

Effects of Elevated [CO₂] on *Populus* Metabolites

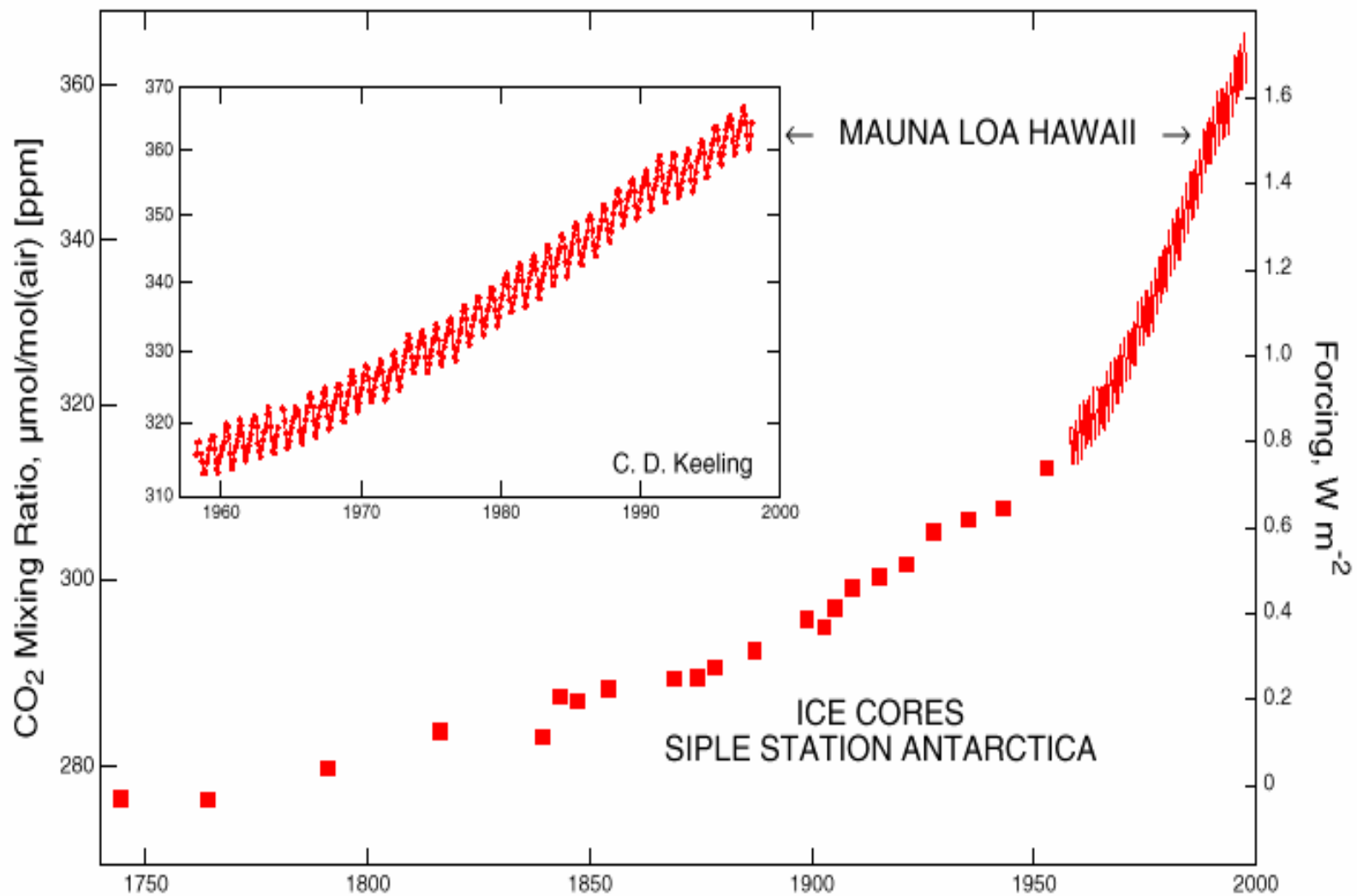
John Bevens

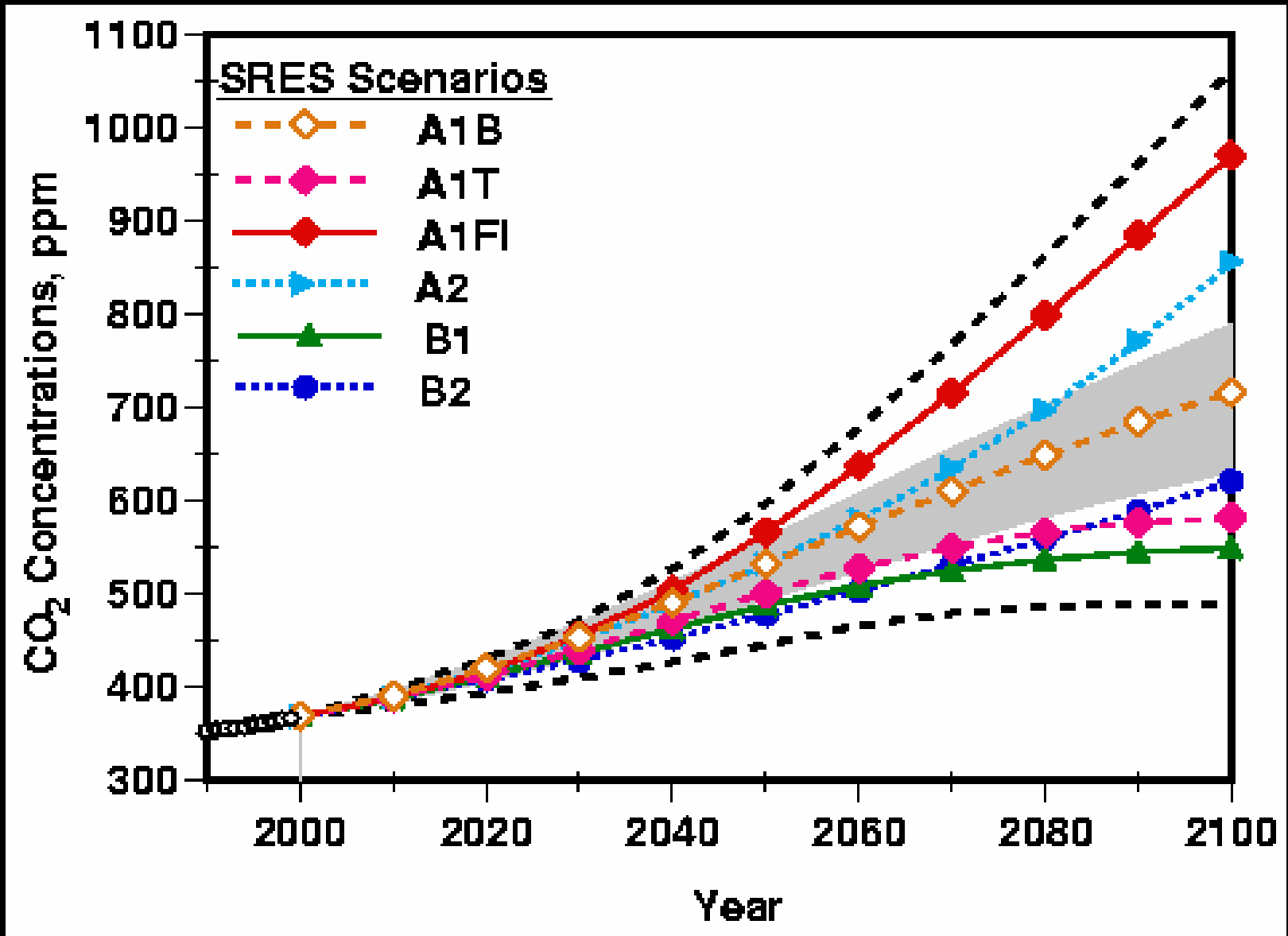
University of Tampa

AspenFACE (Free-Air CO₂ Enrichment)

Brookhaven National Laboratory

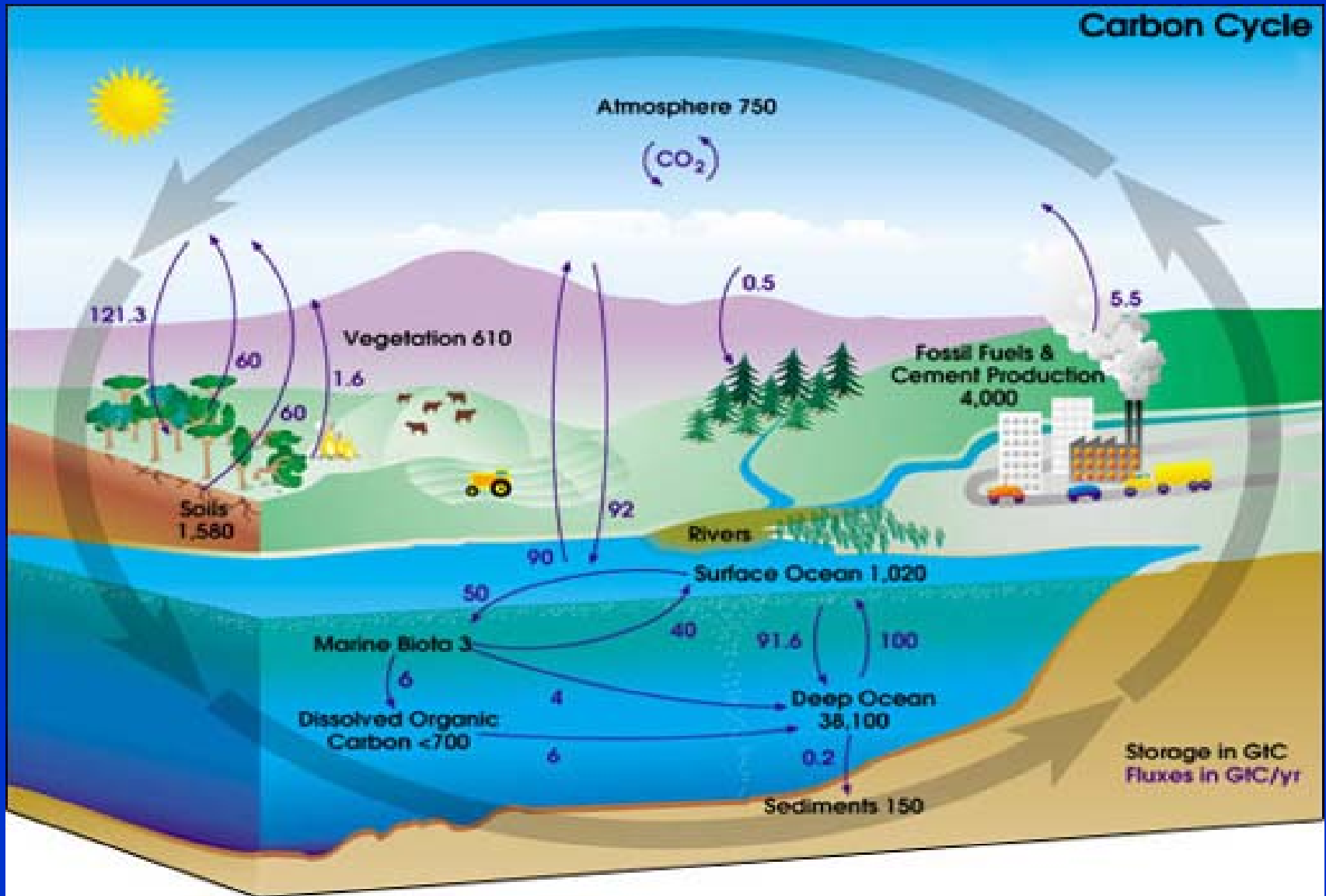
GLOBAL CARBON DIOXIDE OVER THE INDUSTRIAL PERIOD



