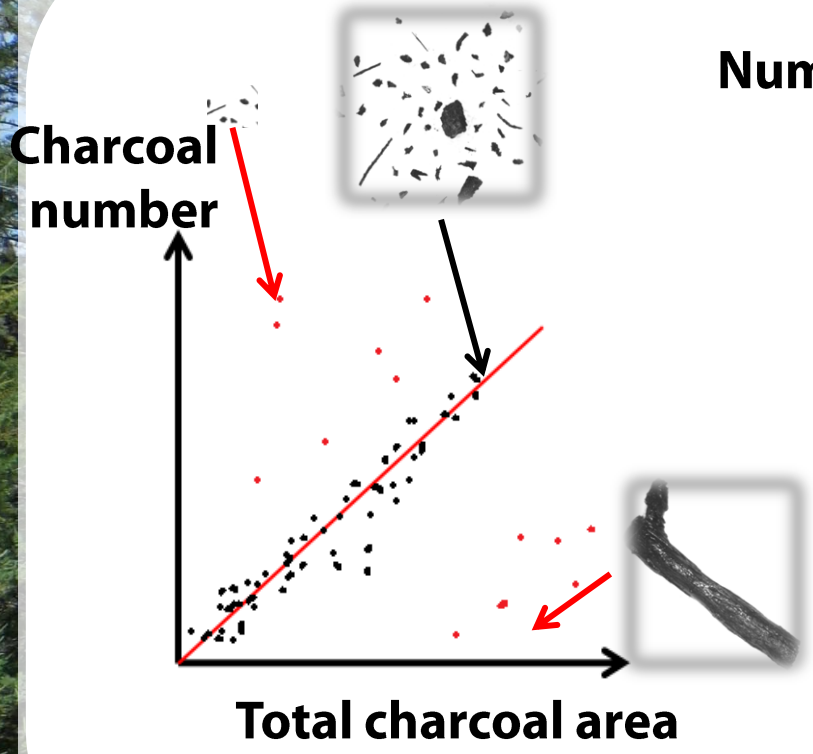
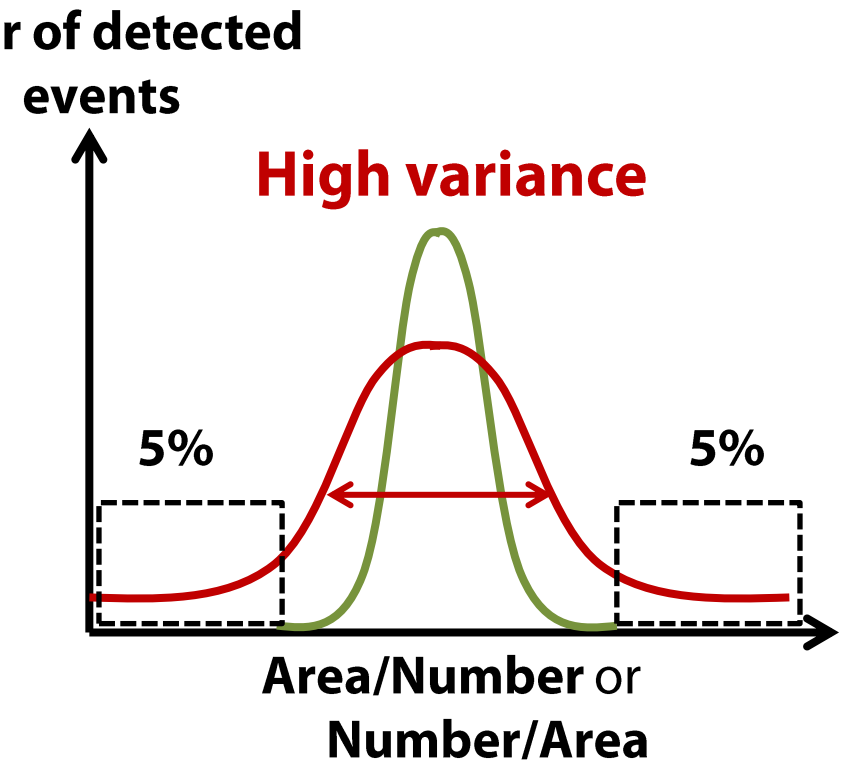
