



**31% of all human-made greenhouse gas emissions
come from agriculture**

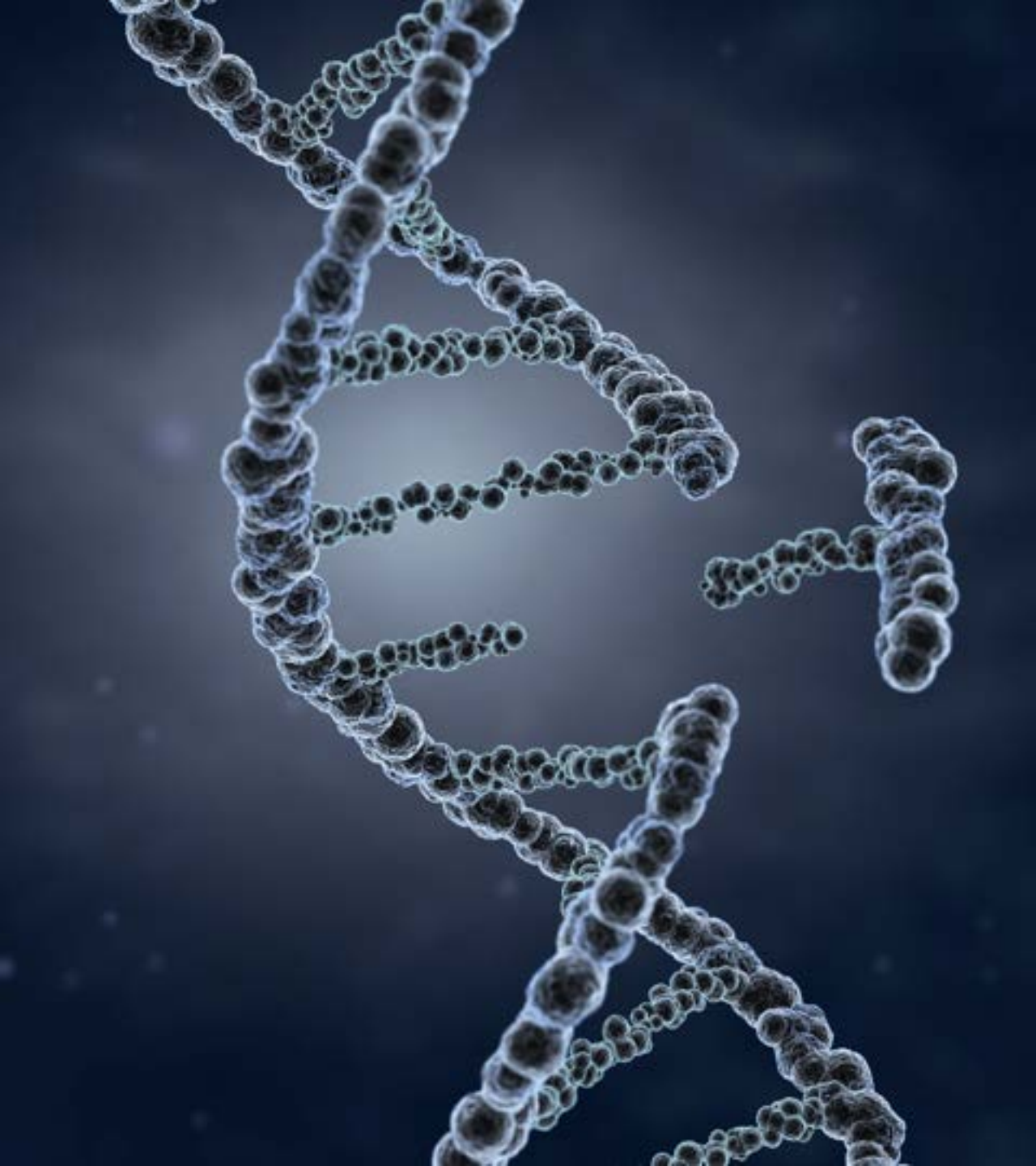
FAO (2022)

