


Terrestrial Biosequestration

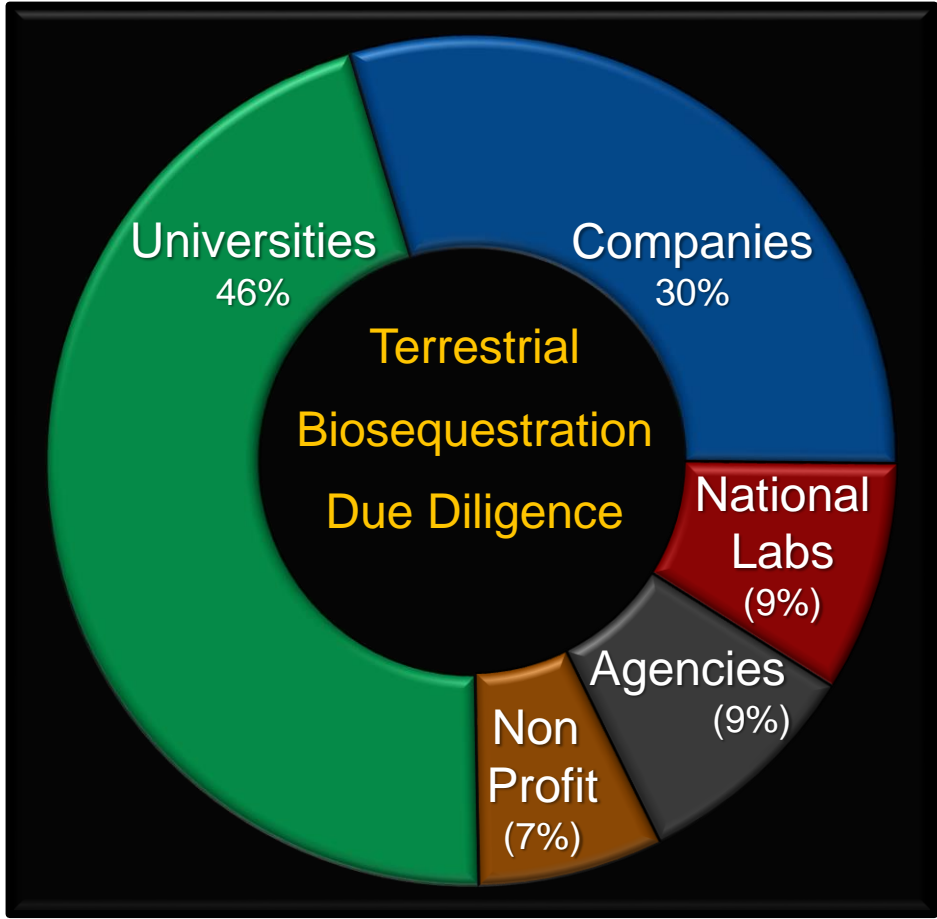
*Development of Innovative Technologies to Enable
Improved Greenhouse Gas Mitigation and Soil Resilience*

ARPA-E Workshop
July 23-24, 2015
Chicago, IL



"A nation that destroys its soils destroys itself. Forests are the lungs of our land, purifying the air and giving fresh strength to our people."

Franklin D. Roosevelt



ARPAE Mission: Reduce Green House Gas Emissions and Maintain Technological Leadership

Climate Change is Real... Now What?

Headwinds:

Fact 1: 2°C “baked in”

