Saved up for a rainy day?
How bomb-radiocarbon can tell us when trees use reserve C

Jan Muhr

(Biogeochemical Processes, MPI-BGC Jena)

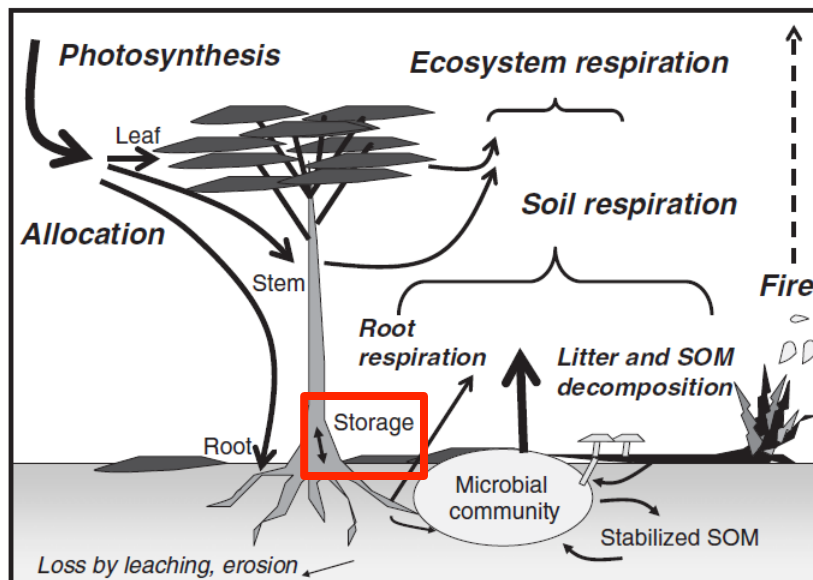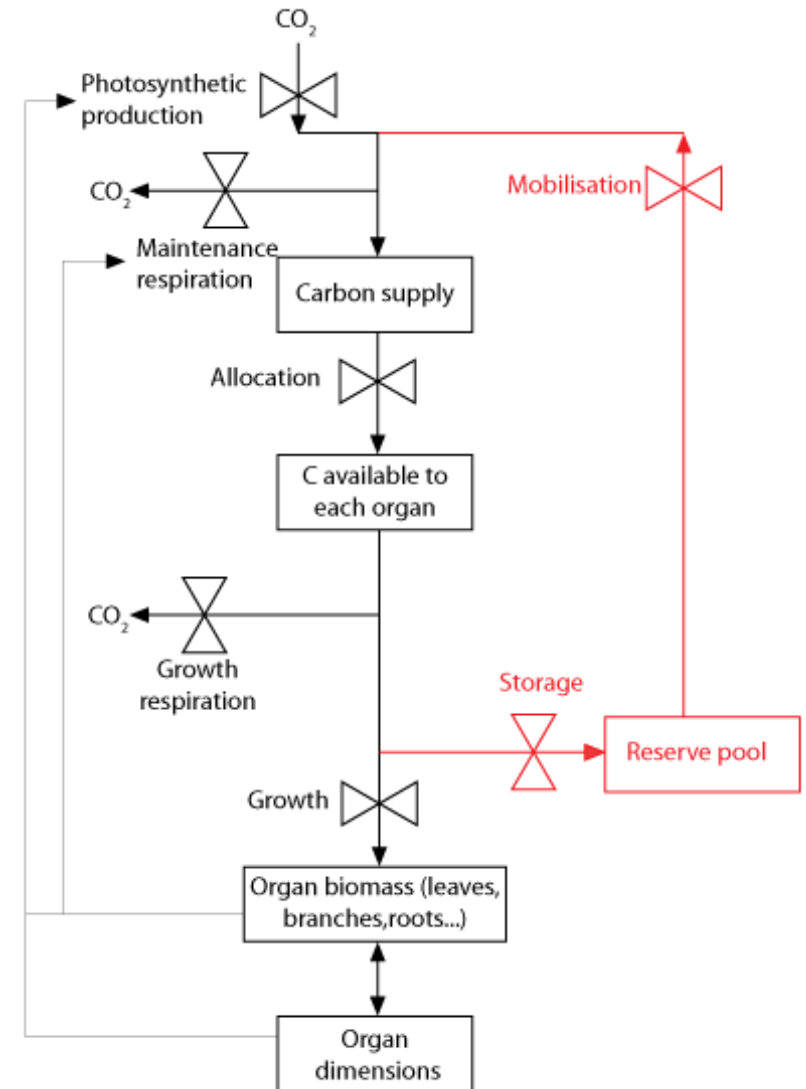Max-Planck-Institut
für Biogeochemie