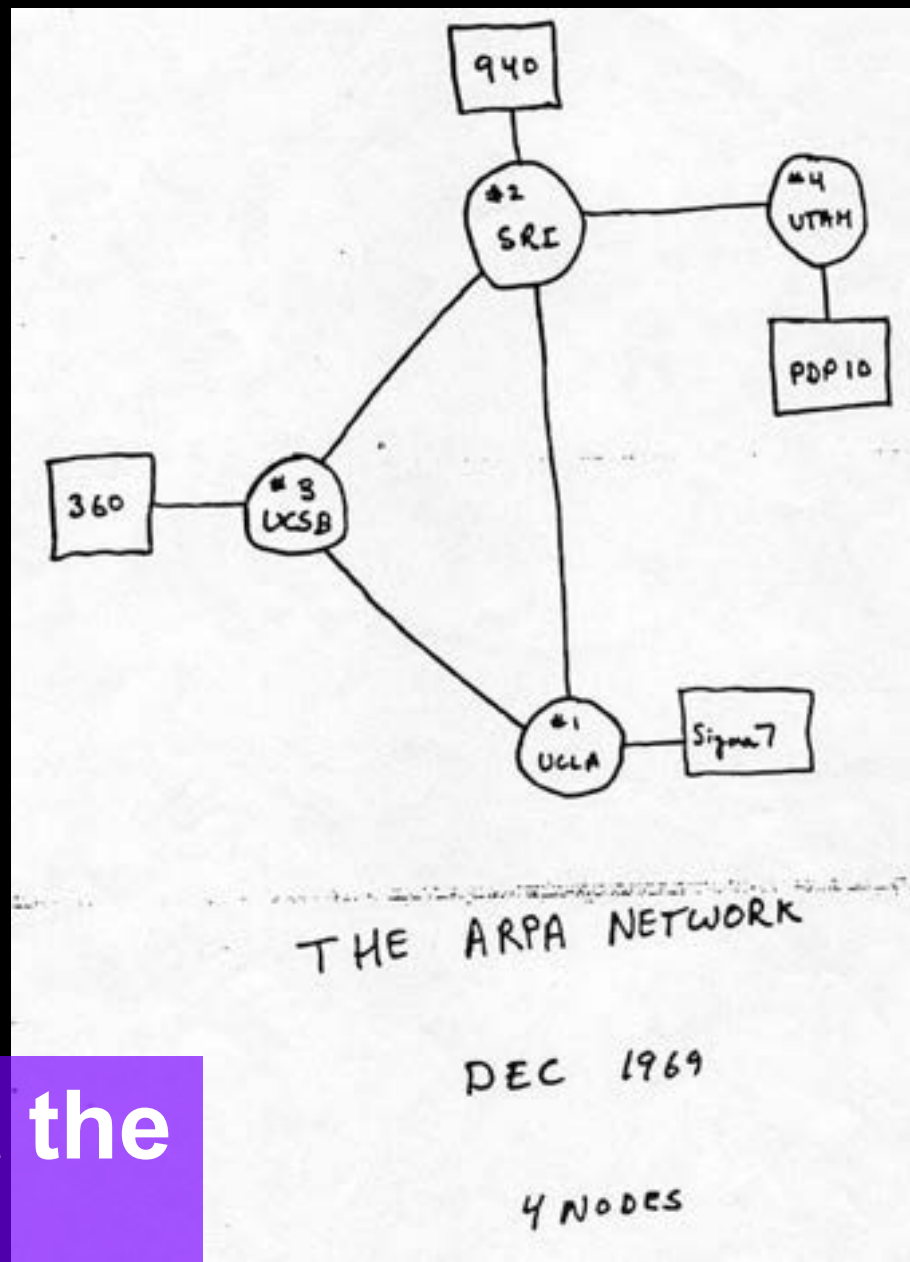






Jennifer Doudna



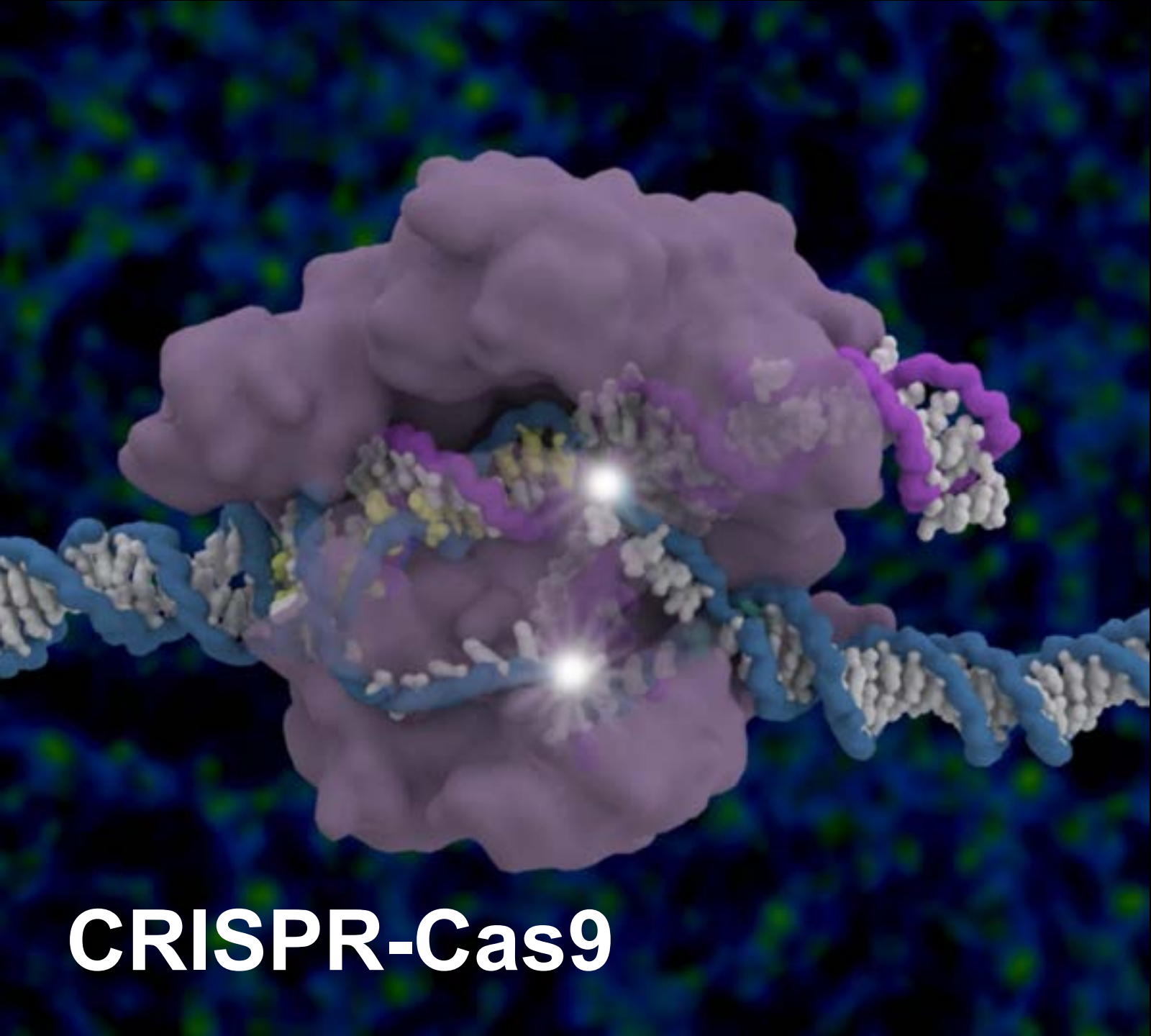


“At DARPA, if you don't invent the internet, you get a B.”





Innovative Genomics Institute



CRISPR-Cas9

1. Find 🔍

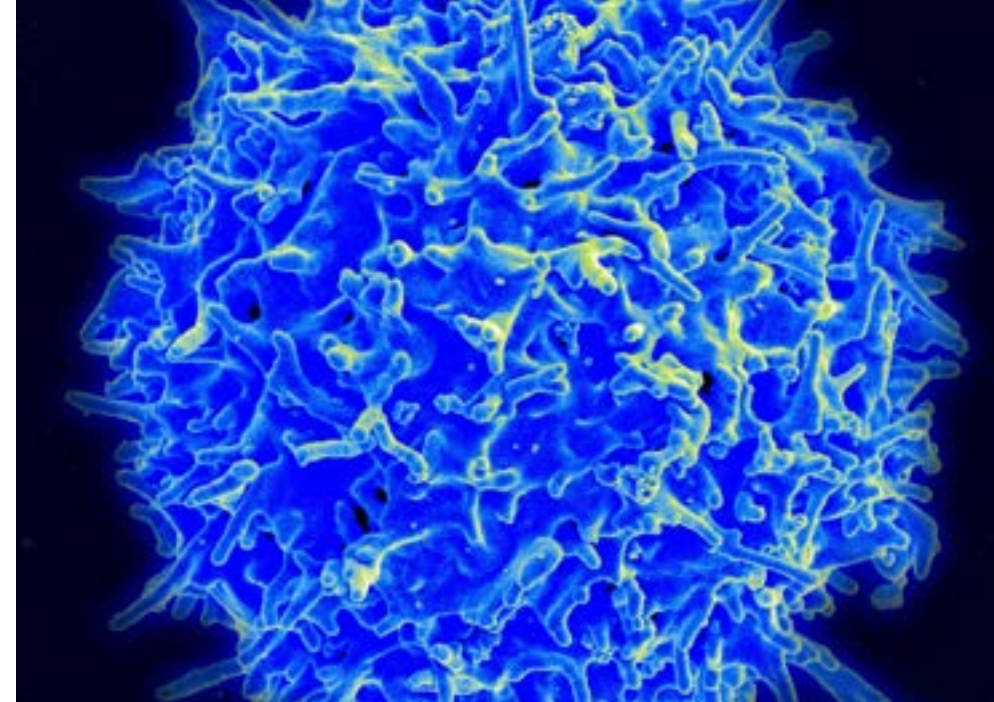
ACGGTATAAAG **CATCAT** GGGTACCAG

2. Cut ✂️

