

“If you can imagine
it, a microbe
already does it”

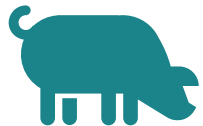
PLUTON[®]
BIOSCIENCES

Investor and public pressure combined with accessible biotechnology creates innovation opening for new natural products

Companies face massive & growing **pressure to innovate** sustainably

BlackRock

Investors **demand sustainable solutions**

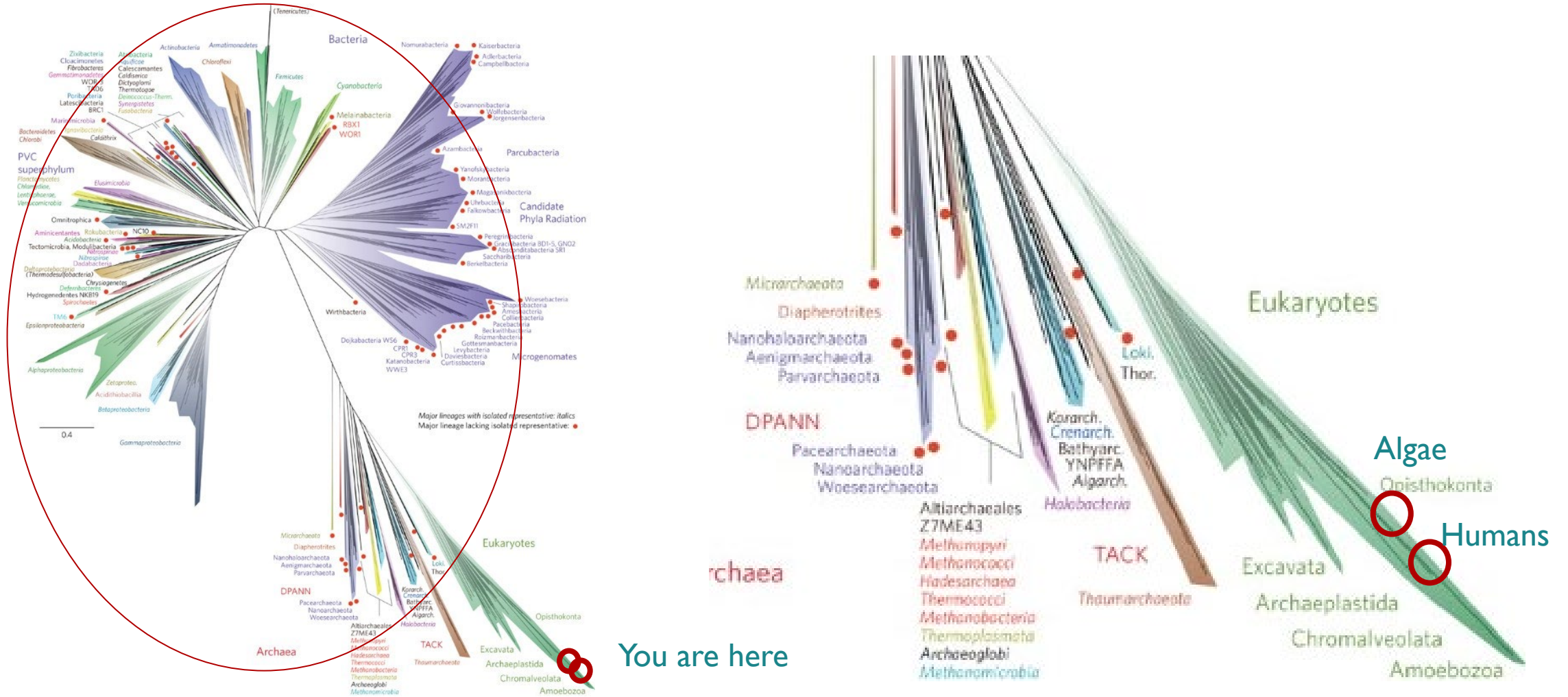


Agricultural GHG emissions are increasingly in-focus



Agricultural companies are spending huge sums to **expand product offerings and offset externalities**