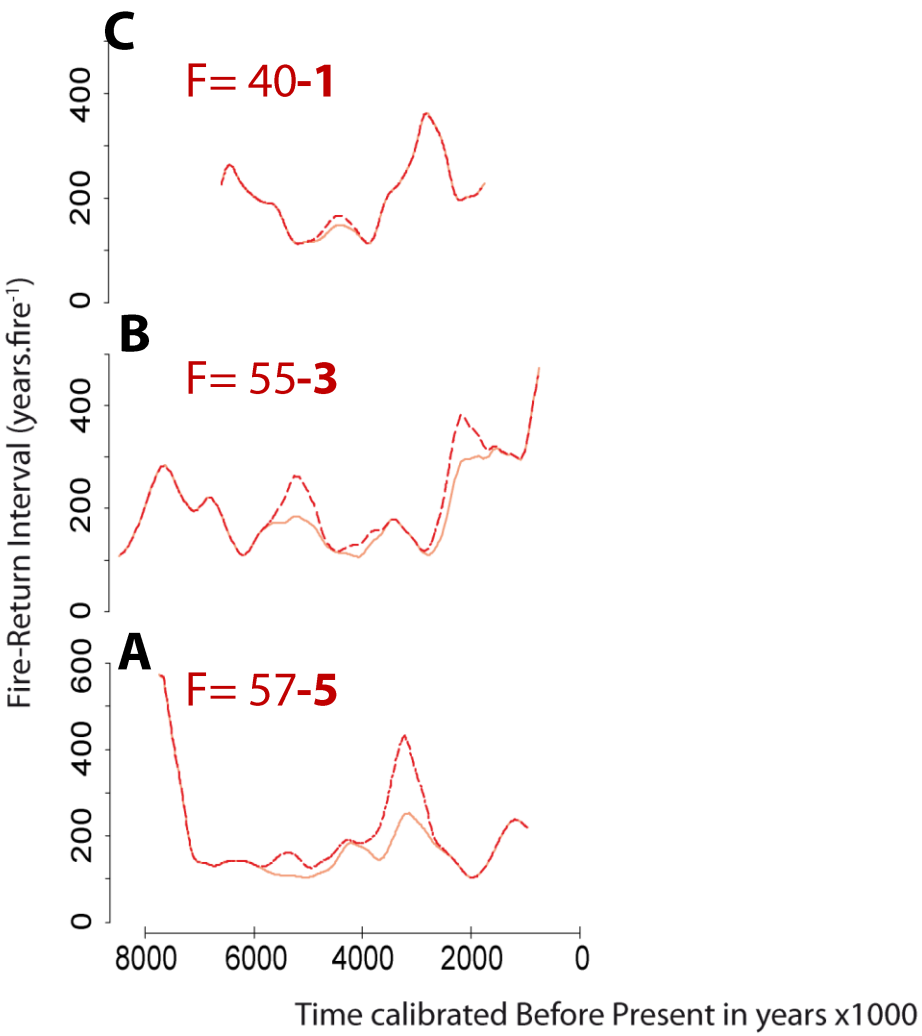




