A lime cordial… or, *Tilia* tales!

Carl Barker, Paul Ashton

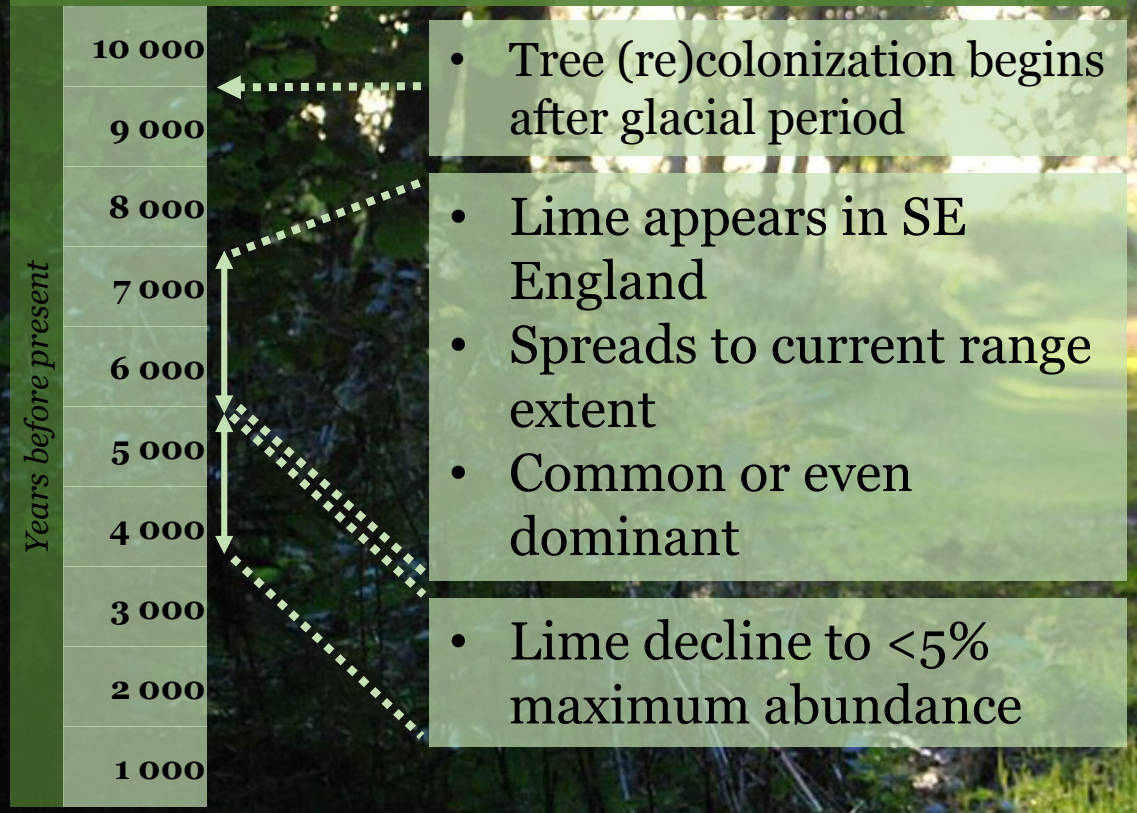
Lime trees, who cares?