ACGGTATAAAG GGGTACCAG
CATCAT

3. Paste 📄

ACGGTATAAAG **CTTCTT** GGGTACCAG





- 1. Improve food security**
- 2. Reduce agricultural emissions**
- 3. Remove gigatons of atmospheric carbon**



1. Improve Food Security

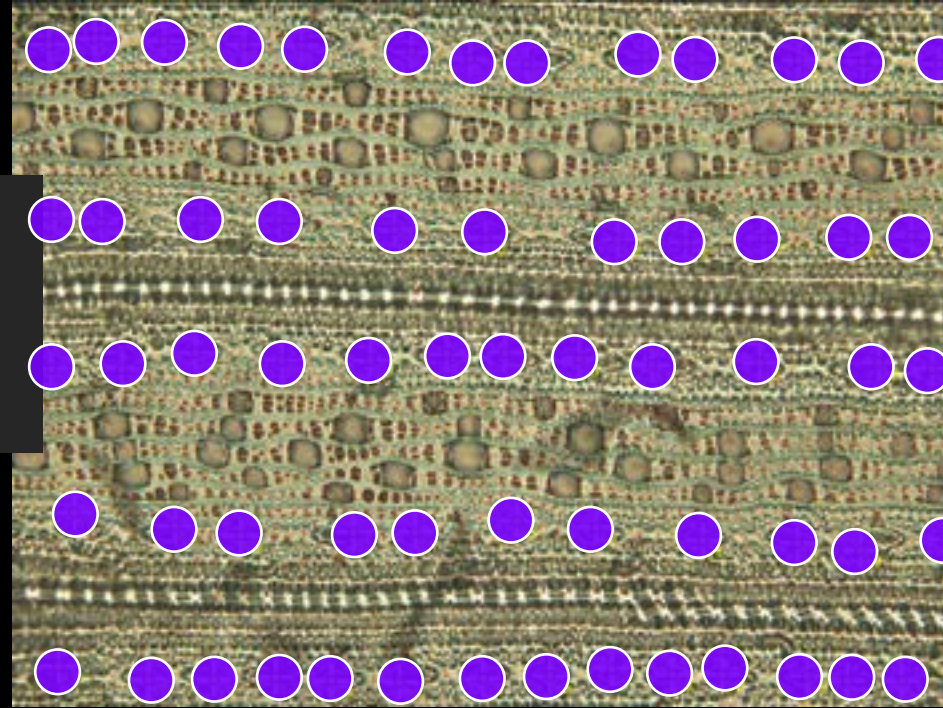
**Cultivated rice
(disease susceptible)**