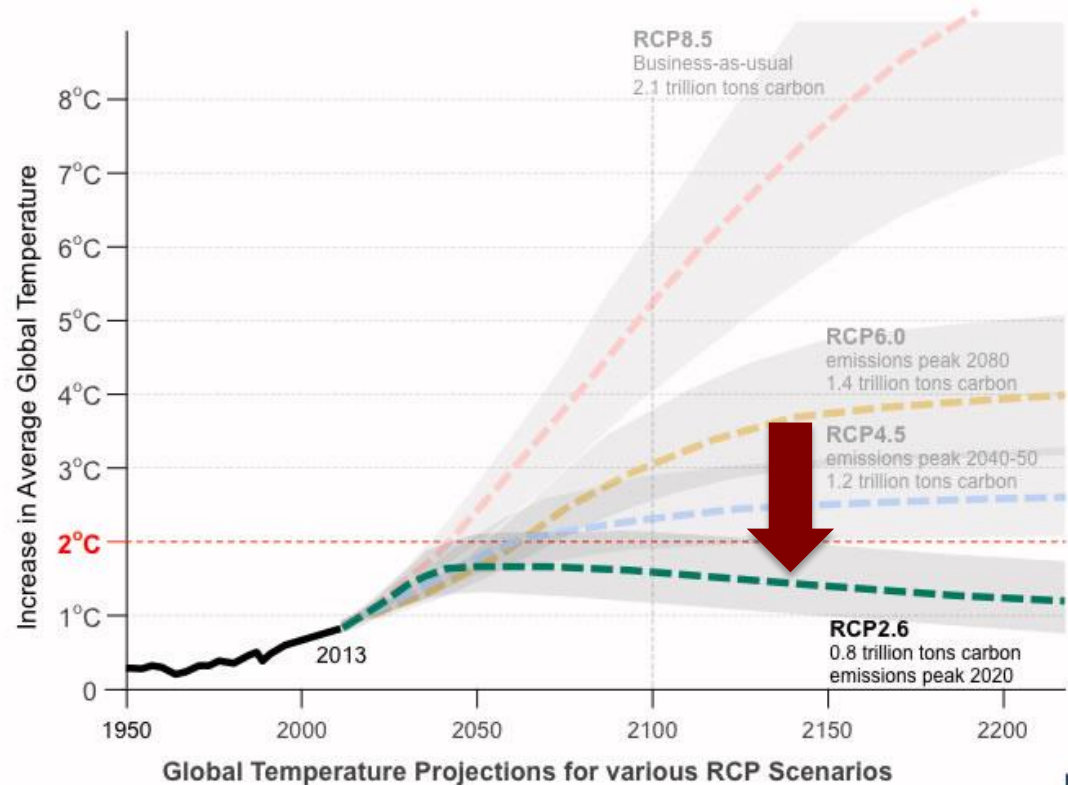
- Peak emissions 2020?

Fact 2: Global Carbon Emissions are Rising

- Fossil Fuels
- Land Use Changes

Fact 3: CAPEX

- Installed Capital 50+ years
- New Direct Air Capture costly
 - Minimum of \$300/ton

