Walnut Shoot Growth

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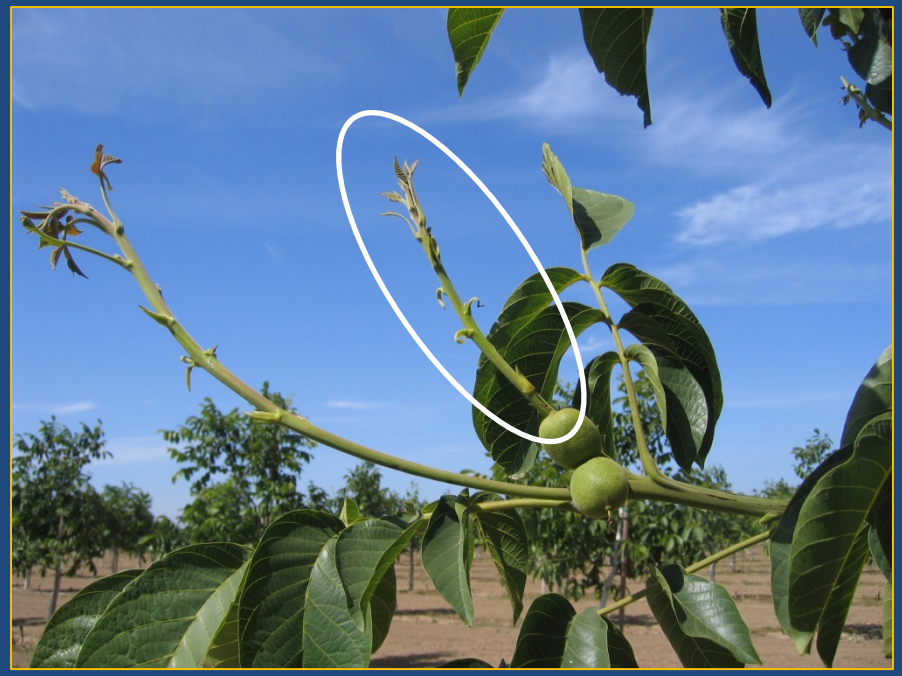
Terminology

Proleptic shoot- grows out of a bud that has gone through a period of dormancy (preformed in the bud the previous year so I will refer to these as **preformed**)

Sylleptic shoot- grows out of a bud in the same season that the bud was formed (no dormancy cycle)- these are formed during the current season so I will refer to these as **neoformed**



Epicormic shoot- grows out of a bud that lay dormant under the bark for some period (usually grows out in response to injury of some type)

Normally there are two buds at the base of each leaf that can potentially produce a preformed shoot

Study to look at preformed buds-

Dormant Howard shoots were sampled from a commercial orchard near Dixon, CA in February