Microbes represent the major diversity of life



Significant global problems solved with just five microbes

Therapeutics

Acremonium/Streptomyces



Antibiotics

Transgenics



Food & Ag

Bacillus/Agrobacterium

Diagnostics

Thermus aquaticus



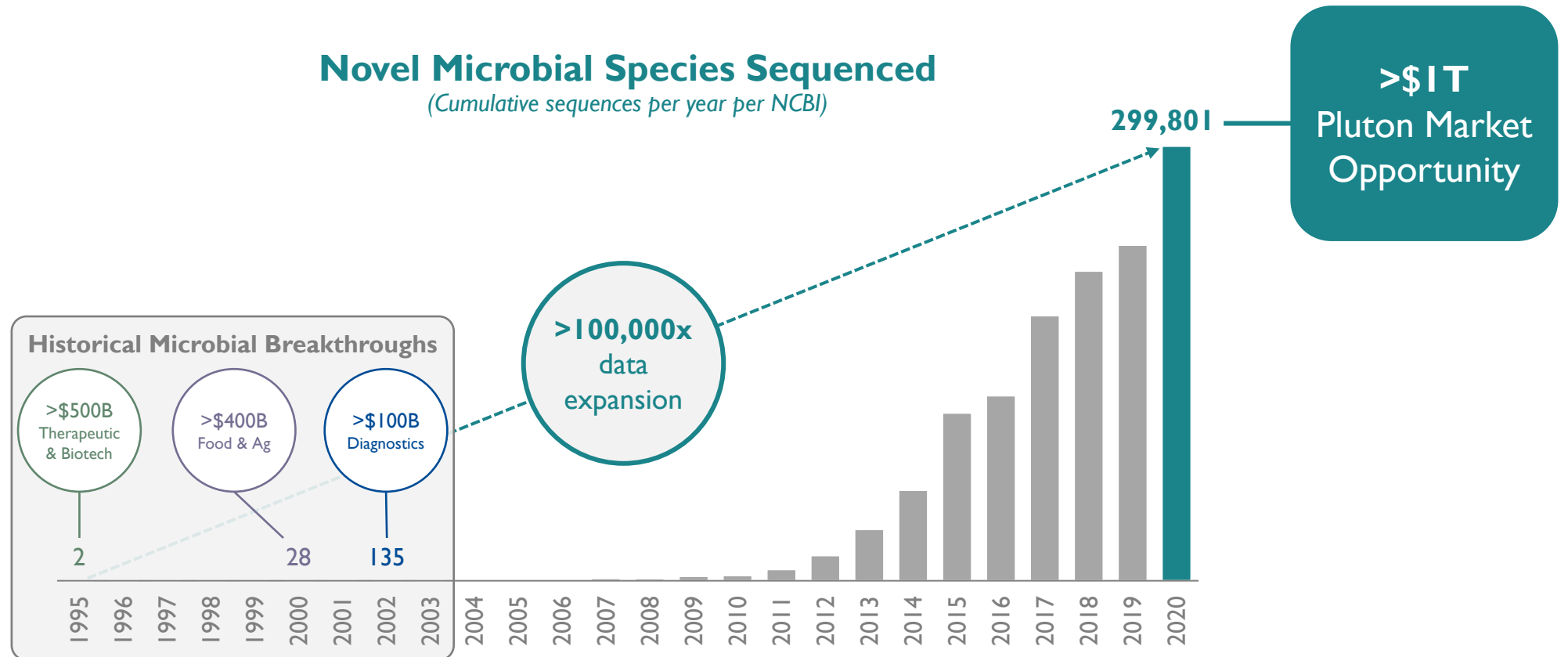
**PCR / DNA
Sequencing**

(1) New World Encyclopedia: Alexander Fleming

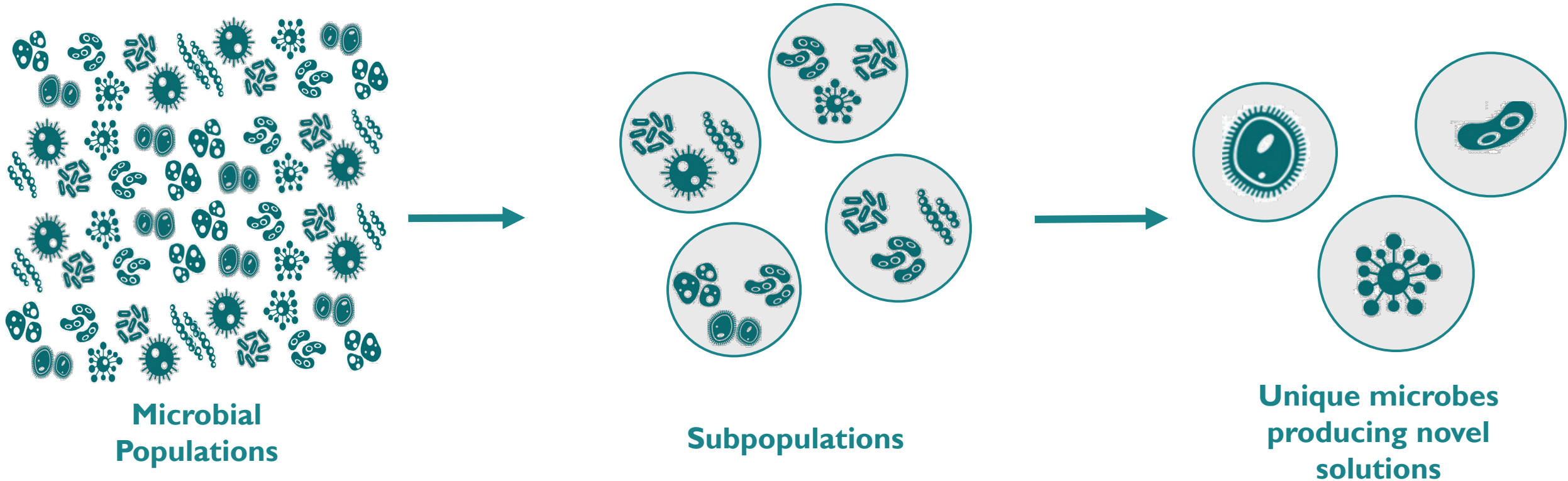
(2) National Center for Biotechnology Information: Impact of genetically engineered maize on agronomic, environmental and toxicological traits: a meta-analysis of 21 years of field data

(3) John Hopkins Medicine: How Statin Drugs Protect the Heart

Exponentially more microbes enable exponentially larger solutions



Micromining™ finds the right microbe fast



6 months/1 researcher

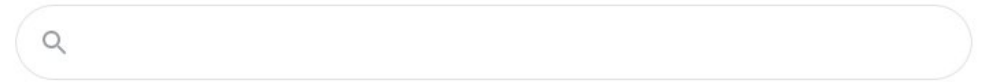
Micromining[®] enables Pluton to rapidly find purpose-suited microbes that traditional methods would never uncover

Traditional biomining was like searching microbial yellow pages



Traditional biomining is time and cost intensive because discovery is not scalable and novel results are uncertain

Micromining brings Google Search to 1 Trillion undiscovered microbes



Google Search

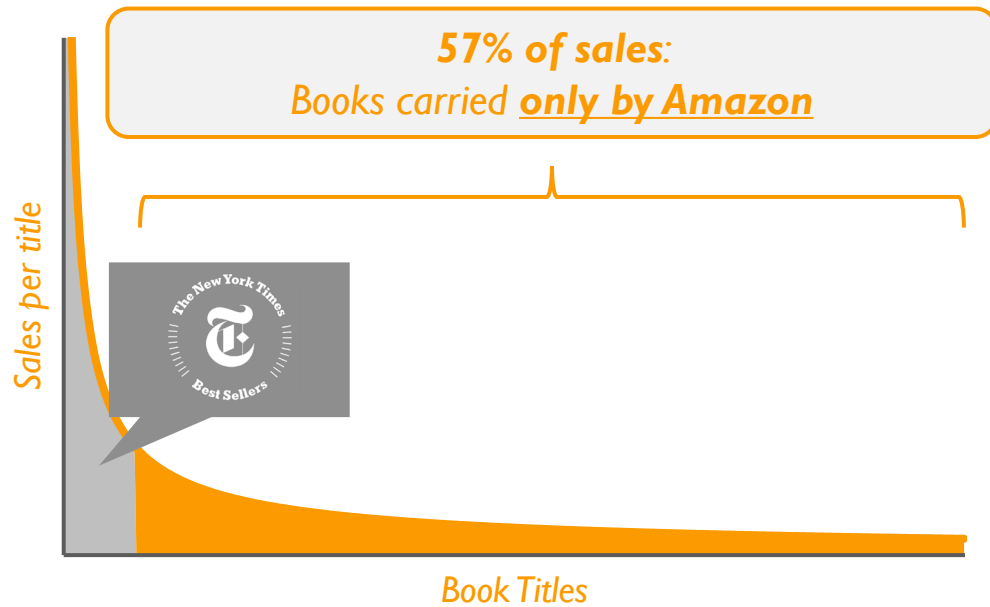
I'm Feeling Lucky

Micromining enables search for specific modes of action through entire microbial populations