MAX-PLANCK-GESELLSCHAFT

Radiocarbon in the Earth System , September 26 2017
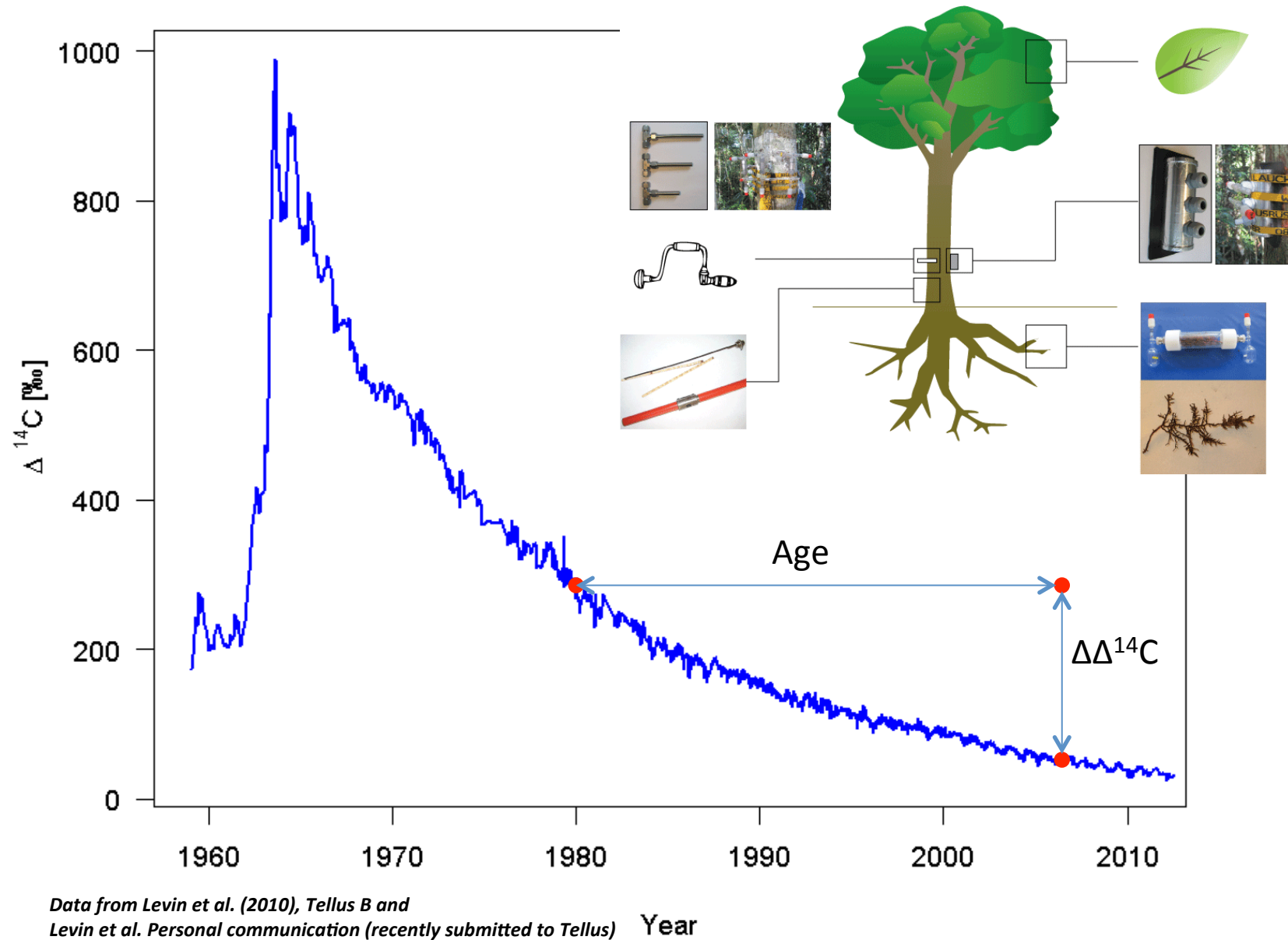
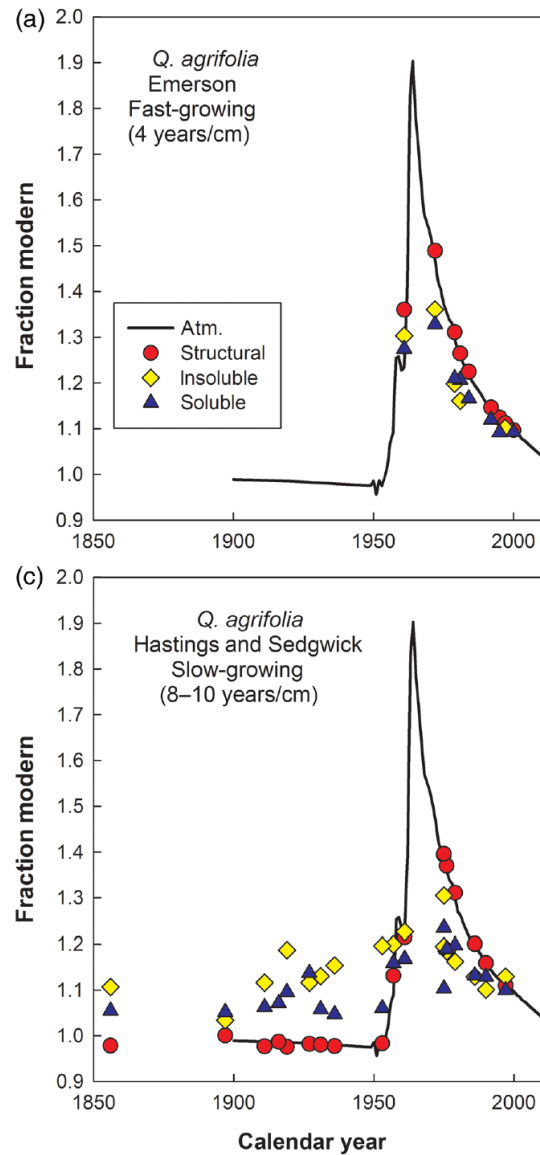# Storage C pools in trees – stress buffer function?

Trumbore 2006
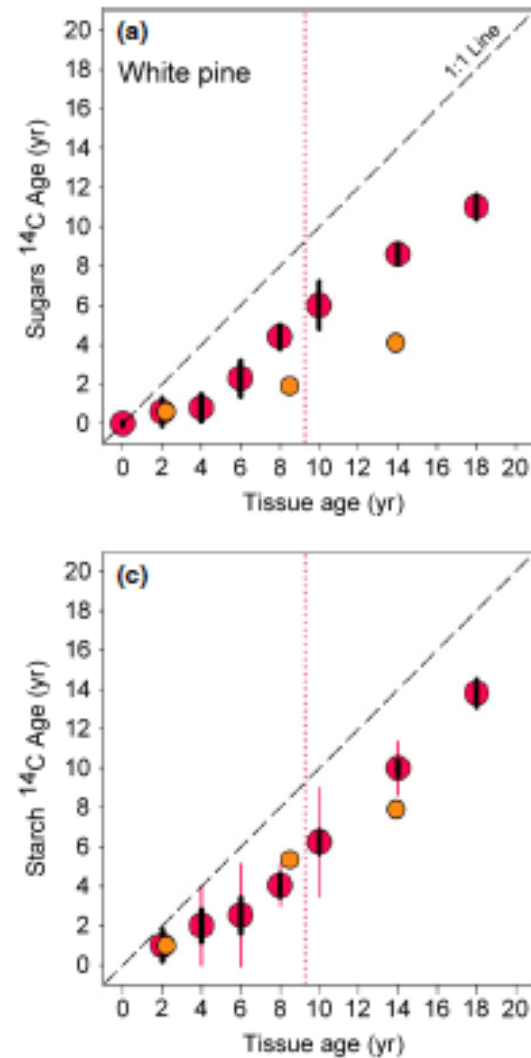
Redrawn from Le Roux et al. 2001, Ann. Forest Sci.