Dormant walnut bud dissection


Leica
WILD
mpc


Germany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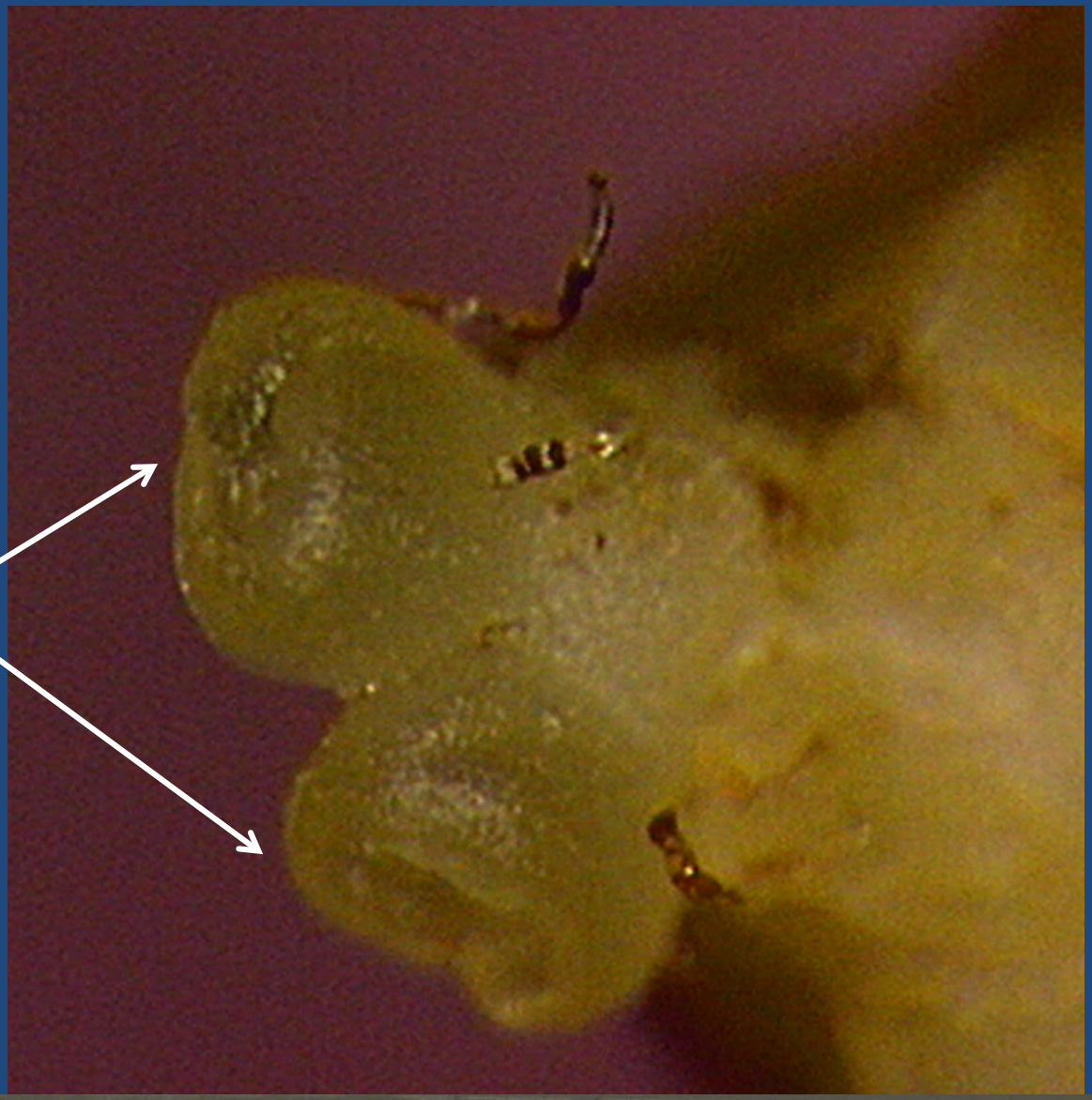
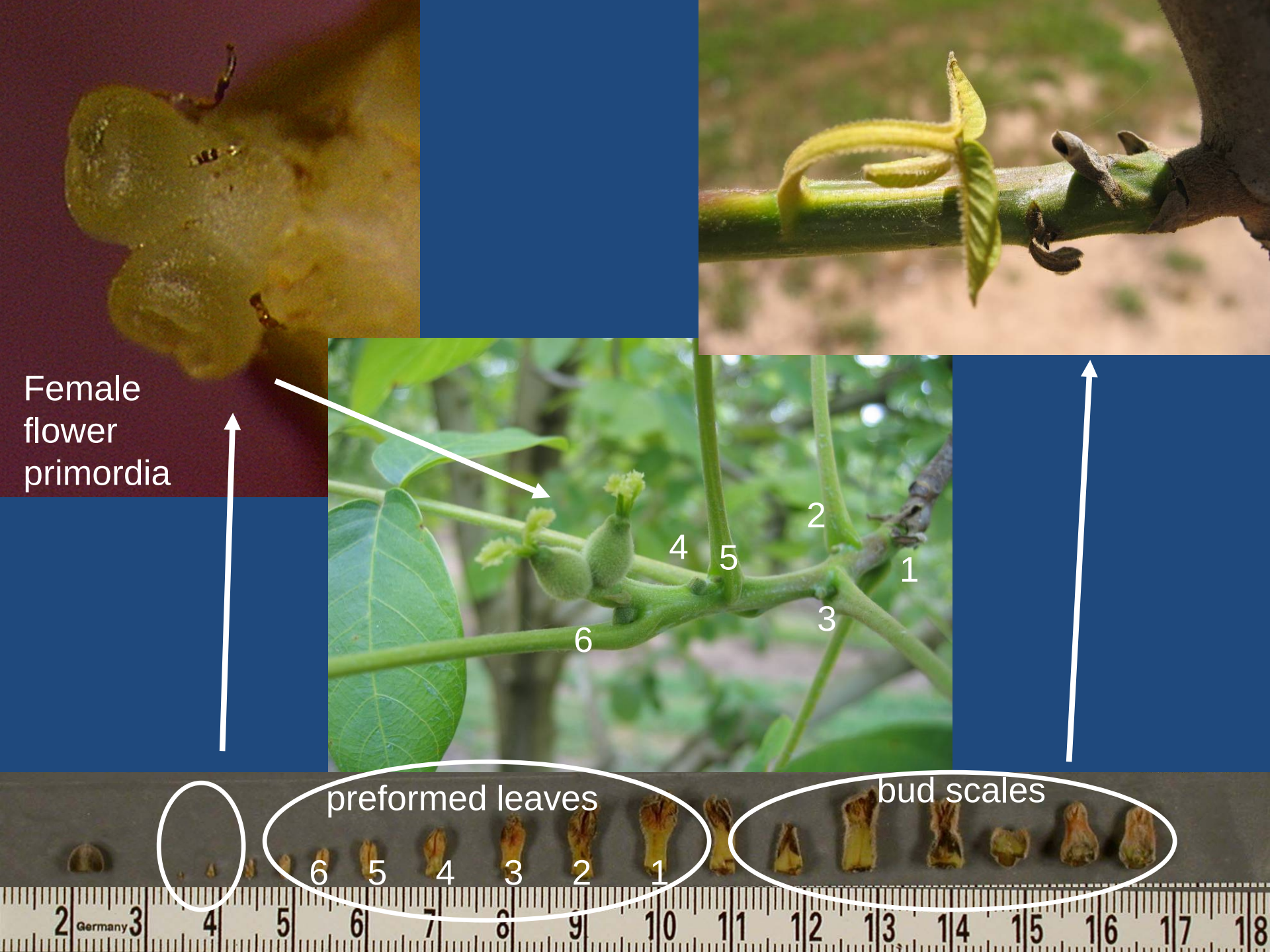
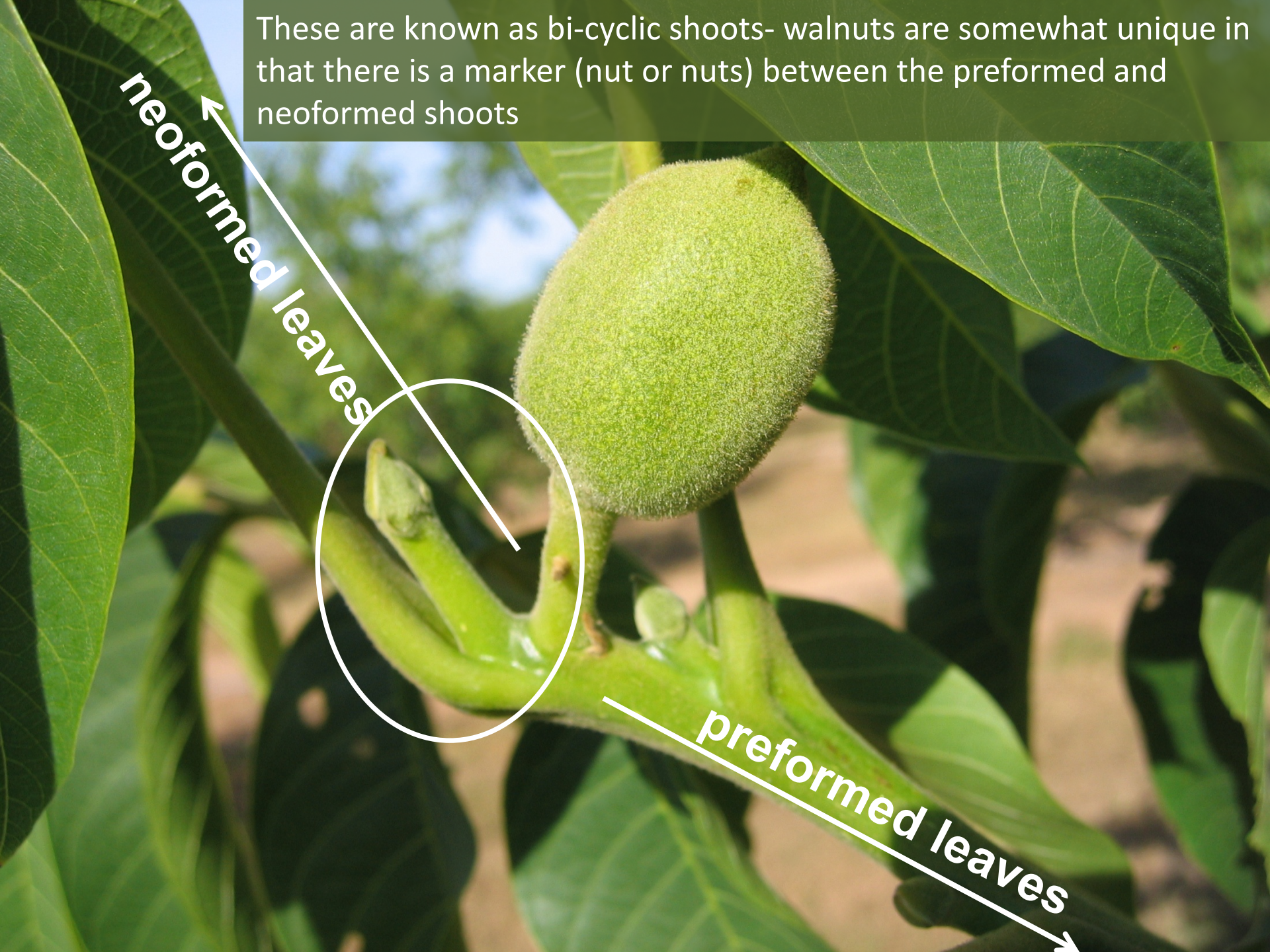
Female flower primordia