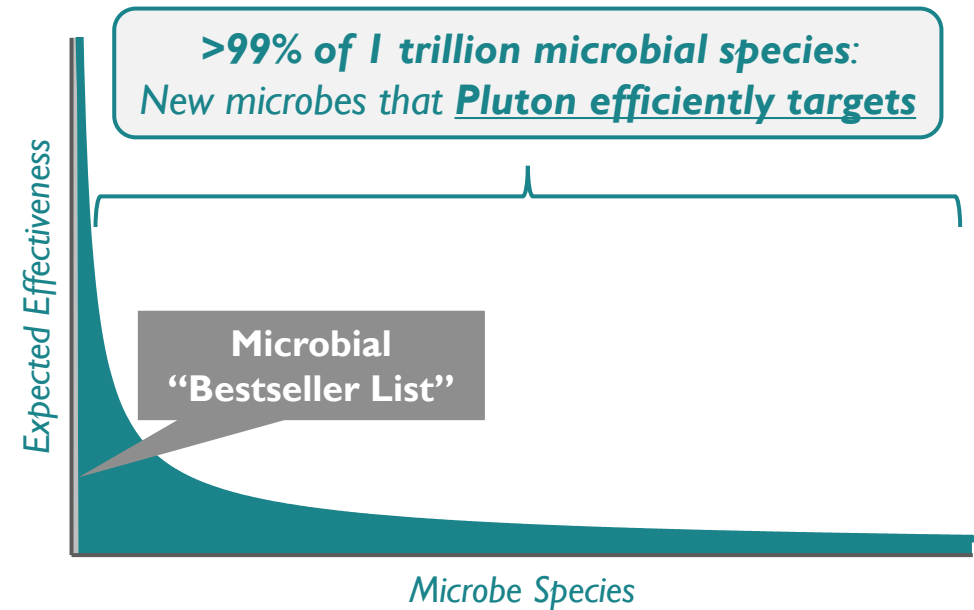
As Amazon generated value through books not sold elsewhere, Micromining targets microbes outside the “Bestseller List”