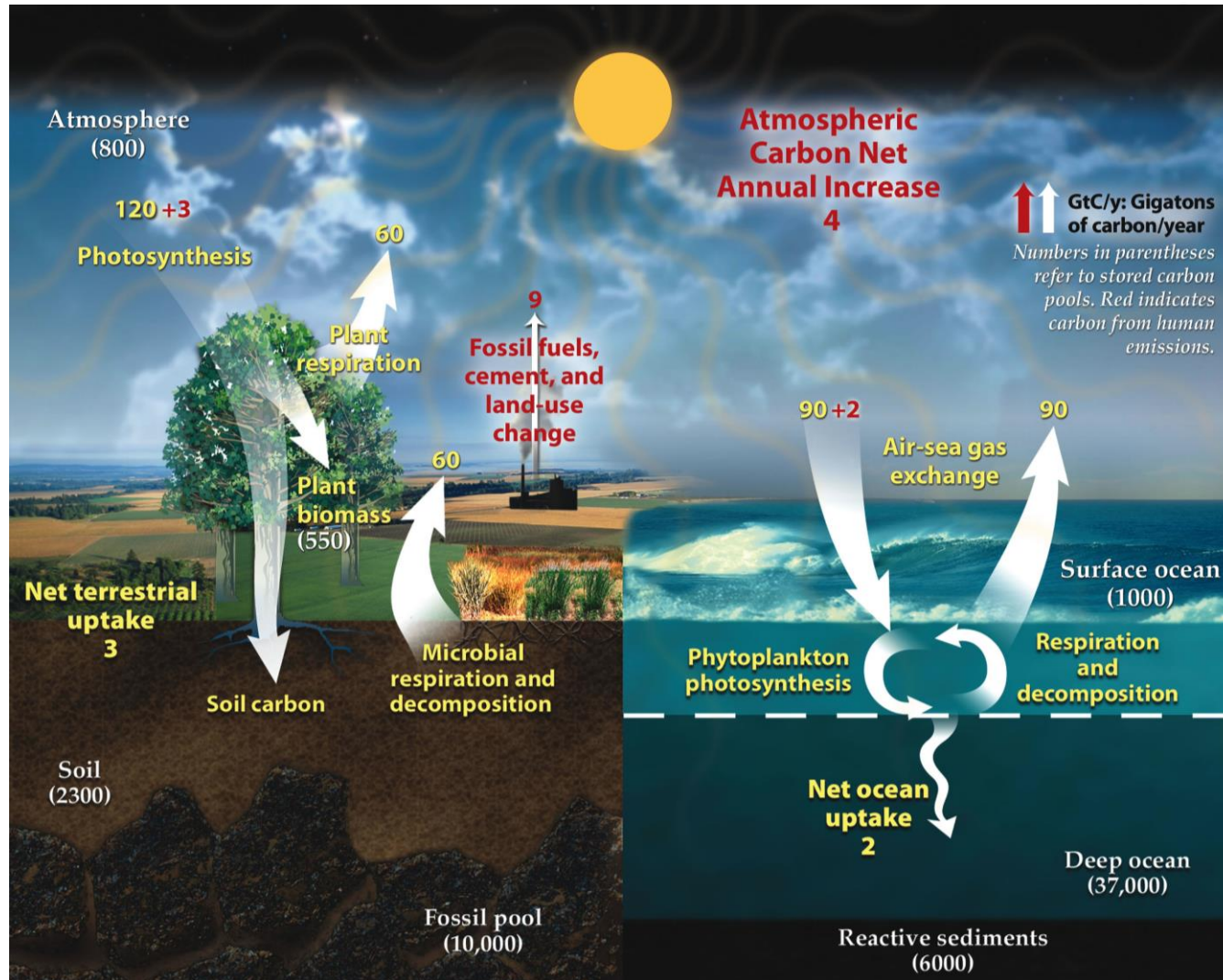


Source: Architecture 2030: Adapted from IPCC Fifth Assessment Report, 2013
Representative Concentration Pathways (RCP), temperature projections for SRES scenarios and the RCPs.