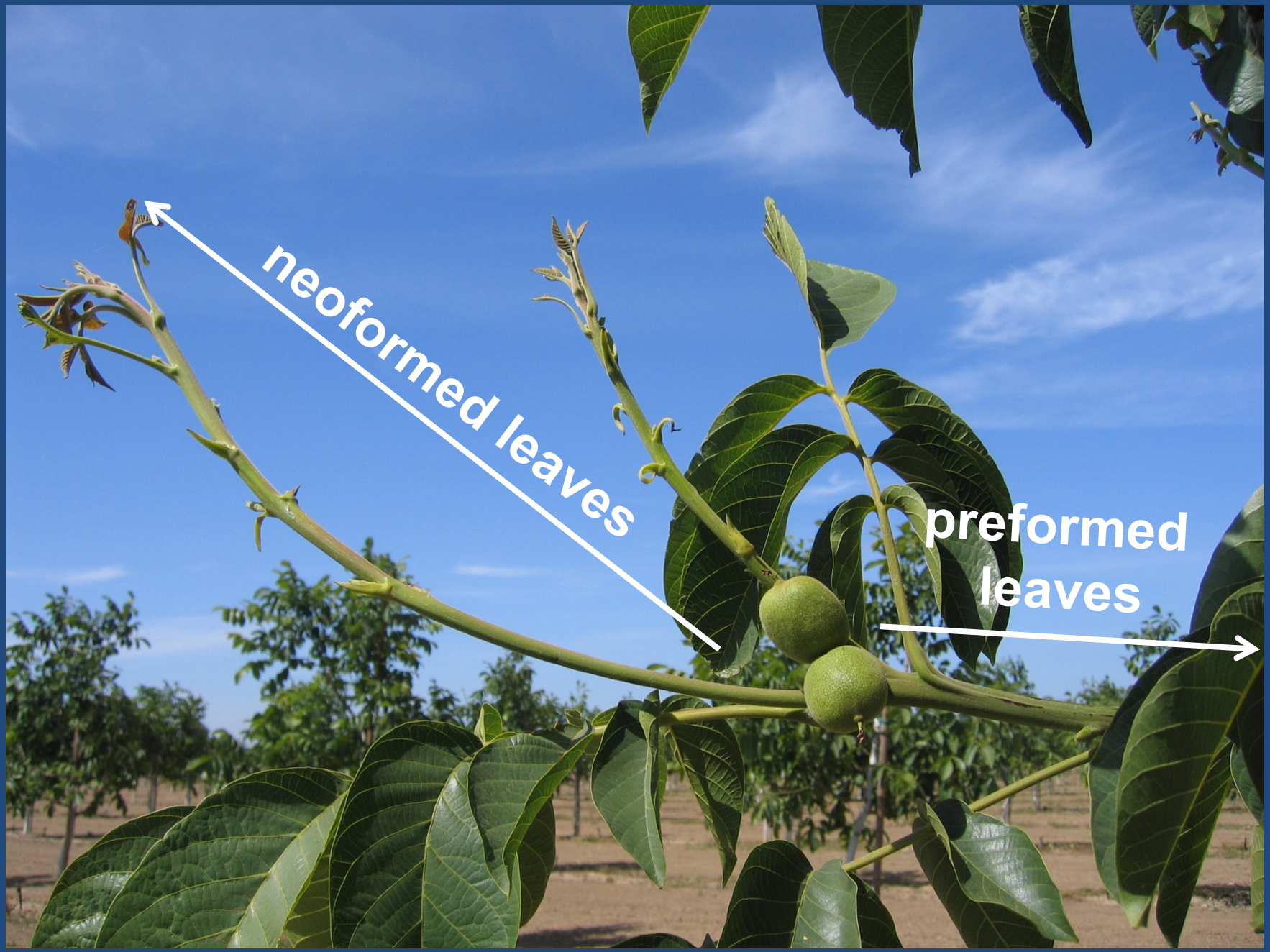



Female flower primordia
2
4
5
1
3
6
preformed leaves
6 5 4 3 2 1
bud scales

These are known as bi-cyclic shoots- walnuts are somewhat unique in that there is a marker (nut or nuts) between the preformed and neoformed shoots




neoformed leaves
preformed leaves


neoformed leaves
preformed leaves

Frequently no viable buds will form here

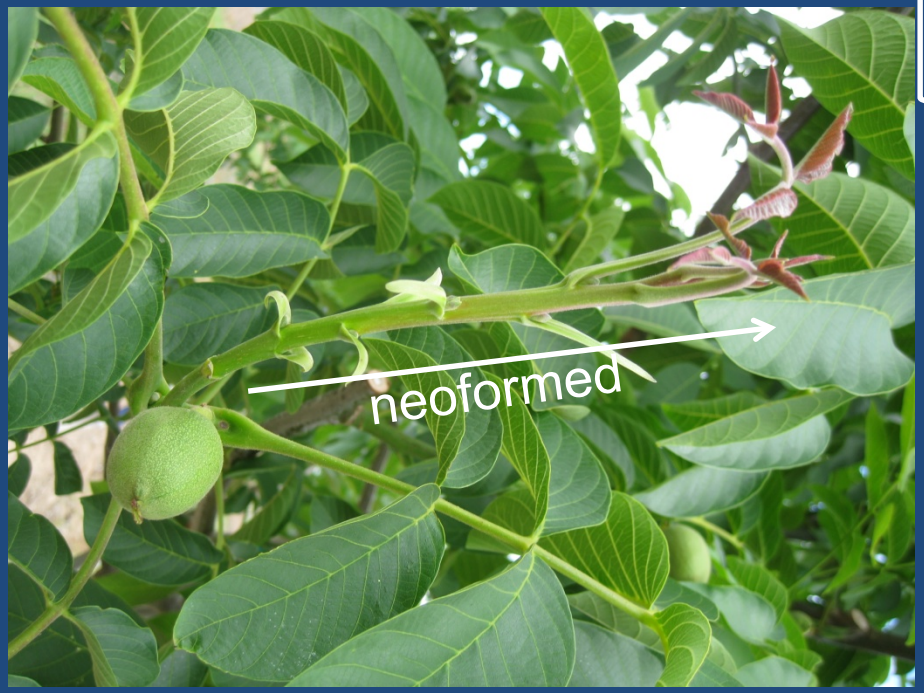
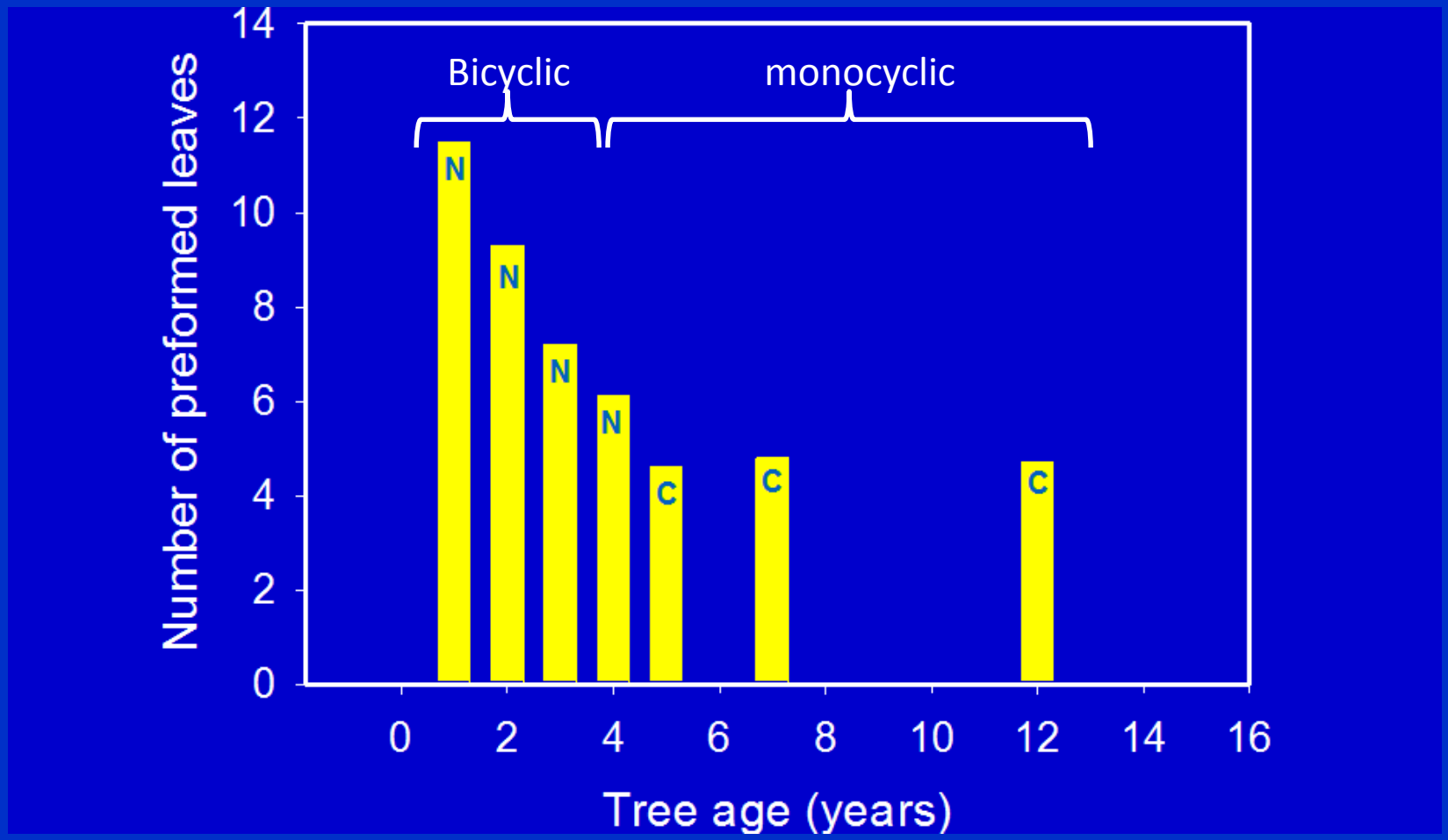