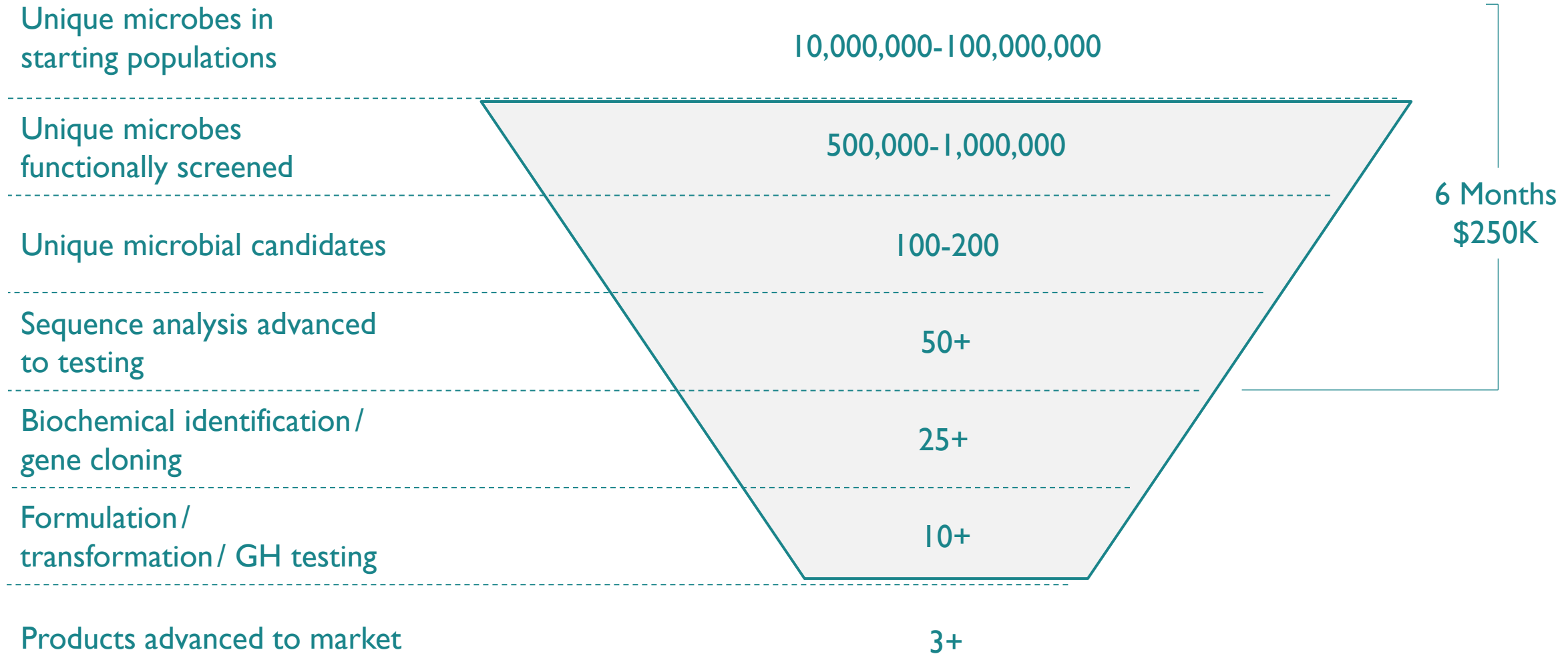
Internet & Centralized Warehousing



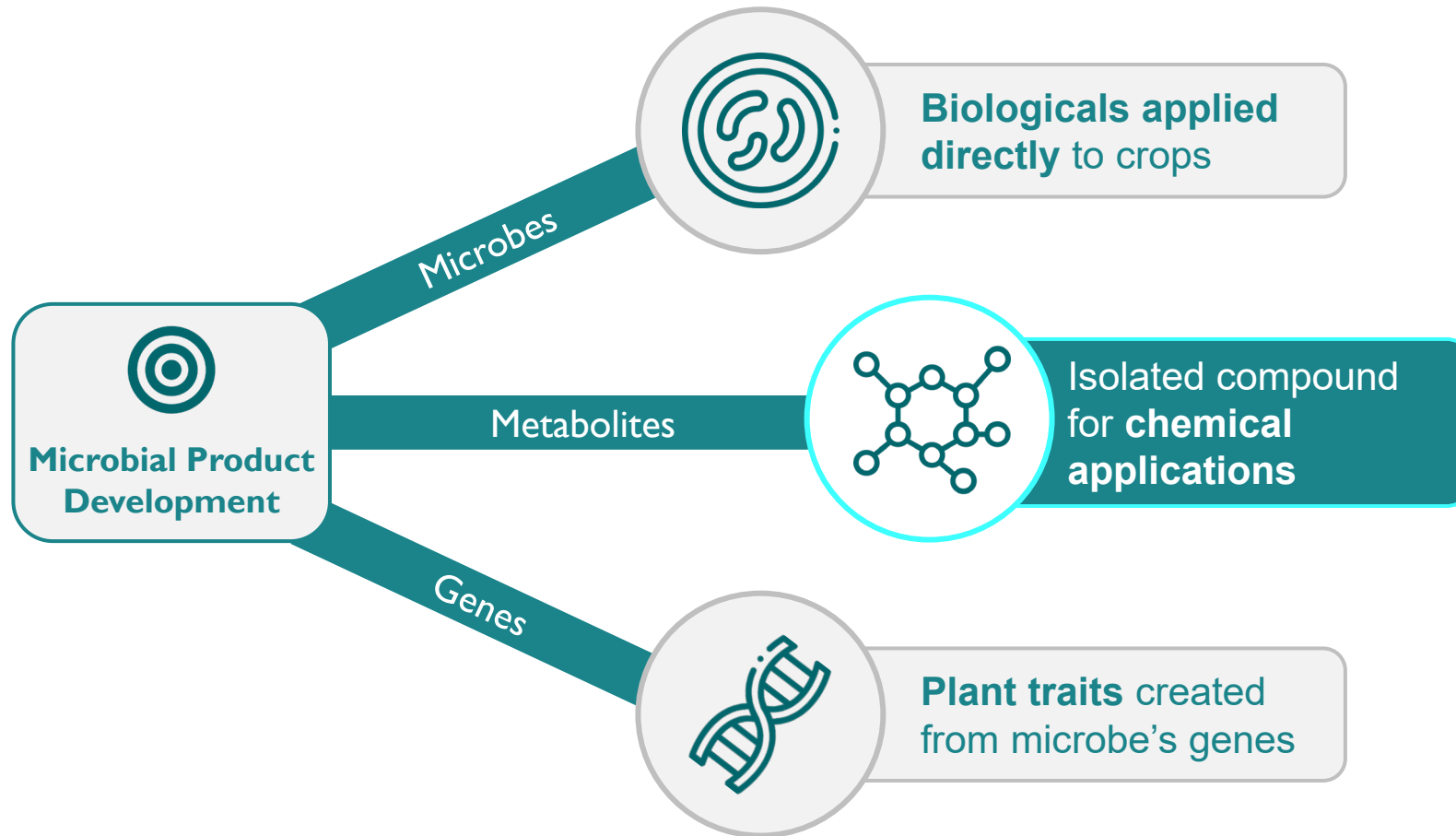
Sequencing & Micromining



We test more microbes faster to create better products



Pluton's Micromining Innovation Engine generates three distinct product opportunities in crop protection and pest control



Algal systems are cropping systems



=





Rotifer = 100 μ M



Chlorella = 10 μ M

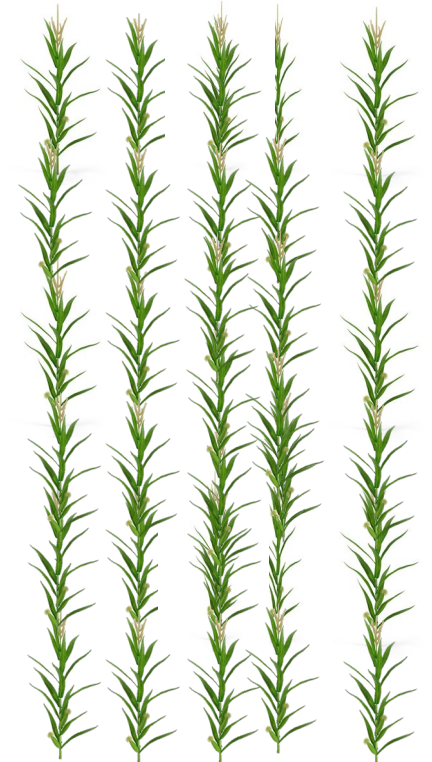
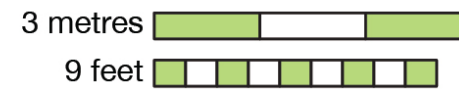
As if a Brontosaurus was dropped in a field of corn

Brontosaurus

66 feet (20.1 metres) from head to tail
estimated weight: 28.1–34.5 metric-ton range



© Encyclopædia Britannica, Inc.