Final reconstructions

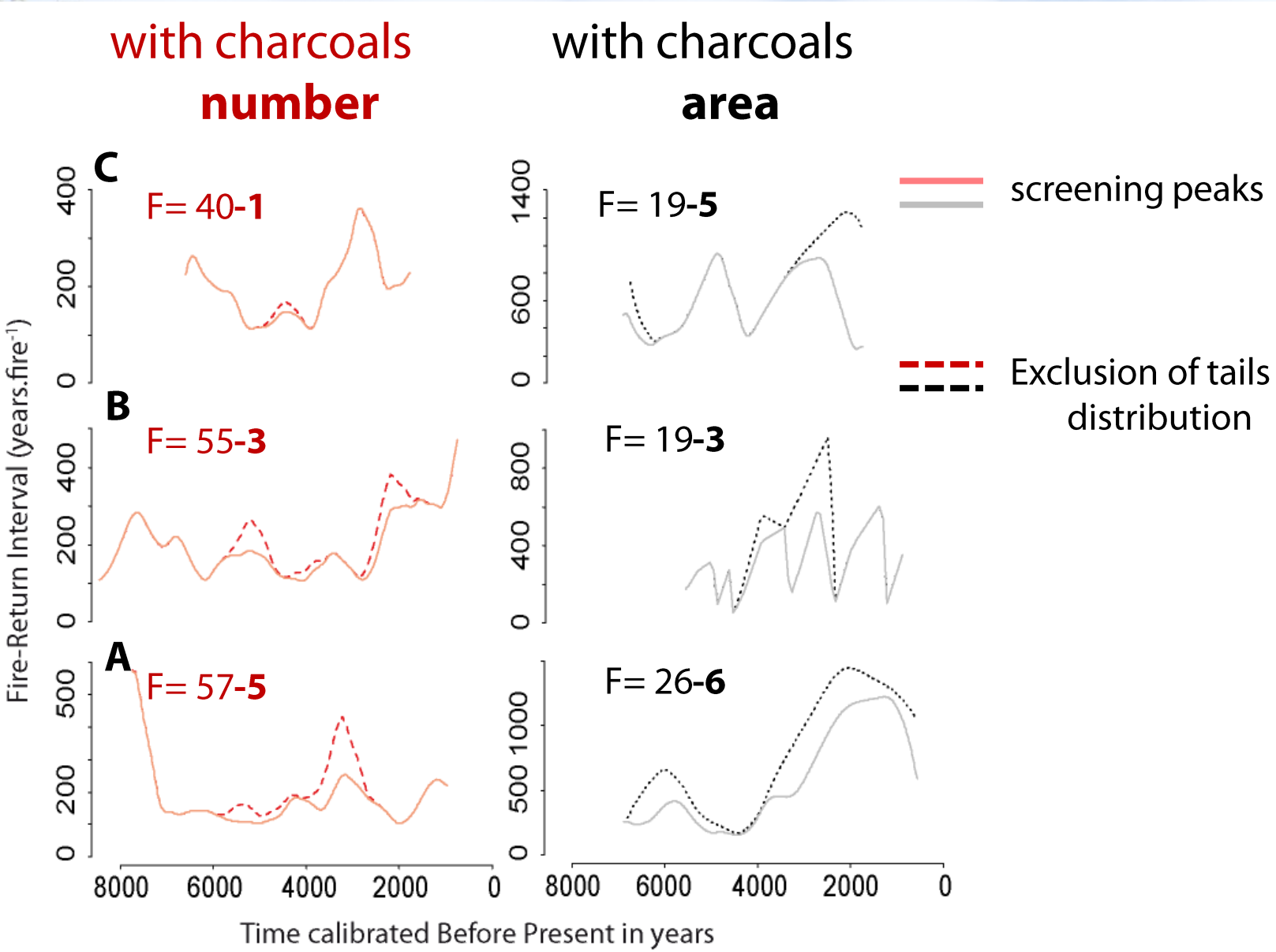
with charcoals
number



screening peaks

Exclusion of tails distribution

Final reconstructions



Conclusion

Step 1: detected peaks of charocal number or total charcoal area

Step 2: Screened peaks