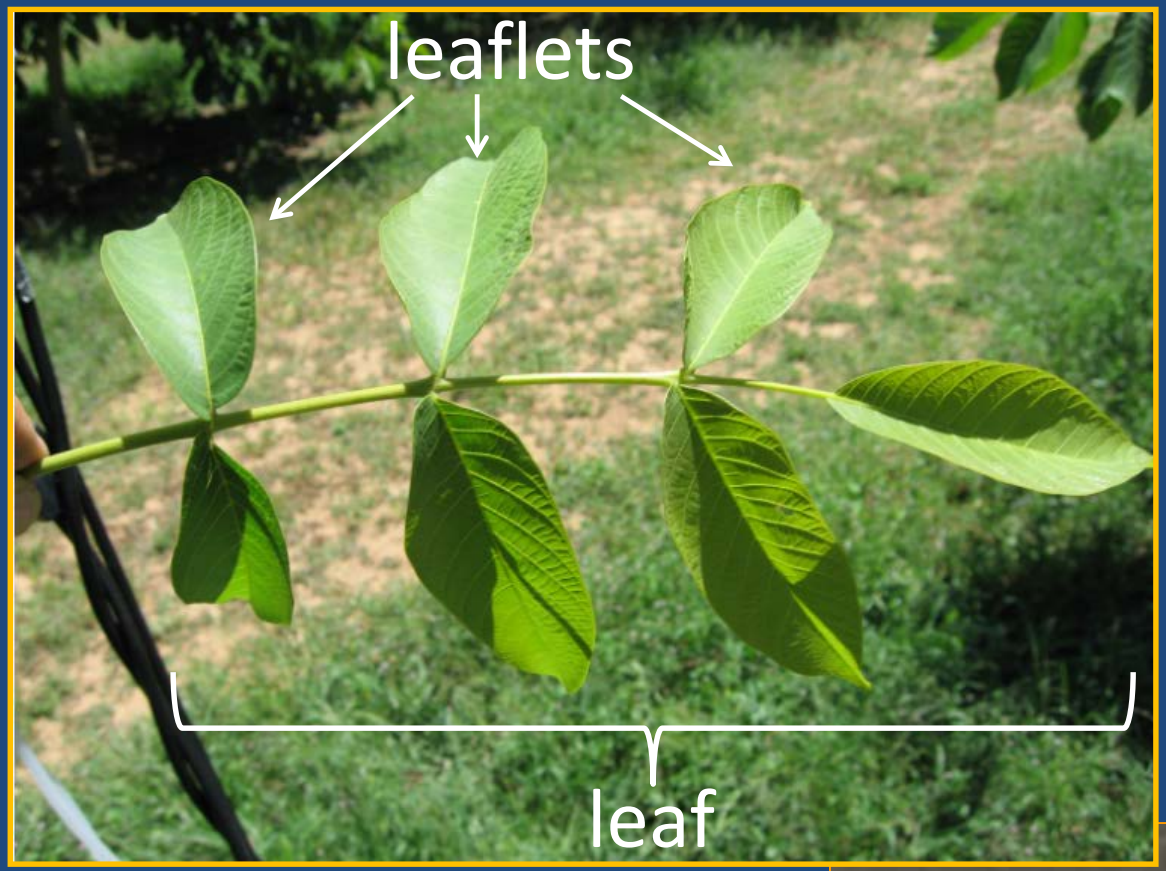
Photo by Bob Beede



Preformed leaf summary- number of preformed leaves can be influenced by:

- Tree age- older the tree, less preformed leaves
- Position on shoot- terminal bud has 2-4 more preformed leaves compared to lateral positions
- Canopy position- higher number of preformed leaves high in canopy than low
- Stress- less preformed leaves due to lack or excess of water