Using the bomb-spike for estimating the age of C

Data from Levin et al. (2010), Tellus B and
Levin et al. Personal communication (recently submitted to Tellus)
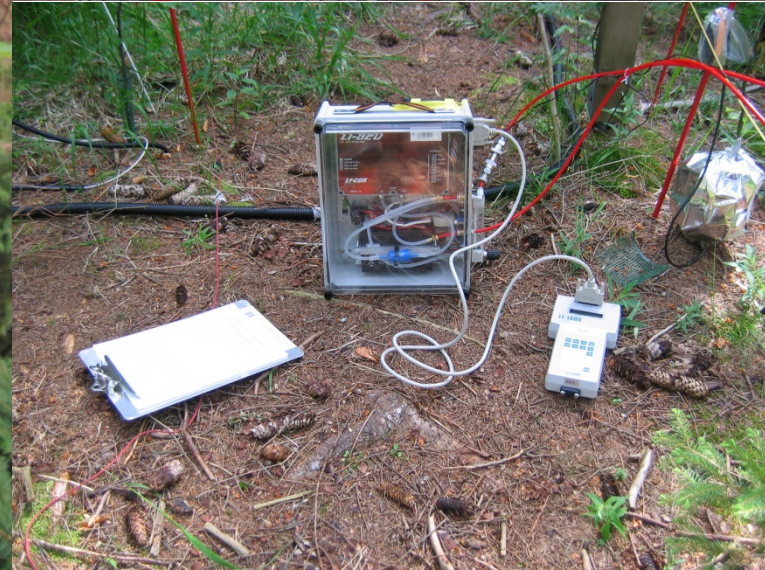
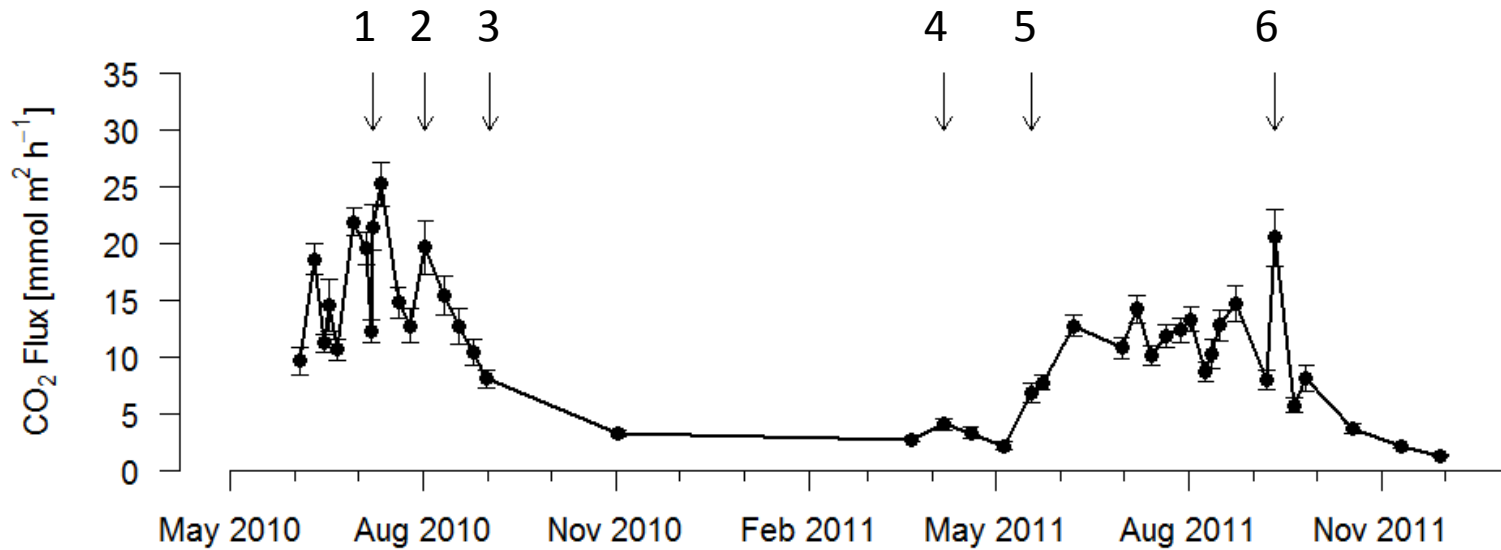# Old NSC in tree stems