on charcoal number analyses

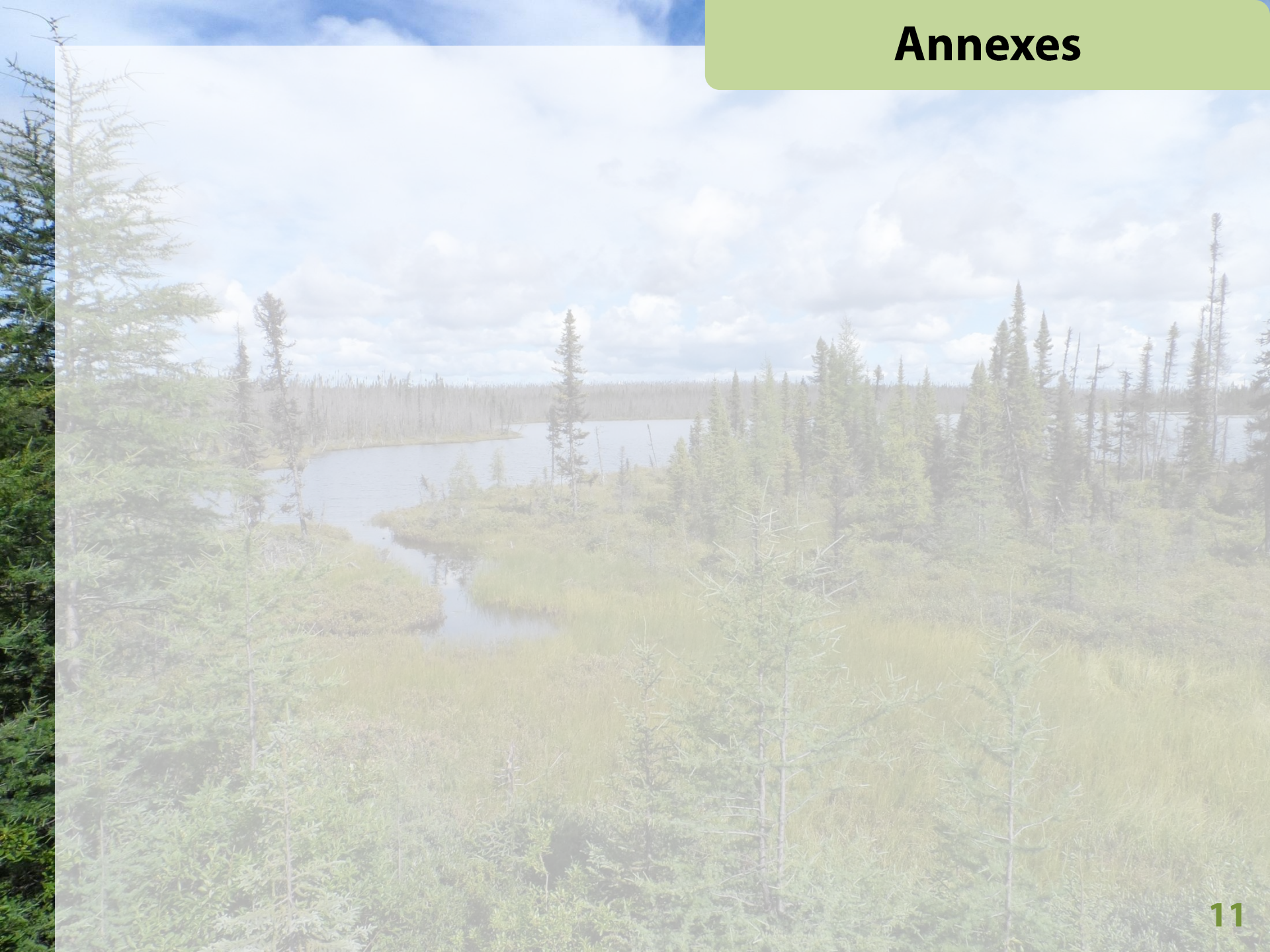
~~on total charcoal area analyses~~

Step 3: Refining by deletion of tails of distribution

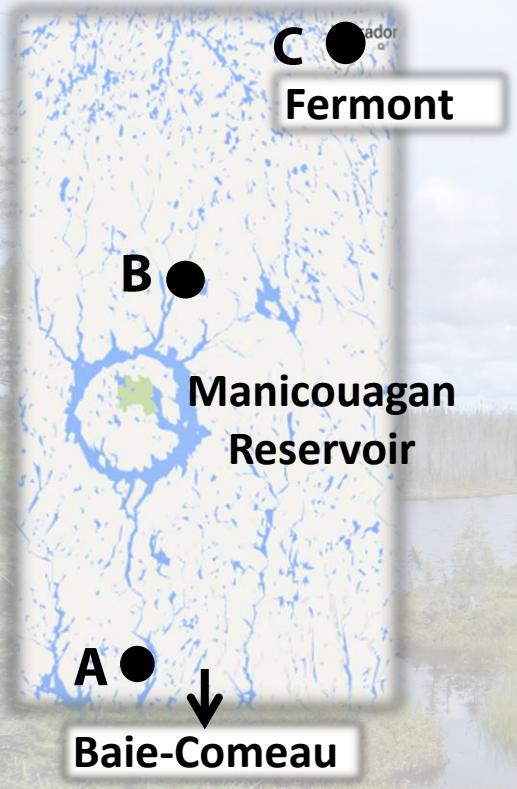
Perspectives: Developed fire reconstructions method with charcoal number analyses