The terminal bud normally has two more preformed leaves compared to lateral buds

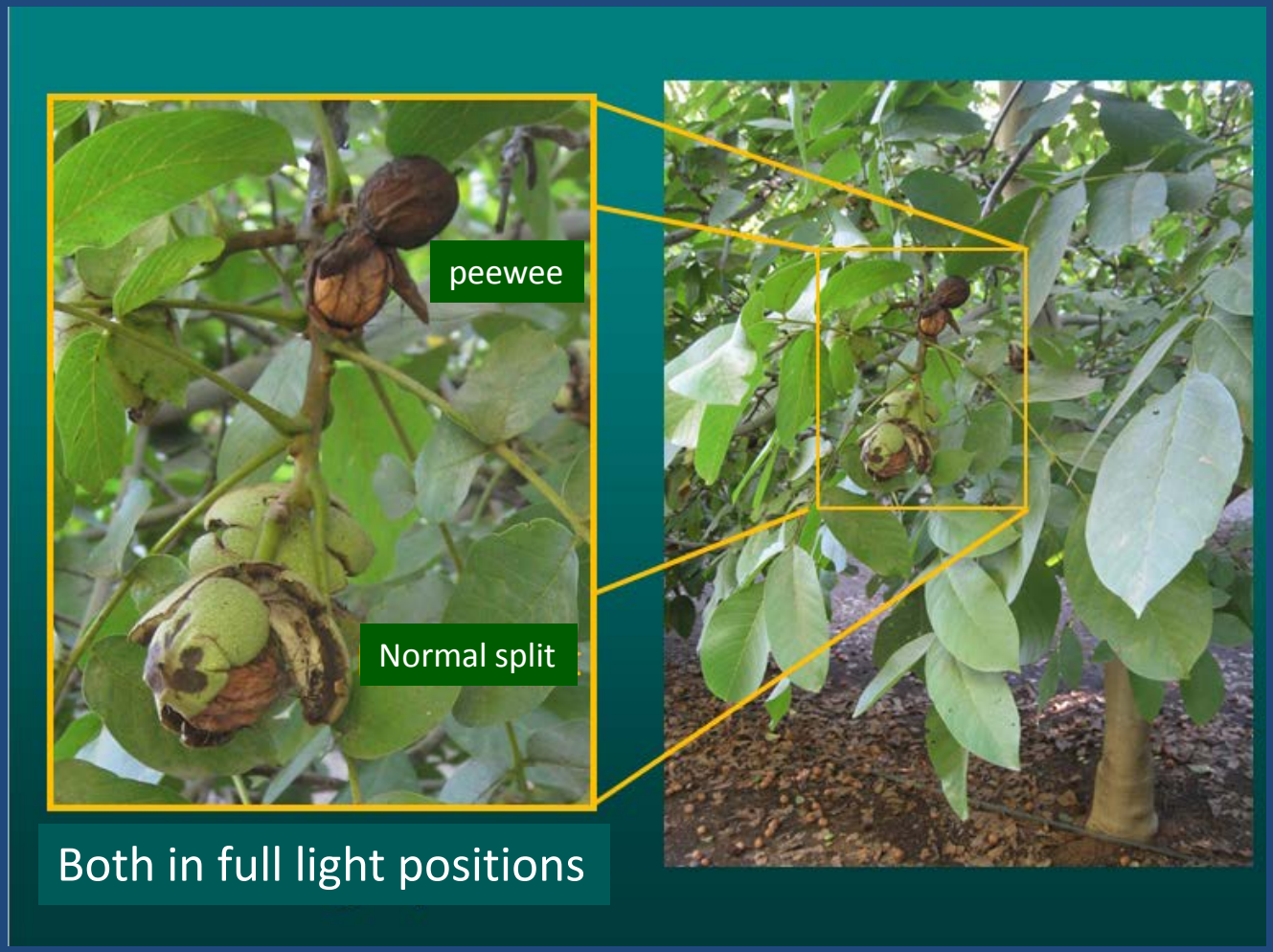


Walnuts have compound leaves. The individual leaflets are already formed in the bud


Number of leaves and number of leaflets tells you about conditions last year
Number of leaves and number of leaflets tells you about conditions this year

This allows diagnosis of potential problems over two years- when a tree suddenly dies during the growing season, we can look back and see that the problem actually started a year or more earlier based on much lower numbers of preformed leaves in previous years compared to adjacent healthy trees.

In this case the pee wee nuts are associated with a position that was in the shade last year (few number of small leaves) and then exposed by hedging).



What are the implications of this on how a tree grows?

We did a study on Chandler to determine if there is a relationship between the number of preformed leaves in the dormant bud and the number of neoformed shoots that grow the following year.

