Phenological observations in beech ~~and oak~~ by daily photos: experiences from Denmark

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Phenology photo experiences DK

Advantages and disadvantages

1. When does beech flushing start ?

2. How long does it take ?

3. Correlation with litter fall data

4. Beech flushing triggers

5. Nonconforming years

Perspectives for the future

Please note: PRELIMINARY RESULTS !!

Phenology by camera

Advantages

- Saves man power / trips to forest
- Enables collection of daily phenology data
- Correlation with other information

Disadvantages

- Expensive equipment (camera & laptop) in forest
- Technical problems, especially due to moisture, may cause data gaps
- You need someone to climb a tree
- Data storage space for photos

Beech – flushing event scores

1. (Absent) <1%

2. Slight or infrequent 1-33%

How many days from stage 2 to stage 4 ?

3. Common or moderate >33% - 66%

4. Abundant >66% - 99%

5. (Full) >99%

Flushing photo interpretation

1. (Absent) <1%

2. Slight (start flush) 1-33%

3. Common (main flush) >33% - 66%

4. Abundant >66% - 99%

5. (Full) >99%

1 < May 1st

– May 5th

2 May 3rd

3

May 6th

4 May 7th – 10th

5 May 11th 2016

Fast beech flushing 2016

A. Rapid daily temperature increase induces flushing (stage 1 → 2)

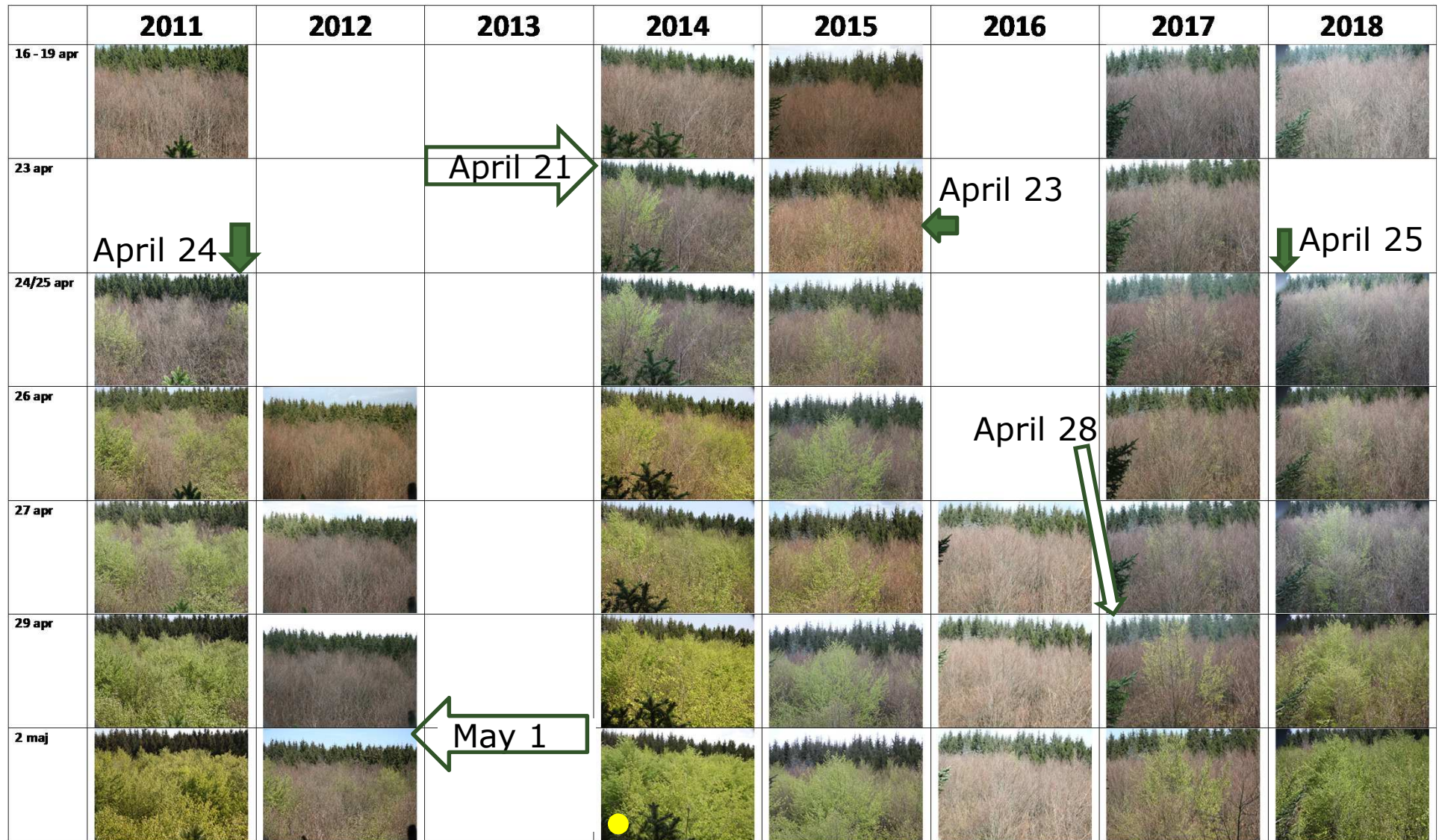B. Rapid daily temp. increase accelerates events (stage 2 → 4)