Trumbore et al., 2015, Tree Physiology

Richardson et al., 2015, New Phytologist

Stem CO$_2$ emissions from Norway spruce

Stem CO_2 emissions from Norway spruce

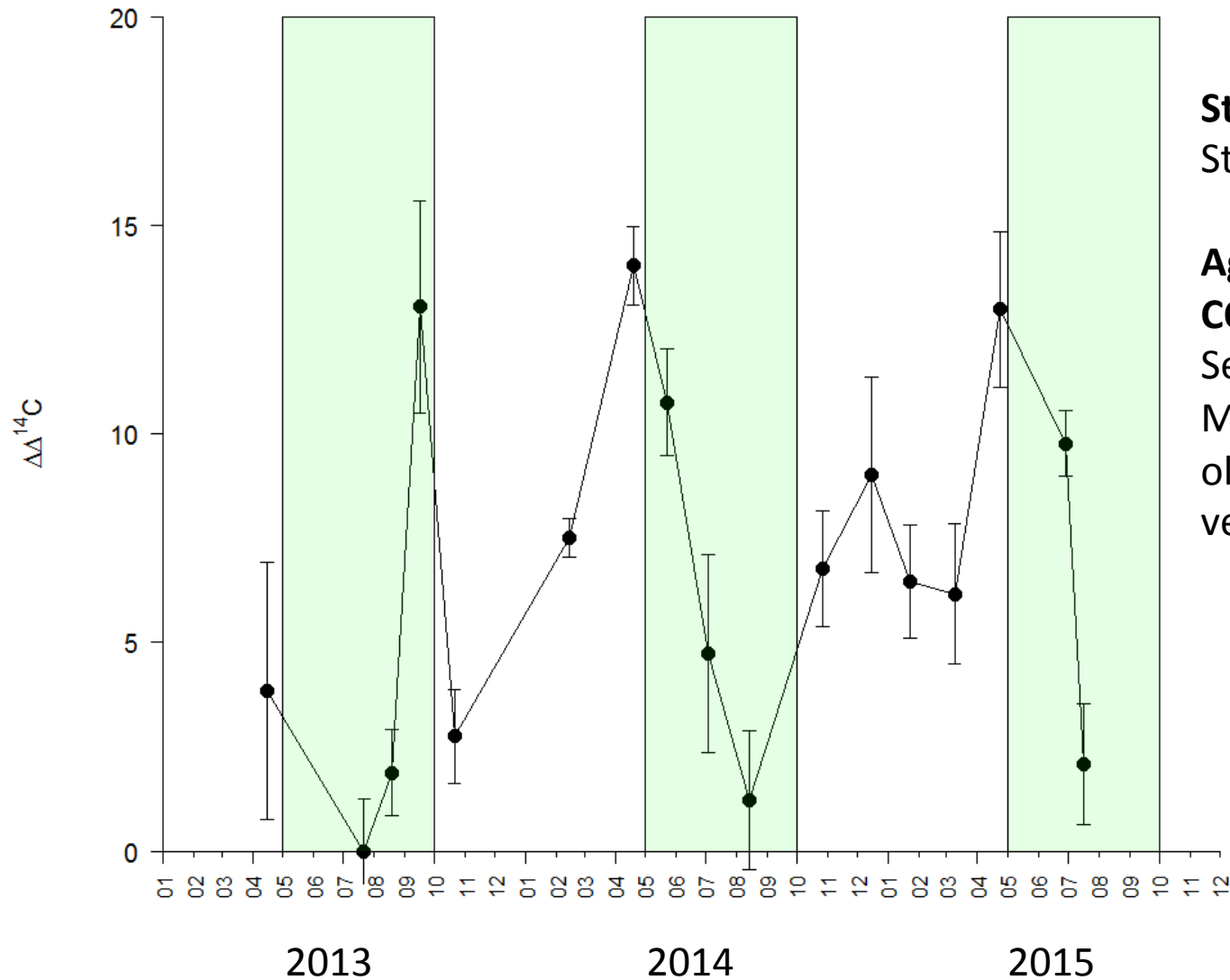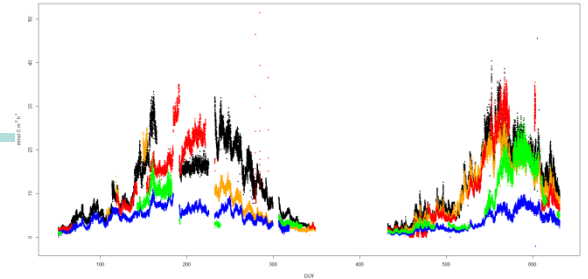| Date	1	2	3	4	5	6
Age	0.8	1.2	1.1	1.8	0.8	1.7
±SE	0.3	0.3	0.1	0.3	0.1	0.2

Stem CO_2 efflux: Strong seasonality
Age of the emitted CO_2: No seasonality, recent assimilates dominate at all times!