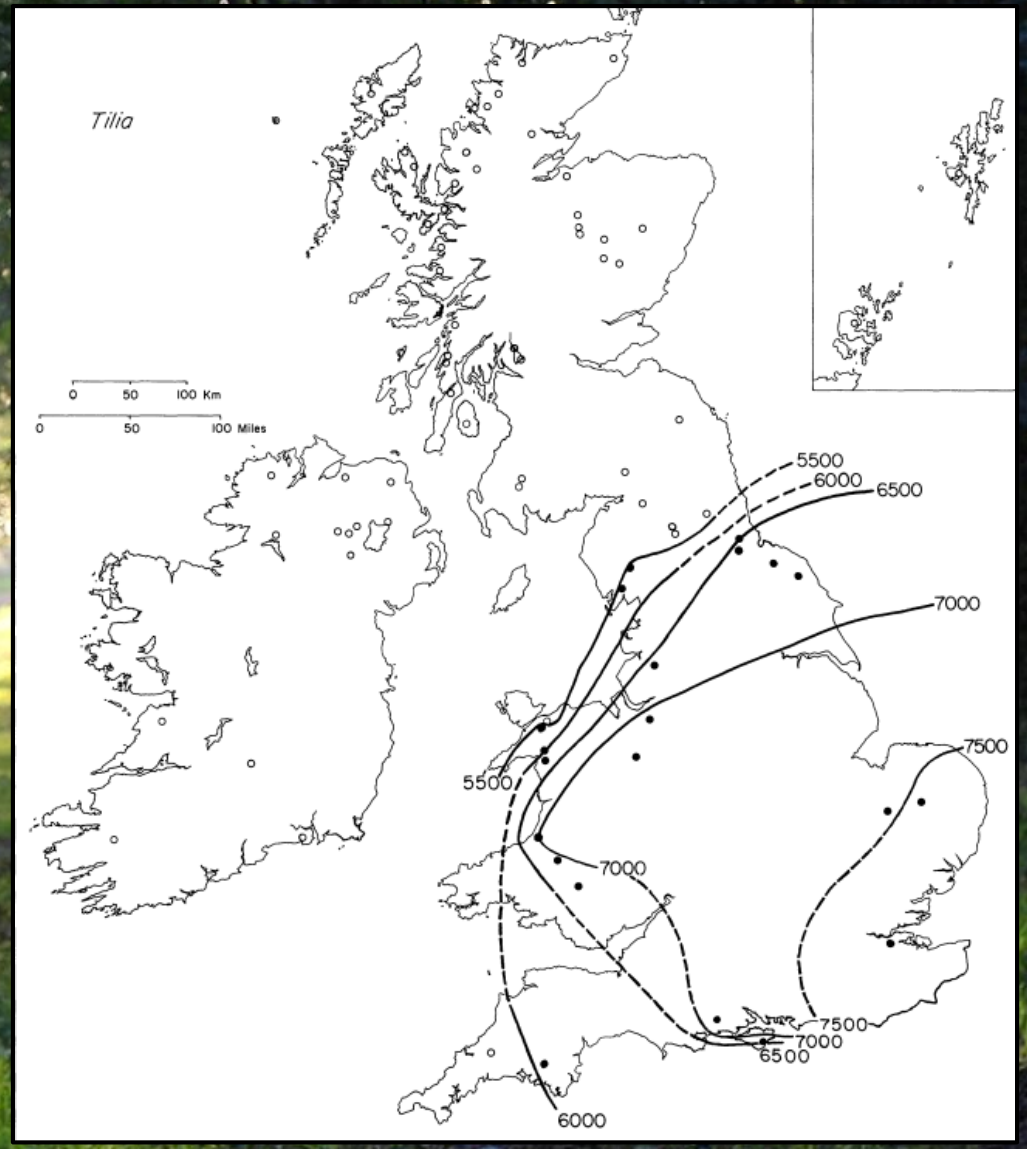
- Broadleaf canopy tree
- Two native spp. in Britain
  - ***Tilia cordata*: small leaved lime (right)**
  - *T. platyphyllos*: large leaved lime

Lime trees, who cares?

- Scattered: occupies ancient woodlands
- No recolonization of secondary
- Particular natural history