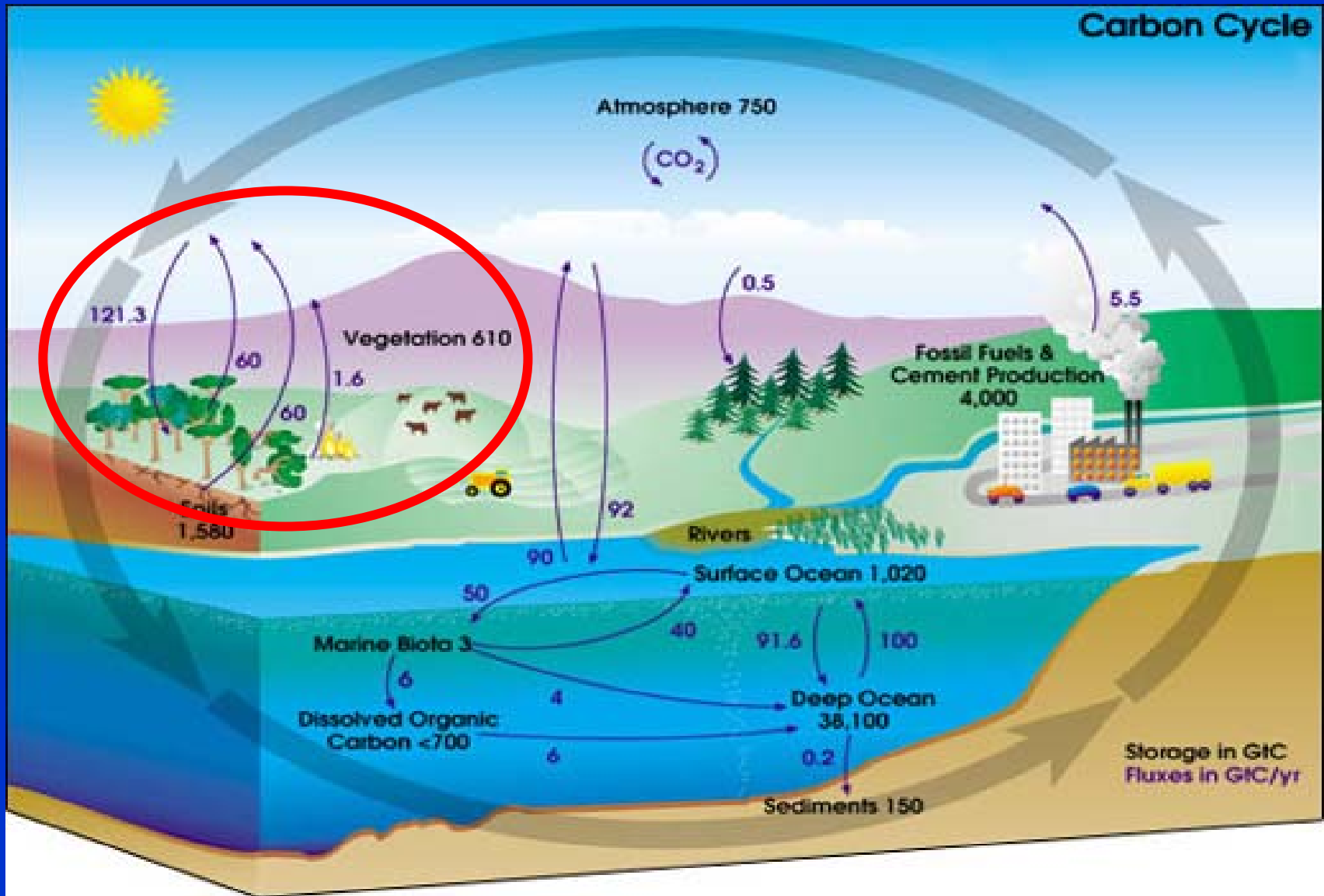


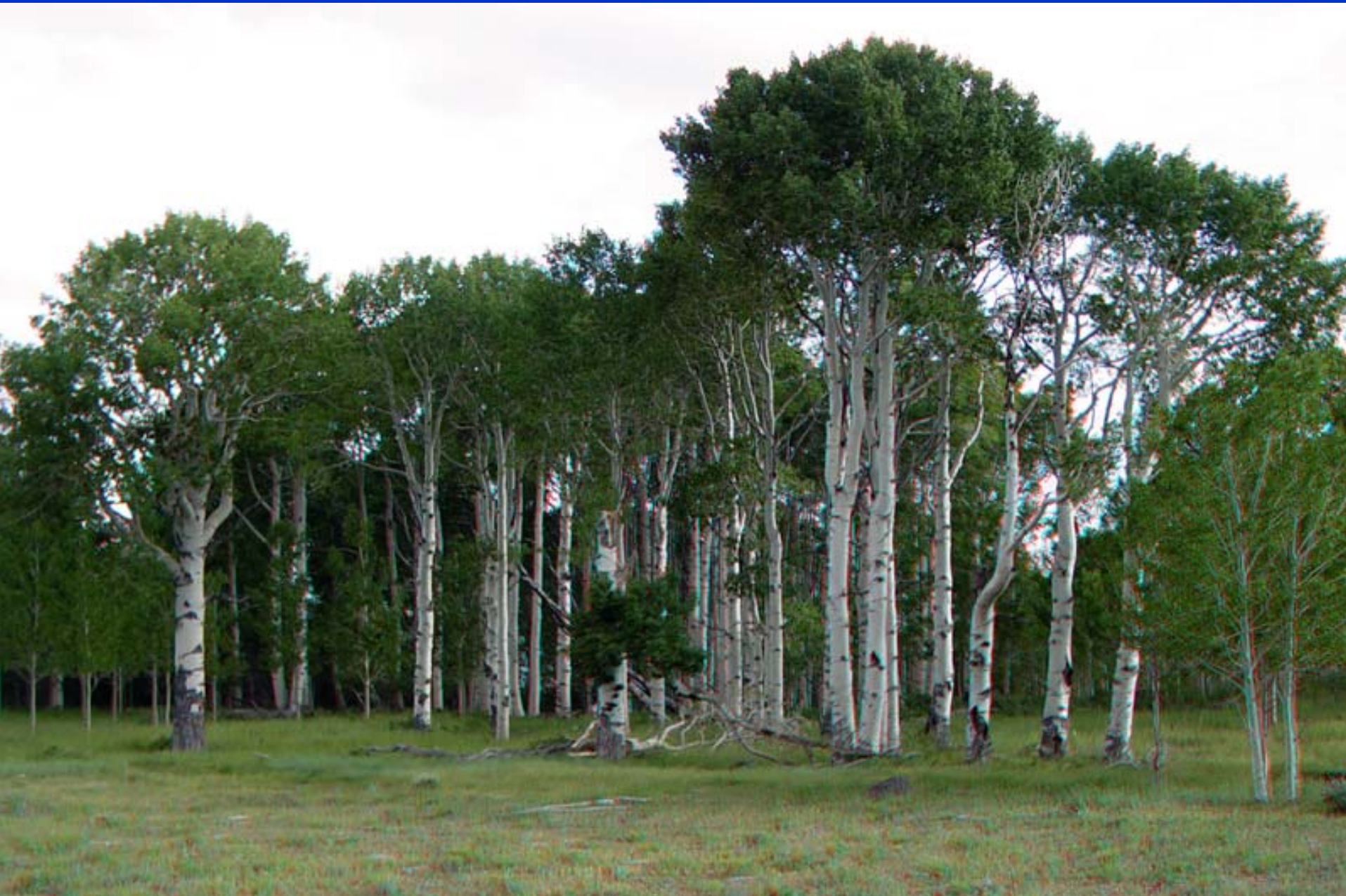
U.N. Intergovernmental Panel on Climate Change (2001)

Carbon Cycle



Carbon Cycle





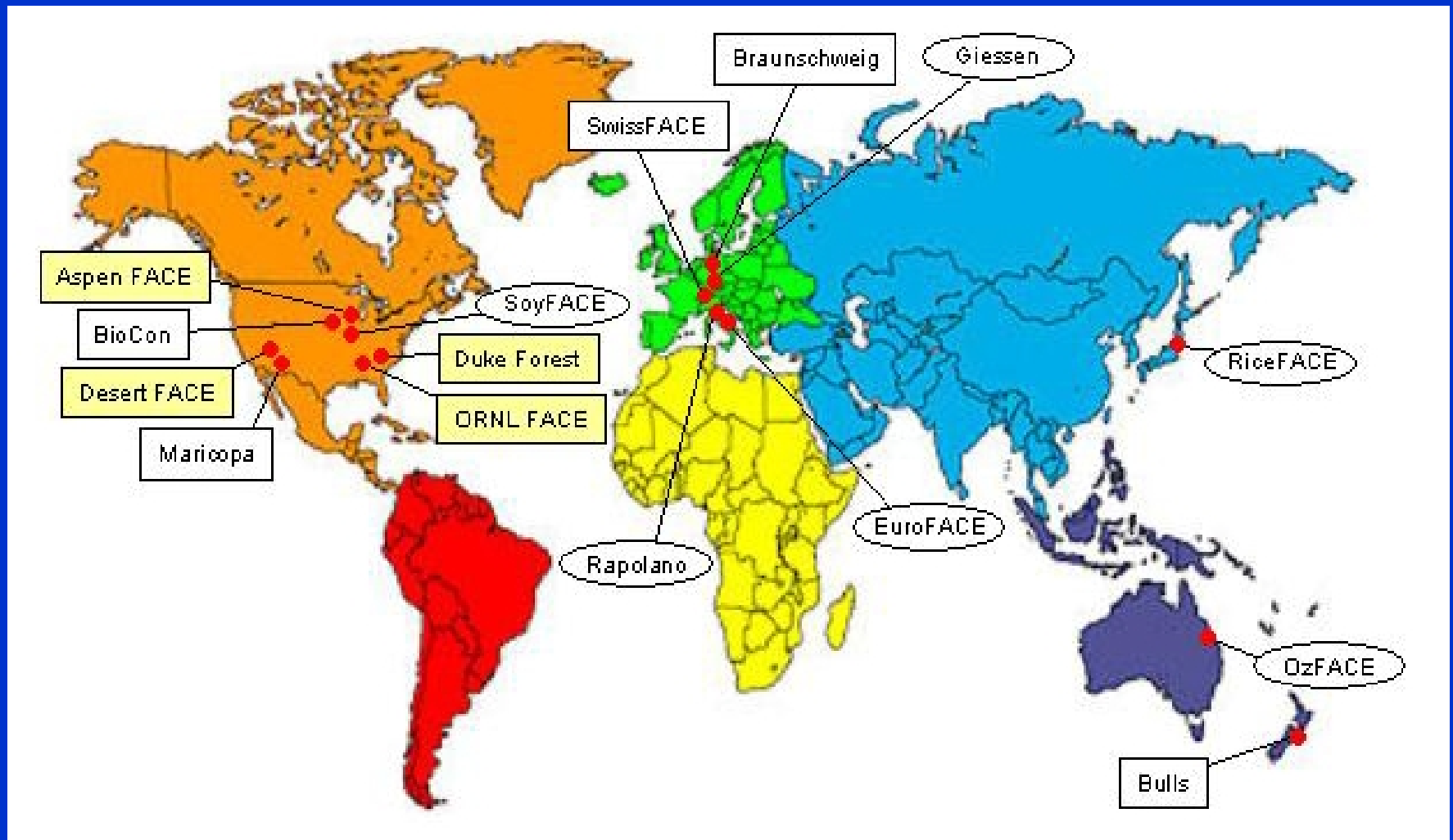
Source 3dparks.wr.usgs.gov/escalante/html/3d4670.html

FACE Technology

Aspen FACE Experiment

- Are forests carbon sources or sinks? Do they change overtime?
- Will more or less [CO₂] be sequestered by forests as [CO₂] levels rise?
- Where is the missing carbon from global carbon models? Are forests sequestering it?

International FACE Sites



Source: http://www.bnl.gov/face/Research_Sites.asp




Source: <http://wpp.greenwichmeantime.com>



Source: <http://aspenface.mtu.edu/>

AspenFACE Plant Metabolites

- 7 experimental assays: Protein, Starch, Glucose and Fructose (Hexose), Sucrose, Amino Acid, and Nitrate.
- Treatment:
 1. Ambient: 37 kPa
 2. Elevated: 70 kPa

The diagram shows two lines originating from the text '1. Ambient: 37 kPa' and '2. Elevated: 70 kPa'. These lines converge towards a right-pointing chevron shape that encloses the chemical formula '[CO₂]'. This indicates that the two different CO₂ concentrations are being compared or grouped under the general term of CO₂ treatment.
- Foliar samples, 2 Clones (216 & 271).