Stem CO$_2$ emissions in beech

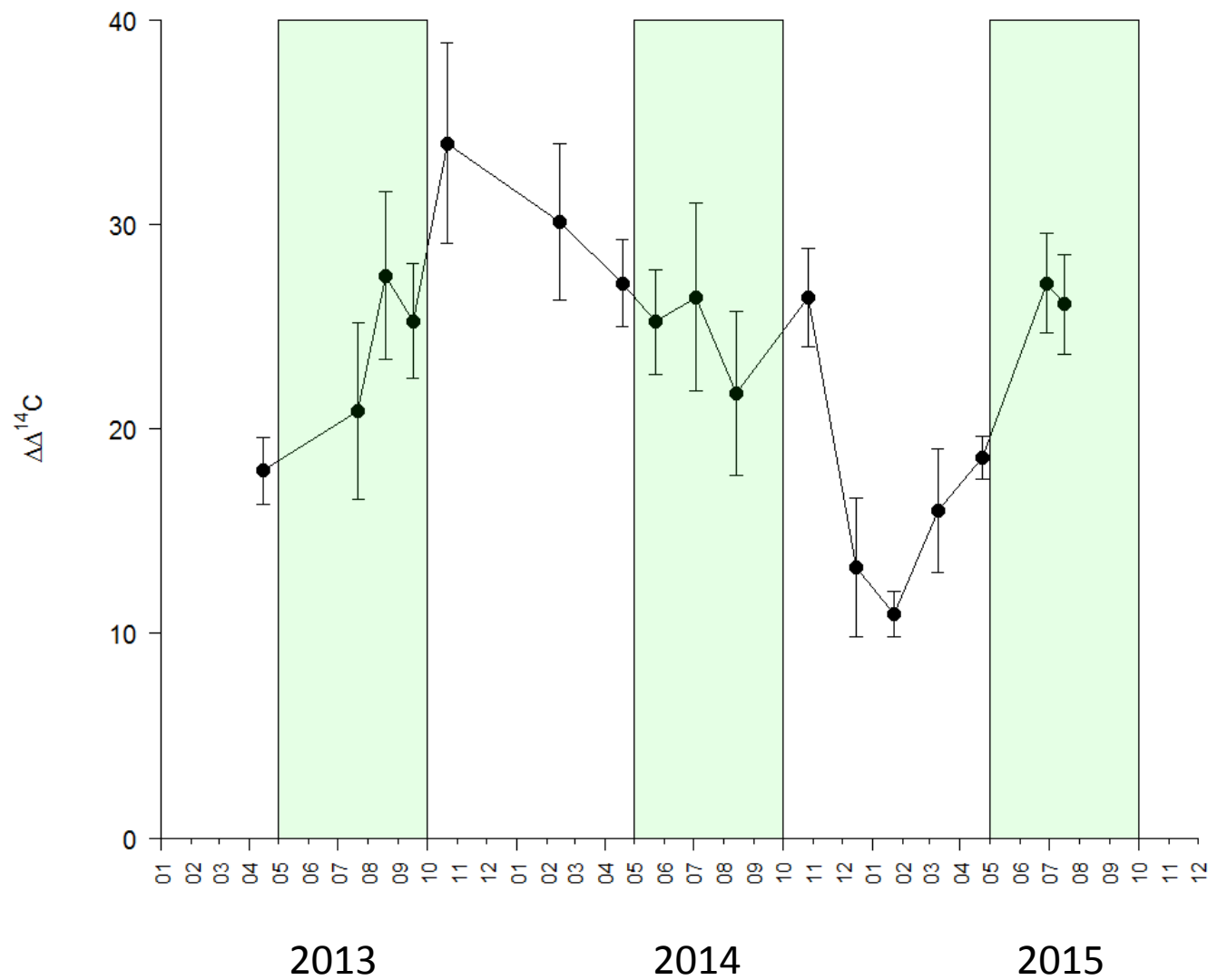# Stem CO$_2$ emissions in beech

Stem CO$_2$ efflux:
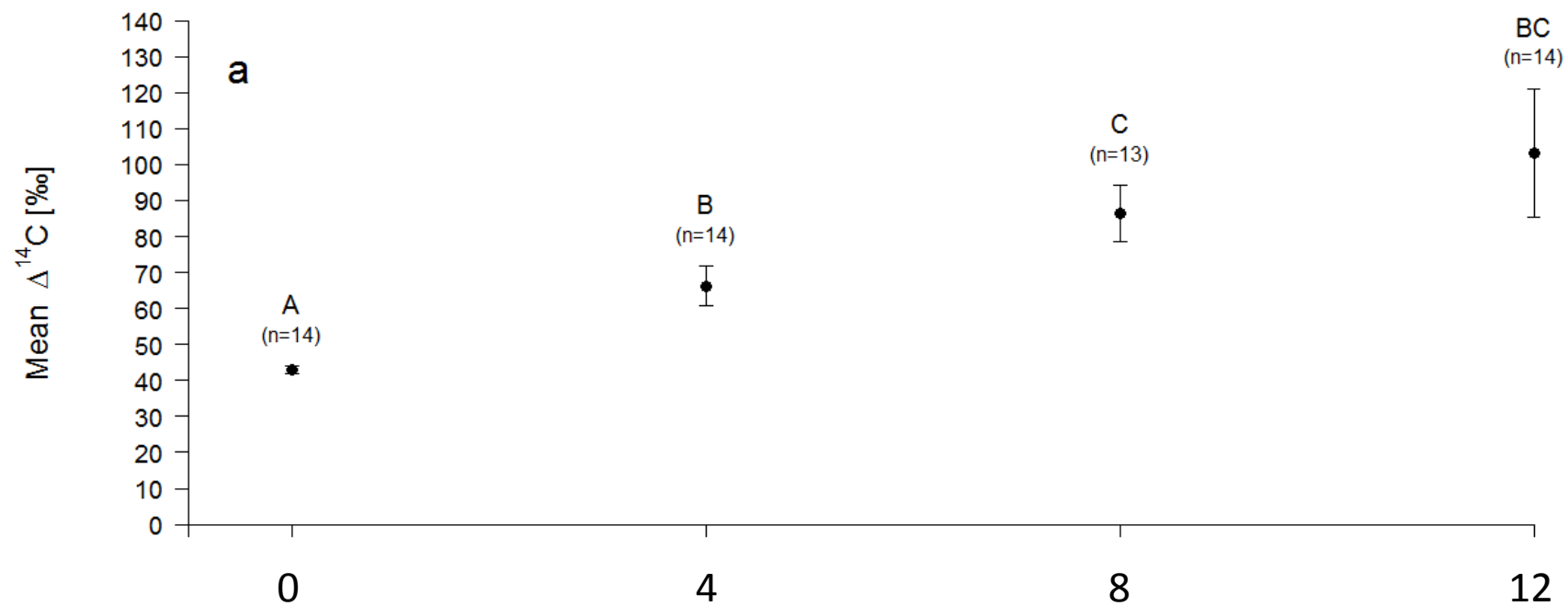Strong seasonality

Age of emitted CO$_2$:
Seasonality –
Mobilization of
older C outside
vegetation period