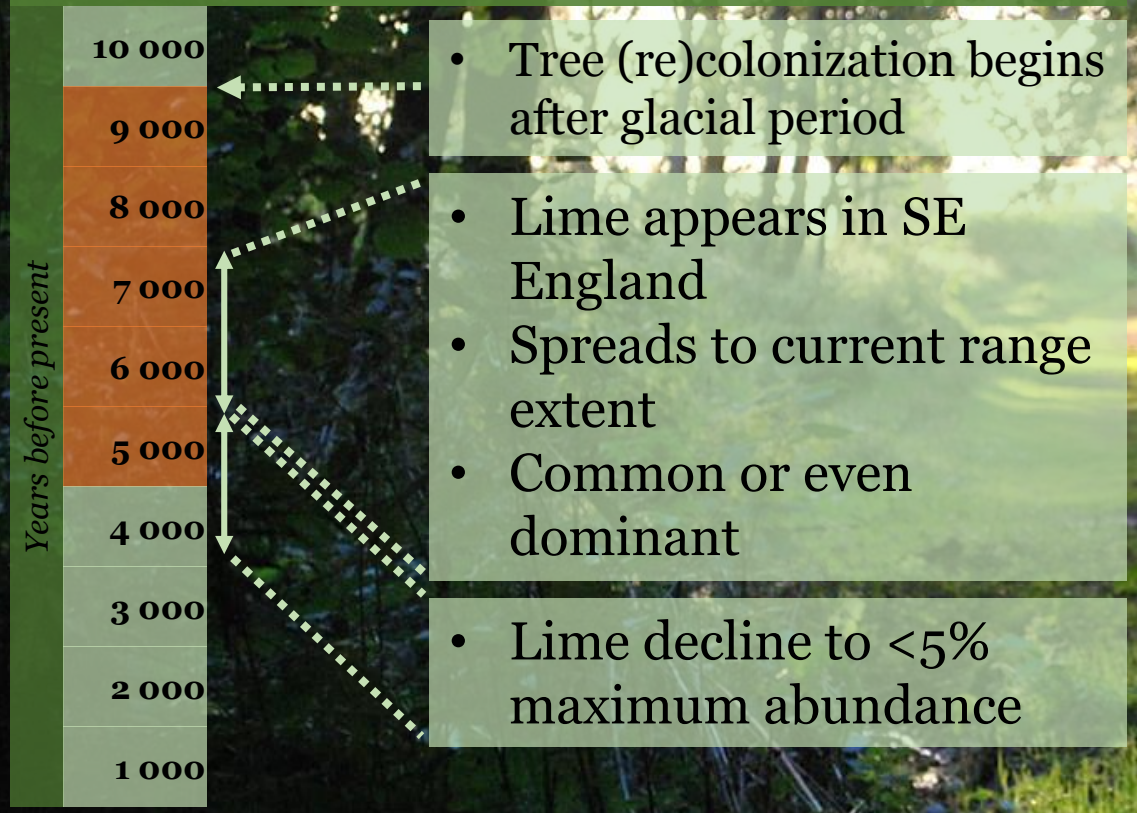
Natural history





Birks (1989) J Biogeogr 16 (6)

Natural history



- Tree (re)colonization begins after glacial period
- Lime appears in SE England
- Spreads to current range extent
- Common or even dominant
- Lime decline to <5% maximum abundance

- Orange indicates warm period (1 – 2°)
- Decline linked with human activity
- Temperature change prevents recovery
- Not typically planted
- No recolonization secondary woodland
- Hence presence in ancient woodland

Current status

- Fertile seed production intermittent (temperatures)
- Few seedlings
- Longevity & clones allow persistence

Hulhoven (2013)

Current status

- Northern populations persist entirely due to clonality
- Isolated, often small populations
- Loss of genetic diversity:
  - Clonality
  - Low gene flow
  - Smallness

Our work

- Ecology
- Metabolic variation
- Fertility trends
- **Clones**
- Effects of fragmentation
- Hybridisation
  - Patterns, amount
  - Morphology as a tool for hybrid identification

Clonality in small leaved lime

- Propagates itself:
  - Shoots from base
  - Branches touching ground
  - Fallen trees can make shoots, root
- No root suckers

Clonality in small leaved lime

- Don’t actually know:
  - How common
  - How arranged
  - What promotes/reduces clonality