AspenFACE Data Collection

Ambient



Clone 216



Elevated CO₂

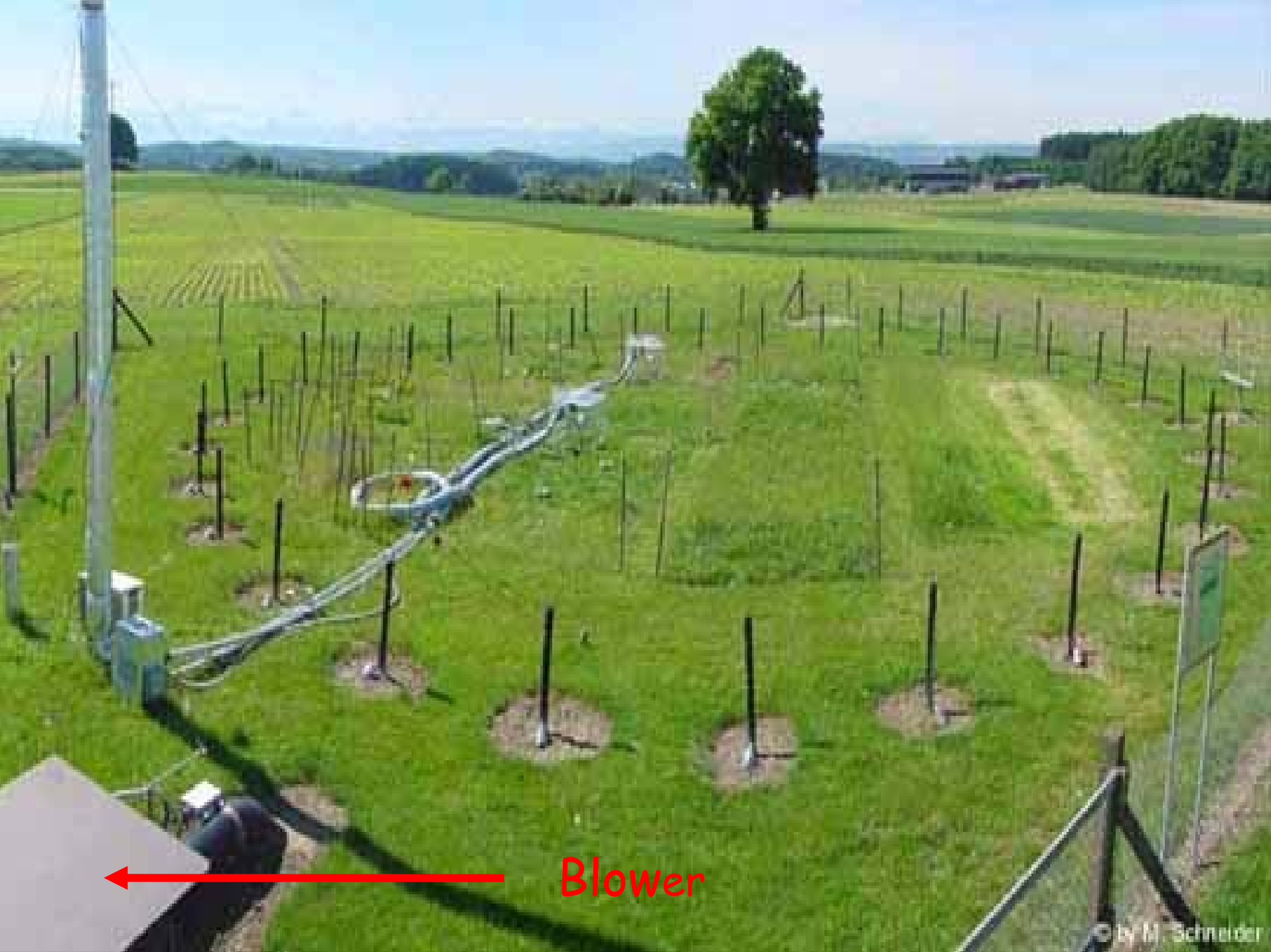
Elevated CO₂



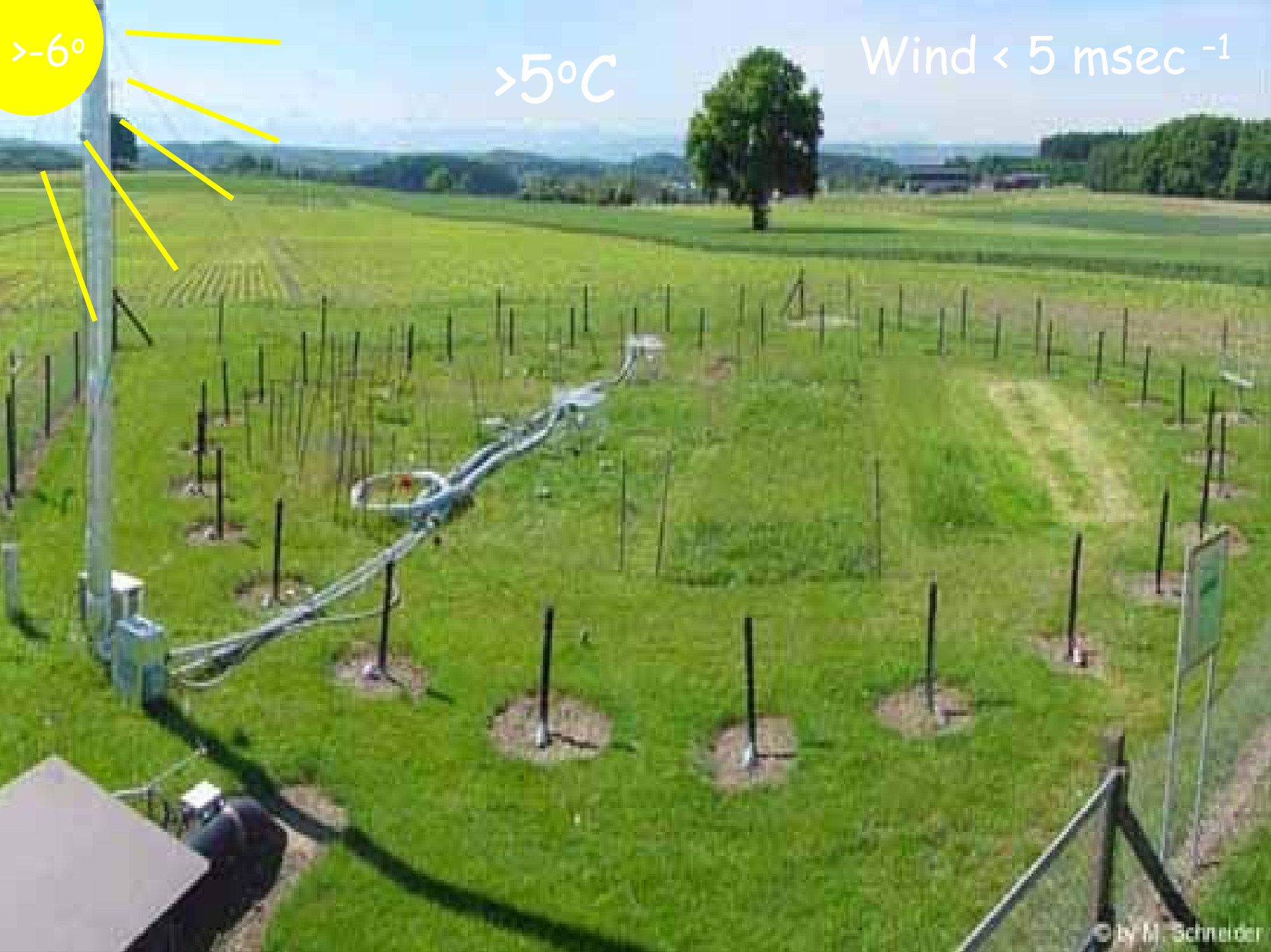
Clone 271



Ambient



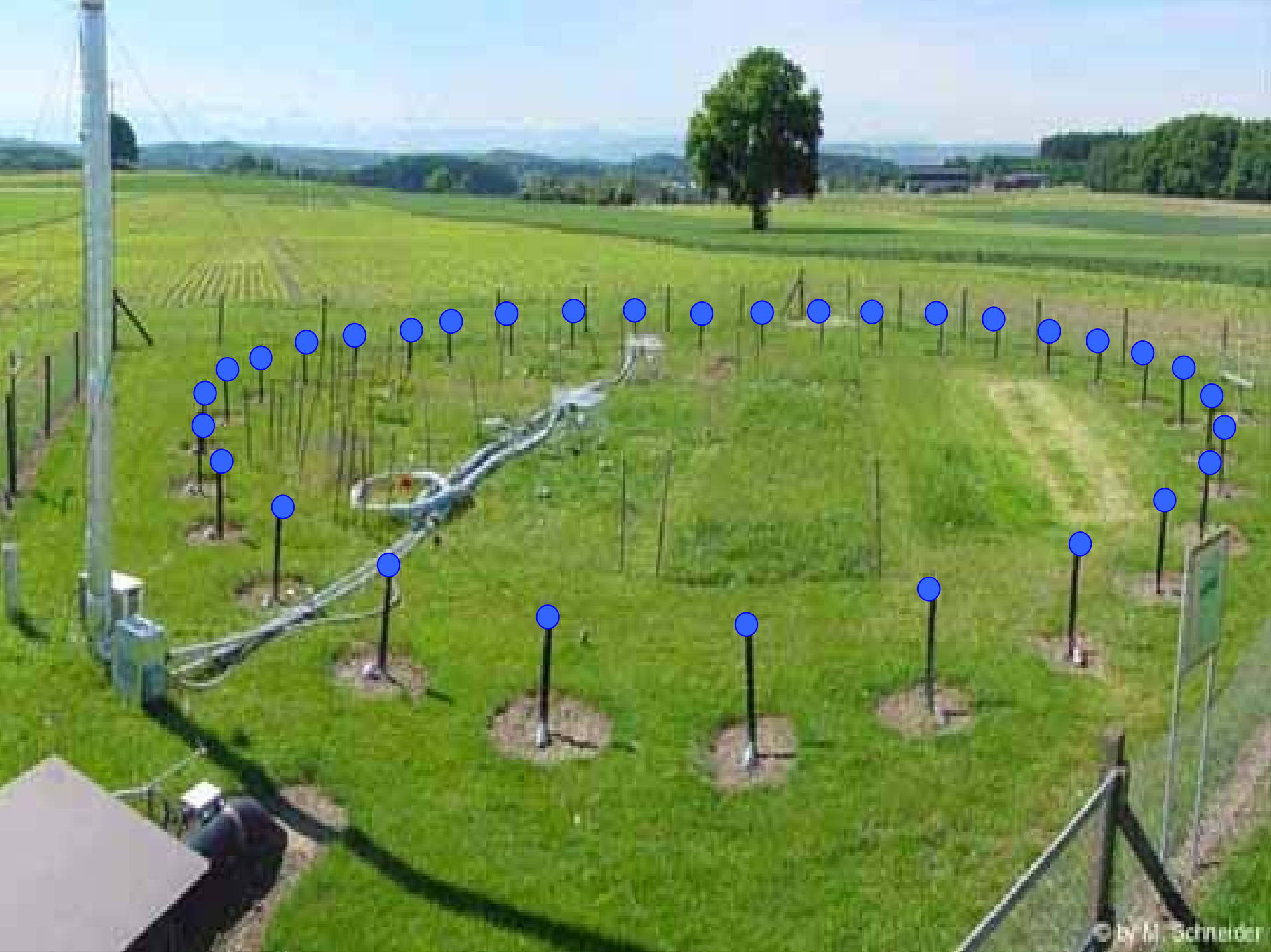
Blower