Flushing in beech is usually fast.
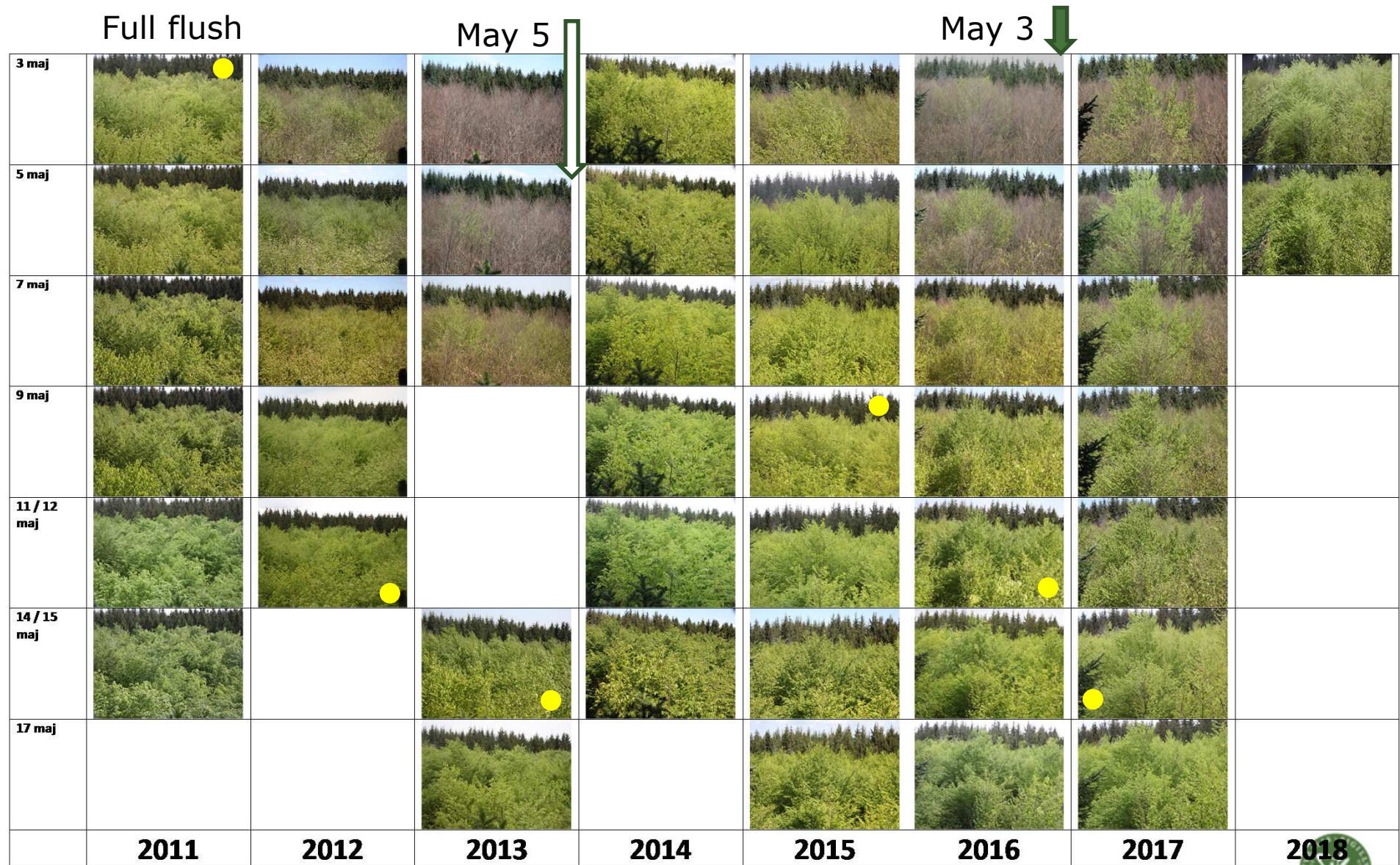
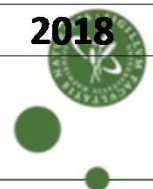Stage 2 → 4 takes 1 week in average.
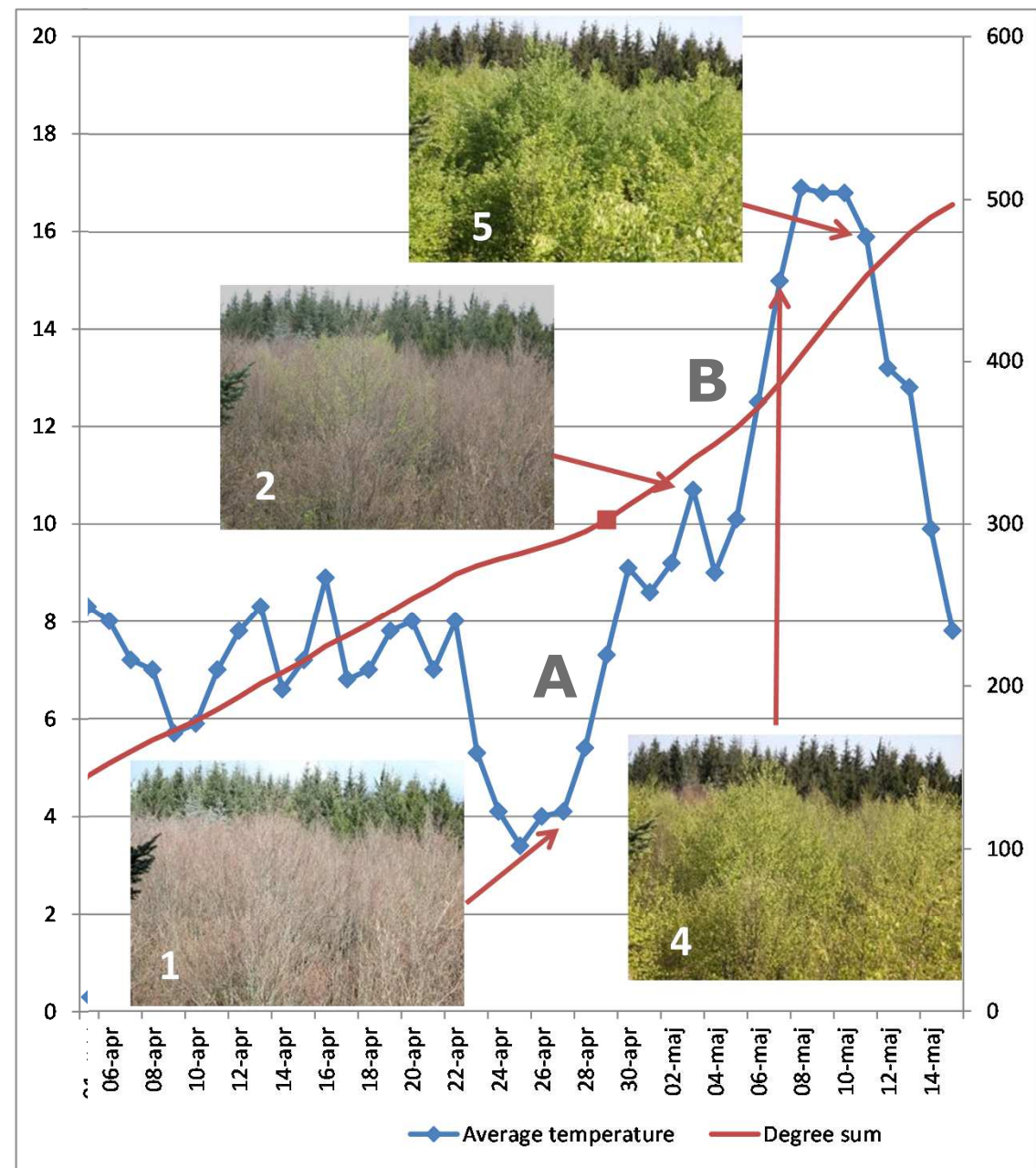
Beech flushing 2011-2018