Clonality in small leaved lime

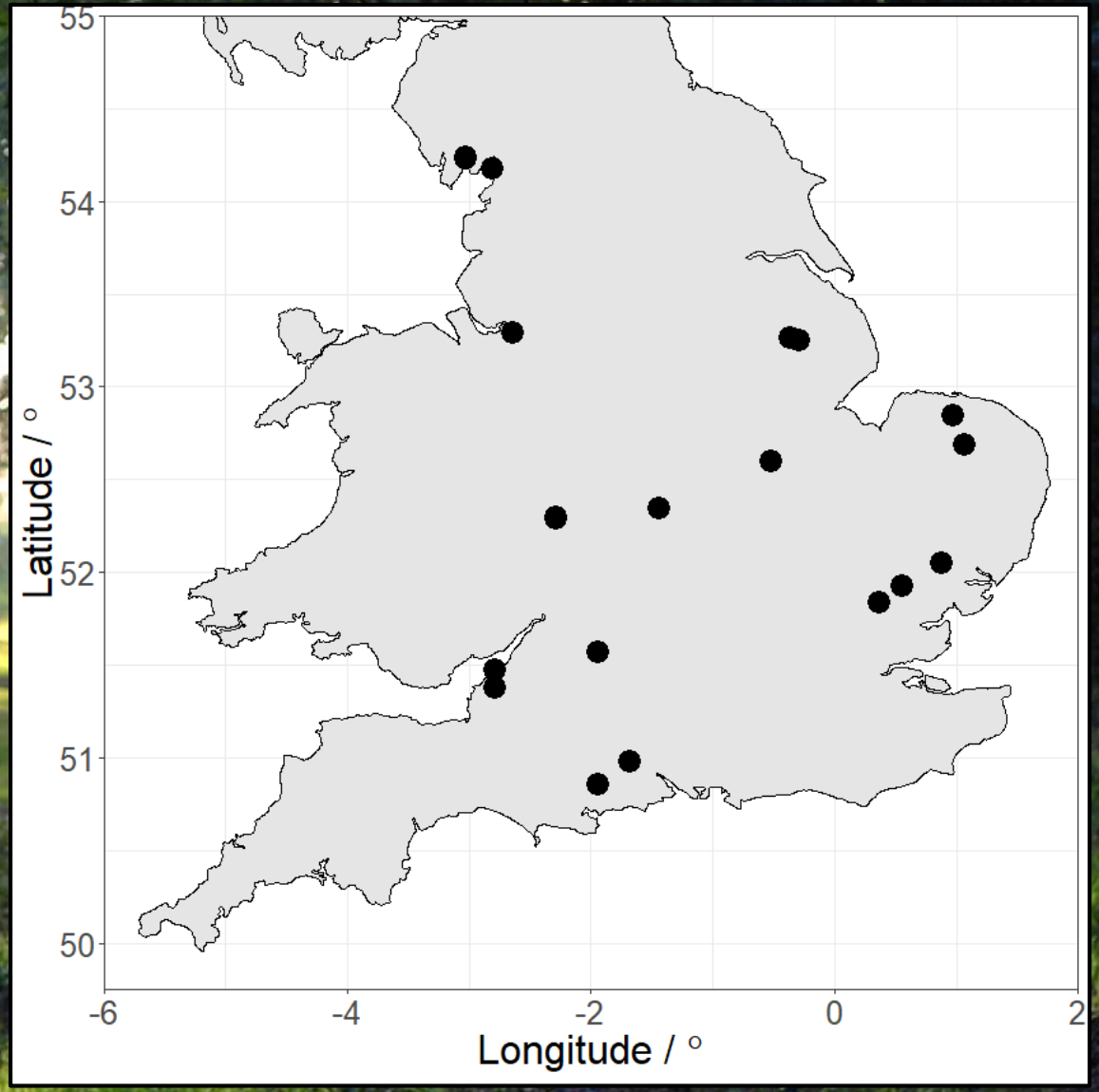
- Should understand balance of sex vs. clonality
  - Reduces genetic diversity (fewer genotypes)
  - Makes neighbourhoods of closely related trees

Questions

- Need to understand clonal growth
  - Numbers of clones?
  - Arrangement?
  - Trends or environmental influences?

Methods

- Looked at 18 sites across UK
- 30x30 m, all trees mapped
- Collected leaves from 790 individuals
- Genotyped, identified clones