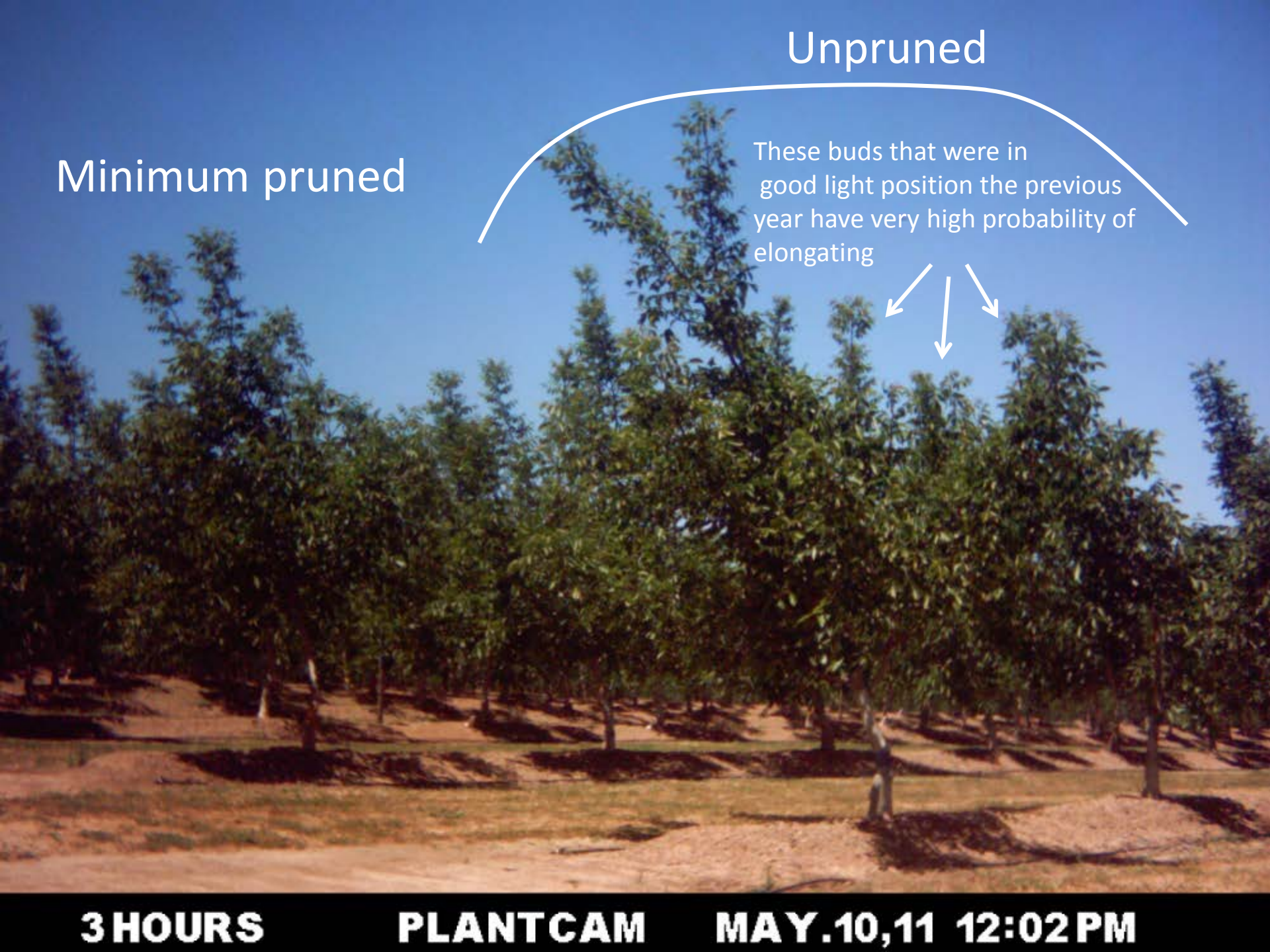

1 neoformed)
(need 7 preformed)

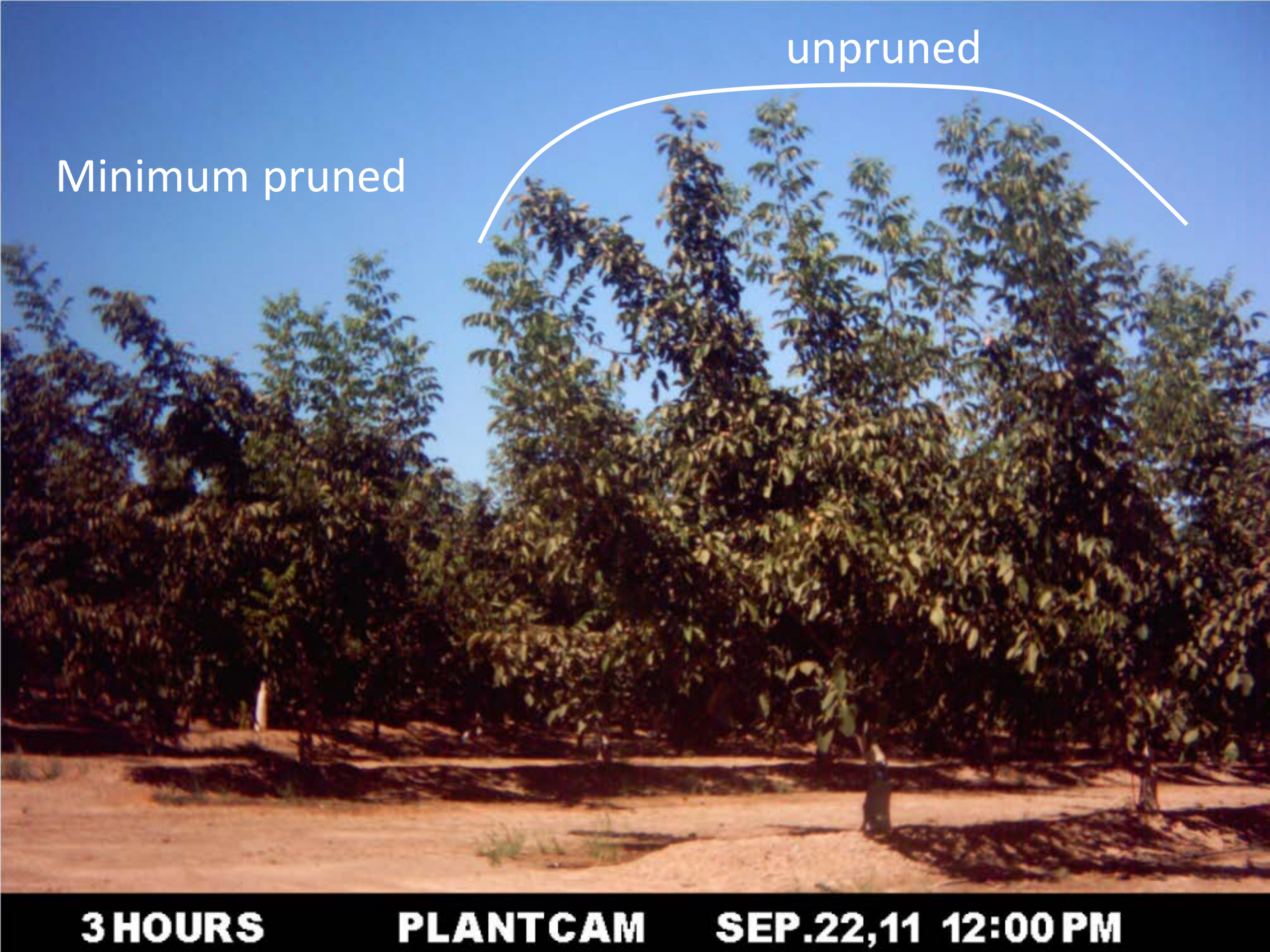

2 neoformed
(need 9 pref.)