Stem-internal CO$_2$ in beech
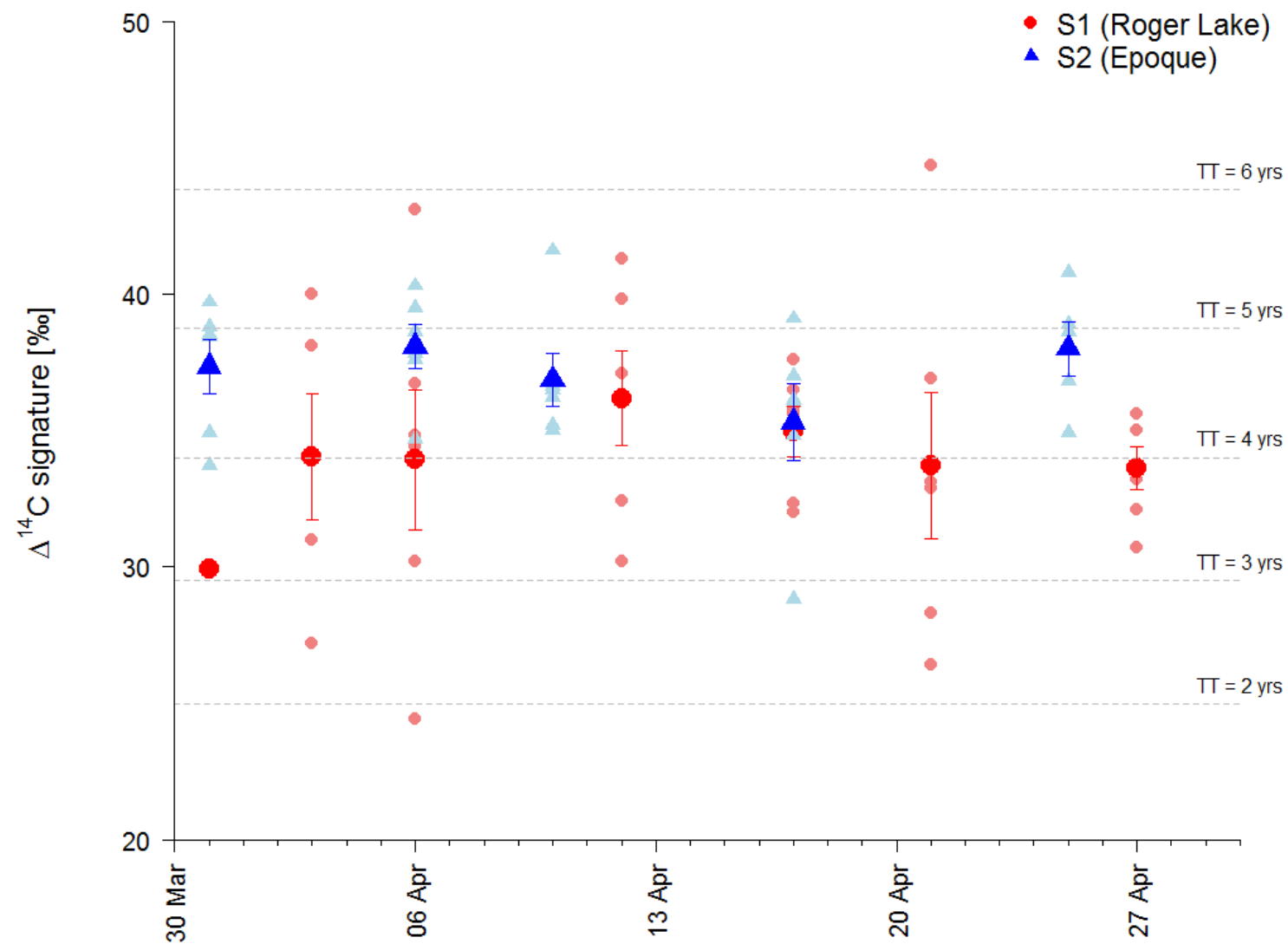
Sampling in-stem profiles of CO$_2$

Sampling sugar maple and birchsap
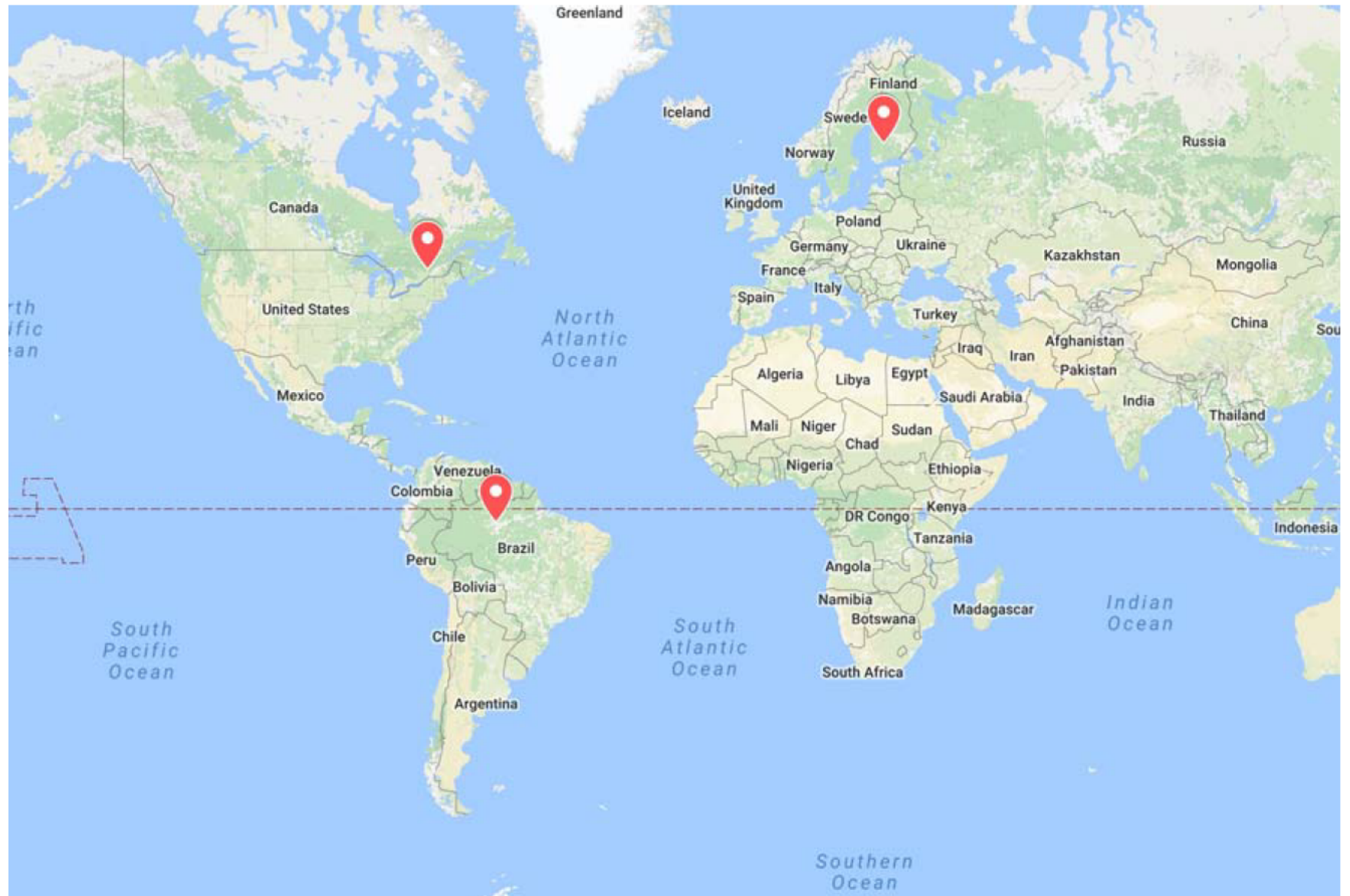
Mobilization of old C in maple sap