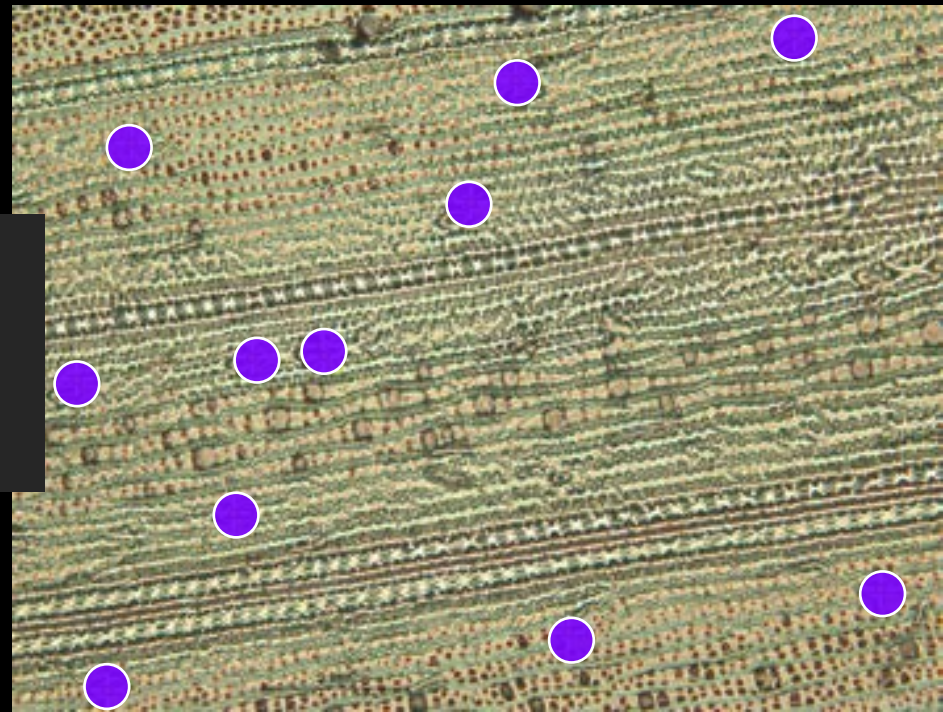
**Edited variants
(disease resistant)**



**Rice with
normal
stomata
density**



**Rice edited
for reduced
stomata
density**





N/O

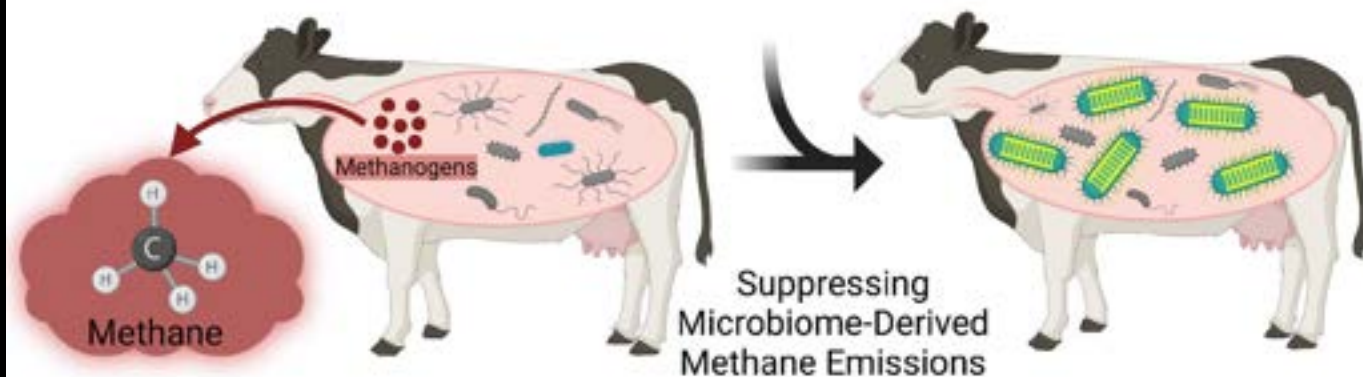


2. Reduce Agricultural Emissions



Nearly 15% of all GHG emissions stem from livestock production

CRISPR-Cas
Integrated DNA Edit





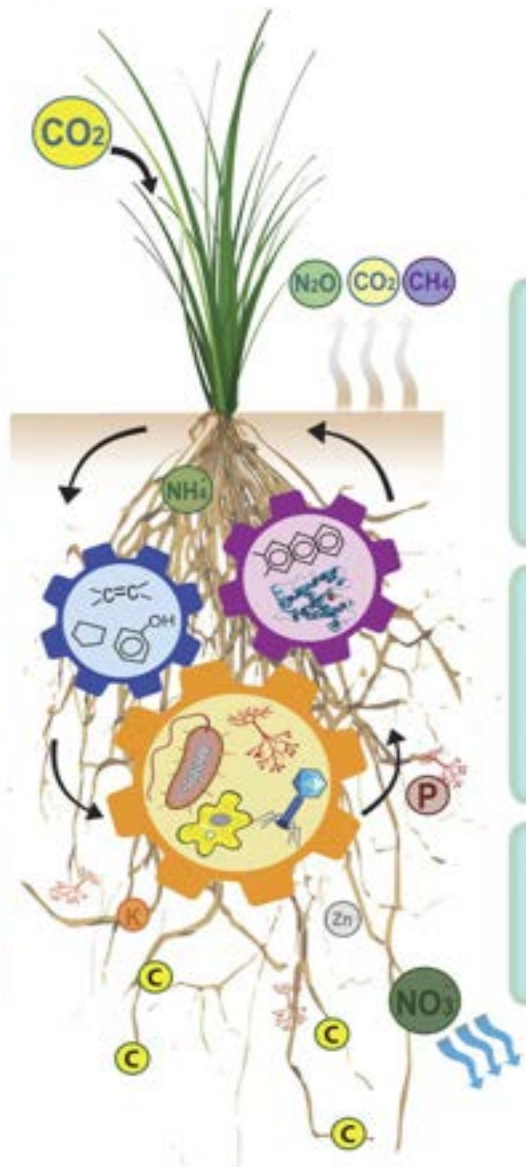
**75% of global N₂O
emissions come from
agriculture**

Soil Microbiomes Support Plant Productivity &



Ecosystem services

- ↑ Carbon sequestration
- ↓ Greenhouse gas emissions
- ↑ Biodiversity
- Biomass for energy needs
- Bioproducts
- Phytoremediation
- ↓ Nitrate leaching and runoff
- ↑ Water use efficiency



Microbiome services

- Plant nutrient acquisition:**
 - Nitrogen fixation
 - Phosphate solubilization
 - Production of siderophores