3 neoformed
(need 11 pref.)

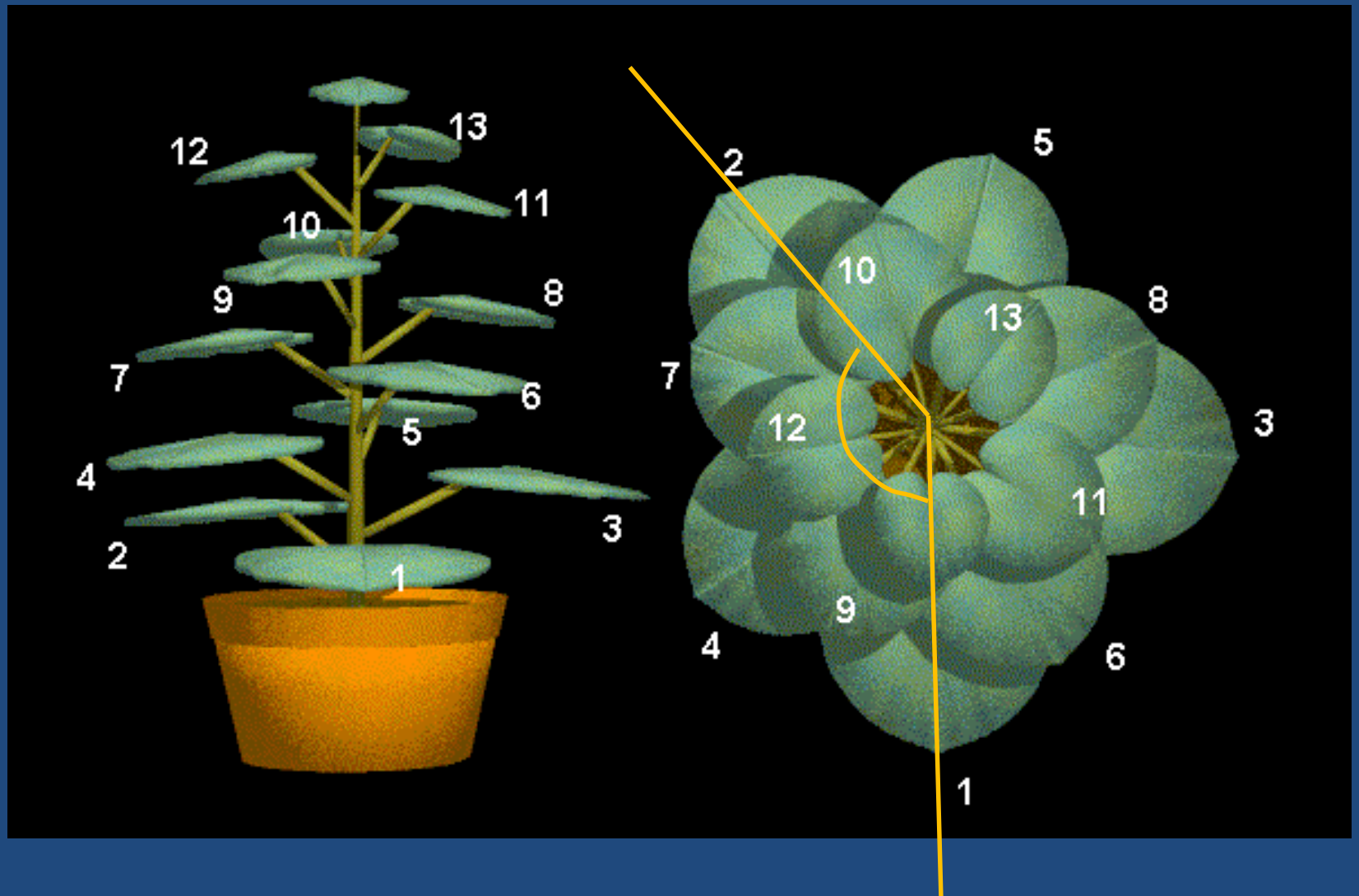

4 neoformed
(need 13+ pref.)

Because of this trees are able to straighten themselves out over several years


Unpruned
Minimum pruned
These buds that were in good light position the previous year have very high probability of elongating
3 HOURS
PLANTCAM
MAY.10,11 12:02 PM


unpruned
Minimum pruned
3 HOURS
PLANTCAM
SEP.22,11 12:00 PM

Walnut leaves are arranged in a Fibonacci series with each succeeding leaf arising at an angle of 137.5 degrees (“known as the golden angle”) from the previous one. This give the least overlap of leaves when seen from above.



In Andalusia, Spain there is a solar plant that uses an array of mirrors set in a pattern mimicking the spiral phyllotaxy of a sunflower to reflect sunlight onto a central tower and produce steam for energy

Photo of Andalusia Spain solar plant as sun begins striking panels in the morning

137.5 degree angle between adjacent branches

Conclusions

Walnut shoots grow in a bi-cyclic pattern with preformed leaves (preformed in the bud) and neoformed leaves (formed during the current season)

- In mid-summer, this allows us to make some observations regarding conditions both in the current season as well as the previous season (e.g. weather, irrigation, nutrition)

Walnut shoots emerge in an orderly fashion with each succeeding node having an angle of 137.5 degrees from the last ("Golden Angle")- pruning disrupts this pattern

Because buds in good light positions have more preformed leaves, they have a higher likelihood of elongating into a long shoot- in this ways trees will straighten themselves out over several years

Trees grow in an orderly fashion without our intervention- in general the less they are disturbed the better

Questions?