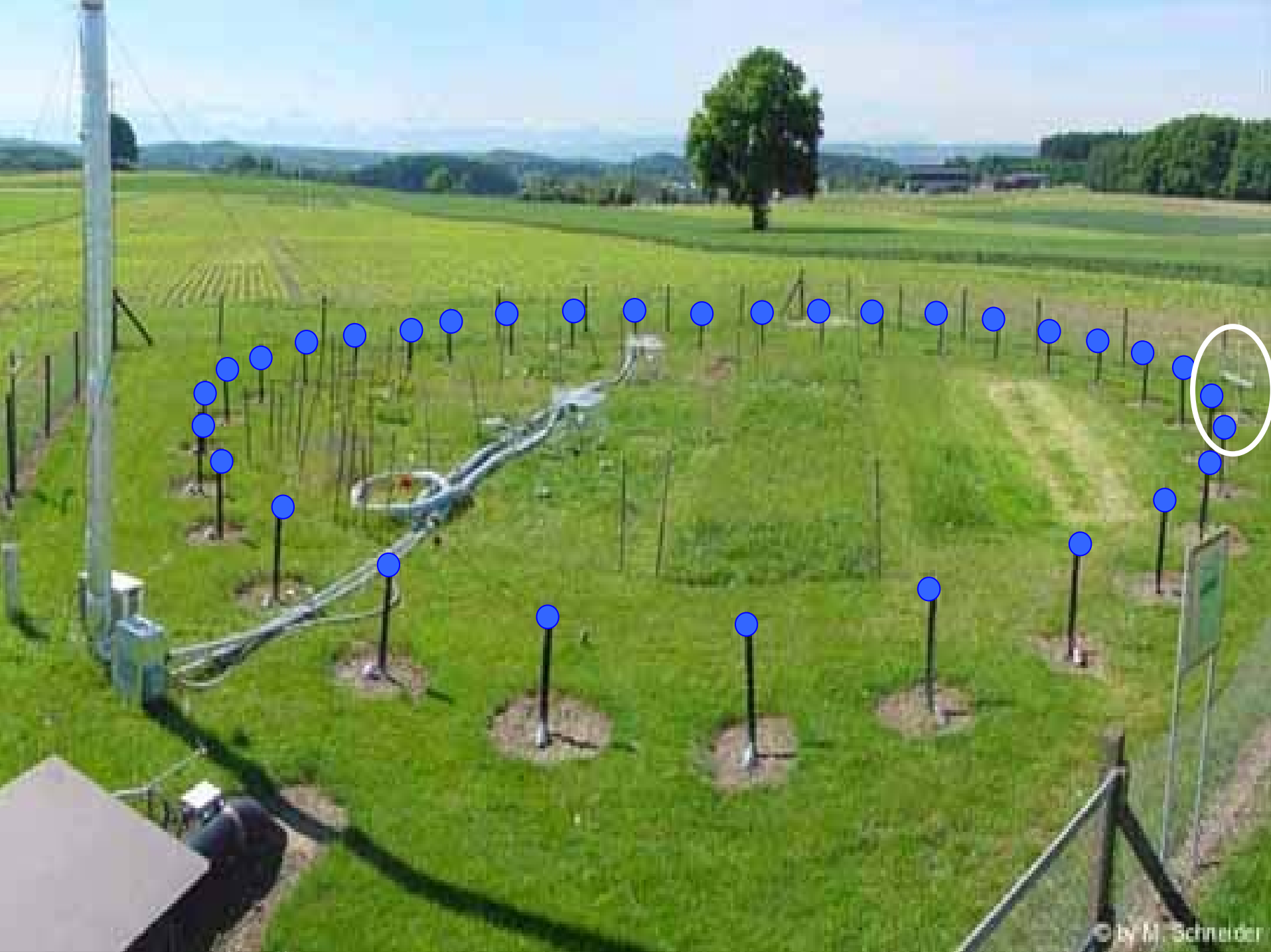


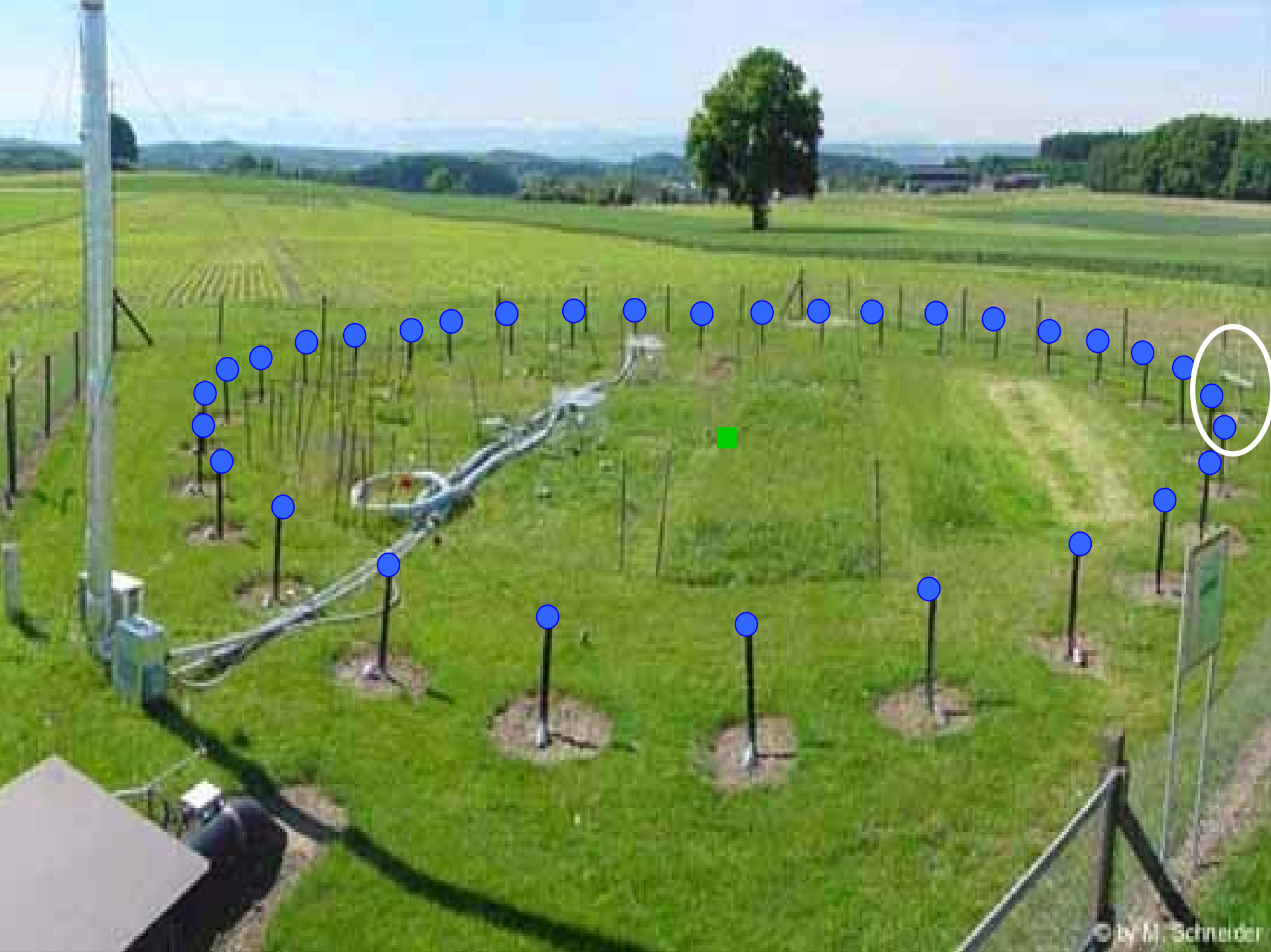
>-6°

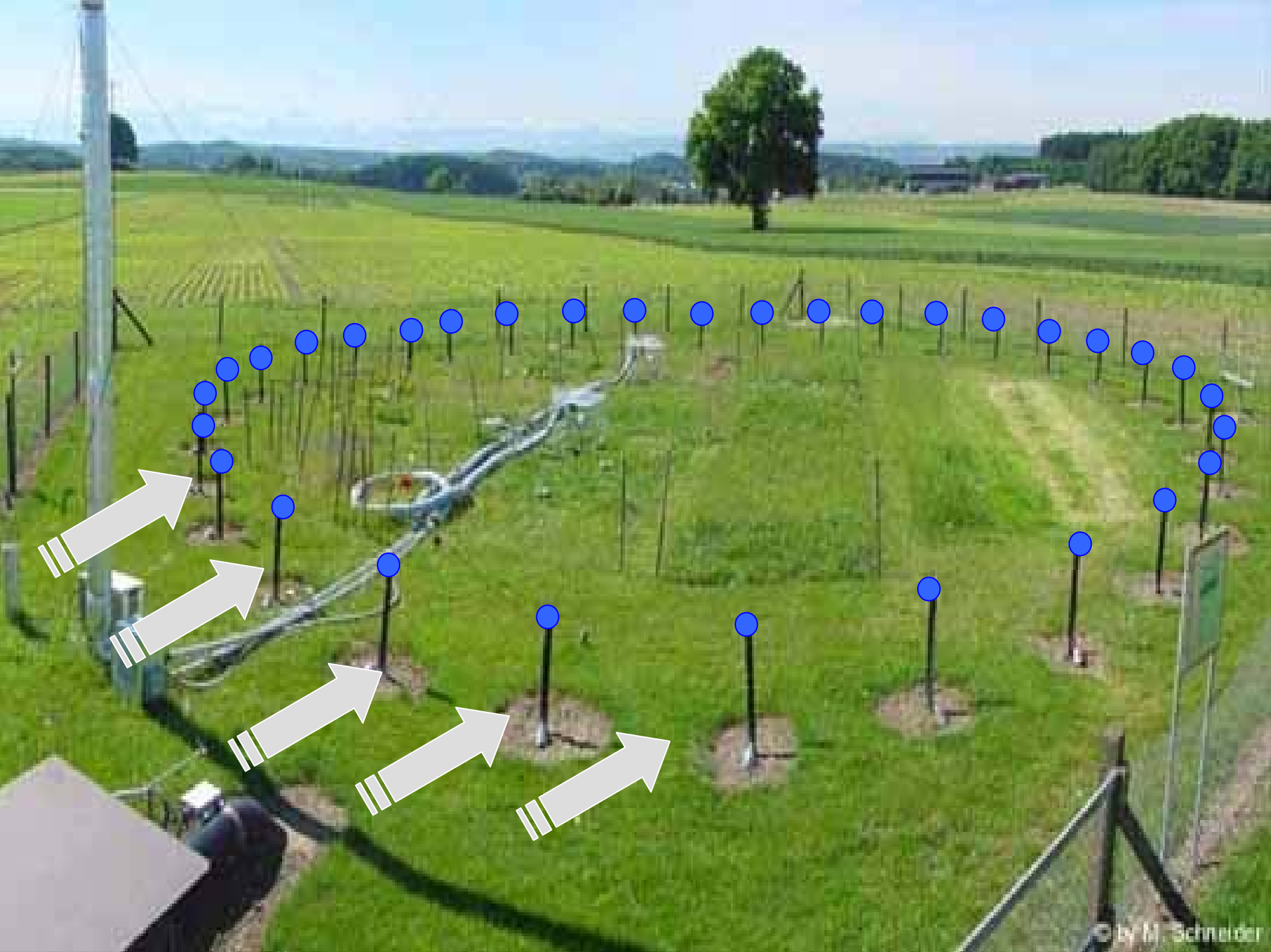
>5°C

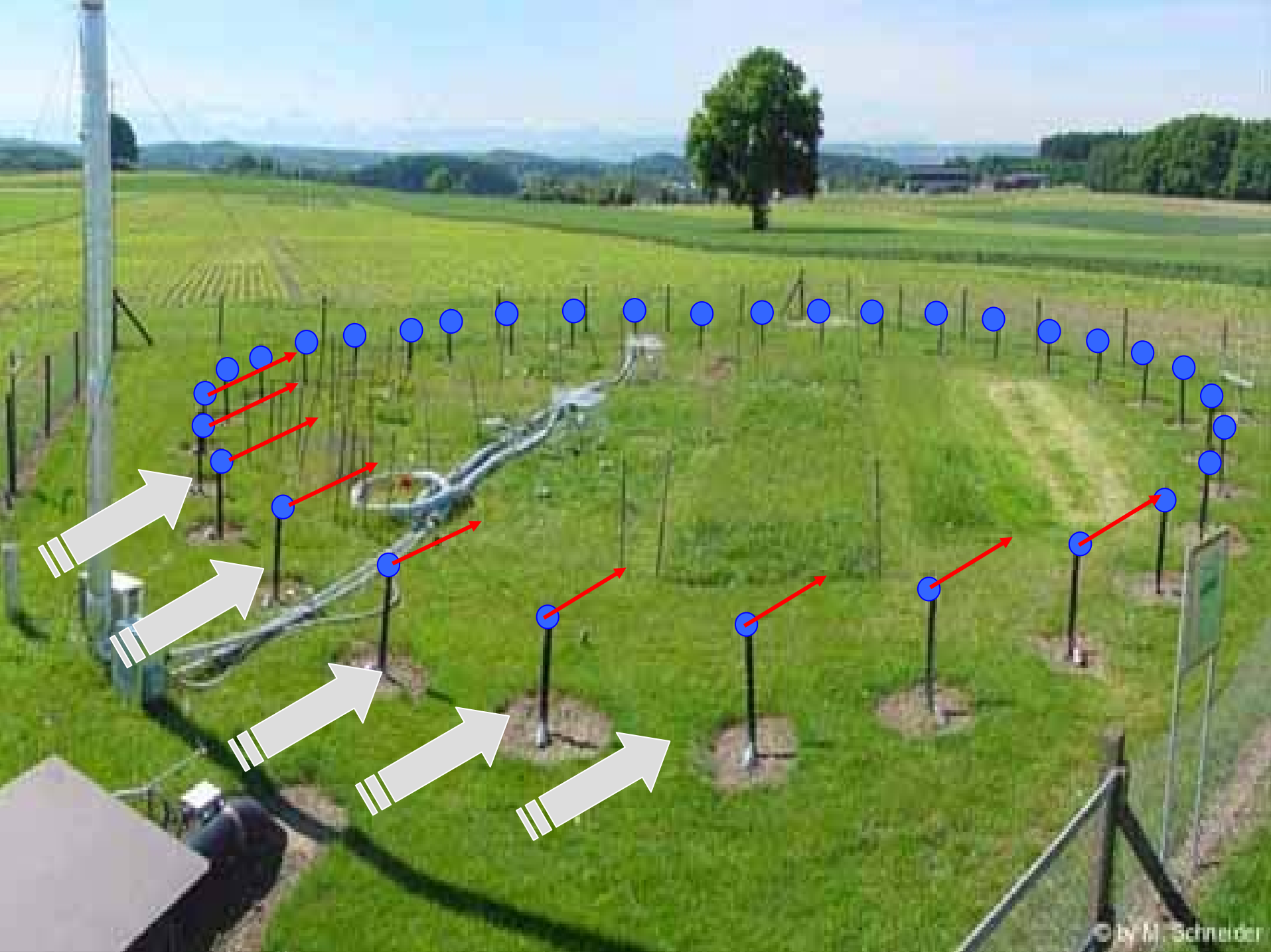
Wind < 5 msec⁻¹

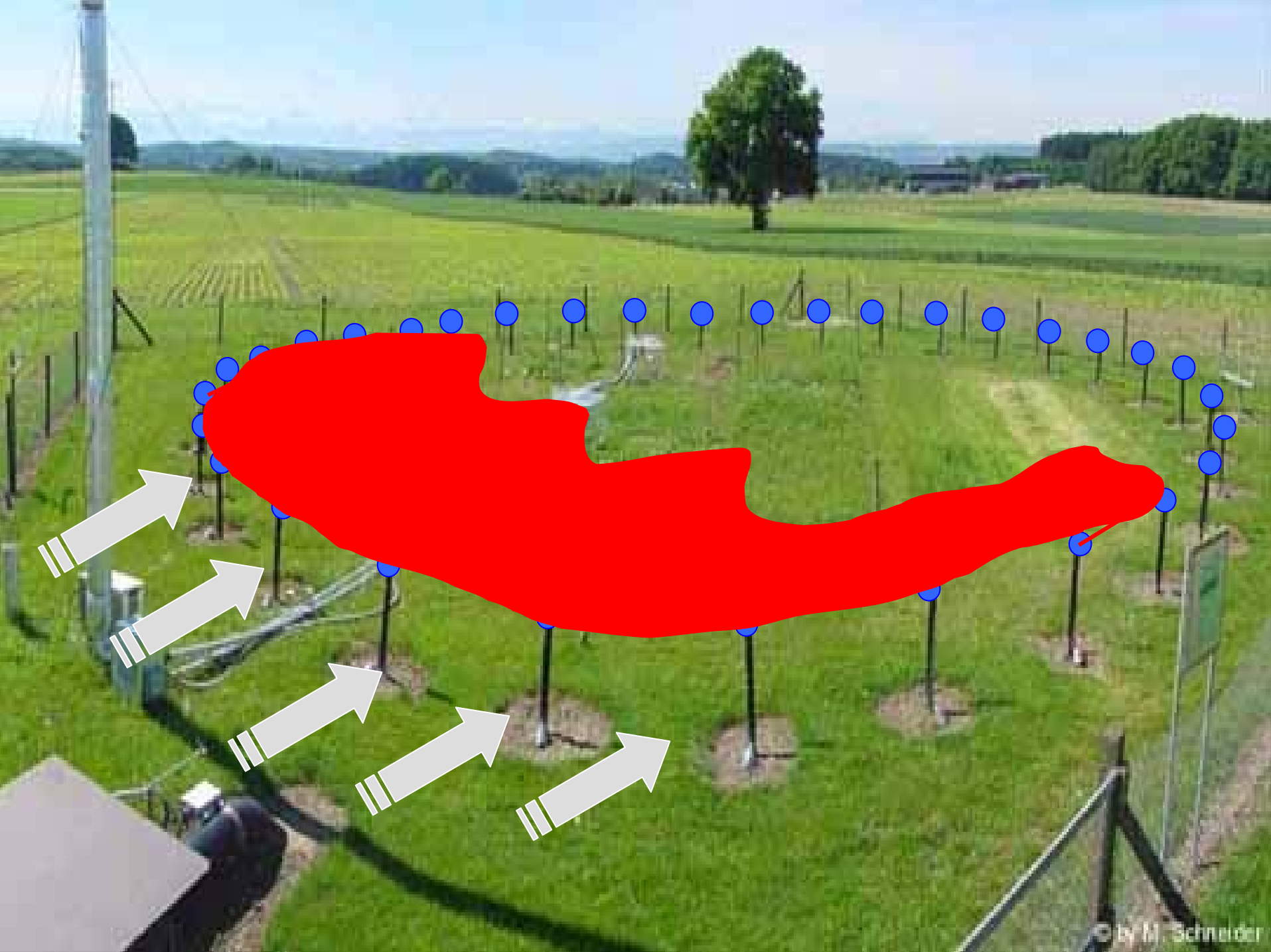


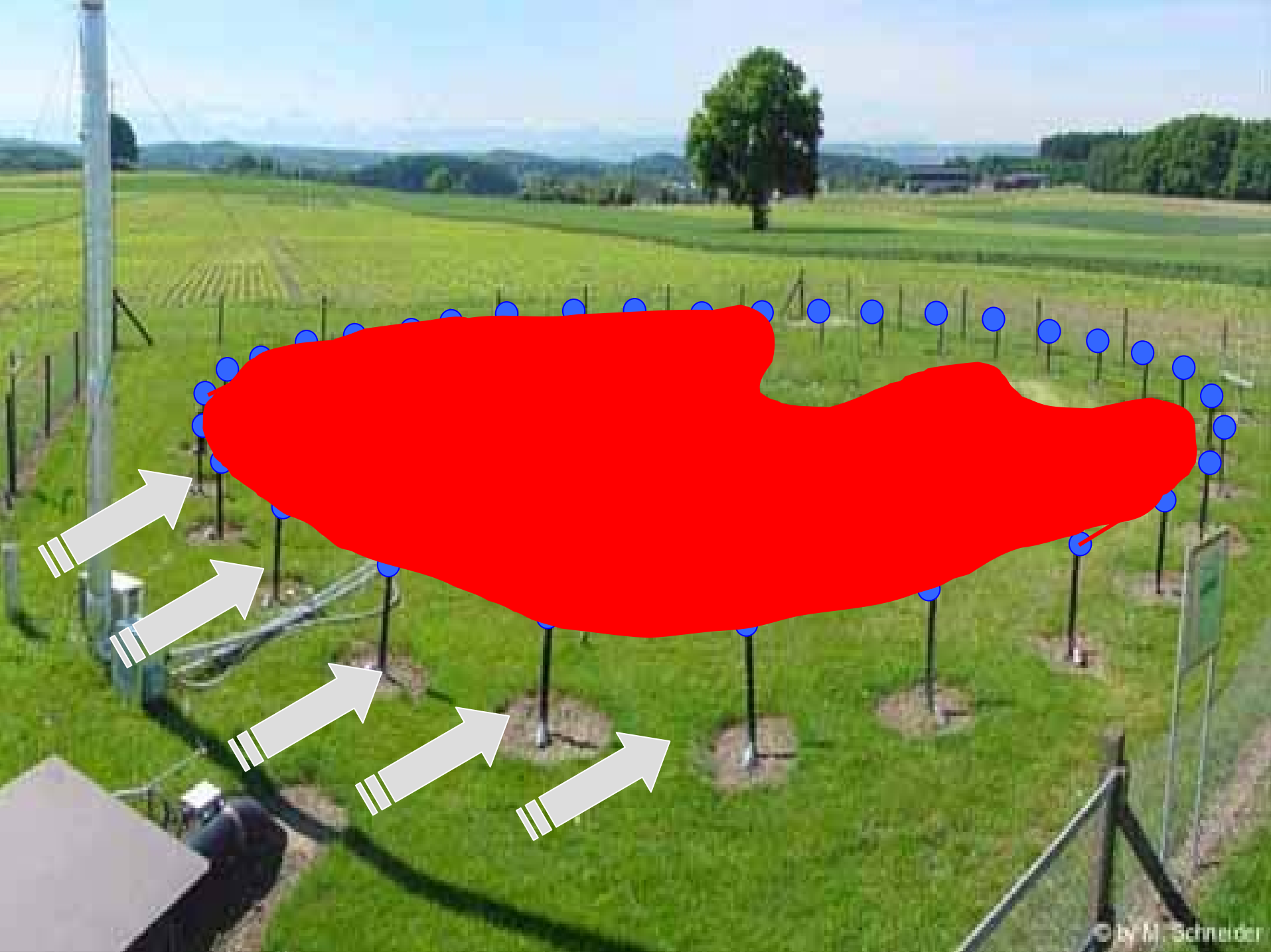