 - Enhanced mobilization of nutrients from soil minerals
 - Mineralization of organic matter
- Defense against pathogens:**
 - Production of antimicrobials
 - Competition for nutrients
 - Predation on plant pathogens
 - Interference with quorum sensing affecting virulence
 - Induced systemic resistance
- Drought and salinity stress:**
 - Production of ACC deaminase
 - Secretion of osmolytes
 - Production of plant hormones
 - Release of antioxidants

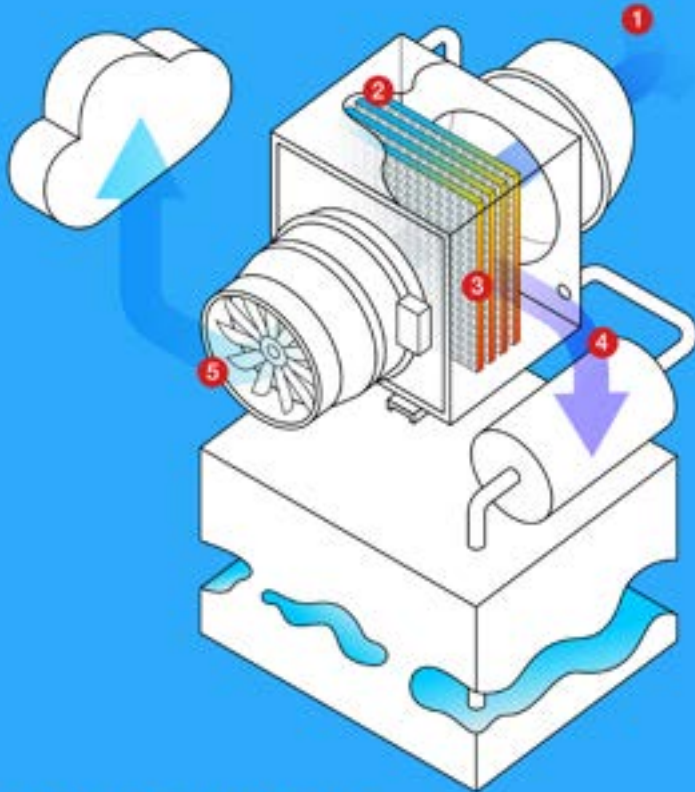




**Agricultural soils have
lost 487 gigatons of
CO₂ (equivalent)**

3. Remove Atmospheric Carbon

CAPTURE CO₂



HOW IT WORKS

- 1 AIR IS DRAWN INTO THE CAPTURE PLANT
- 2 INSIDE CARBON DIOXIDE BINDS CHEMICALLY TO A FILTER.
- 3 ONCE FILTER IS SATURATED, IT IS CLOSED OFF AND HEATED TO 100°C.
- 4 PURE CO₂ IS RELEASES AND COLLECTED UNDERGROUND.
- 5 PURIFIED AIR IS RELEASED