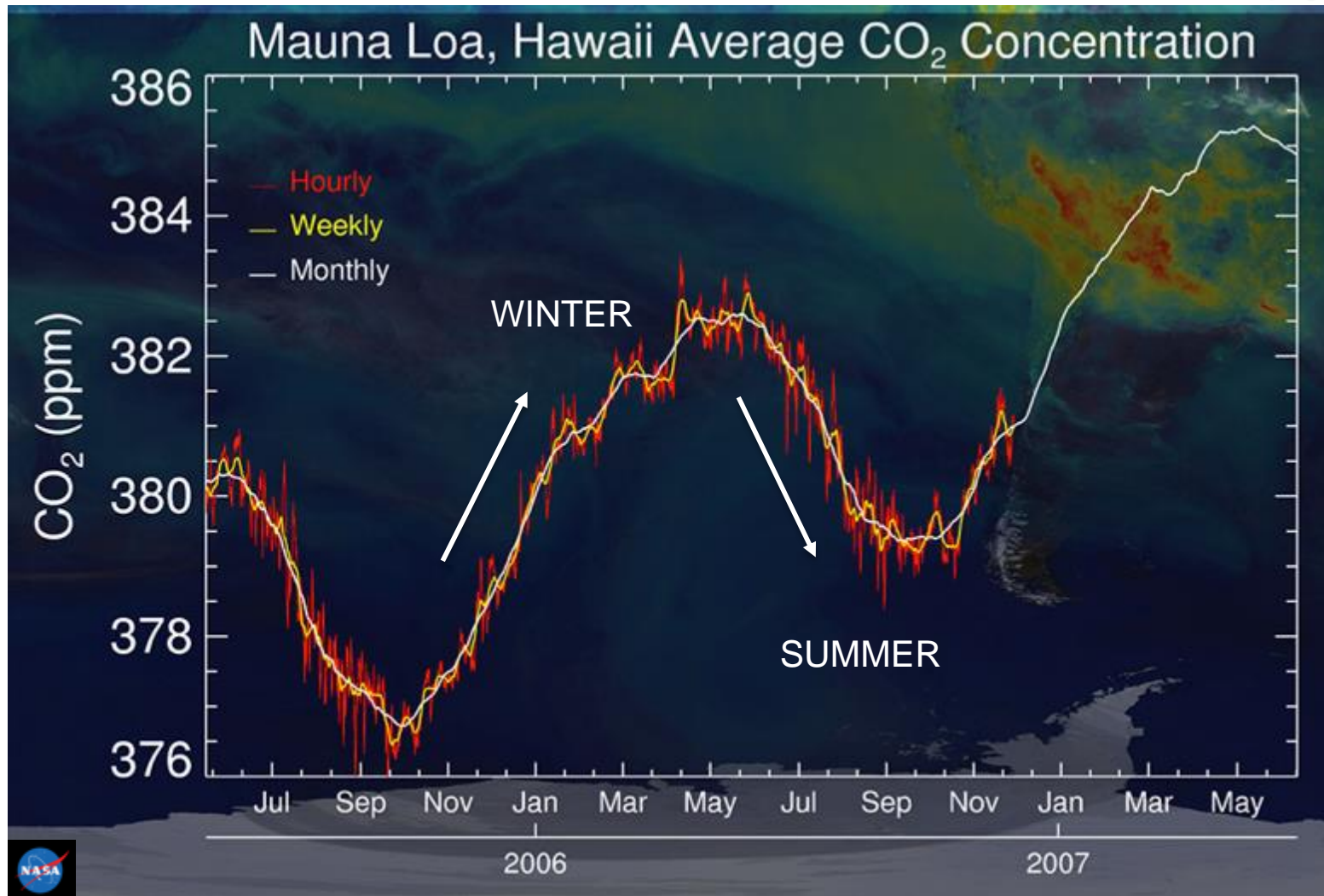
New direct mitigation strategies are needed