The biggest concerns in Cropping Systems are Weeds and Pests

Weeds



Palmer Amaranth

Pests



Corn Rootworm

State of the art

1. Genetic Alterations

- a. Transgenes
- b. CRISPR



PAIRWISE

2. Chemistries

- a. Synthetic
- b. Natural Products



3. Organisms

- a. Microbiome
- b. Single organisms



4. Germplasm/Breeding



CORTEVA
agriscience

Concerns in Cropping Systems

Weeds



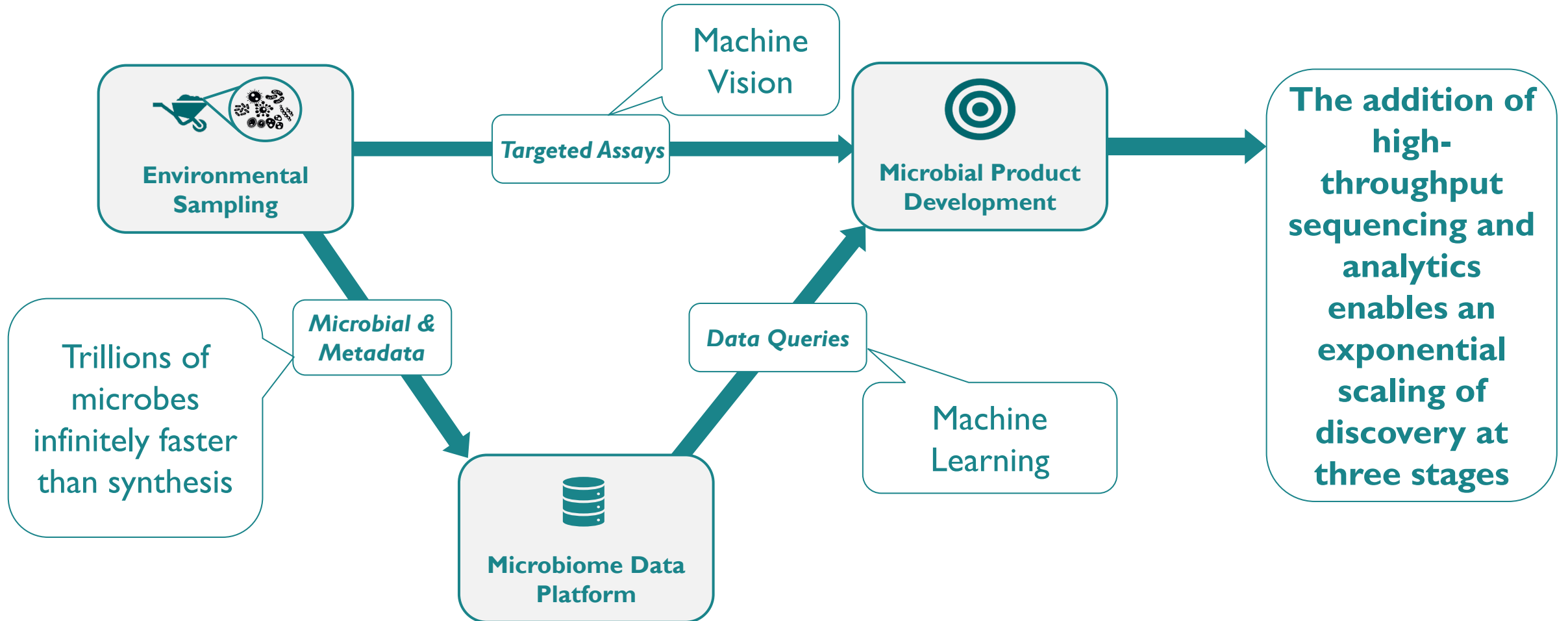
Palmer Amaranth

Pests

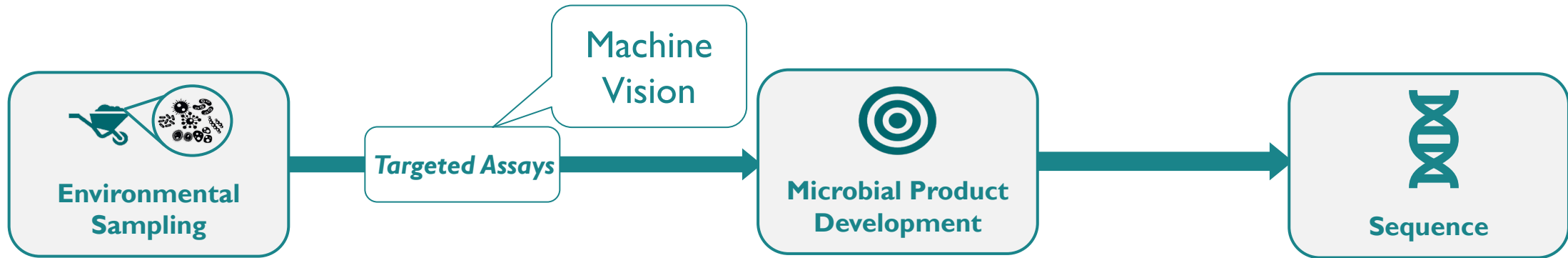


Corn Rootworm

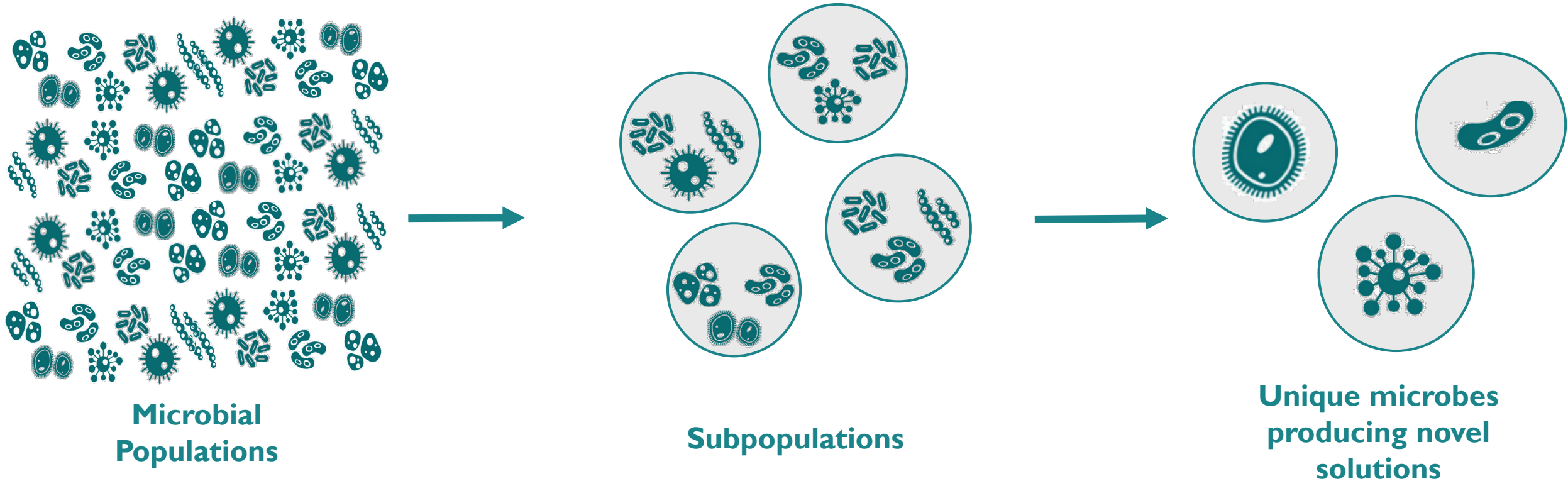
Micromining builds durable competitive advantage by scaling discovery at each stage of the pipeline



Micromining builds durable competitive advantage by scaling discovery at each stage of the pipeline

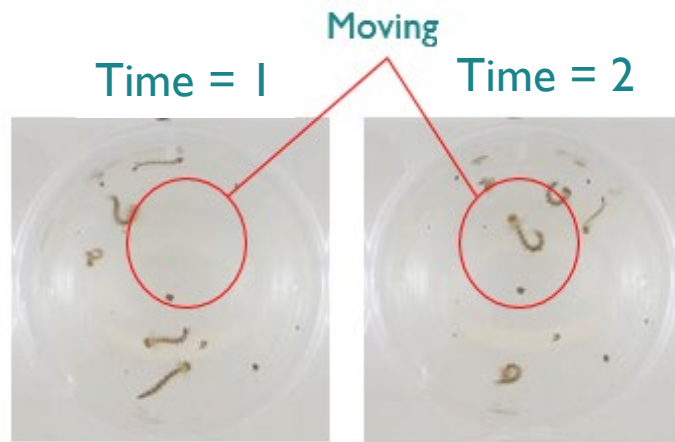
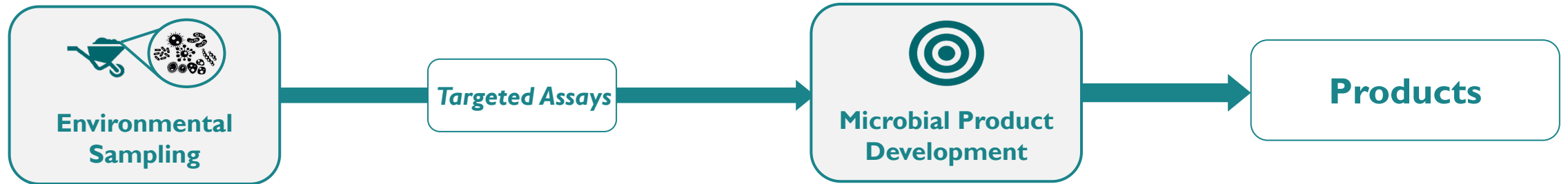


