

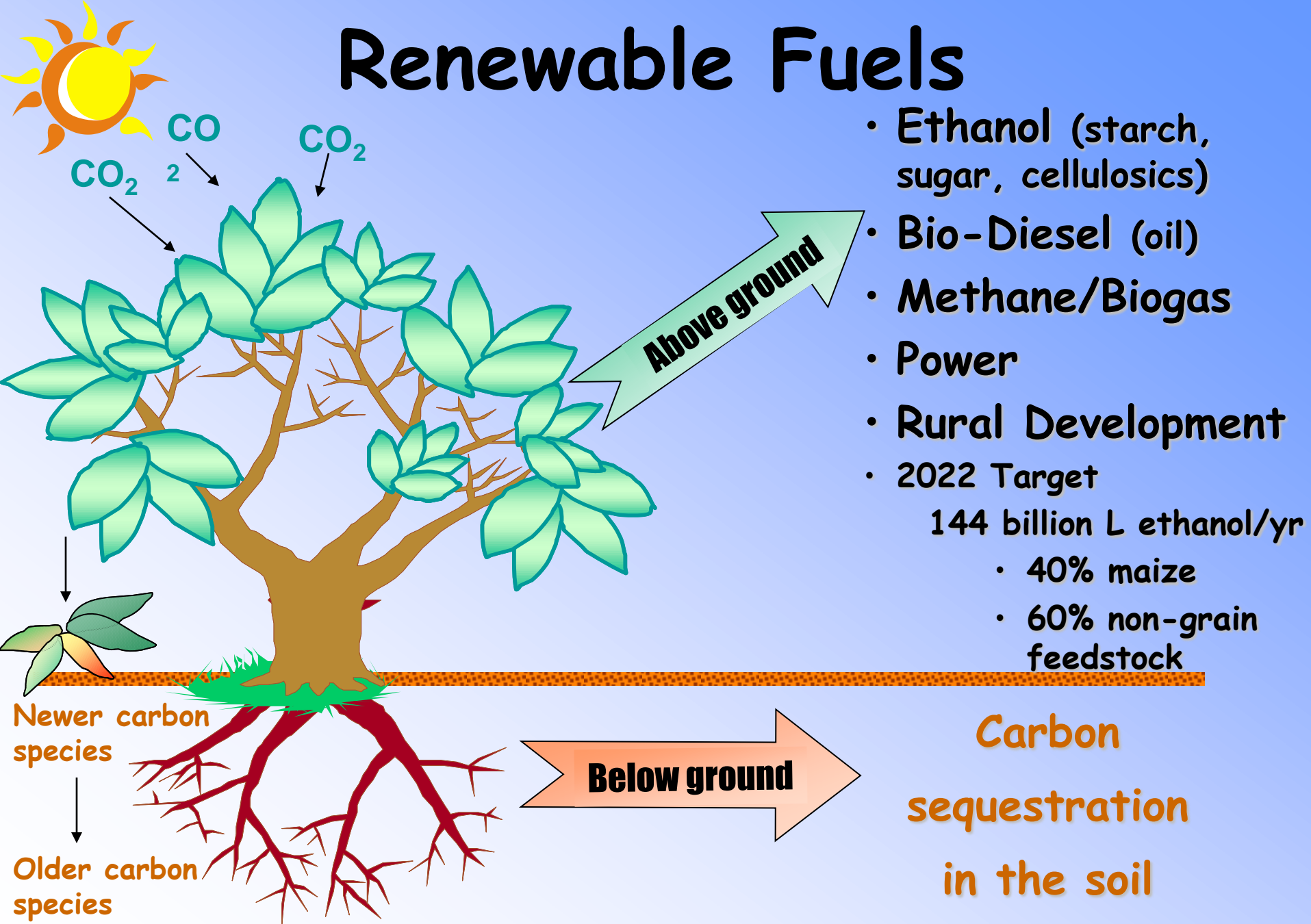
Renewable Energy

Big Questions, Big Opportunities for Agriculture and the Land Grants



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Renewable Fuels



Biofuel Limits

• Light

- C3 species: 1.9 g sugar or 1.4 g plant mass/MJ of solar E
- C4 species: 2.4 g sugar or 1.8 g plant mass/MJ of solar E (Annual mass yield = 43.2 metric tonnes per hectare)
- Oil crops: 0.42 g oil/g of sugar or 0.8 g plant mass/MJ of solar E

• Yield Goals for US in 2022

- 37 million acres of maize (half of the land currently used for maize)
- 118 million acres of cellulose-based feedstock

Big Questions

- How do we increase yield and/or efficiency with low inputs in a sustainable fashion?
- How do we maintain adequate N?
- How do we decrease N leaching and release of greenhouse gases?
- How do we minimize soil erosion and degradation?
- How do we efficiently use water?
- What lands are suitable?
- How do we prevent a net negative energy return?

Not one silver bullet!!!

Genetic Resources

- Existing Mutants
- Reverse Genetics
- Forward Genetics
- Transgenic Approaches (genotype non-specific)
- Breeding and Selection



Big Opportunities

Dedicated Energy Crops on Marginal Lands

- Generate perennial plants that have more biomass, and are faster growing (hormones) with reduced requirements for water and N (photosynthesis, respiration, circadian clocks, etc.) with abiotic (temperature) and biotic stress tolerance (insects and pathogens).
- Explore N redistribution in C4 plants.
- Develop plants with an over-wintering storage capability in below ground tissue.
- Understand and manipulate lignin composition, biosynthesis and regulation (and maintain structural integrity).
- Produce plants that express cellulases and hemicellulases (in subcellular compartments).
- Up-regulate cellulose and hemicellulose biosynthesis enzymes in plants (chloroplast genome) and increase their activity.
- BMPs: cover crops, fertilizer application, irrigation, tillage...

Algae!!!???