Muhr et al., 2016, New Phytologist

"And if thou'rt unwilling, then force I'll employ"

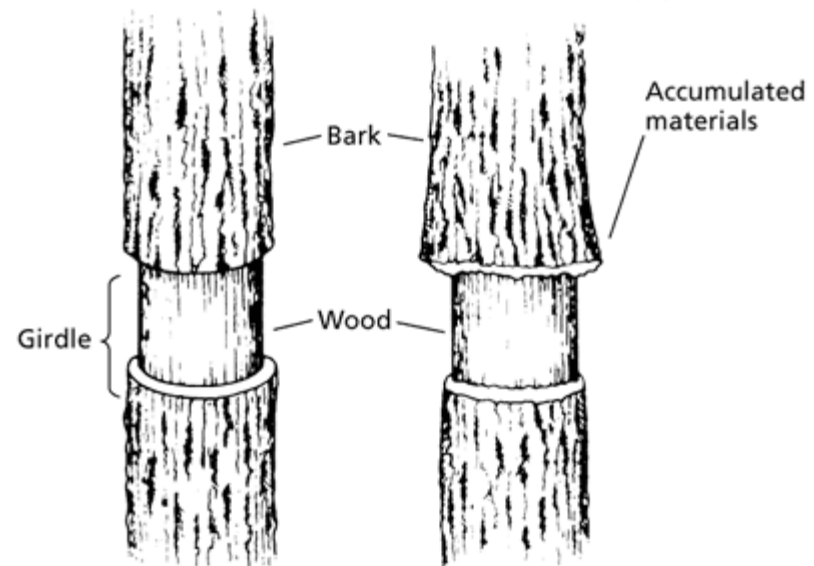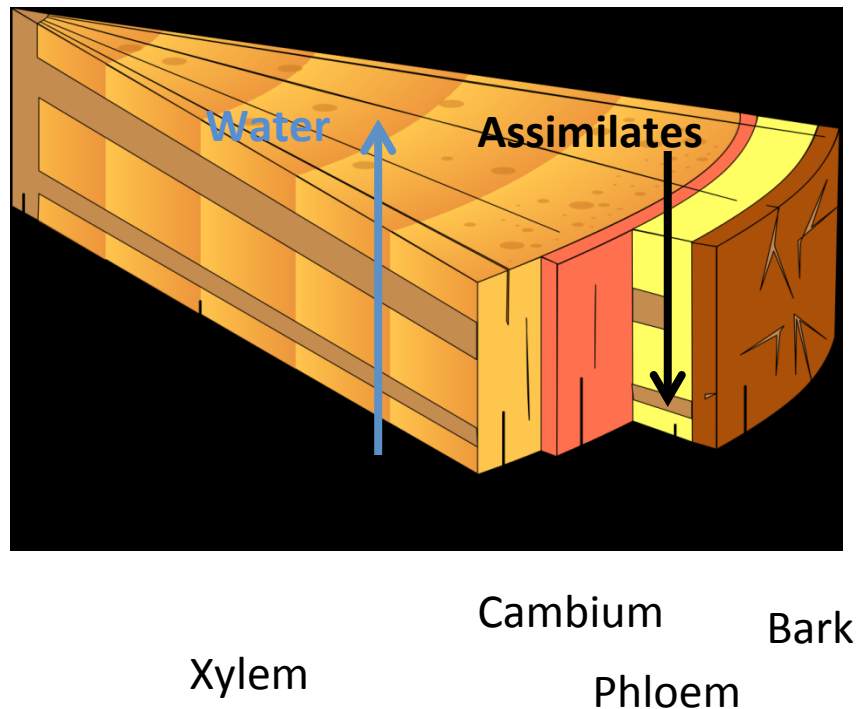How to force trees into using their reserves…

Girdling experiments

Girdling trees – fully shutting down assimilate supply

Definition:

Complete removal of a strip of bark, consisting of cork cambium, phloem, cambium, and sometimes even going into the xylem