Micromining™ finds the right microbe fast

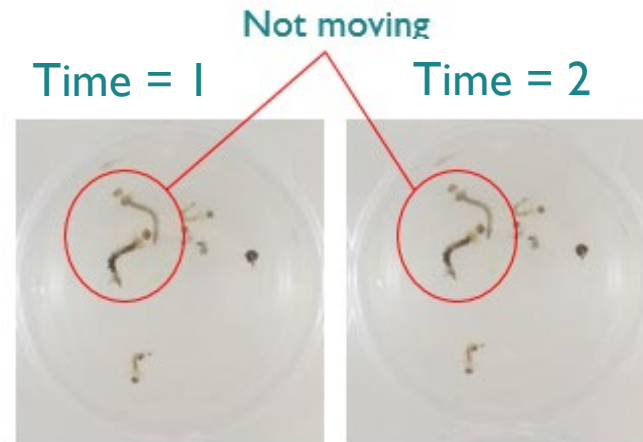


6 months/1 researcher

Machine Vision connected to assay design enables a dramatic increase in testing throughput



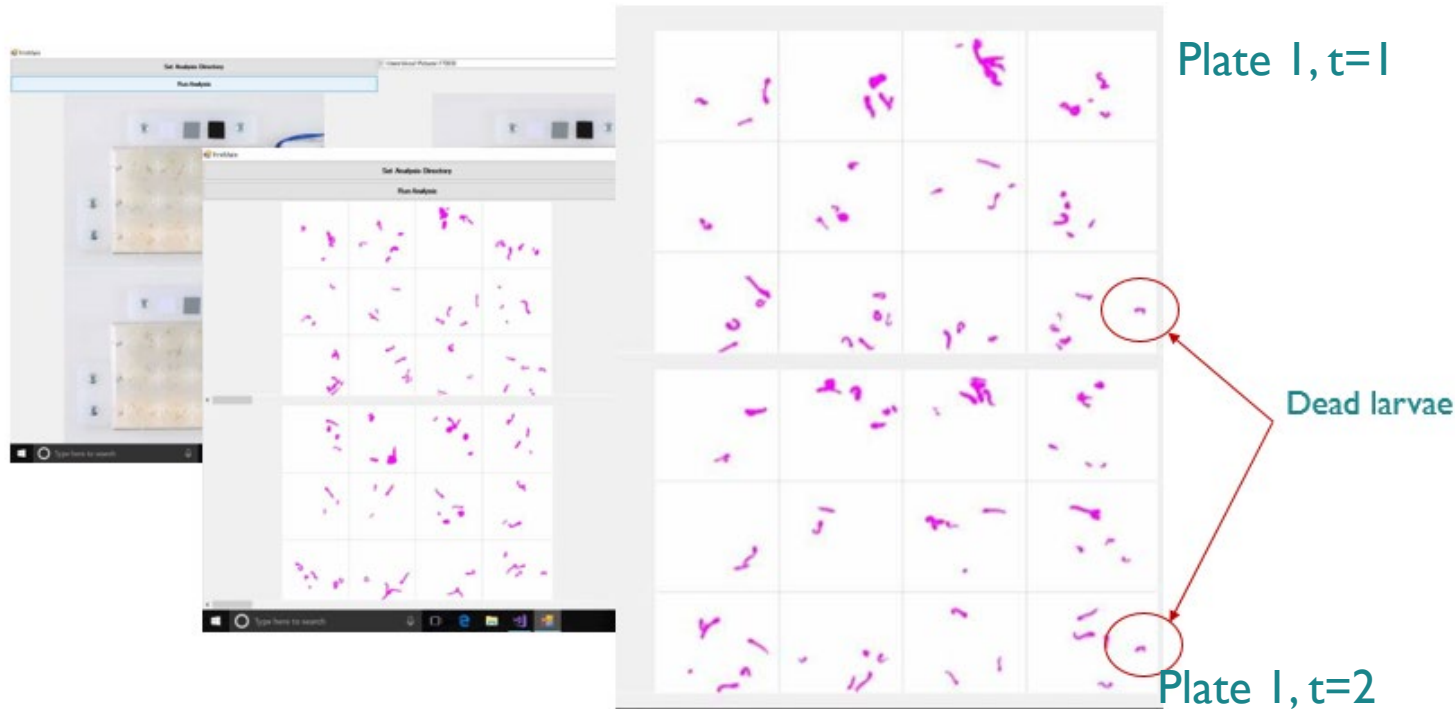
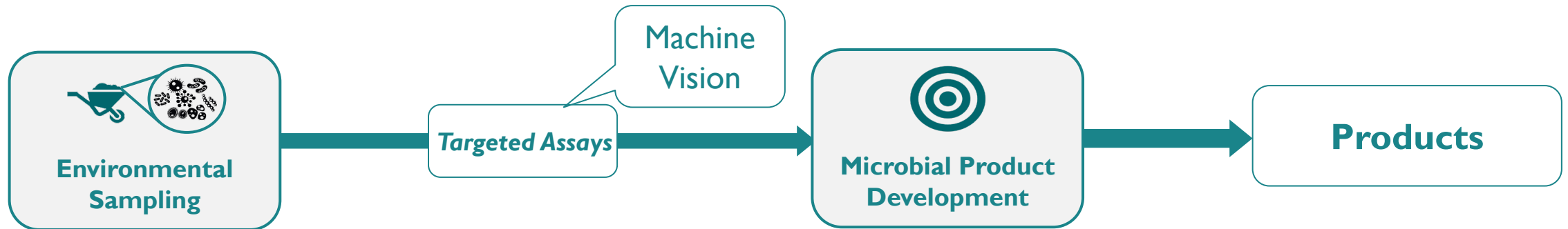
Inactive Sample: 0/5 dead
Larvae move over time