The Big Picture... Terrestrial Ecosystems have Scale



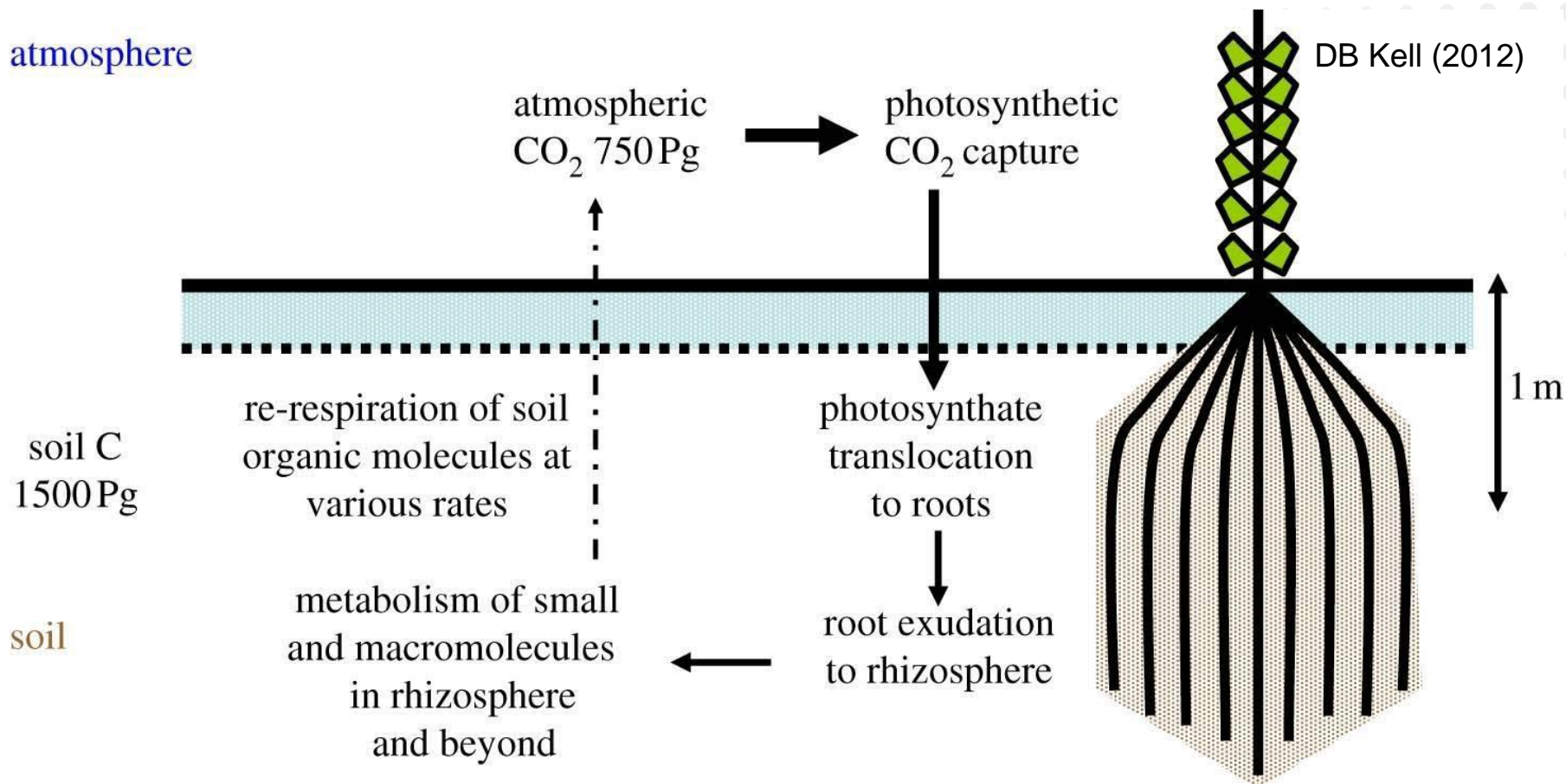
U.S. Department of Energy, 2008

Importance of Photosynthesis...