Full flush

Full flush   May 5   May 3

Early years: 2011, 2014, 2015. Late: 2013

# Flushing and litter fall

Bud scales in litter fall may confirm flushing dates.

The litter fall collection dates in April and May can be crucial.

	March	April	Budbreak	May	June
2010	11-mar		02-maj	05-maj	03-jun
2011	08-mar	07-apr	24-apr	10-maj	07-jun
2012	09-feb	13-apr	01-maj	11-maj	15-jun
2013	06-mar	08-apr	05-maj	06-maj	31-maj
2014	07-mar	07-apr	21-apr	02-maj	25-maj
2015	04-mar	08-apr	23-apr	08-maj	03-jun
2016	28-feb	08-apr	03-maj	09-maj	10-jun
2017	15-mar	10-apr	28-apr	10-maj	08-jun

Flushing / litter fall
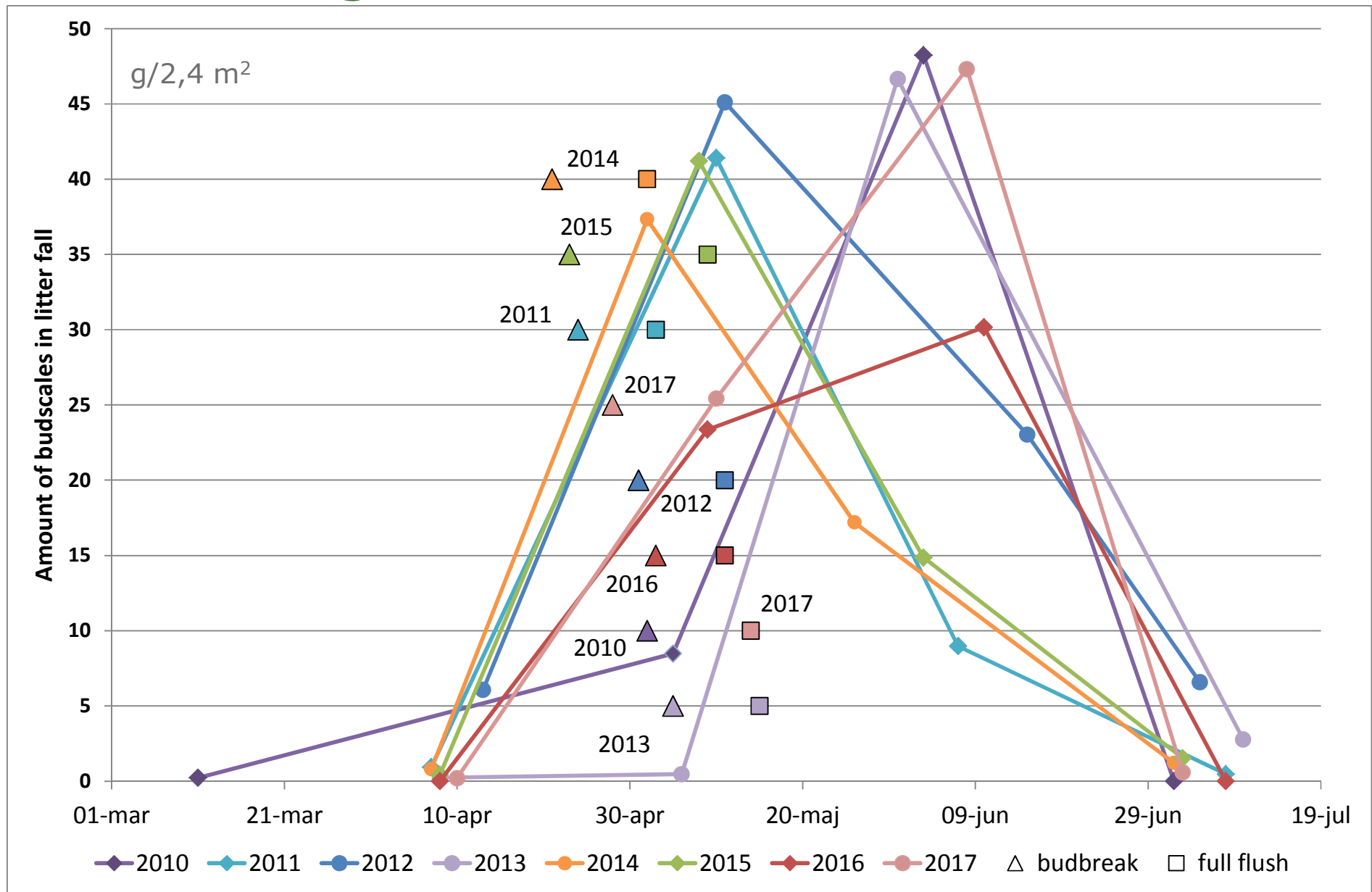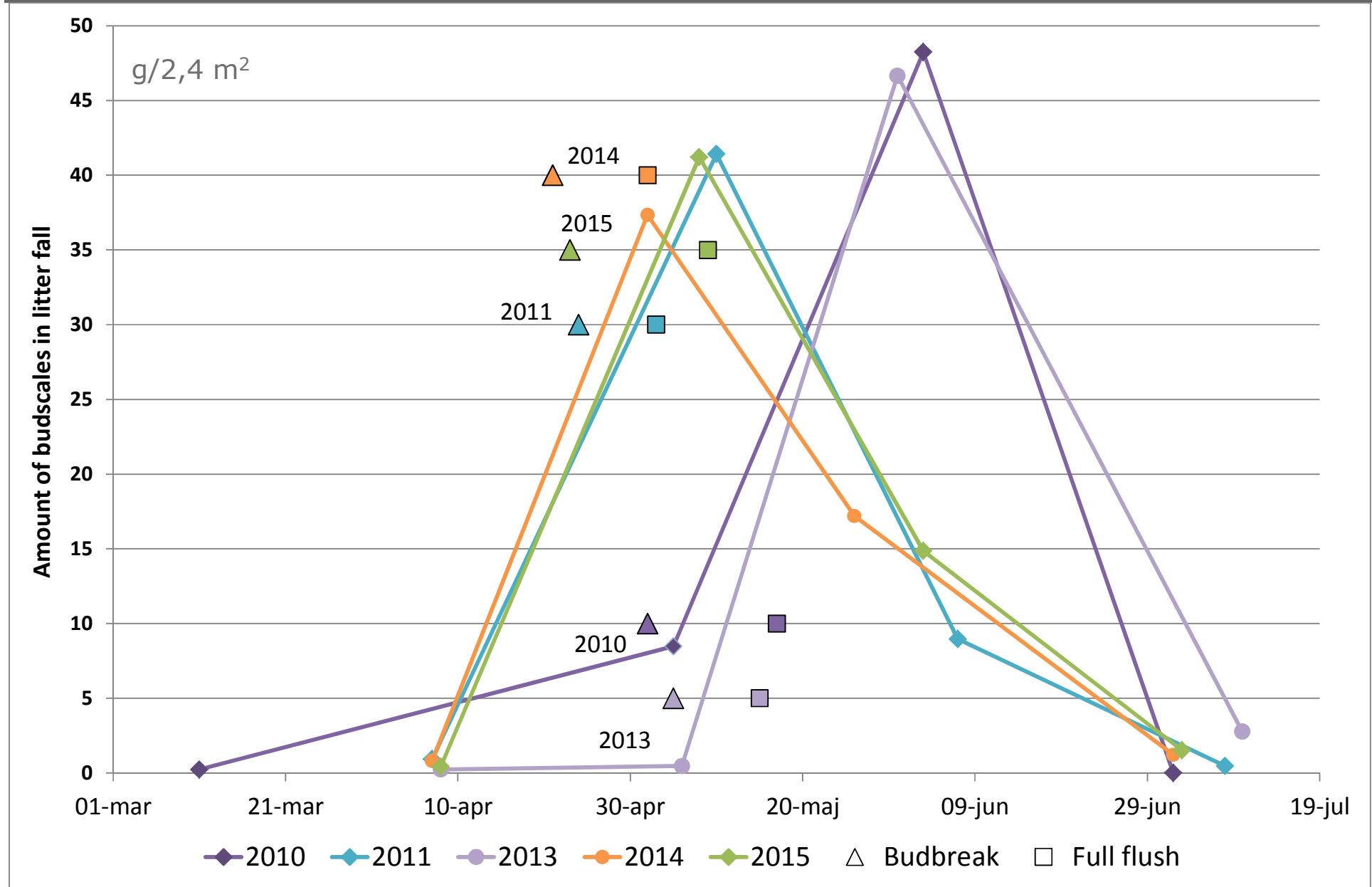
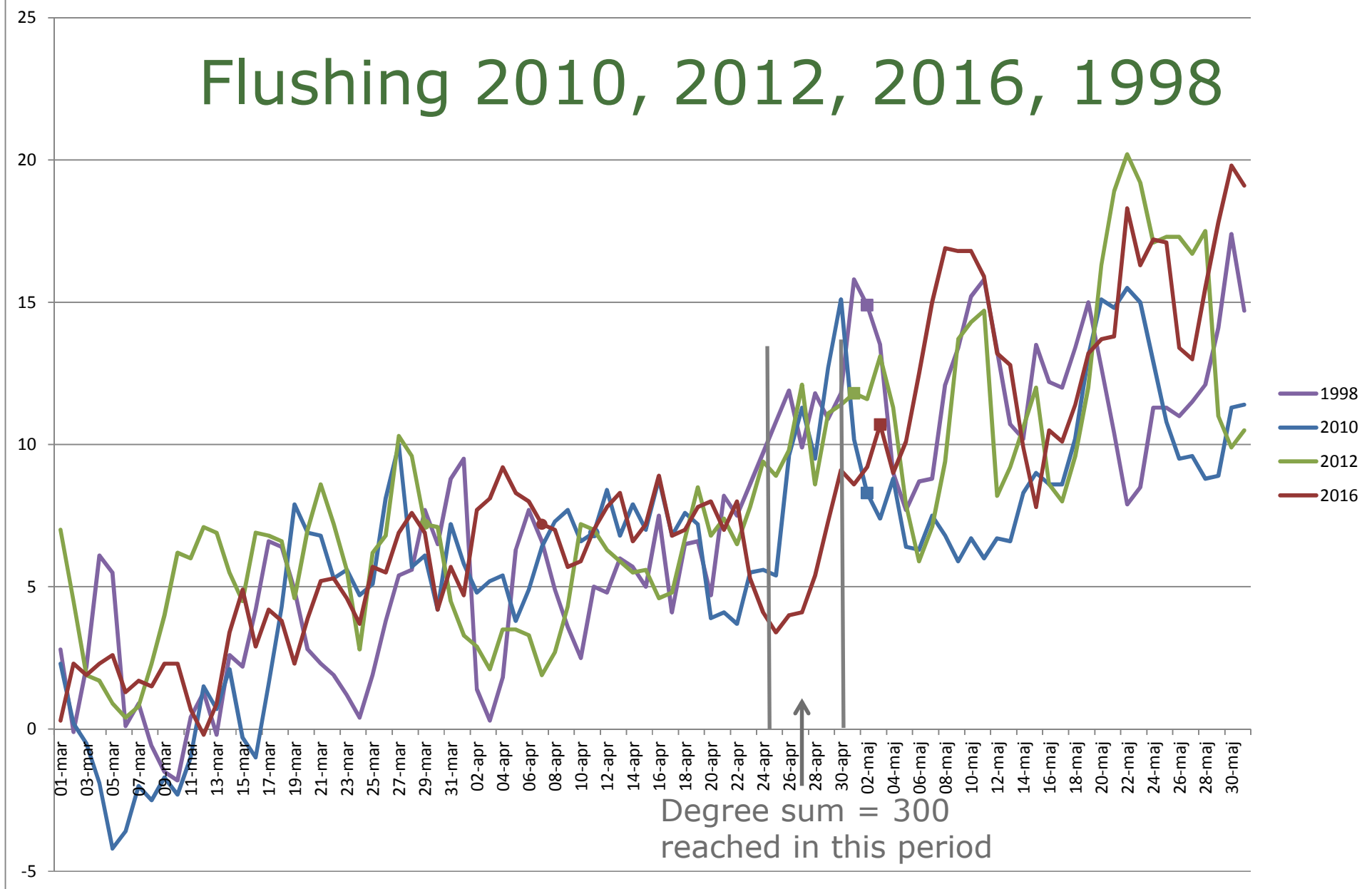Max bud scales in litter in April (early flush) or May (late flush)