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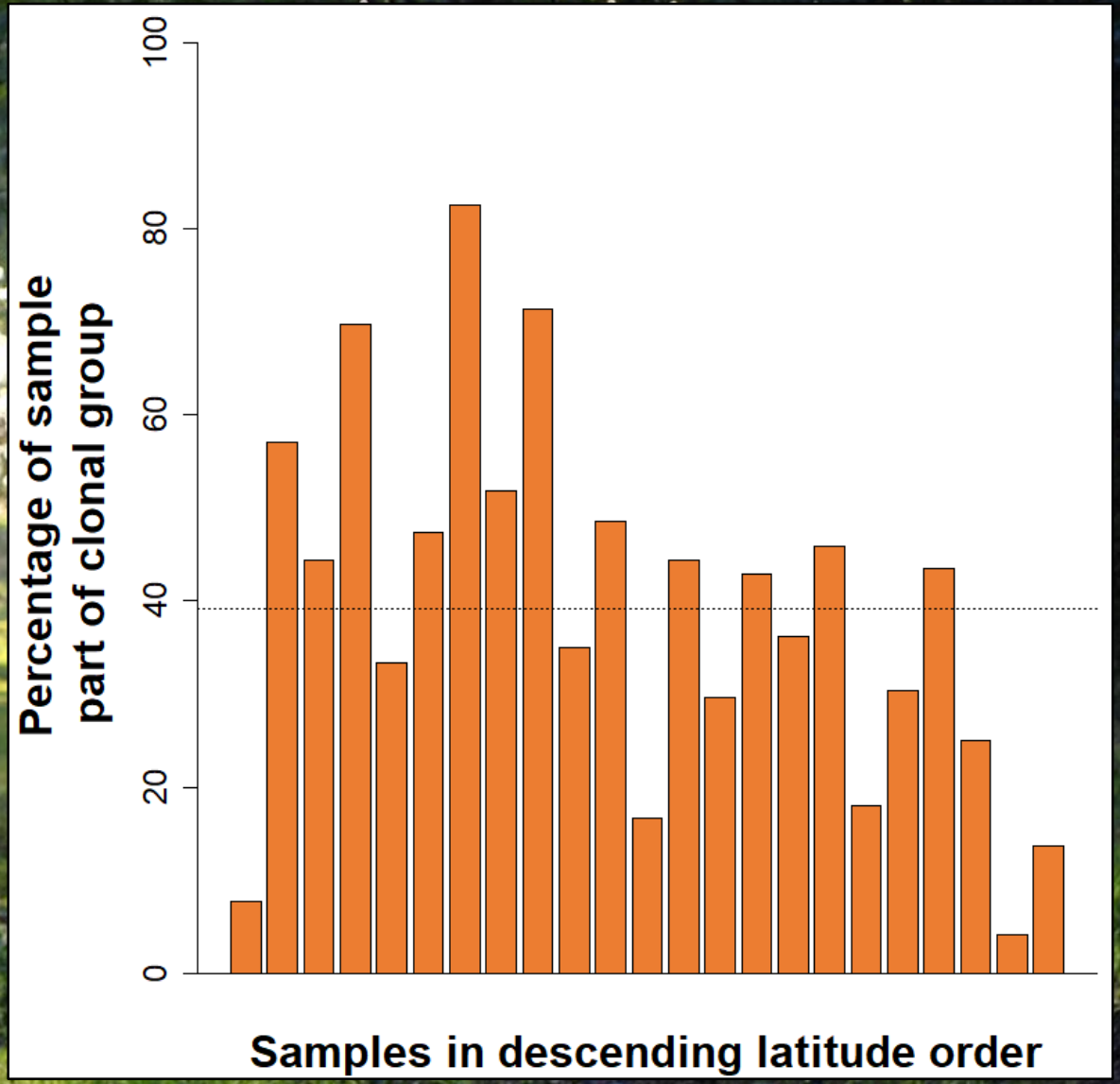
Findings

- Clones everywhere; typically ~40%
- Arranged as expected (clumps)
- Occasional ‘long distance’ dispersal
- Not expected to increase inbreeding