Water Assimilates

Cambium

Xylem   Bark

Phloem

Bark

Accumulated materials

Girdle   Wood
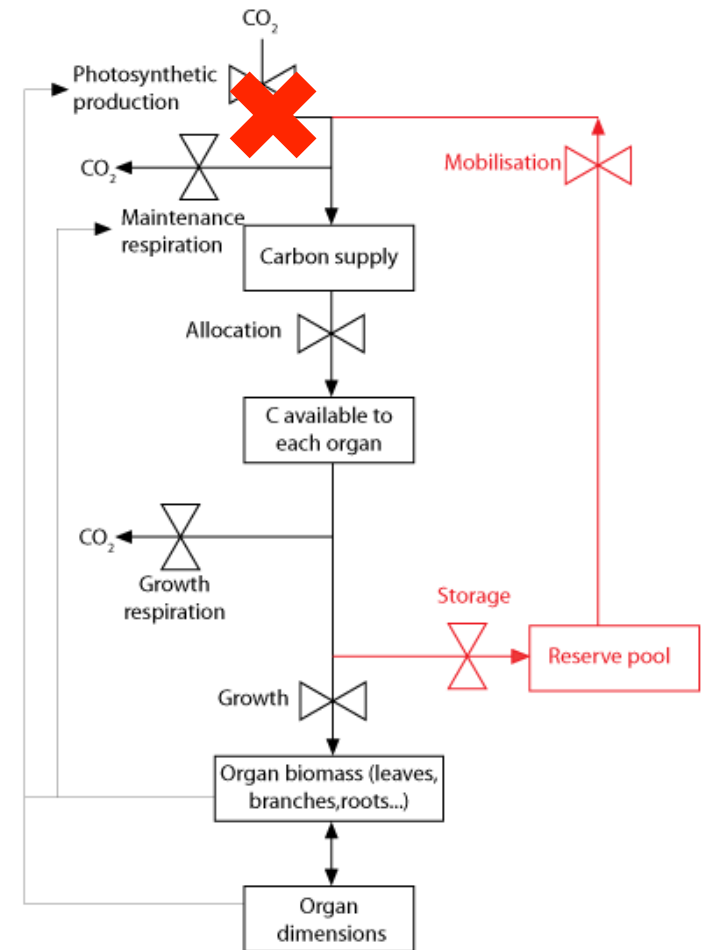
Wikimedia Commons, Stamm.svg   *From Plant Physiology, Taiz & Zeiger*
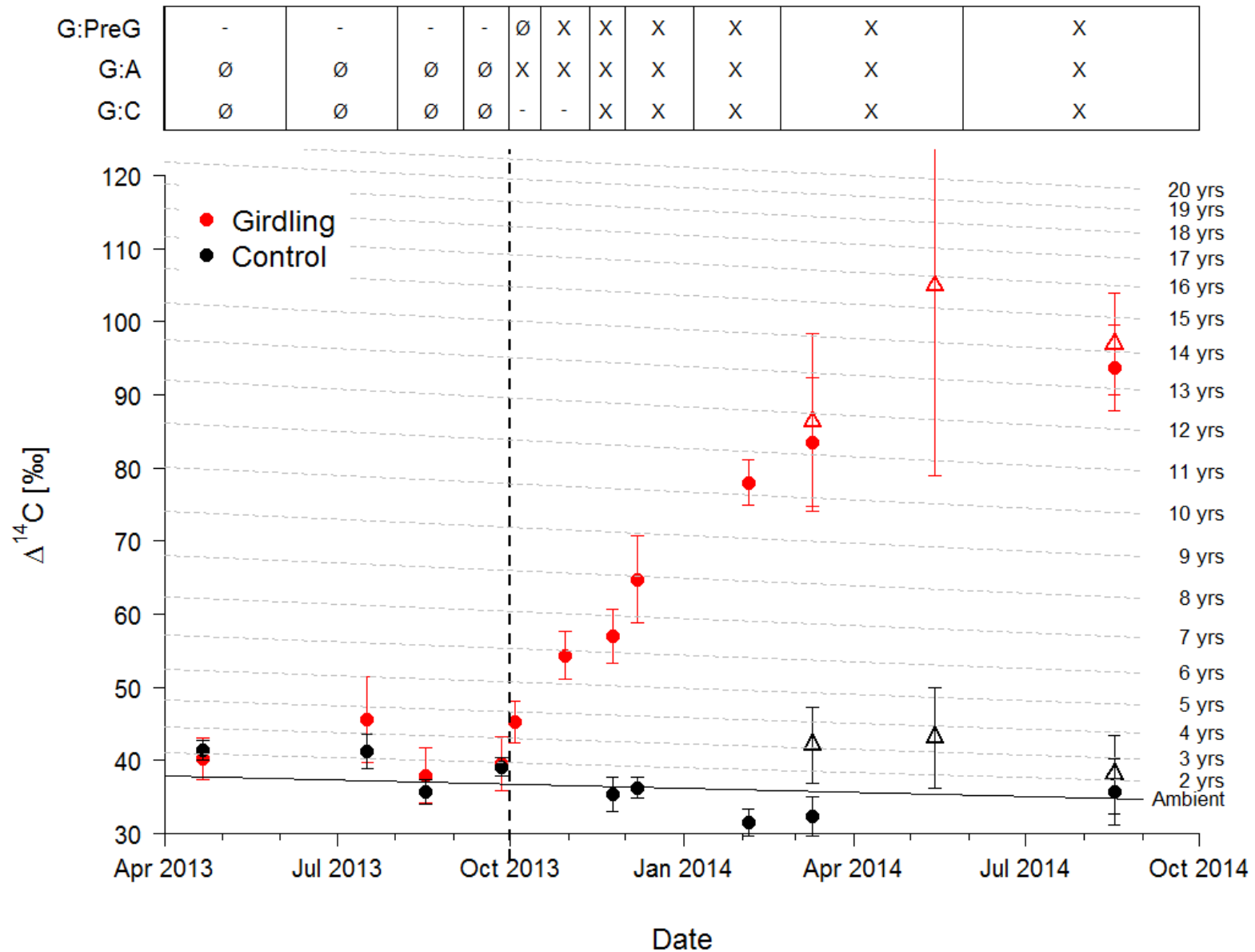
Girdled *Scleronema* tree

Girdling

Sampling

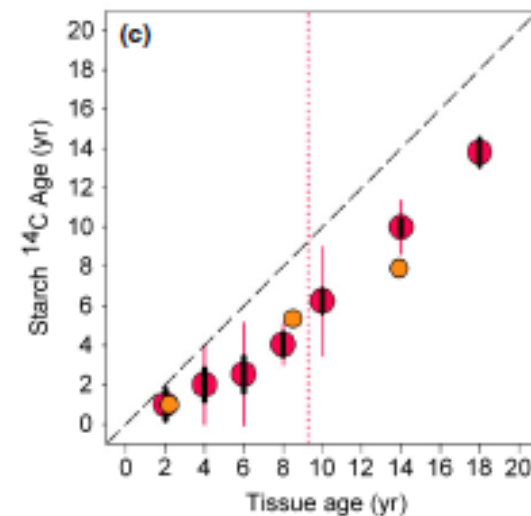# Girdling forces trees into mobilization of old C
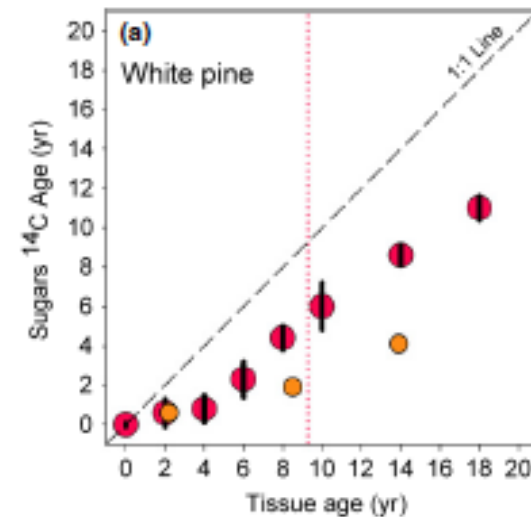
Work in progress

Stem cores for extraction of NSC (sugars, starch, lipids?) and SC (α-cellulose)

Can we detect the effects of girdling in the locally available carbohydrate pools?

Thanks to…

And to you for your attention.

ACKNOWLEDGEMENTS