Degree sum development

Accumulated sum of temperatures > 0°C since March 1st.

300 seems to be the threshold for Level 2 Frederiksborg beech

But not the only explanation…
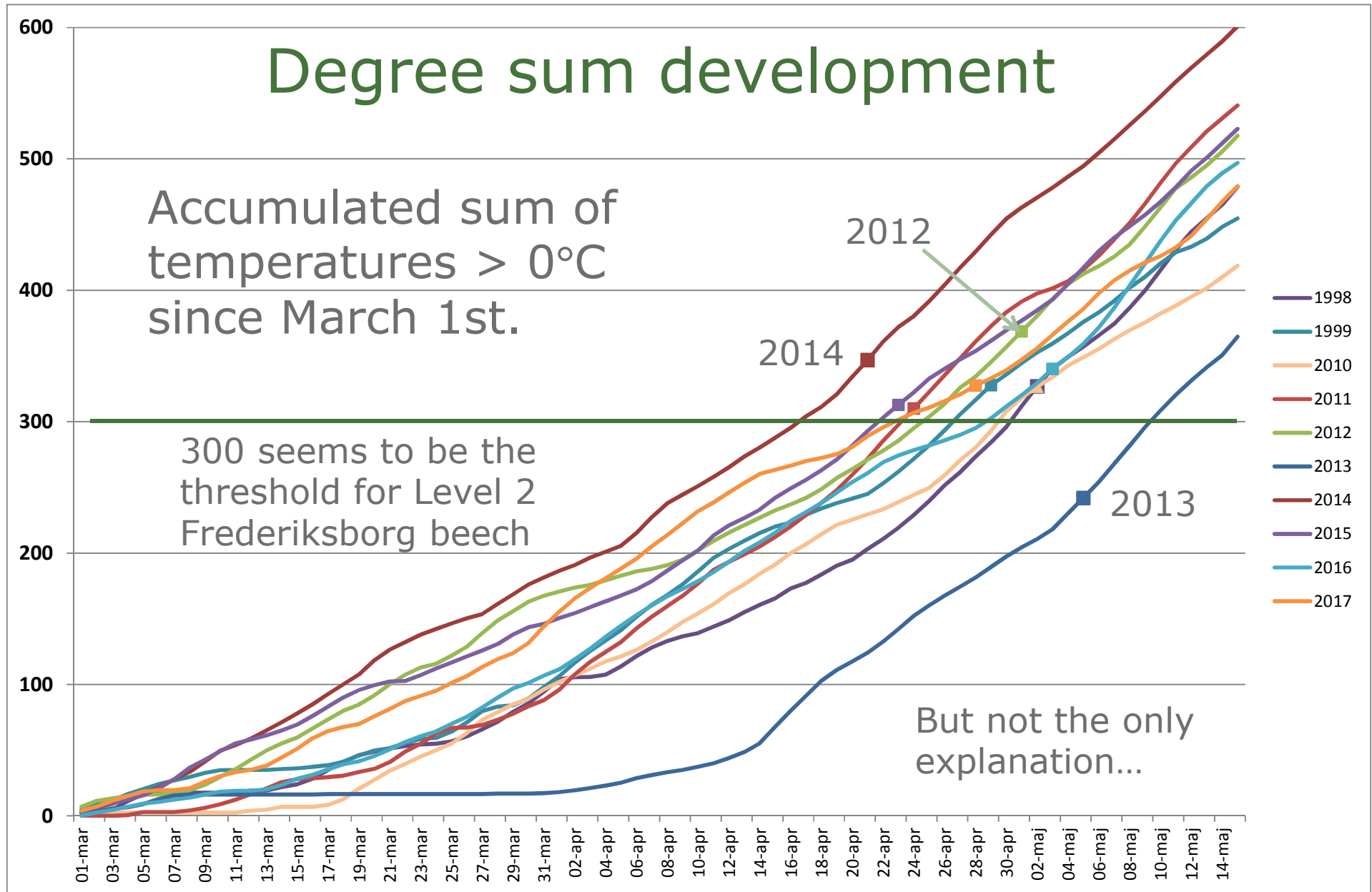
Flushing 2011, 2014, 2015
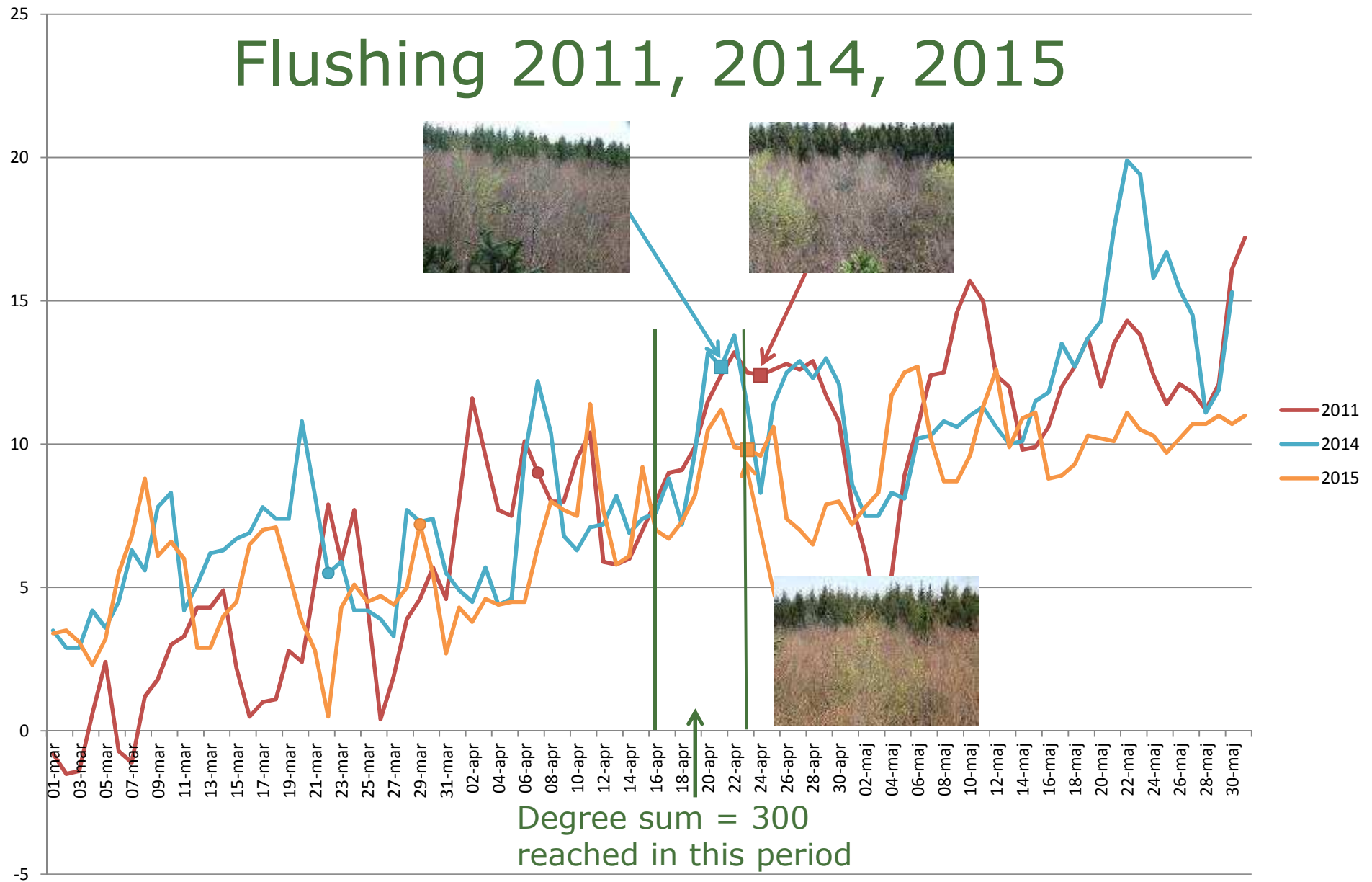
Flushing 2010, 2012, 2016, 1998

Degree sum = 300
reached in this period

Flushing in beech at Frederiksborg

happens when the degree sum hits 300, and there is a sudden warm spell (rapid daily temperature increase).

But what about the years which don't fit ?

- 2013 – a year with prolonged winter and a very cold spring.

- 2017 – a May where flushing went on hold for a few days.

- 2018 – a spring which started cold and suddenly turned warm.