**Agriculture is
Already Global**



Opportunities for CRISPR to Enhance Carbon Capture and Storage

Photosynthesis



Roots



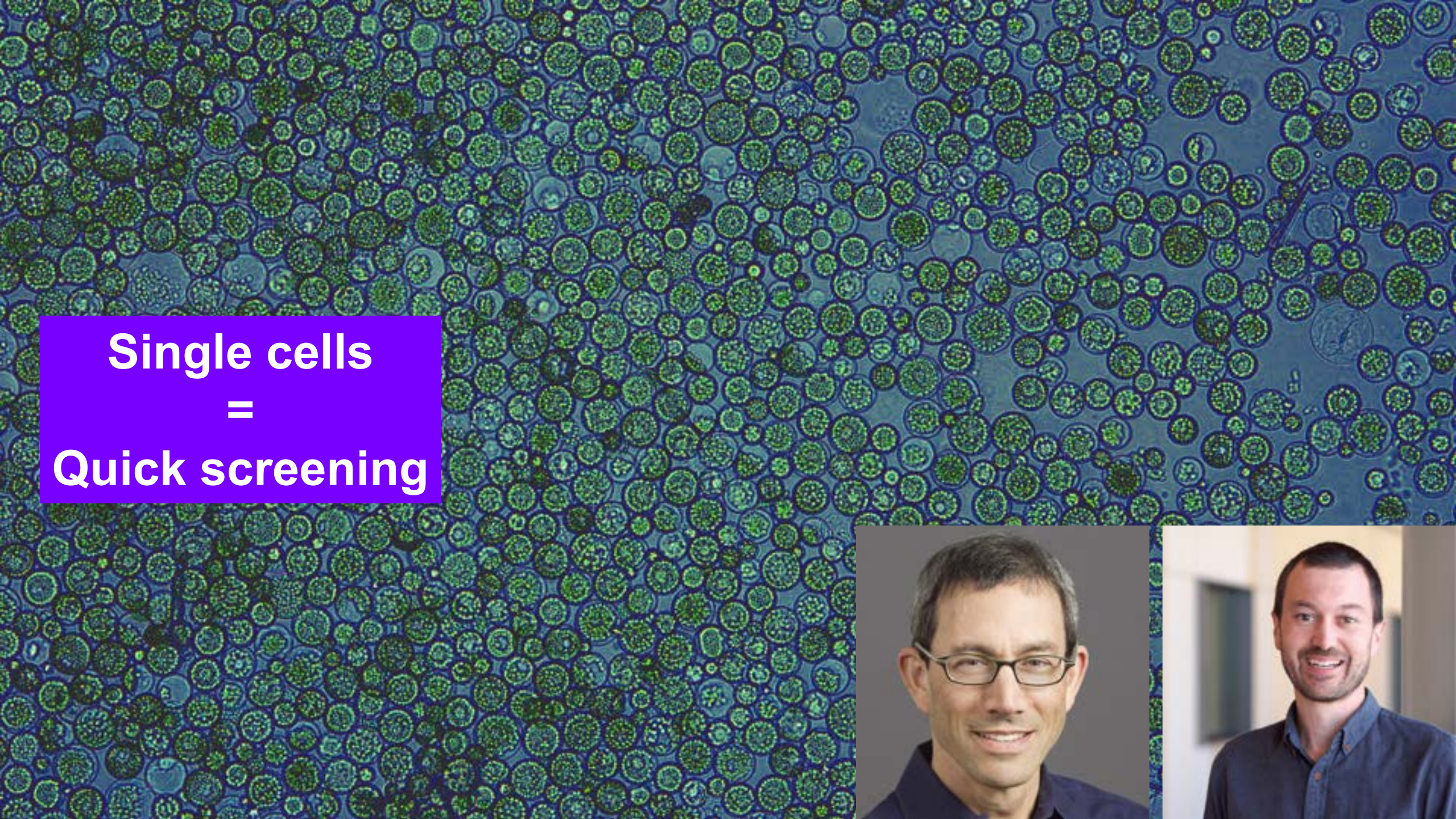
Soil Microbiome