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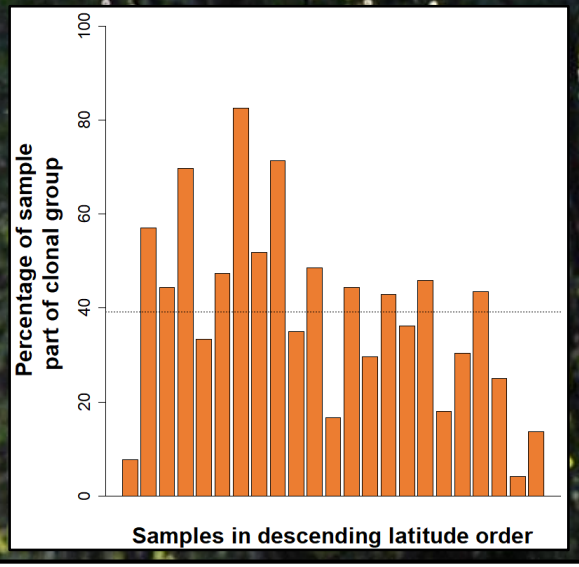
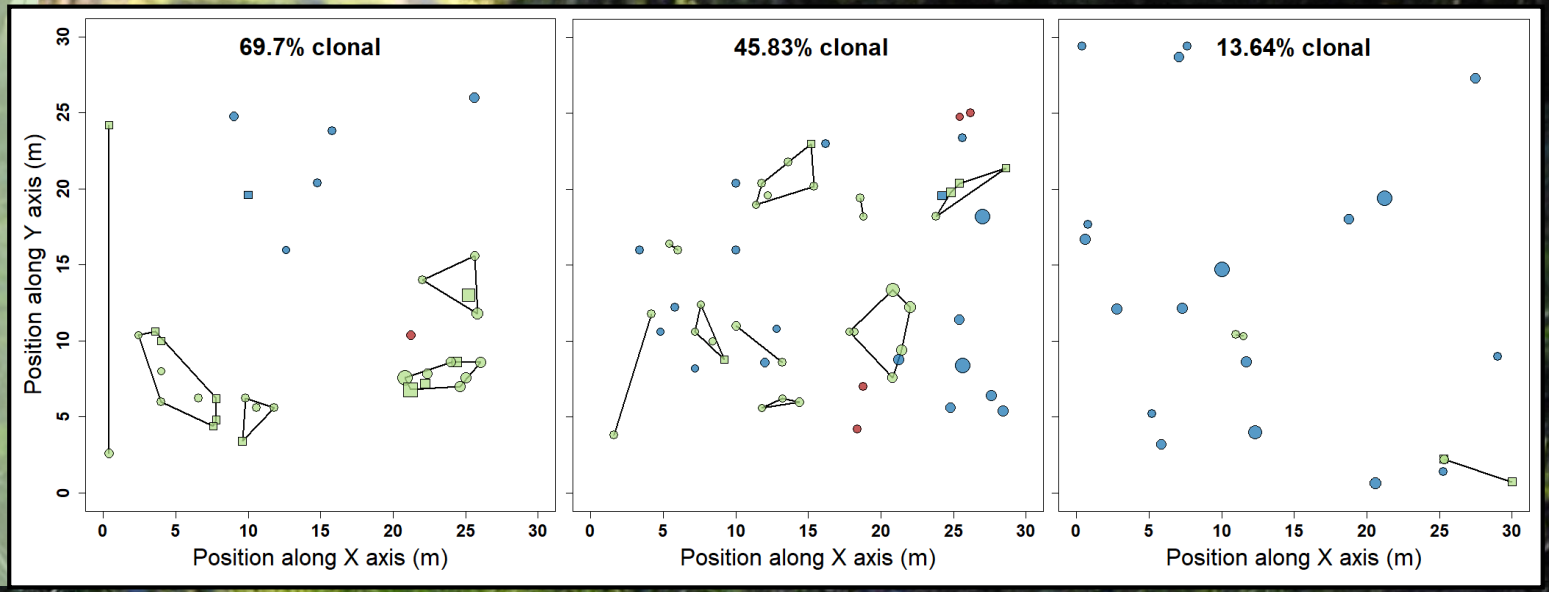
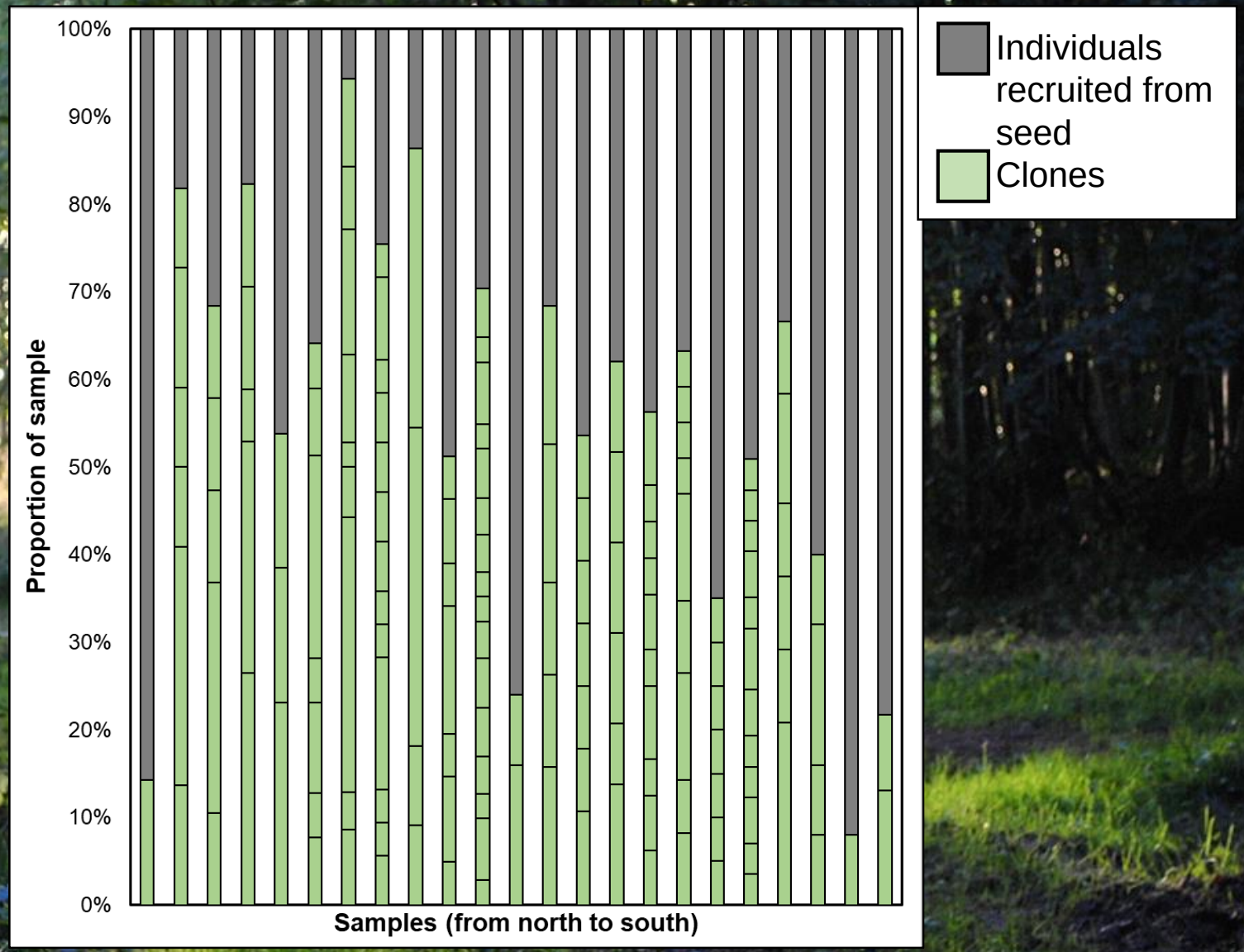