Active Hit: 5/5 dead
No movement

Insects tested against different populations of microbes

Automated data collection enables a dramatic increase in testing throughput



Scalable computational workflows identify hits without human intervention

Concerns in Cropping Systems

Weeds



Palmer Amaranth

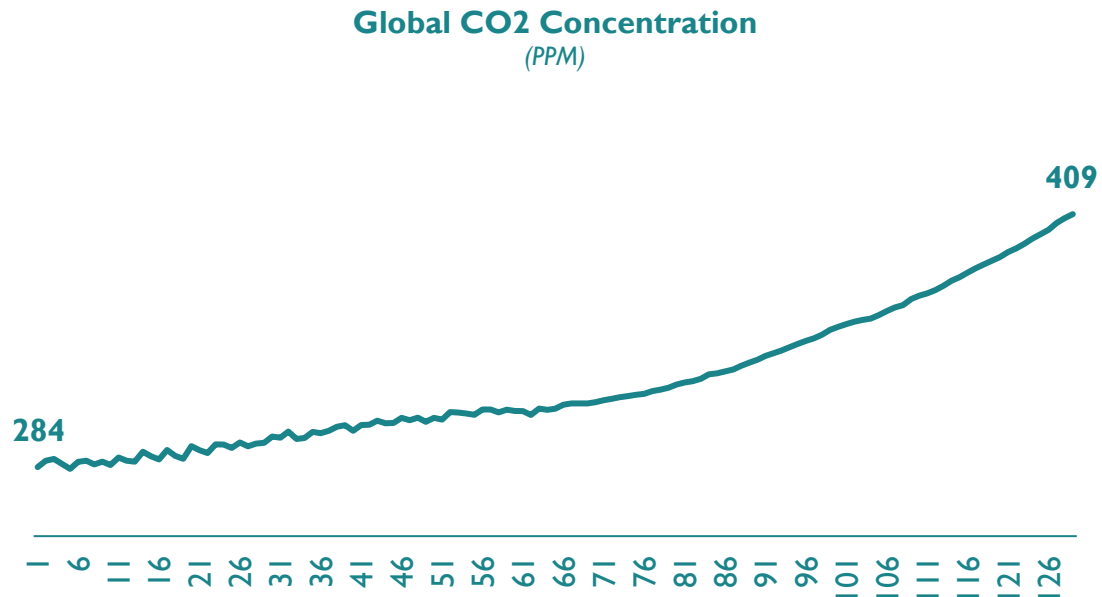
Pests



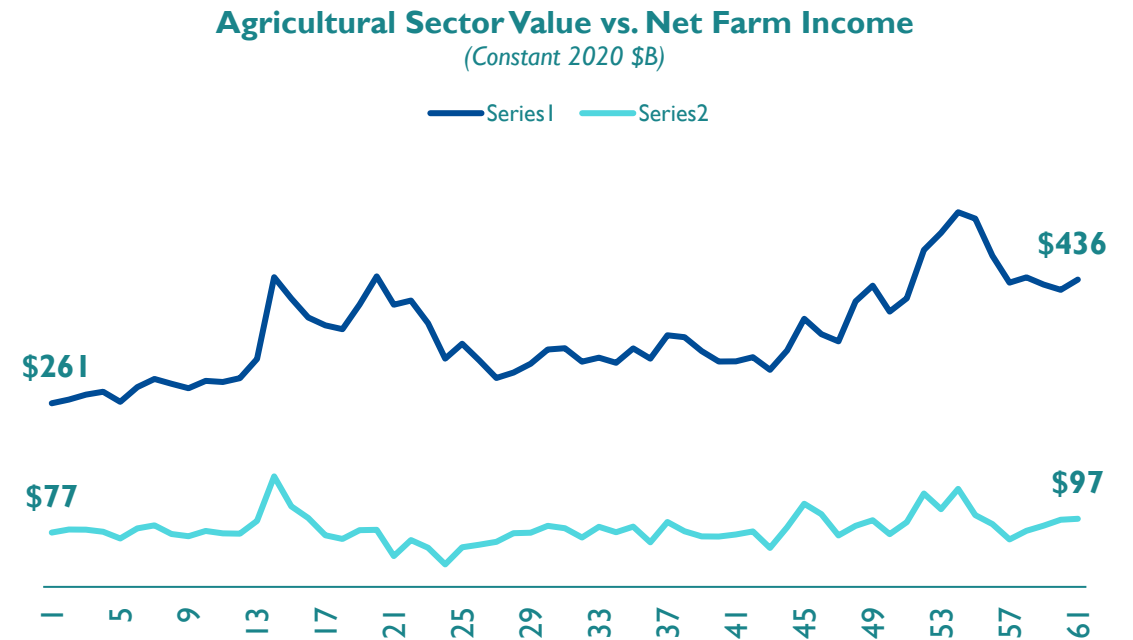
Corn Rootworm

Agricultural and chemical companies face heightened focus on GHG emissions as well as declining farmer profitability

Global industrialization has driven GHG concentrations and emissions to an **unsustainable level**



While production has nearly doubled since 1960, **farm income has stagnated**



Sources: NOAA & ESRL, USDA & ERS Farm Income and Wealth Statistics

Agriculture is uniquely positioned to sequester carbon on farms, providing global environmental benefits and grower incentives



Carbon sequestration **benefits the world**

- Long-term carbon storage in soil **reducing atmospheric carbon**
- Enhances **food production** systems



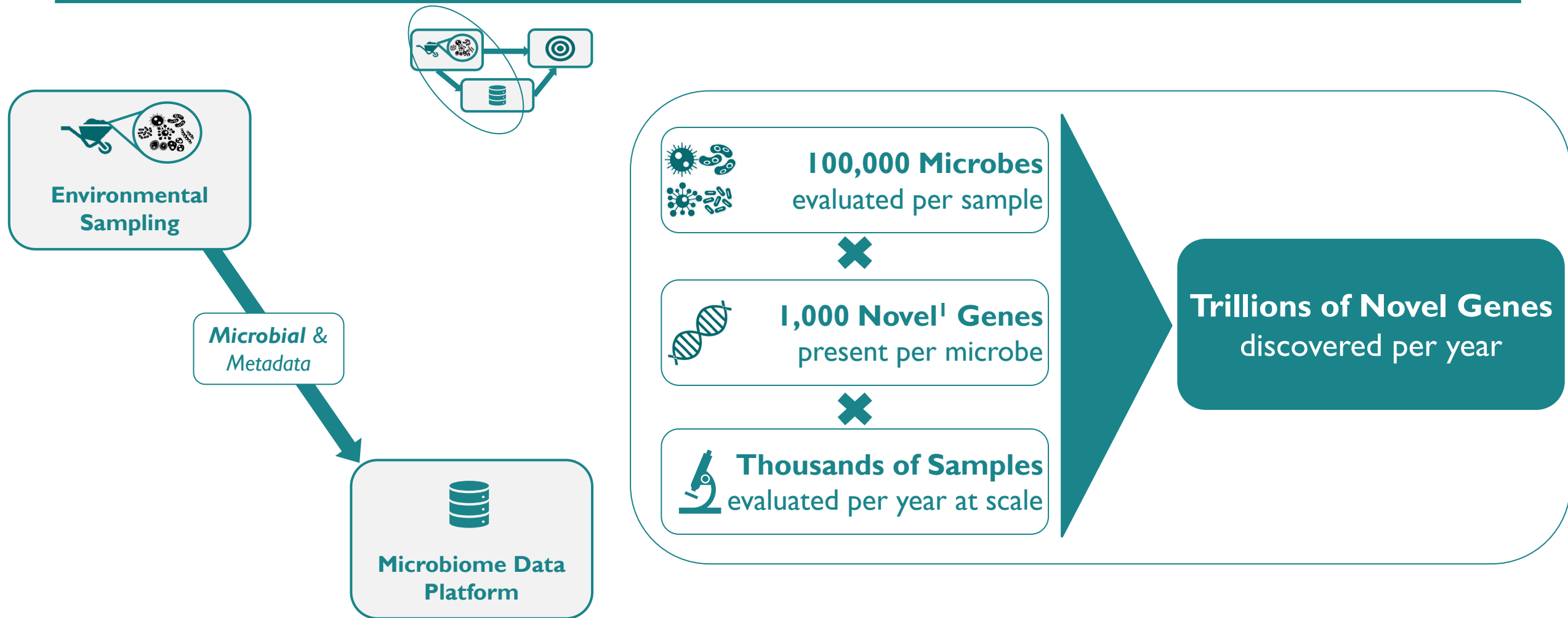
Agriculture is uniquely positioned to transform from a CO₂ emitter to a net CO₂ sequesterer, **benefiting farmers and the world**