Enhance Photosynthesis

CO₂





**Single cells
=
Quick screening**

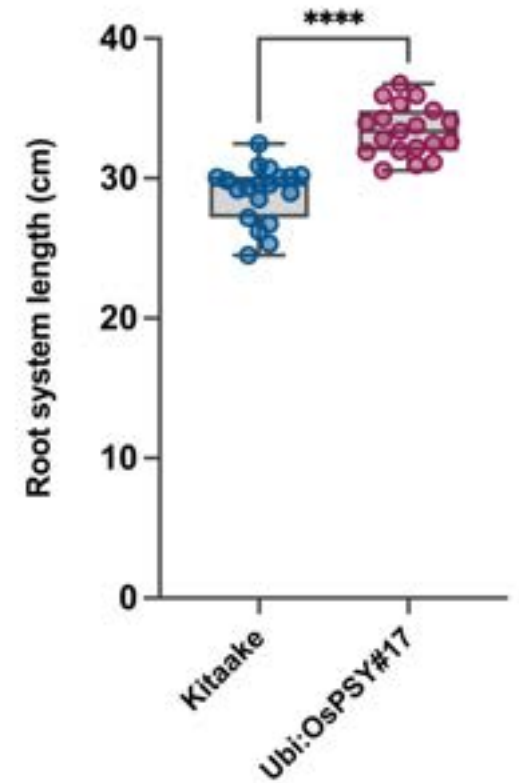


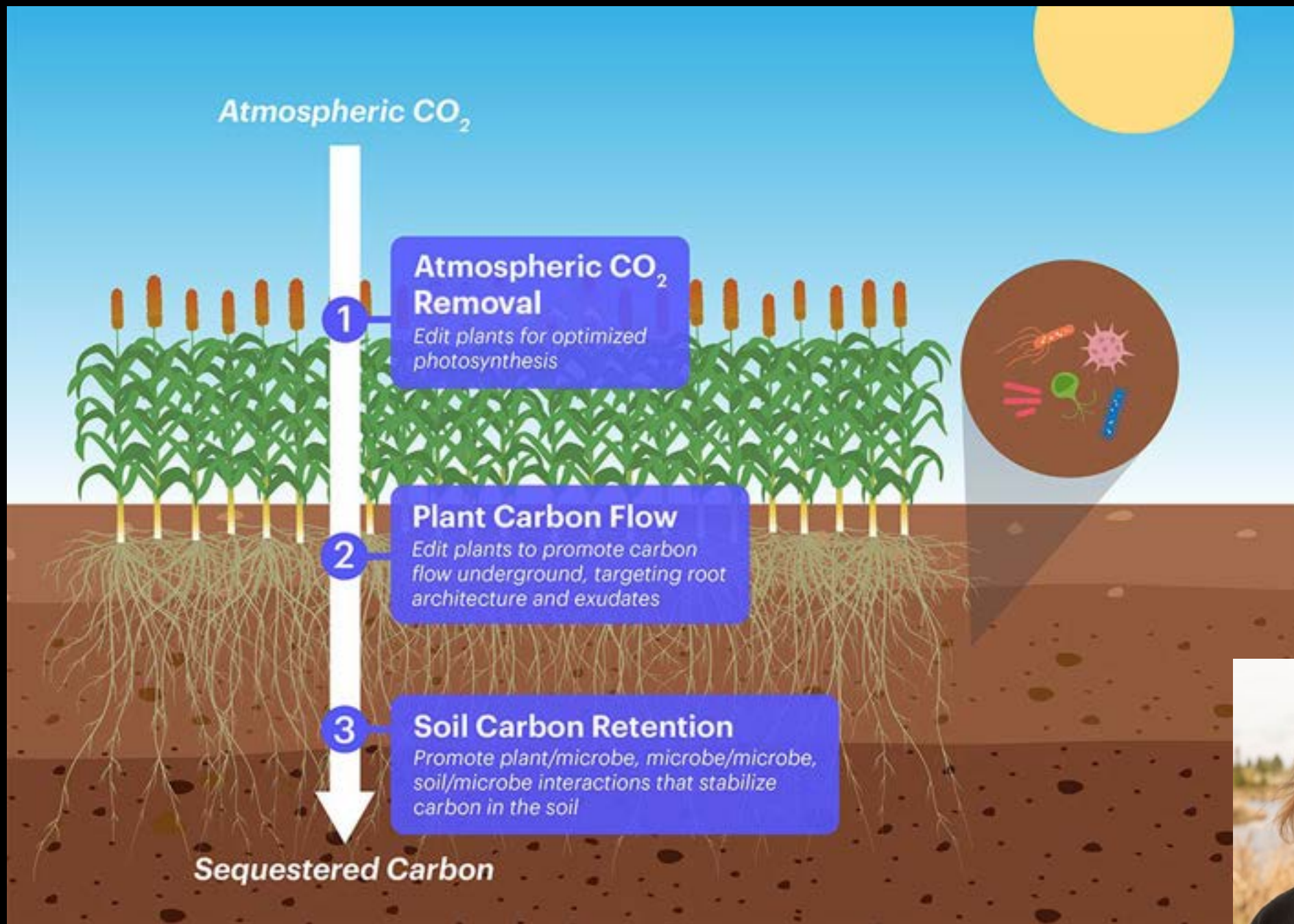
Genetic differences alter root system architecture