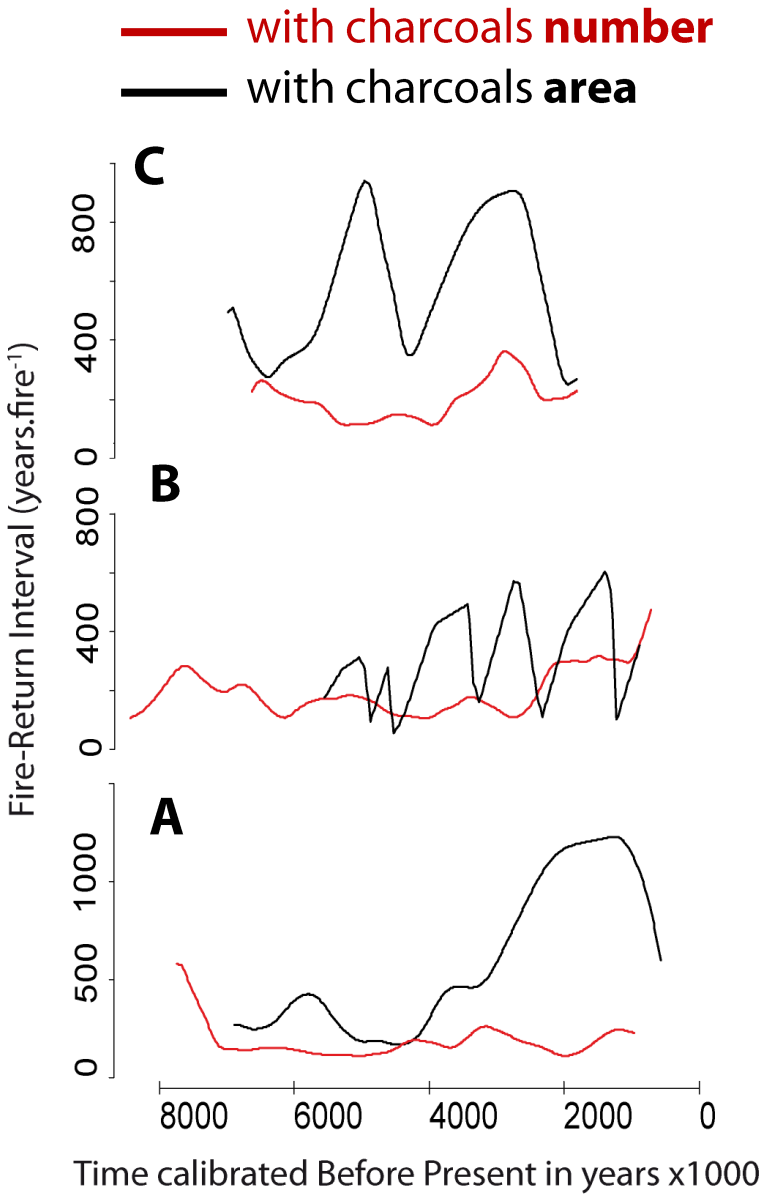

Thank you for your attention

Annexes



Tests of two methods





Charcoal distribution in peaks

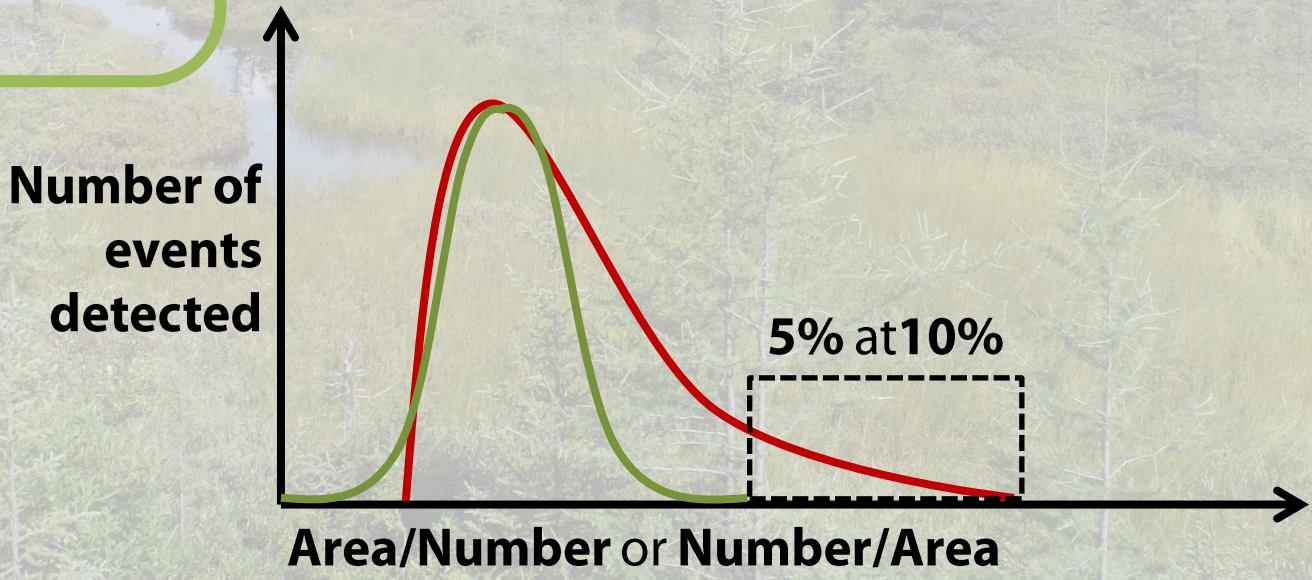
