

Breakout - Atkinson

- Evaluate specific traits of interest [plans + soil]
 - Nitrogen efficiency
 - Fine root production and turnover
 - This will require spatial resolution <1 mm
 - Sink strength of below-ground structure
 - Nitrogen uptake in vivo
 - Surface area and volume of root structure
 - Measure everything!
 - Need systems approach

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- Sensor technology can lead to better management
 - N₂O, CO₂ flux.
 - Real time – need a high sampling rate
 - Very dynamic properties
 - Optodes – inexpensive chip-based fluorescence sensors
 - Sensor systems that can be dragged behind tractor and get large-scale information
 - Some tools are available in this area, but have challenges associated with soil variation, and not at required resolution
- Modeling
 - Current ecosystem models do not contain or have overly simple roots.

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- Measurement techniques
 - Inexpensive and easy to deploy
 - Reduce the cost of eddy covariance instrumentation
 - Reduce the cost of techniques that can discriminate isotopes (CRDS)
 - Improve resolution of TRD
- Lab is important for plant measurements
 - Test hypothesis in lab before field work - Where is sugar going? How does the plant decide where to put it? – there is an opportunity to learn specific things in a controlled lab setting.
 - Not every plant is extremely plastic or labile – don't know enough with respect to roots.
 - In the lab, can leverage advanced tools, and understanding of genetics
 - Sophisticated field with infrastructure for below ground measurements

Breakout – Atkinson

- Teams
 - Fourth circle – modeling
 - Focus on skillsets – need computational imaging, for example
 - Economics
 - Industrial partner
 - Computational side needs to integrate disparate data sets
 - Need to start this at day one – very hard to shoehorn new data into existing models