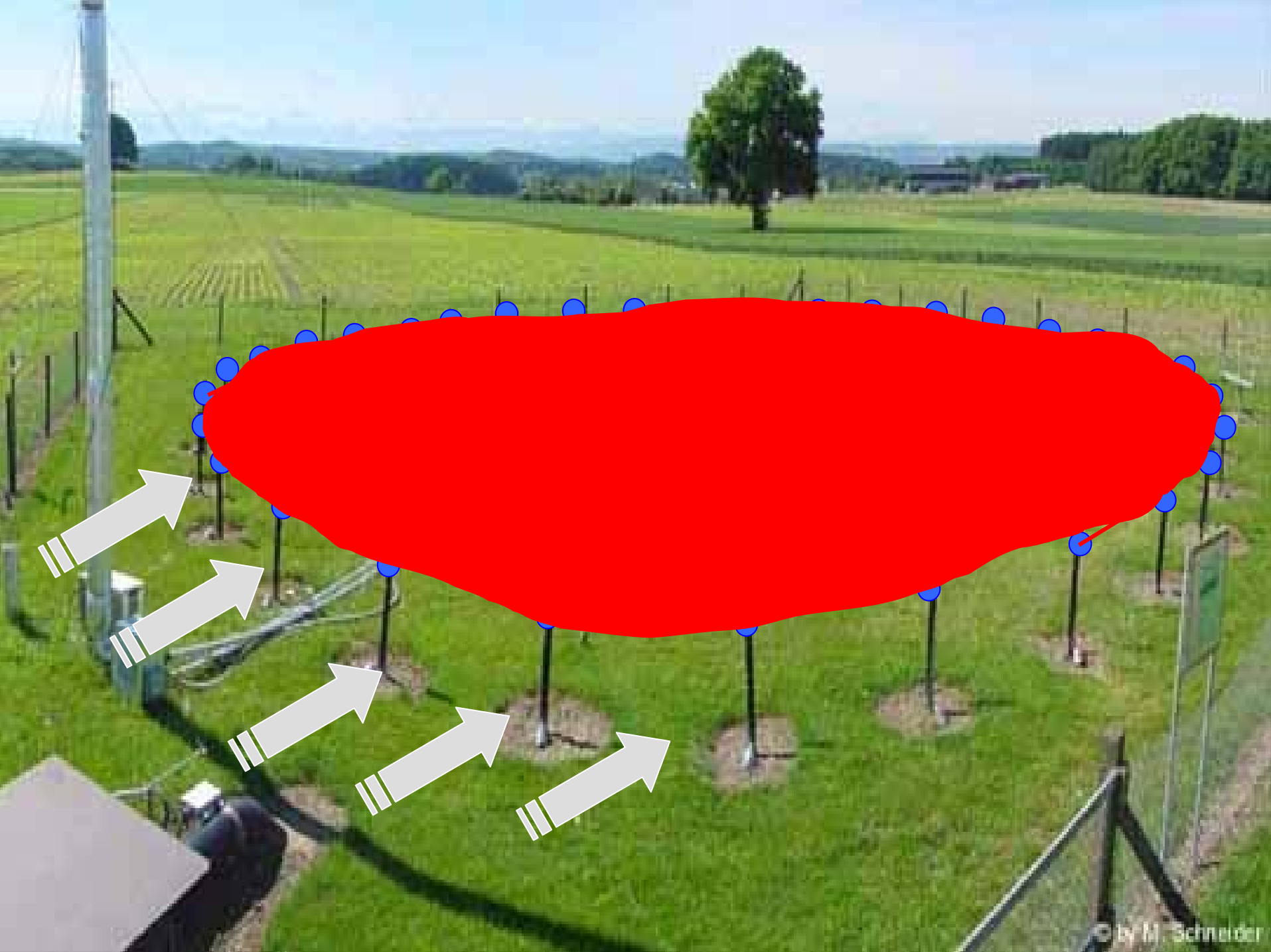












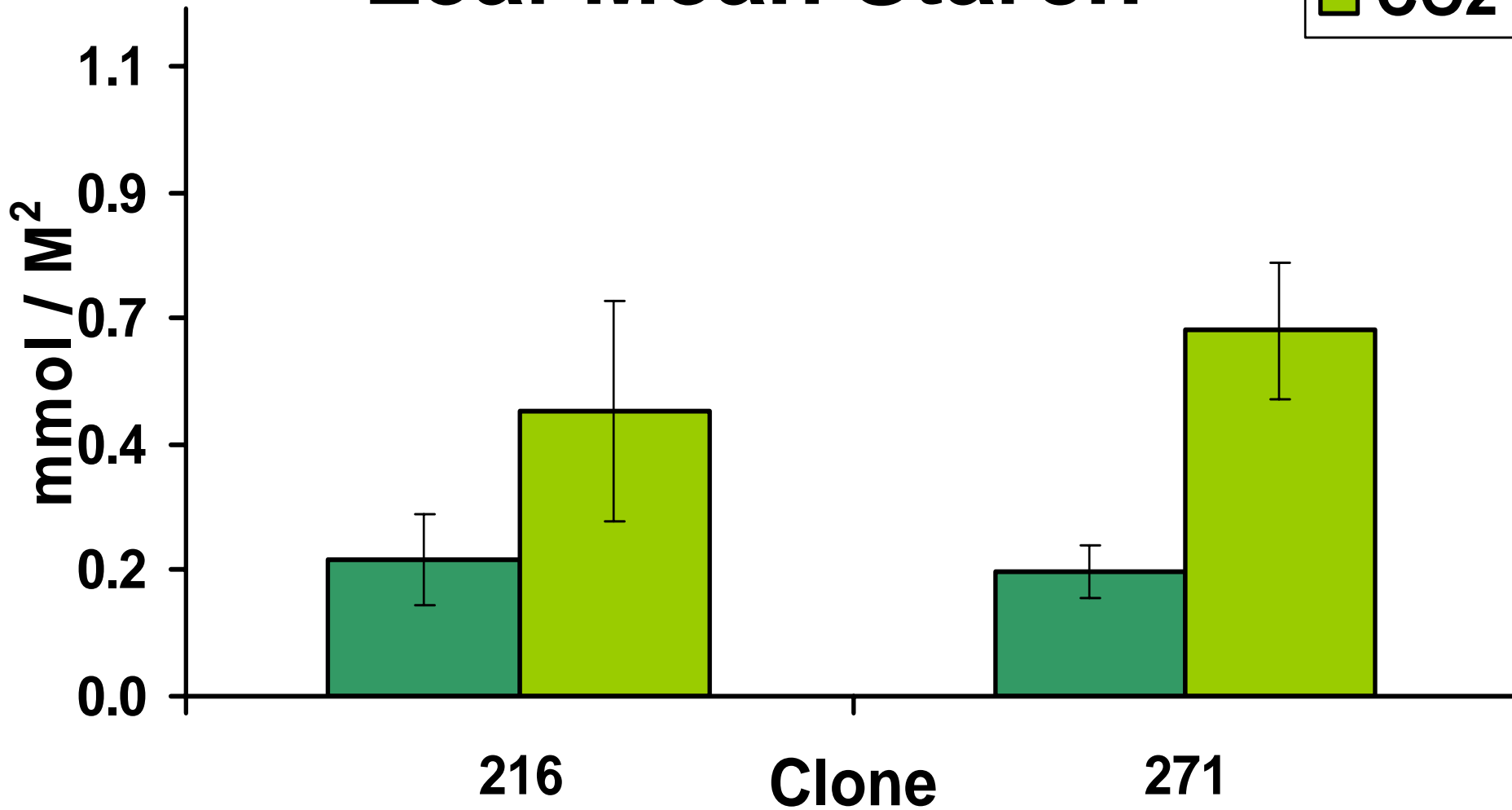
Hypothesis

- We hypothesized that an increase in C metabolites and a decrease in N metabolites would result from exposure to elevated [CO₂].