Degree sum development

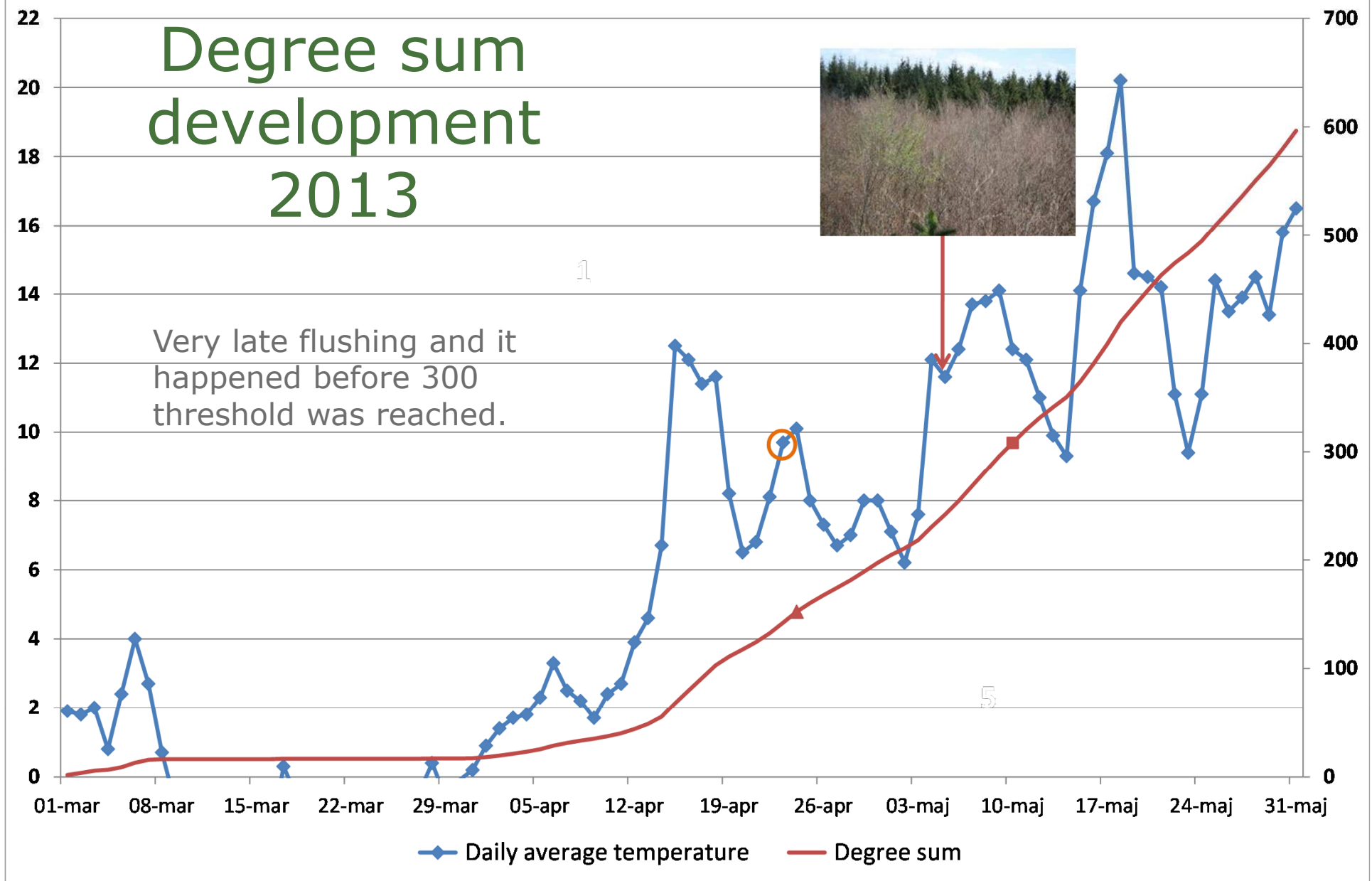Accumulated sum of temperatures > 0°C since March 1st.

So why doesn't 2018 conform ?