Refining the selection of events fires

Low variance

Area/Number

Number/Area

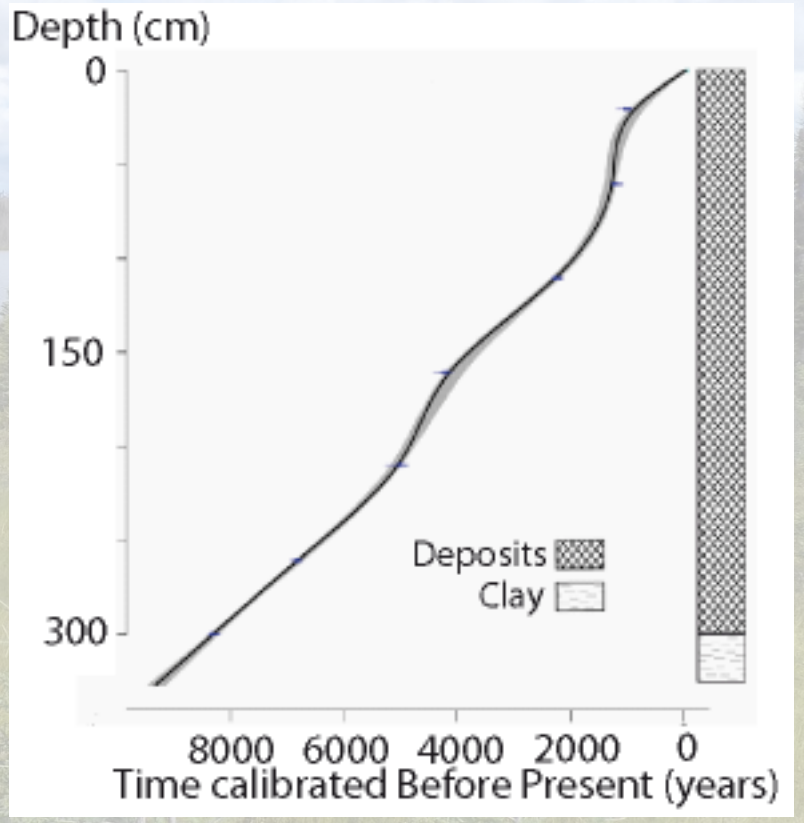
Weibull distribution



Method

Present =

After deglaciation =



Age-depth model