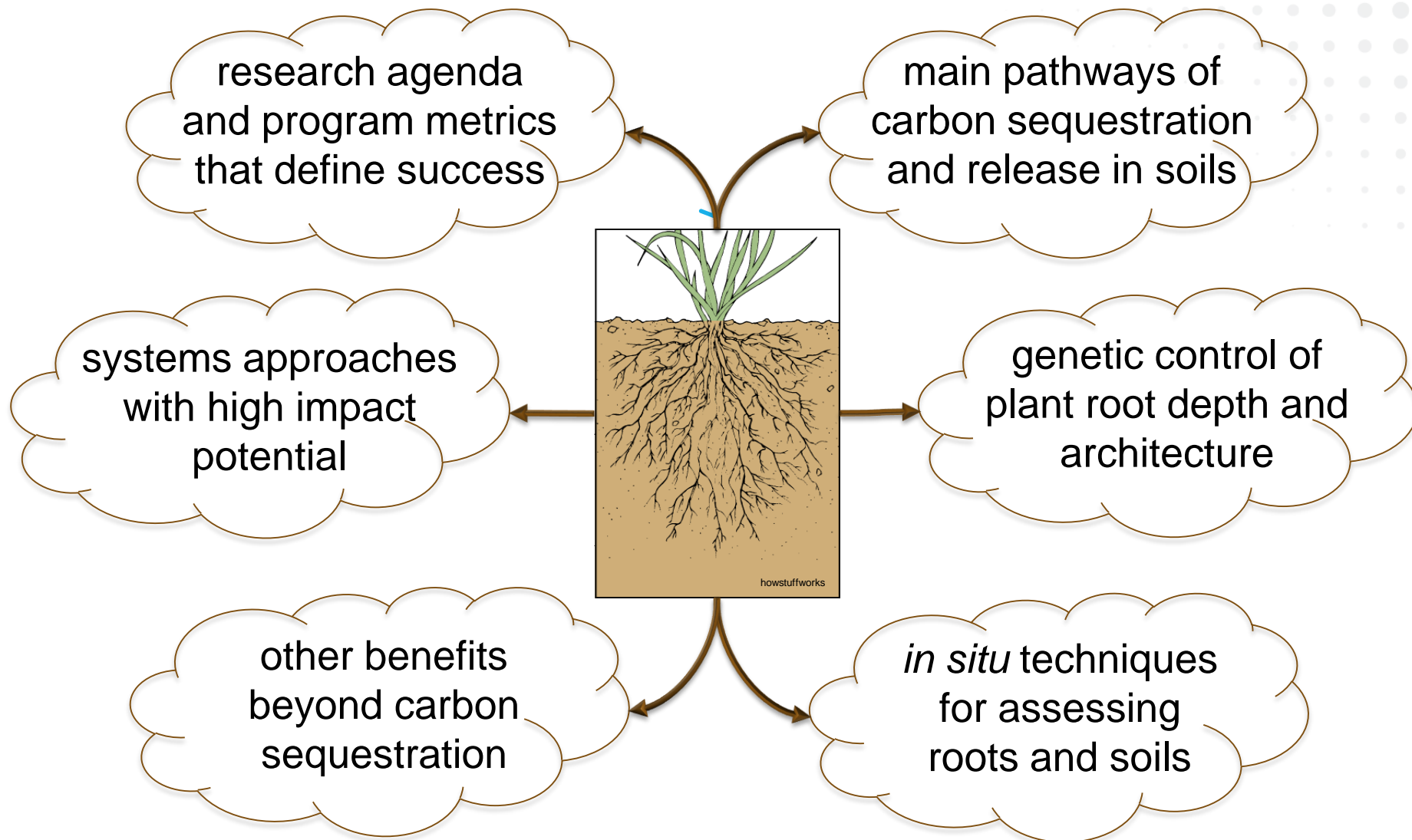
The Big Question... How Much Carbon can we Capture?