Results

Leaf Mean Starch

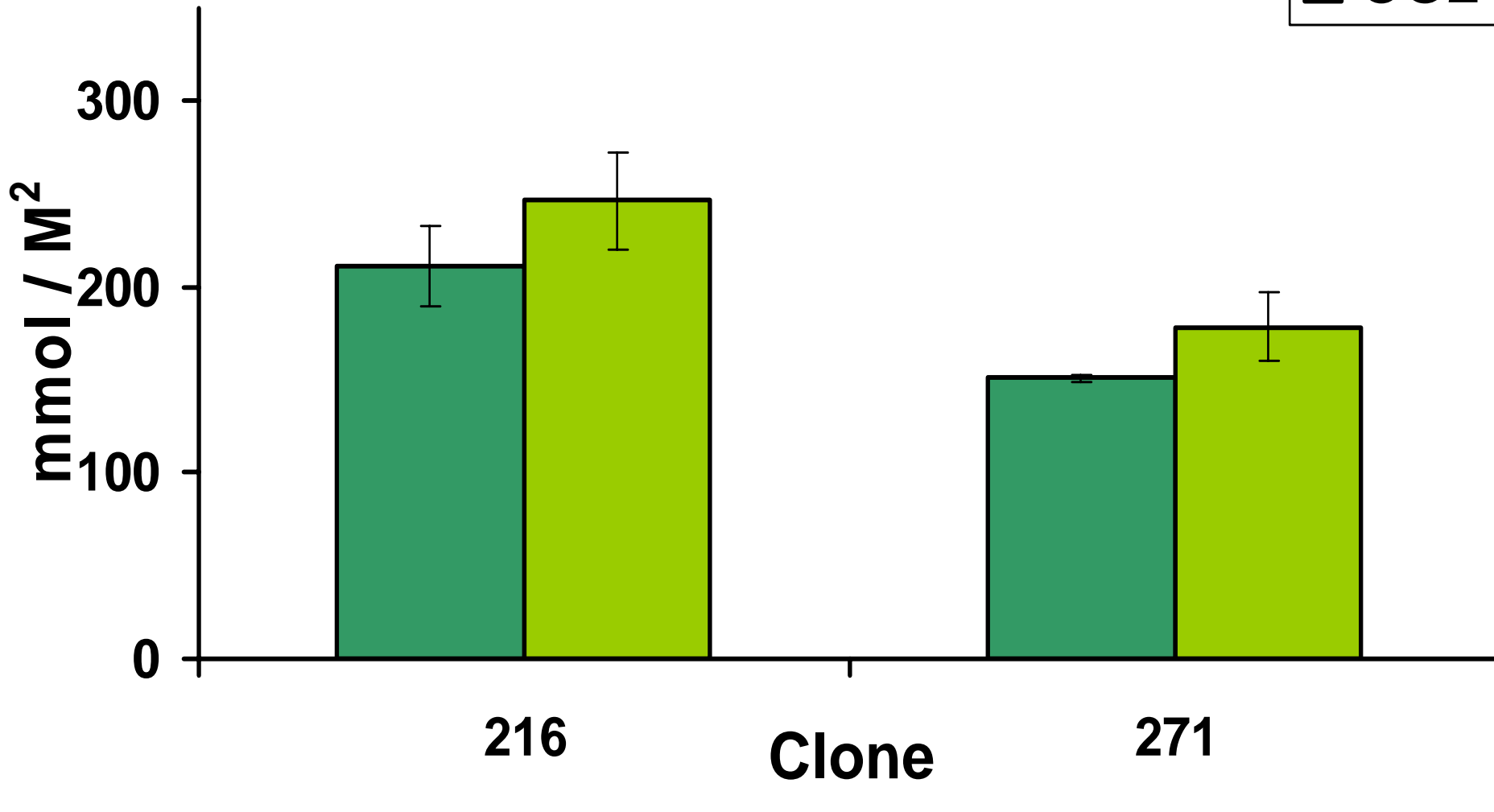
Amb
CO2



Mean \pm SE (n = 3)

Leaf Mean Sucrose

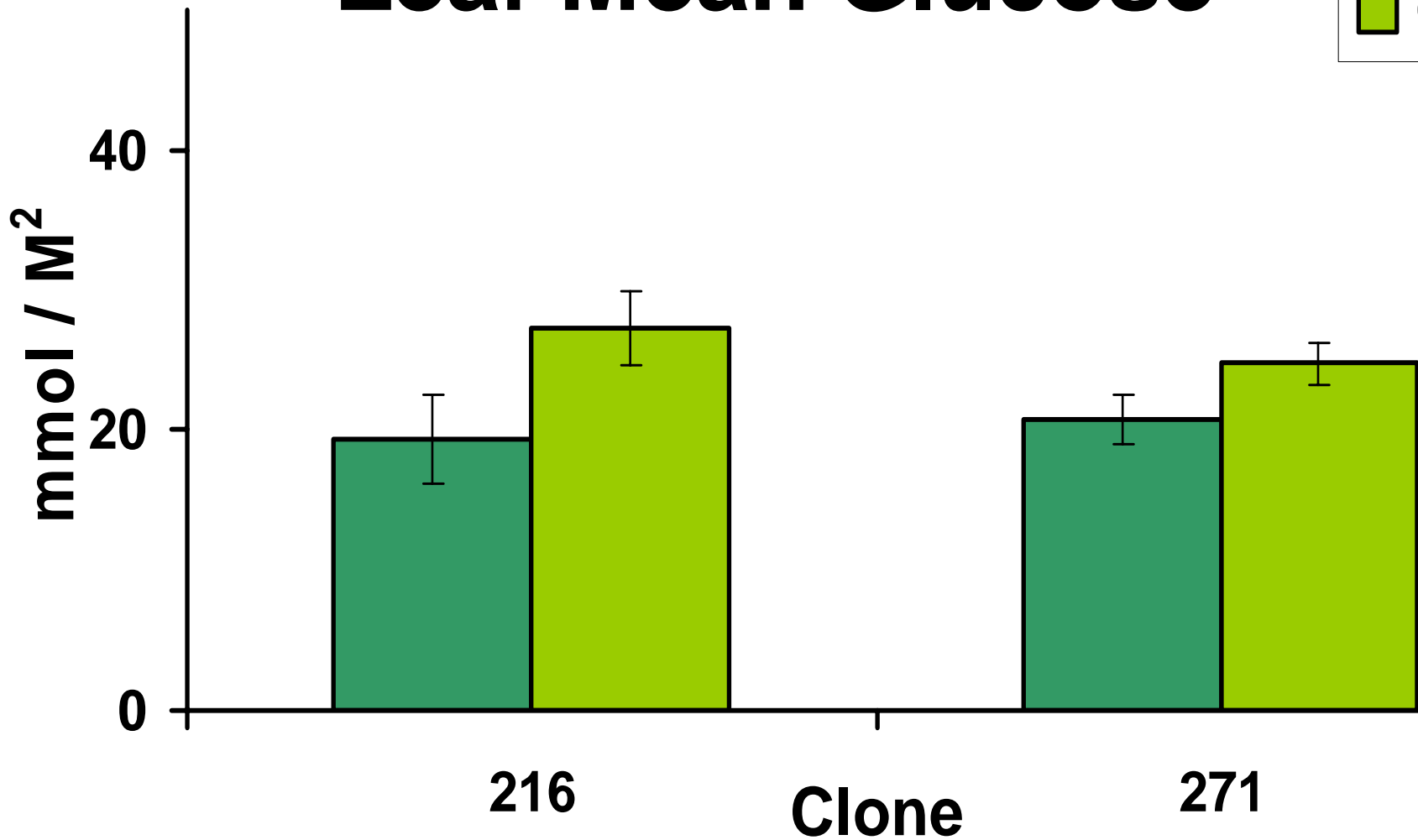
Amb
CO2



Mean \pm SE (n = 3)

Leaf Mean Glucose

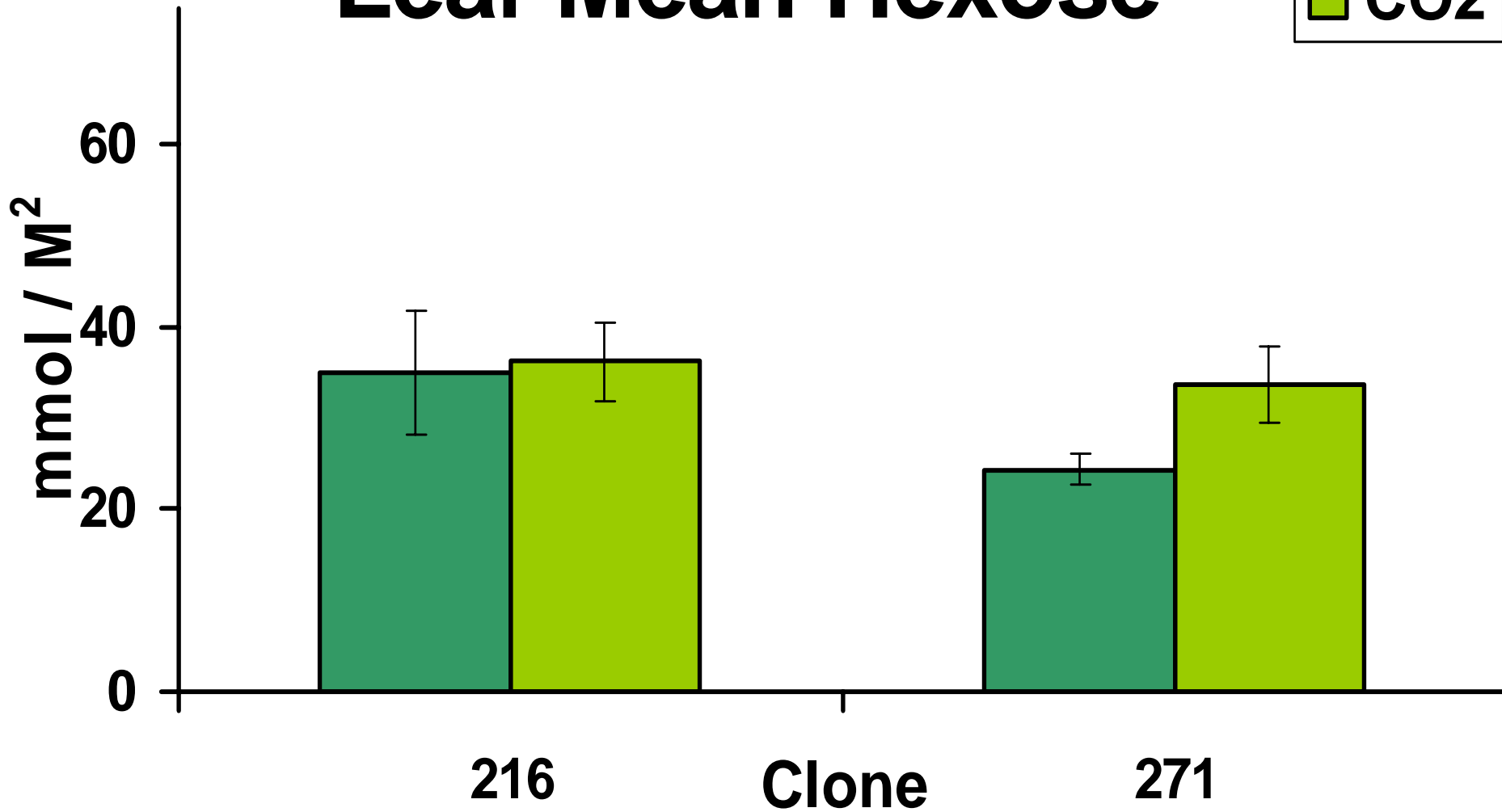
Amb
CO₂



Mean \pm SE (n = 3)