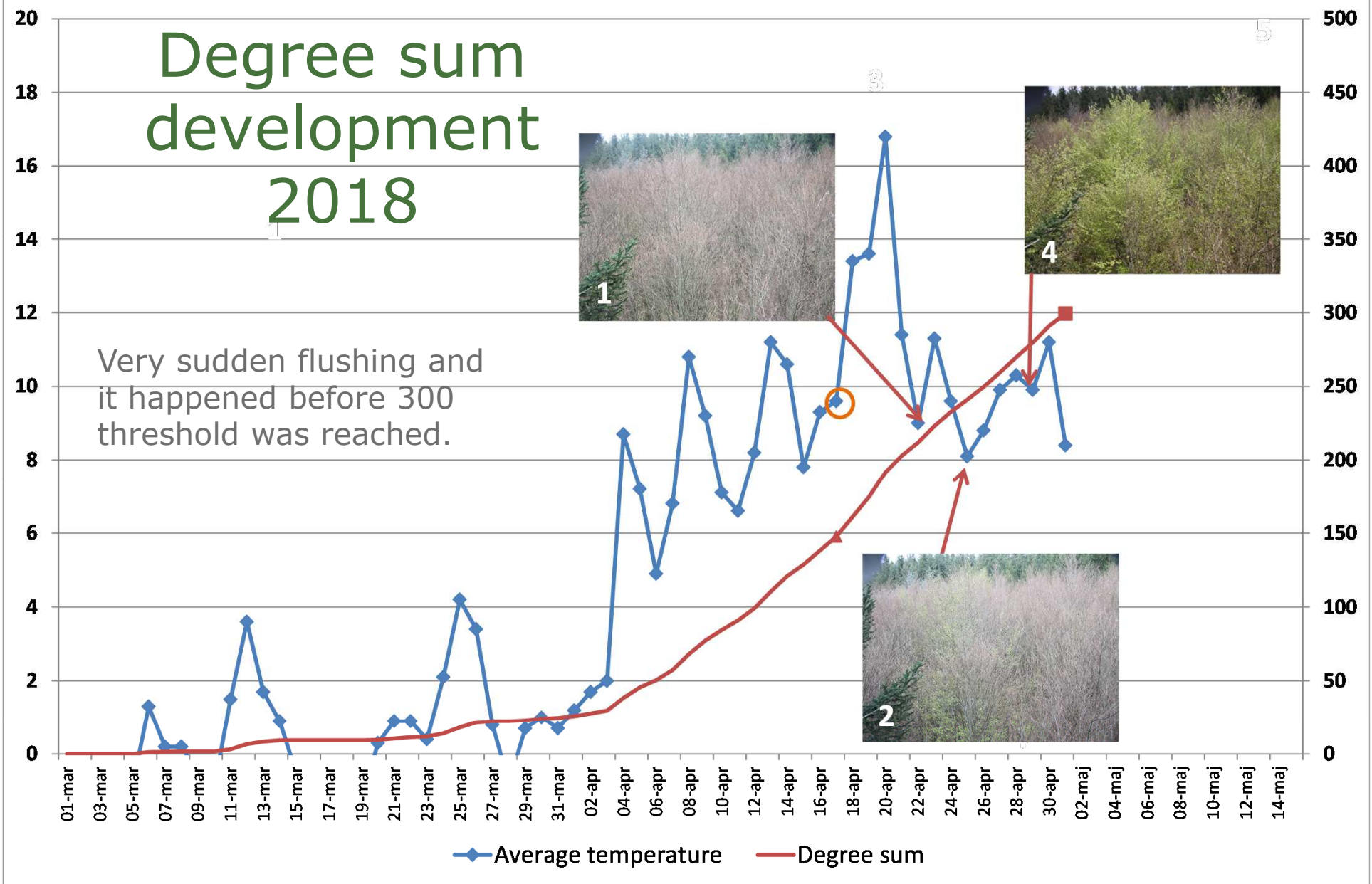2013 and 2018 start out cold

Degree sum development 2013

Very late flushing and it happened before 300 threshold was reached.

Degree sum development 2018

Very sudden flushing and it happened before 300 threshold was reached.

Notice several sharp temperature increases after April 1st.
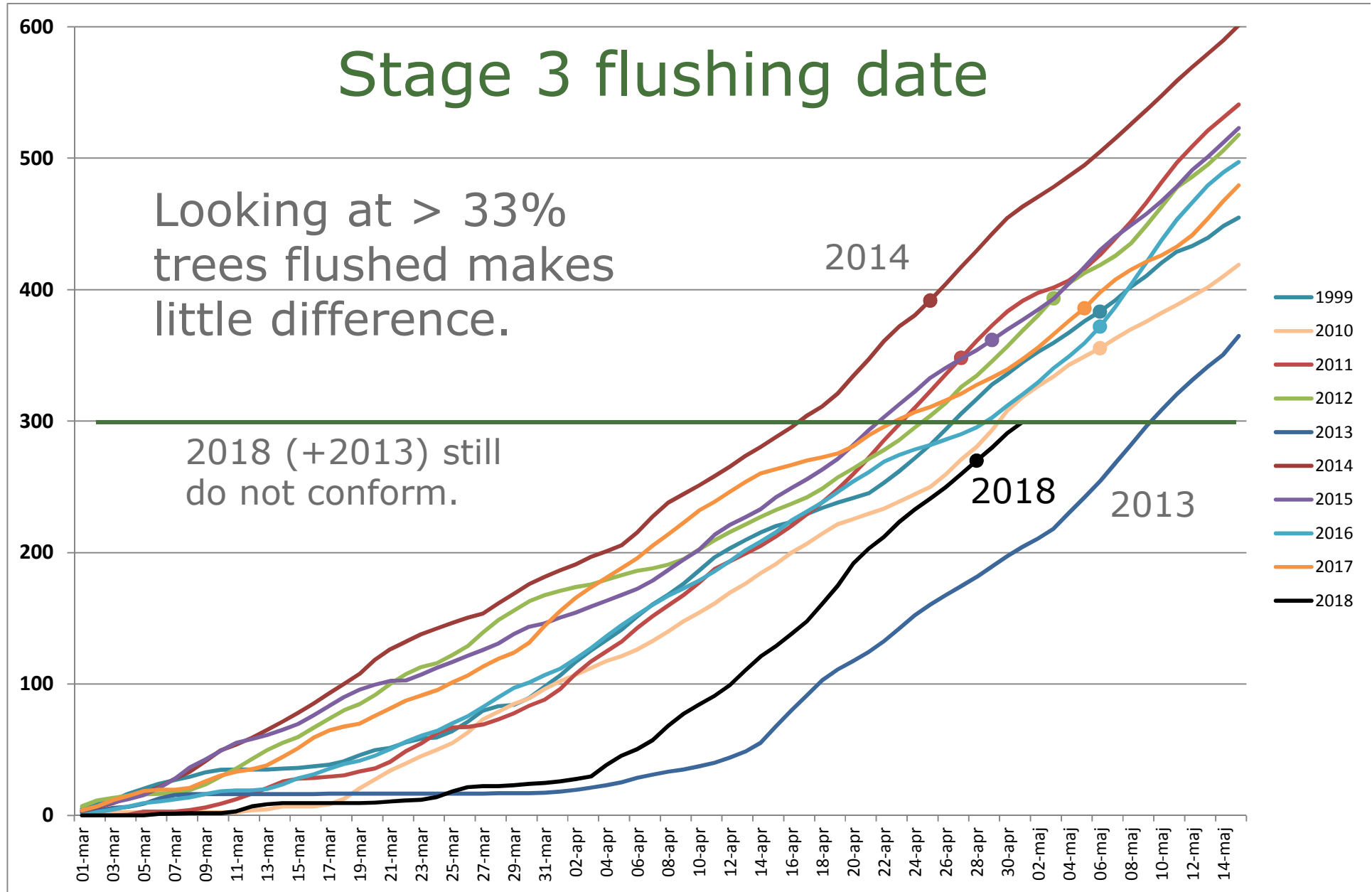
Beech flushing dates 2011-2016

The same tree always flushes first within the stand (same provenance).

Is stage 2 (1-33 % flush) really the best measure of flushing event ?

Perhaps stage 3 is better ?

Stage 3 flushing date

Looking at > 33% trees flushed makes little difference.

2018 (+2013) still do not conform.

Perspectives for the future

Use correlation with litter fall data to estimate early and late flushing years on L2

Photo phenology can help us test theories about flushing triggers. Climate change ?

Beech: Day degree sum (DDS) and/or rapid temperature increase (RTI) ?

Importance of genetics, day length, precipitation, sun hours, other factors ? Find triggers for other tree species (oak, spruce)

If known, 'field obs.' phenology is easier too.

Citizen science perspectives

Thank you for your attention

Frederiksborg beech May 9th 2015