atmosphere



Manage the Roots, Soil and Microbes....
Manage the Carbon

Terrestrial Biosequestration Workshop Mind Map

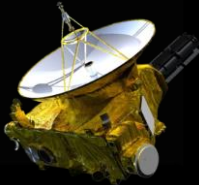
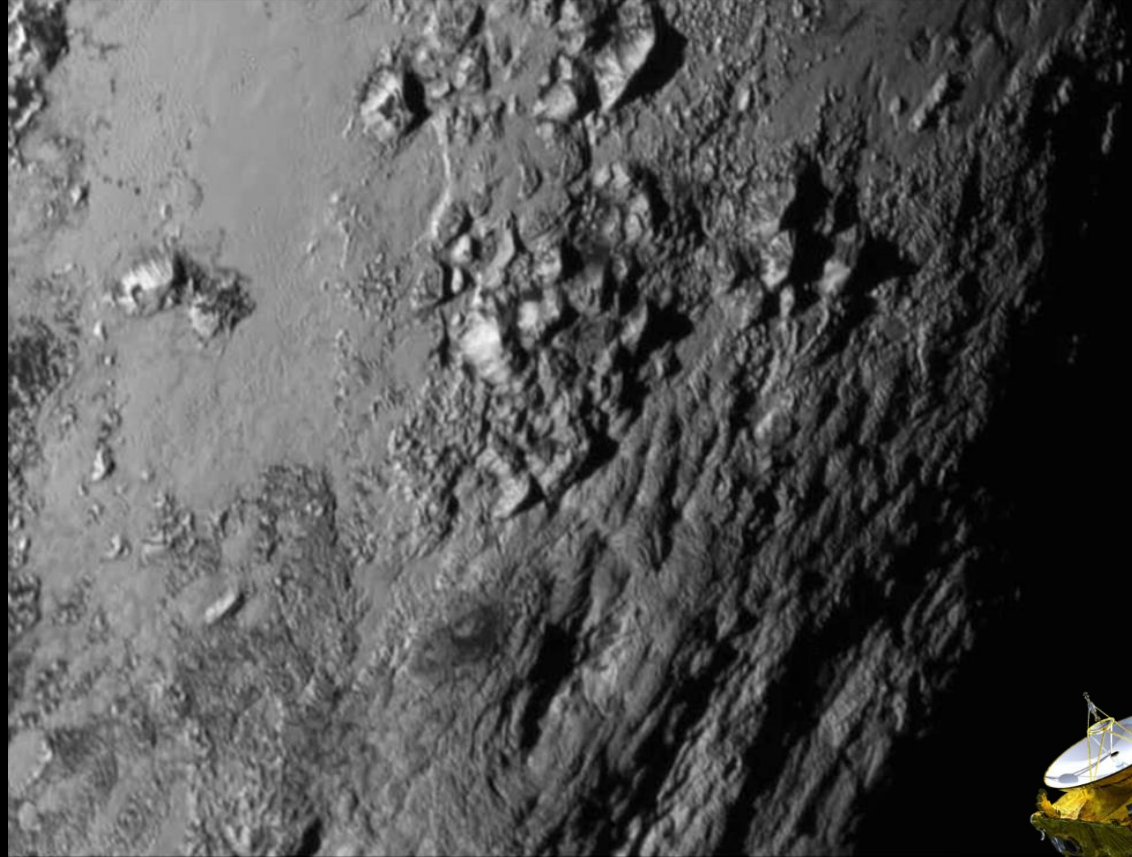


Strange Trip to Pluto... How NASA Nearly Missed It

NASA SUCCESSFULLY PHENOTYPES PLUTO



New Horizons
lifted January
2006



15 years ago
NASA called it
quits on Pluto

The Icy Mountains of Pluto July 2015

*"We know more about the movement of celestial bodies
than about the soil underfoot. " Leonardo da Vinci (1500)*

Biosequestration Workshop Speakers

09:15 – 11:00	<u>Root Physiology and Root Ideotypes</u> (45 min) <ul style="list-style-type: none"> • Root Phenes and Resource Use Efficiency in Plants <u>Genetics and Microbial Influence:</u> (45 min) <ul style="list-style-type: none"> • Genetics of Carbon Allocation and Partitioning in Populus • Field Scale HT Phenotyping 	Jonathan Lynch (PSU) Kathleen Brown (PSU) Gerald Tuskan (ORNL) Jan Leach (CSU)
11:00 – 11:45	<u>Technology Toolbox:</u> (45 min) <ul style="list-style-type: none"> • Modern Tools for Proximal Soil Sensing: Lessons from Field • Probe based laser diagnostics and optical image-guided interventions and metrology • MRI in the Wild 	Cristine Morgan (TAMU) Eric Seibel (U. Washington) Matthew Rosen (Harvard)
12:15 – 02:00	<u>Technology Toolbox:</u> (30 min) <ul style="list-style-type: none"> • Ground Penetrating Radar • Non-Contact Imaging of Internal Structures in High Loss Packaging <u>Leveraging Industrial and Medical Phenotyping Tools</u> (20 min) <ul style="list-style-type: none"> • Integrated Understanding of Plant-Environment Interactions <u>FutureRoots – Systems Solution Root Phenotyping</u> (30 min)	Scott Macintosh (Black Cat Sci.) Amin Arbabian, (Stanford) Chris Topp (DDPSC) Tony Pridmore (U. Nottingham)

Workshop Goals

Learn

- Leading experts in biology, physics geochemistry and imaging technologies — take advantage!

Evaluate

- Sharing our collective due diligence, but we want you to validate, challenge and improve the data.

Collaborate

- If this effort leads to an APRAE funding opportunity multidisciplinary teams will yield the best results. Think about teams and look for partners!