Kitaake



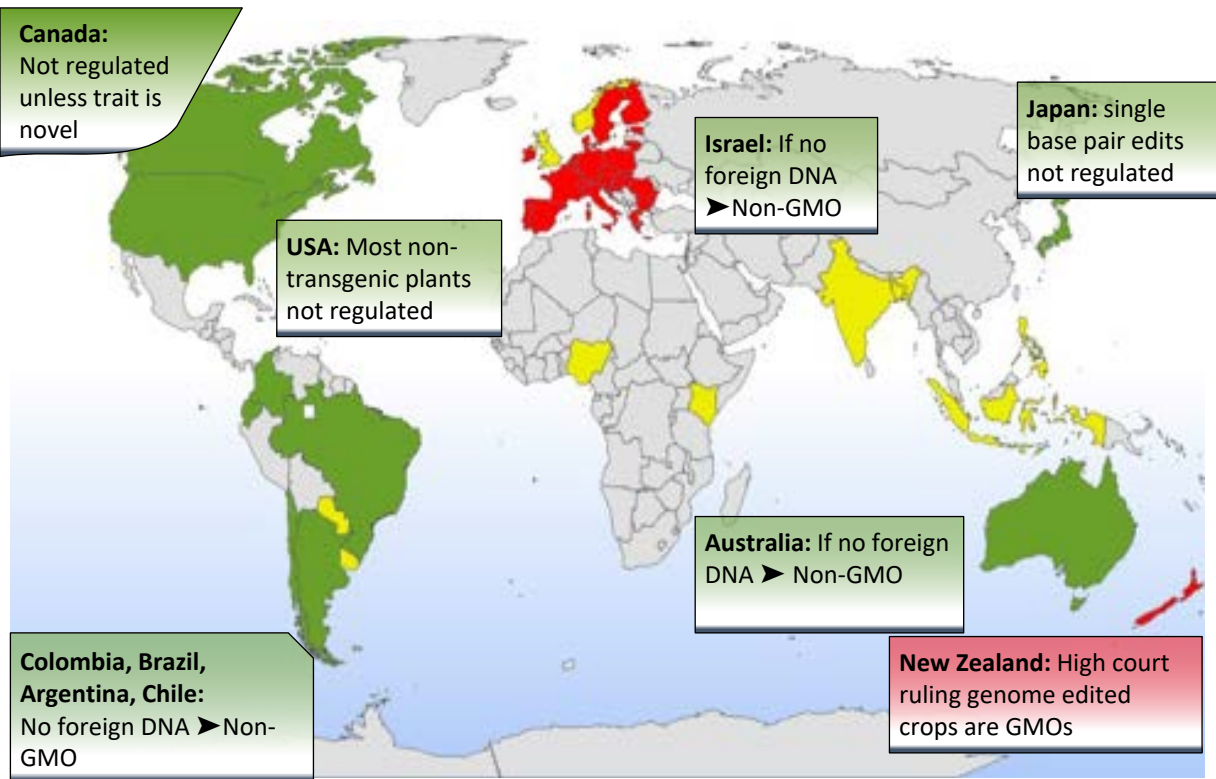
Ubi:OsPSY1#17



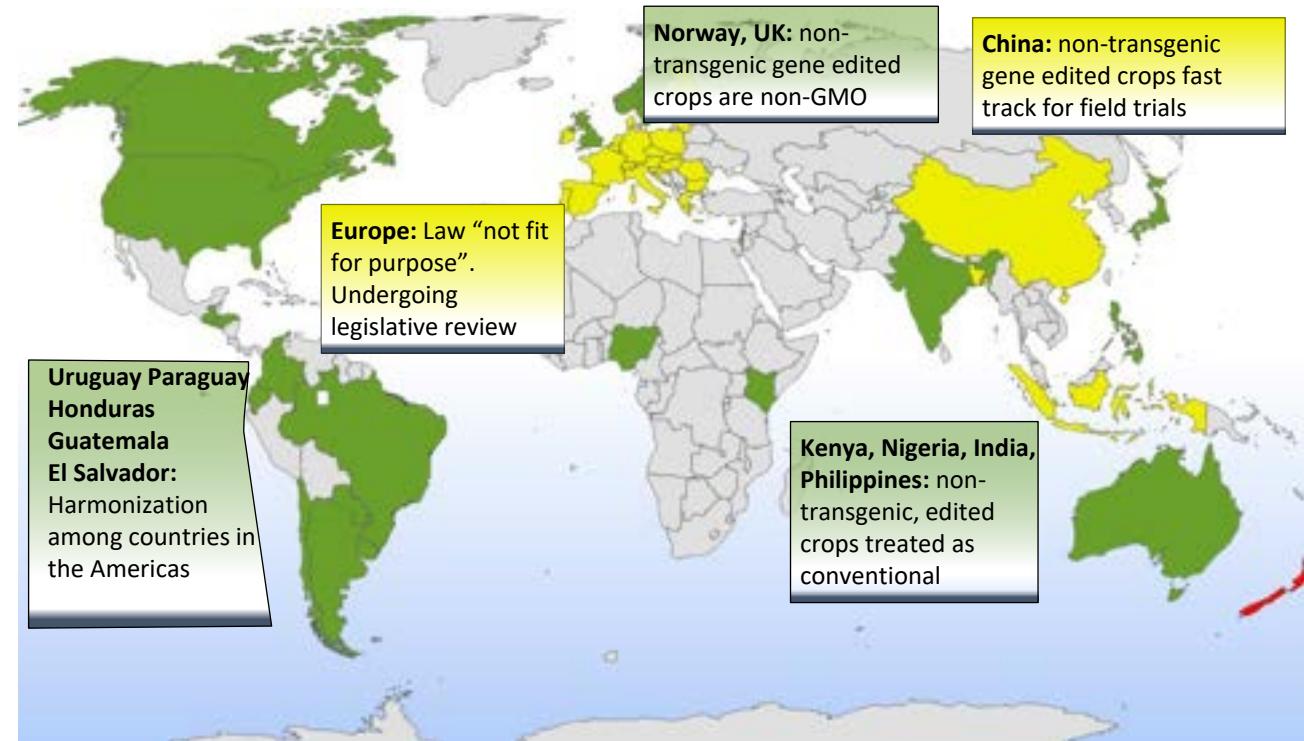


Global Policies Are Shifting Rapidly

2020



2022



Genome-edited crops receive light touch regulations or are non-GMO



Draft policies Discussion ongoing



Genome edited crops regulated as GMOs

CGIAR Partnership for Translation



- 15 top-class Research Centers
- 108 countries
- 770,000+ germplasm accessions
- 50 years' experience

- Memorandum of understanding to **share technology and resources**
- Field trial and translation of IGI developed products
- Direct access to local farmers and value chains
- Seed scale up and distribution





END