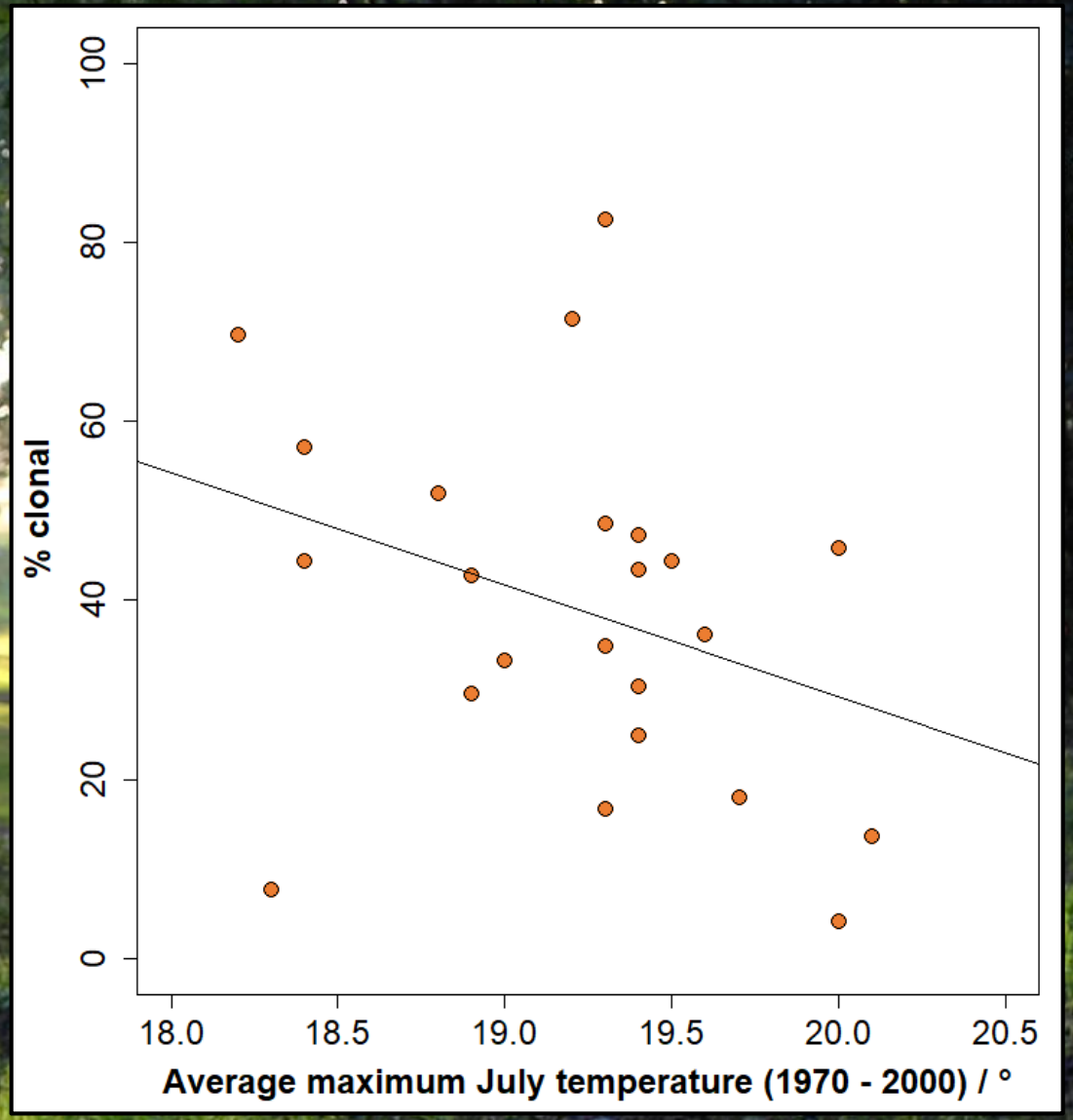
Findings

- Although ubiquitous, amount varies
- Barely any to most of sample (4 – 82%)
- Everyone gets involved (clones diverse)



Causes

- Rough trend of more northern, more clones
- Temperatures during flowering (July) can predict amount of clonality – albeit not well
- Real picture more complicated
- Other factors involved:
  - Coppicing
  - Herbivory



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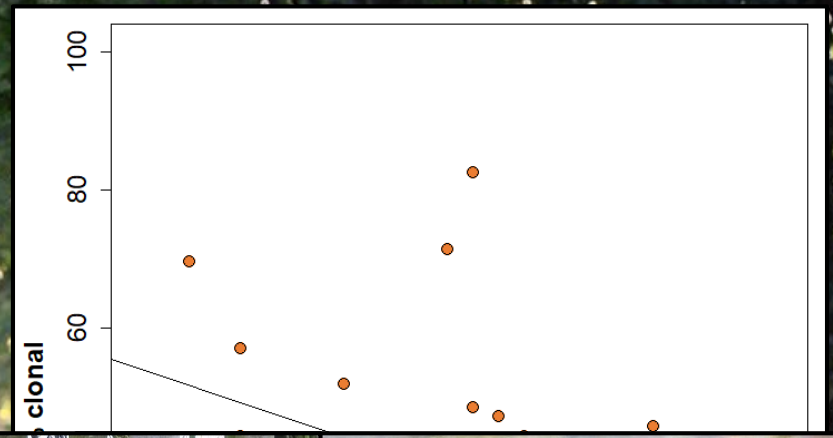

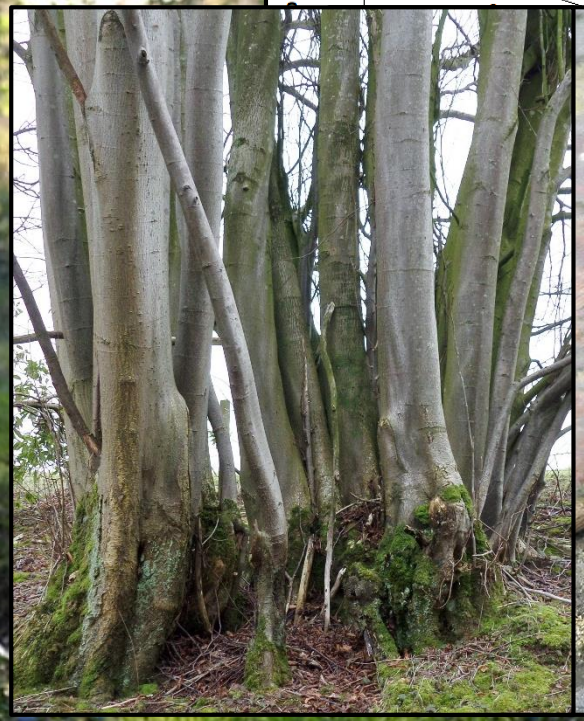

Rosser (2014)

O'Connor (2013)

Overall picture, projections

- Lime doing OK
- Clones not expected to impact future success (probably helping)
- Given climate link – future looks bright for lime?
  - Maybe (e.g. weather/parasites)