Leaf Mean Hexose

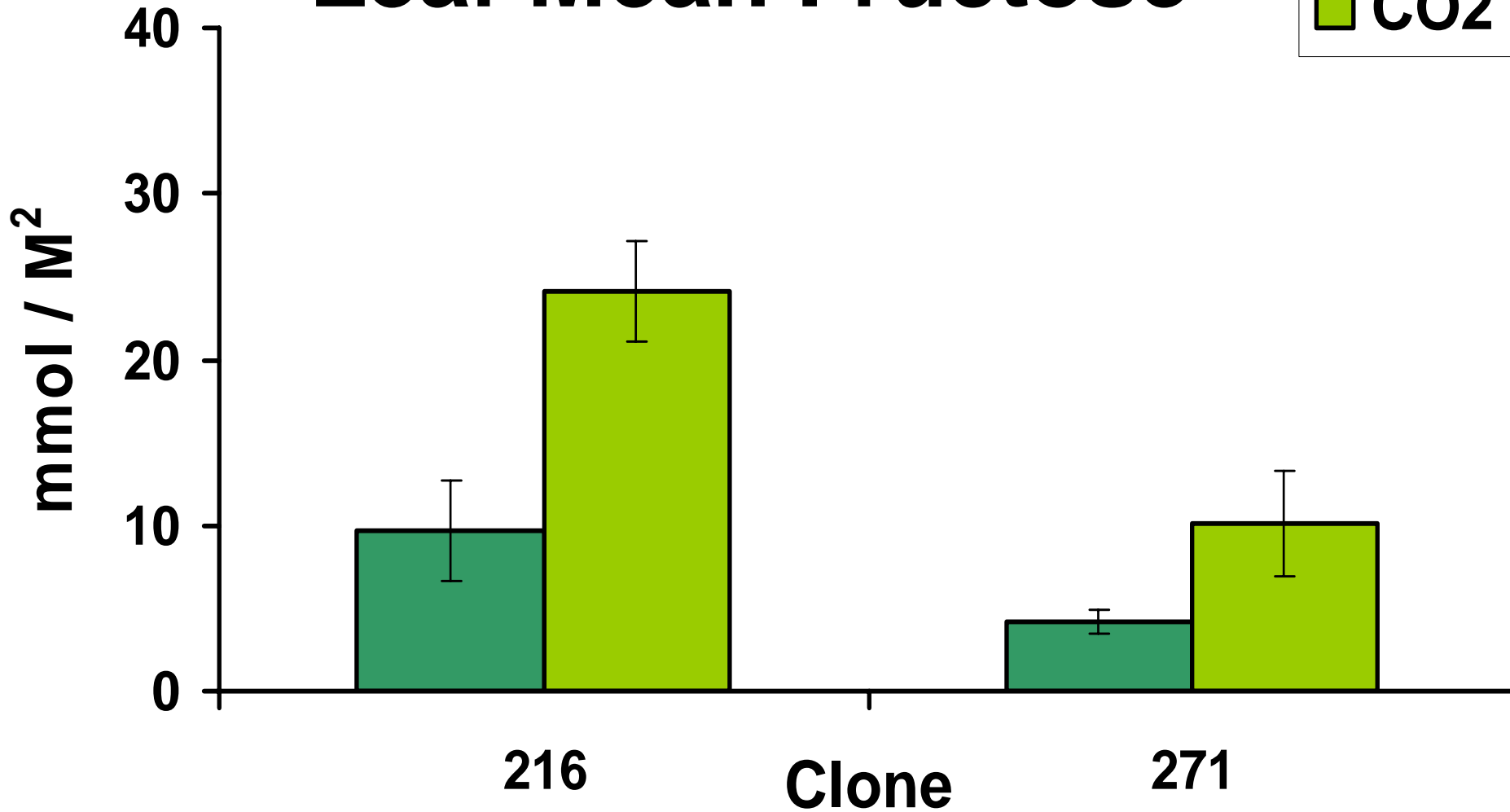
Amb
CO2



Mean \pm SE (n = 3)

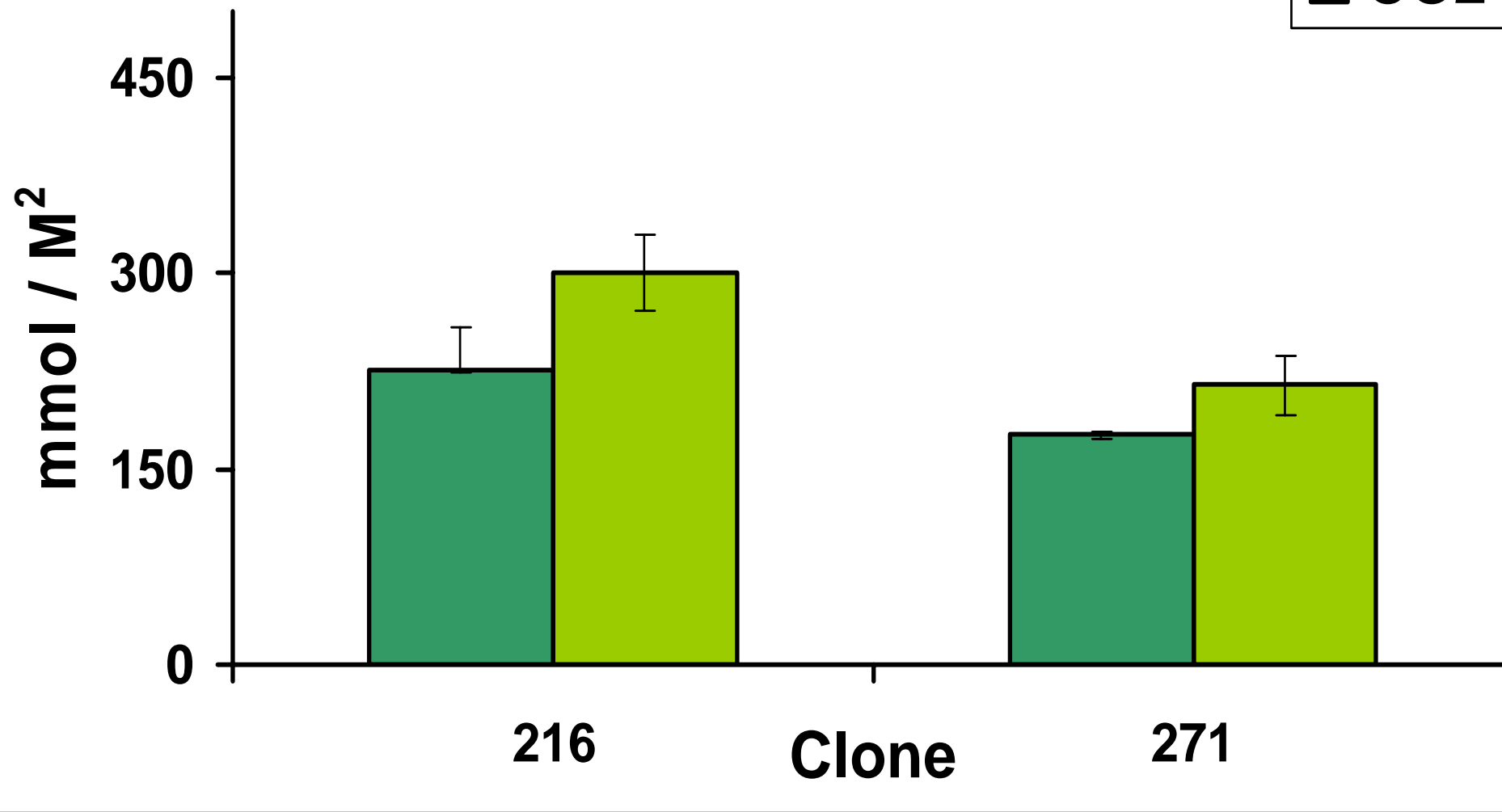
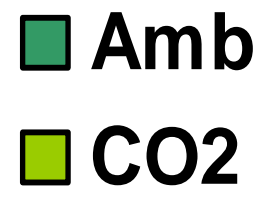
Leaf Mean Fructose

Amb
CO2



Mean \pm SE (n = 3)

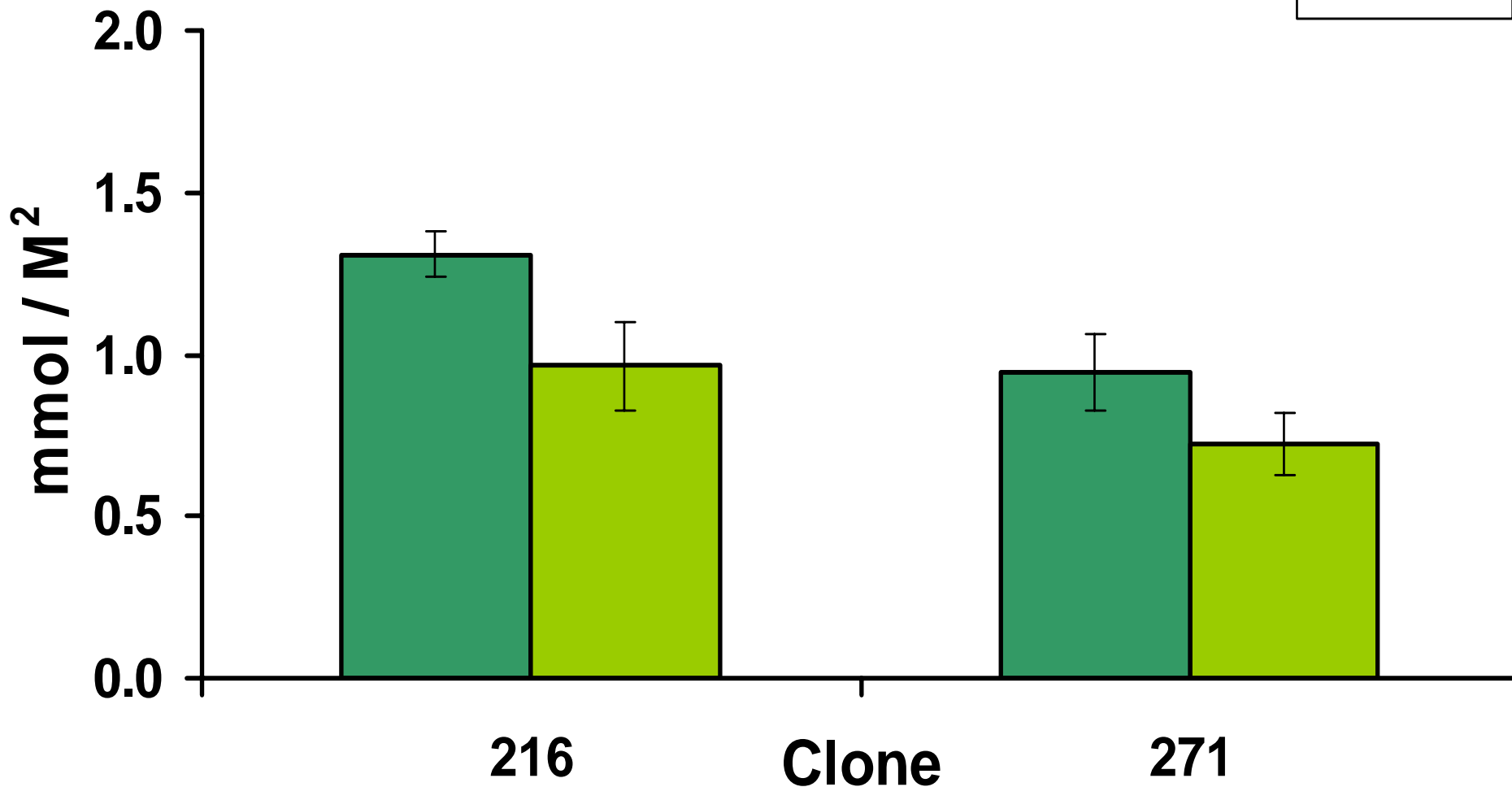
TNC



Mean \pm SE (n = 3)

Leaf Mean Amino Acids

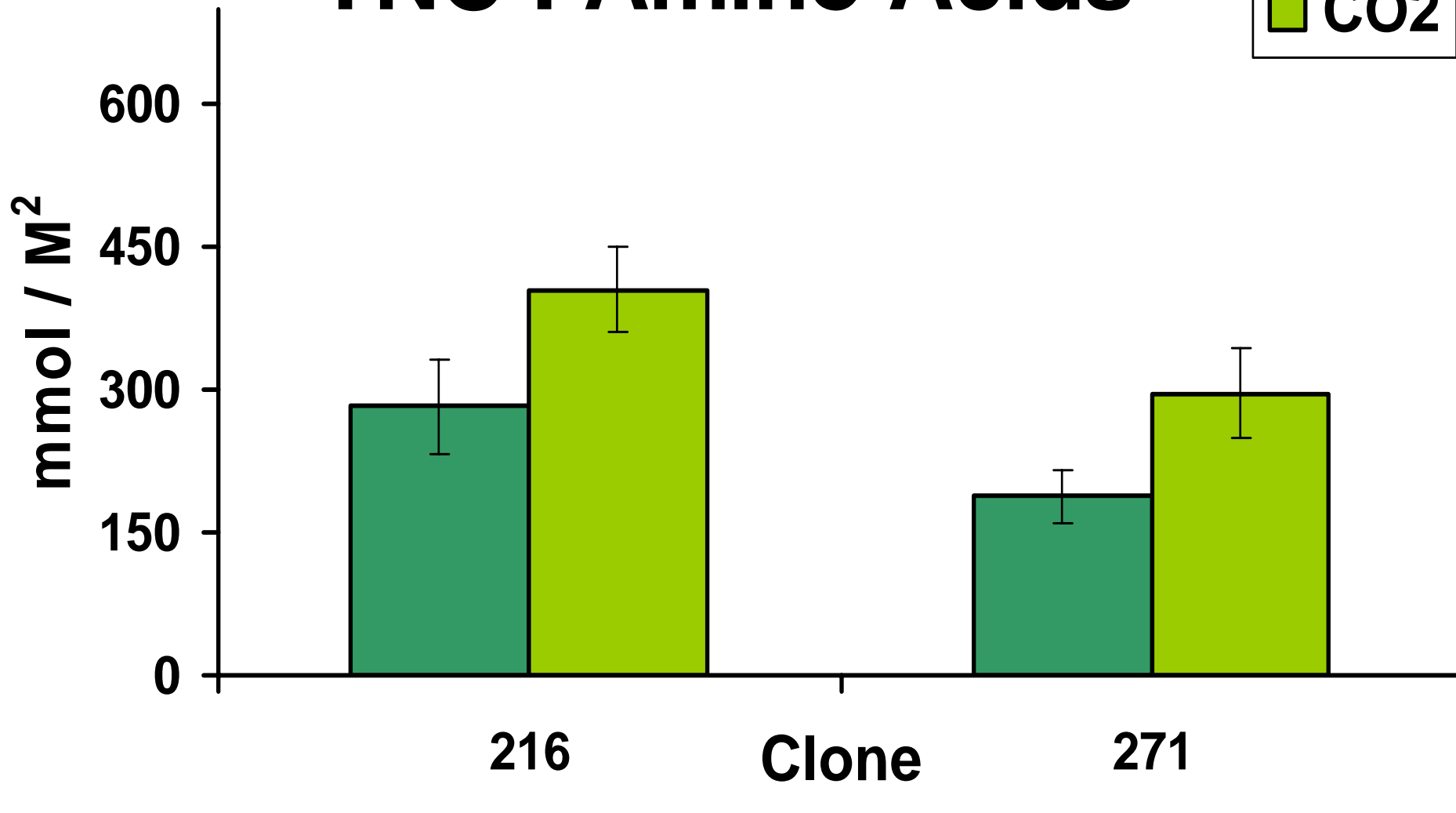
Amb
CO2



Mean \pm SE (n = 3)

TNC : Amino Acids

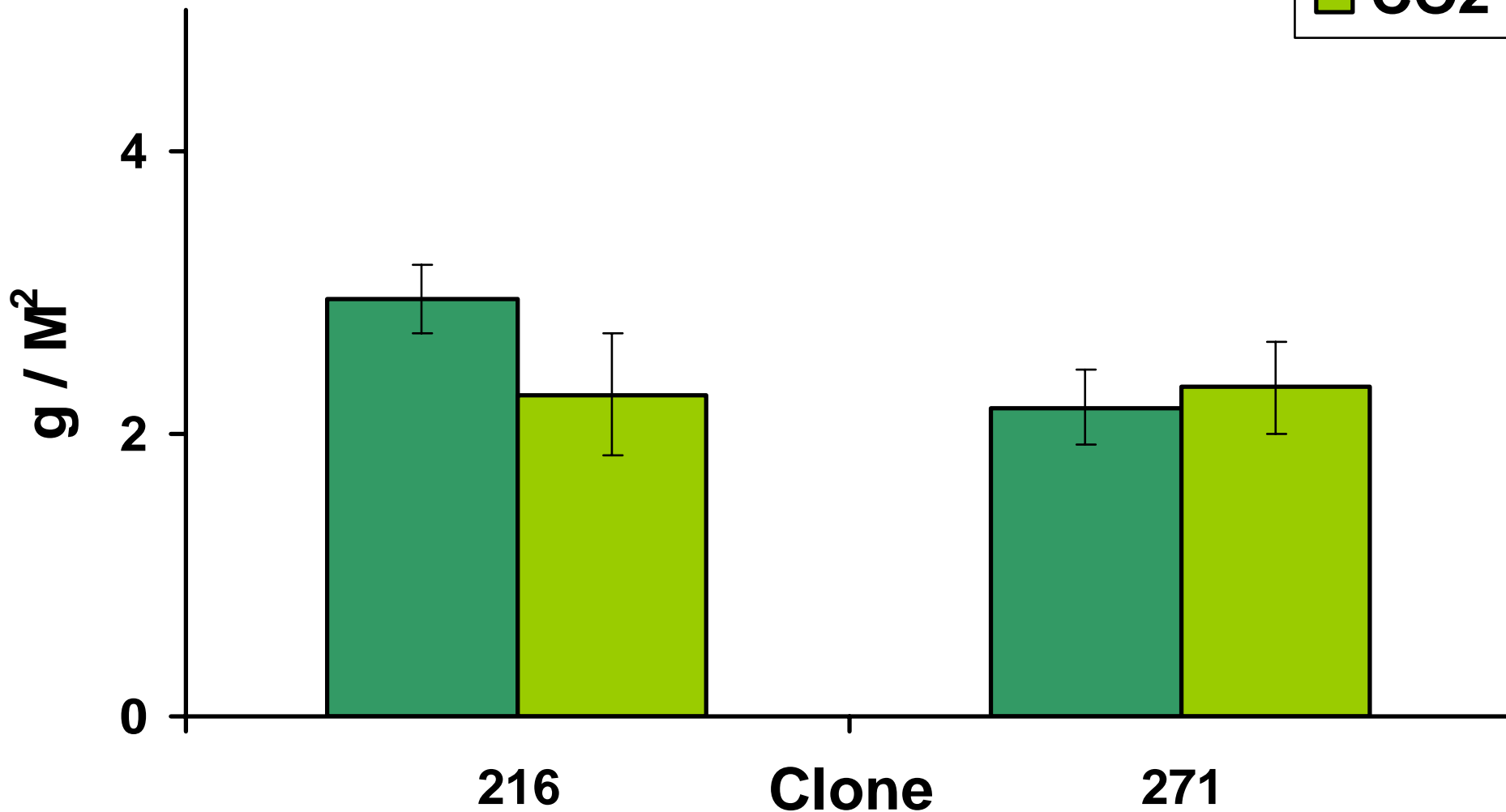
Amb
CO₂



Mean \pm SE (n = 3)

Leaf Mean Protein

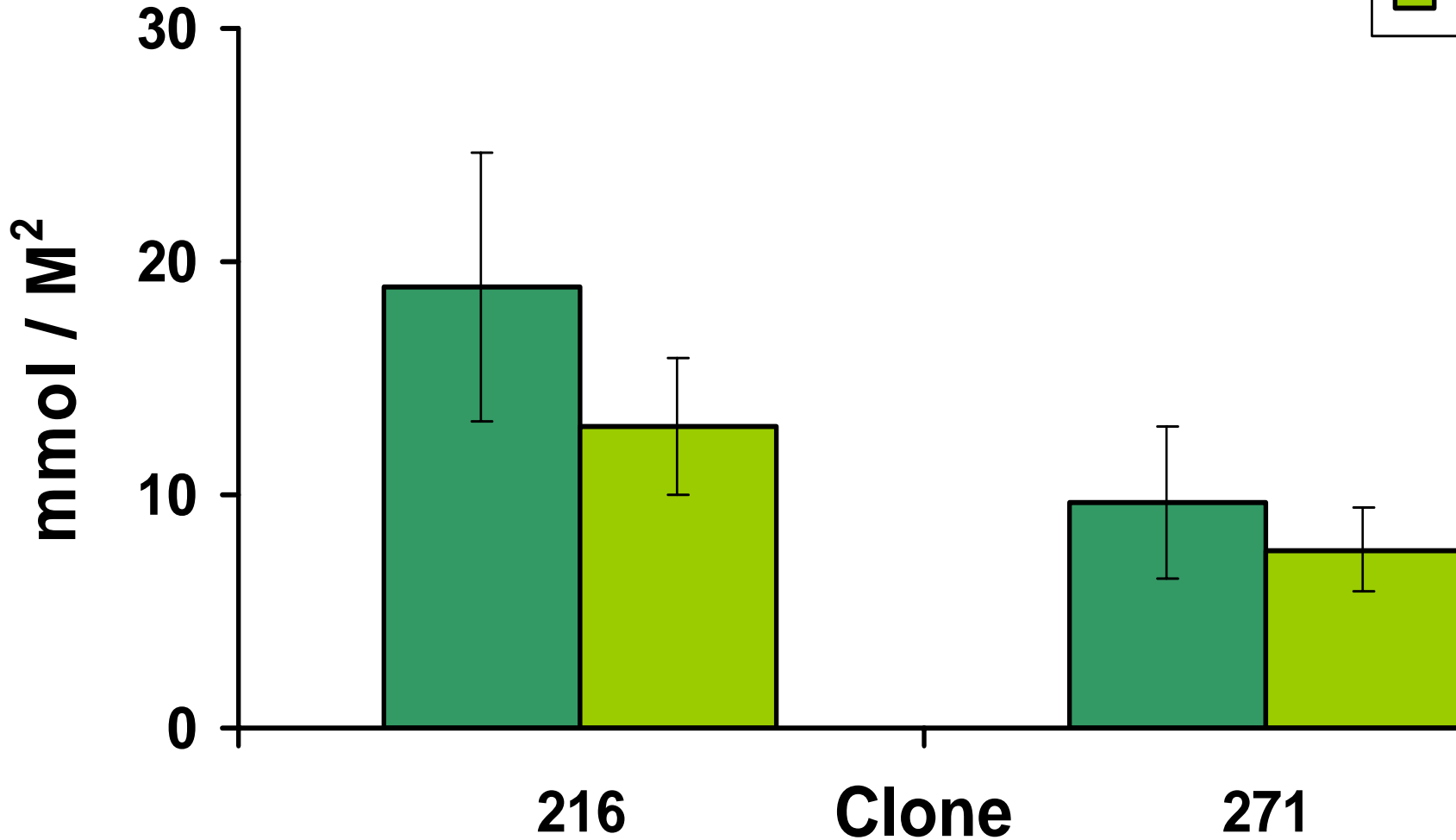
Amb
CO2



Mean \pm SE (n = 3)

Leaf Mean Nitrate

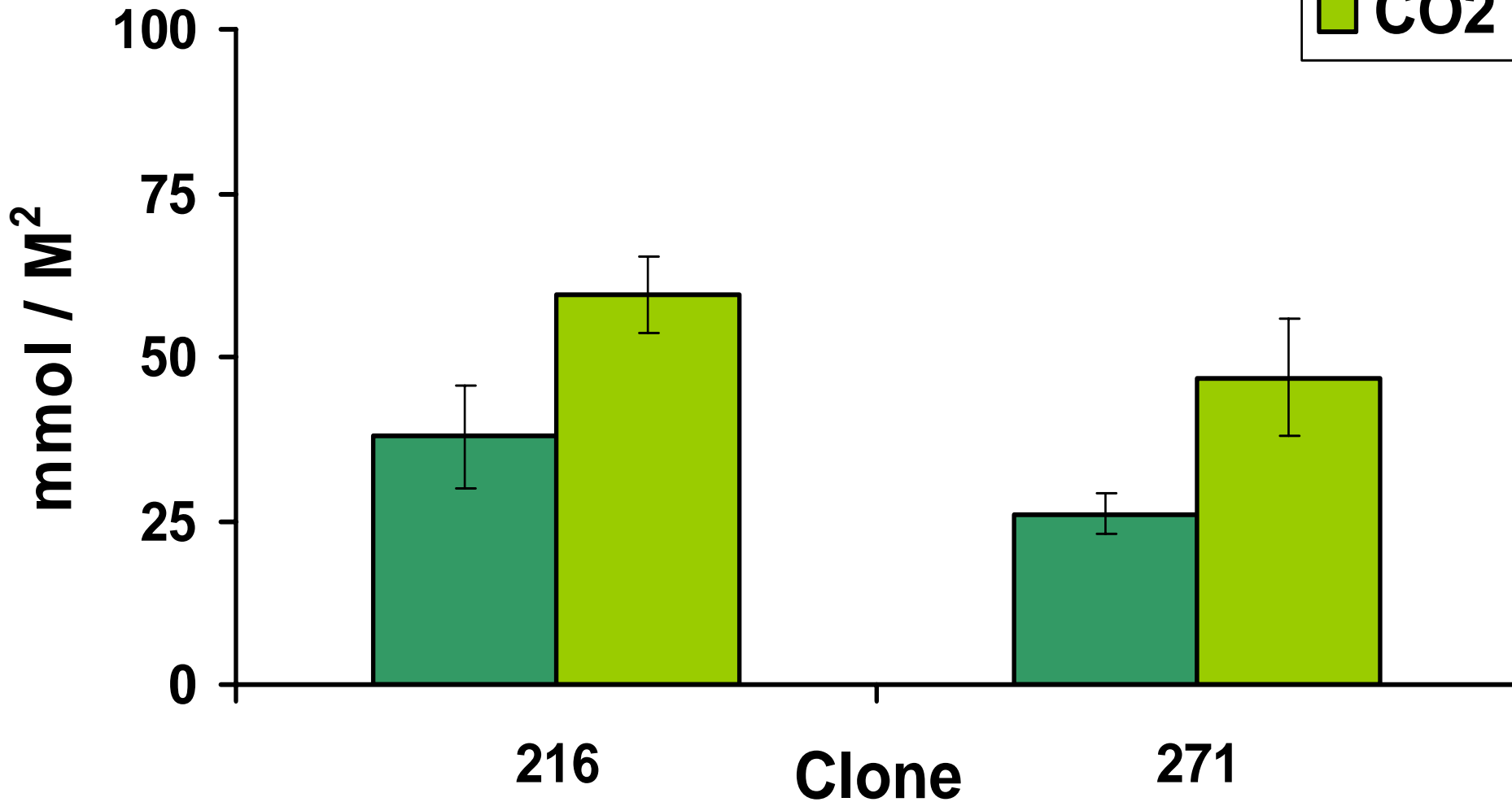
Amb
CO2



Mean \pm SE (n = 3)

Hexose:Amino Acids

Amb
CO2



Mean \pm SE (n = 3)

Conclusions

- On the whole there was a trend for a greater C metabolite content and a lower N metabolite content at elevated $[\text{CO}_2]$.
- TNC:amino acids and hexose:amino acids provide an indication of available C-skeletons and amino acids for protein synthesis, and indicates a significant shift in C/N availability at elevated $[\text{CO}_2]$.

Acknowledgements

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- **University of Tampa.**

THANK YOU!



Source: www.nwplantsart.com