Carbon sequestration **benefits farmers**

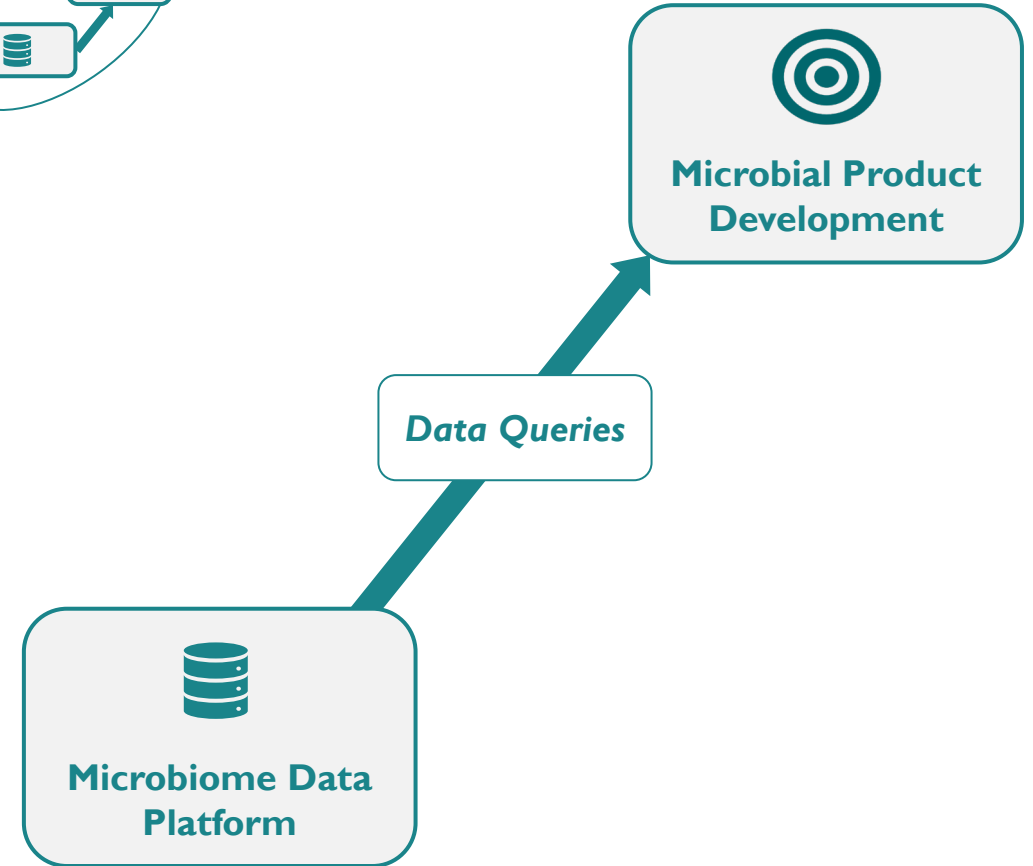
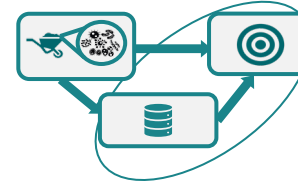
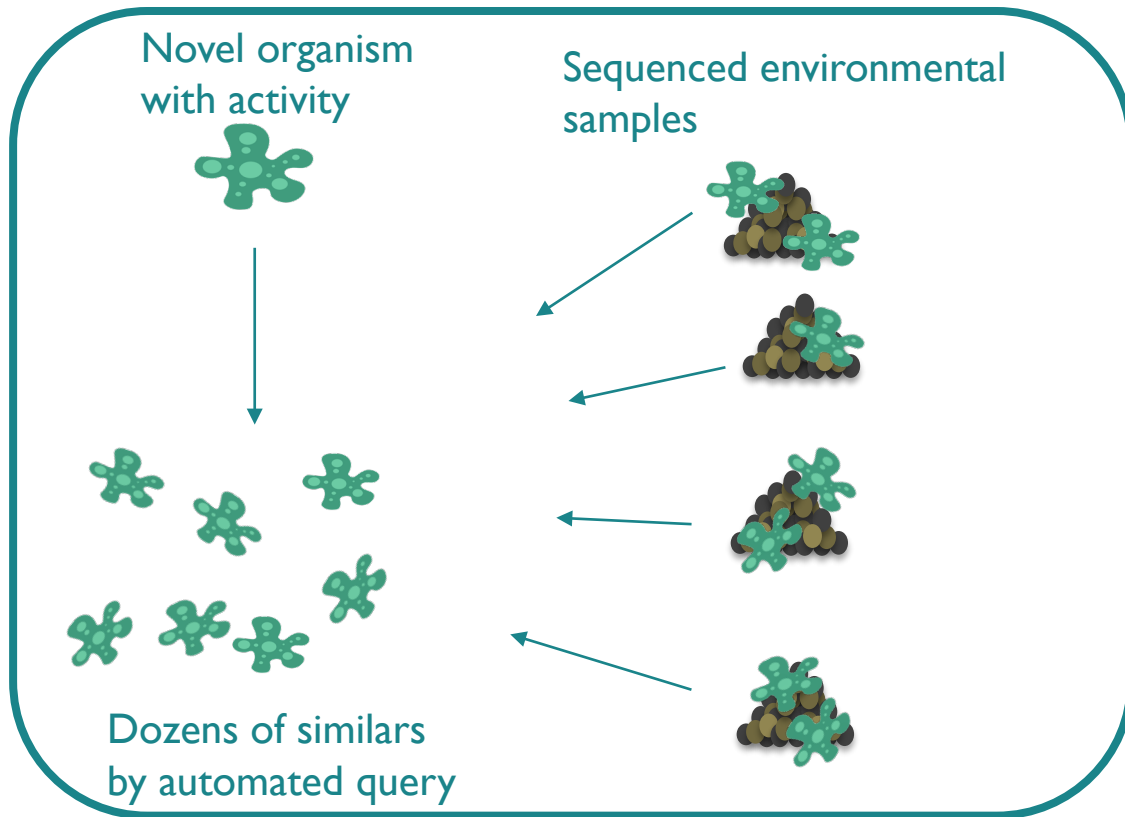
- **Reduces nitrogen inputs**
- Improves **soil health & diversity**
- Natural **disease suppression**
- **Carbon market income**

Micromining at scale enables Pluton to discover an entire universe of novel microbes, proteins, genes, and metabolites

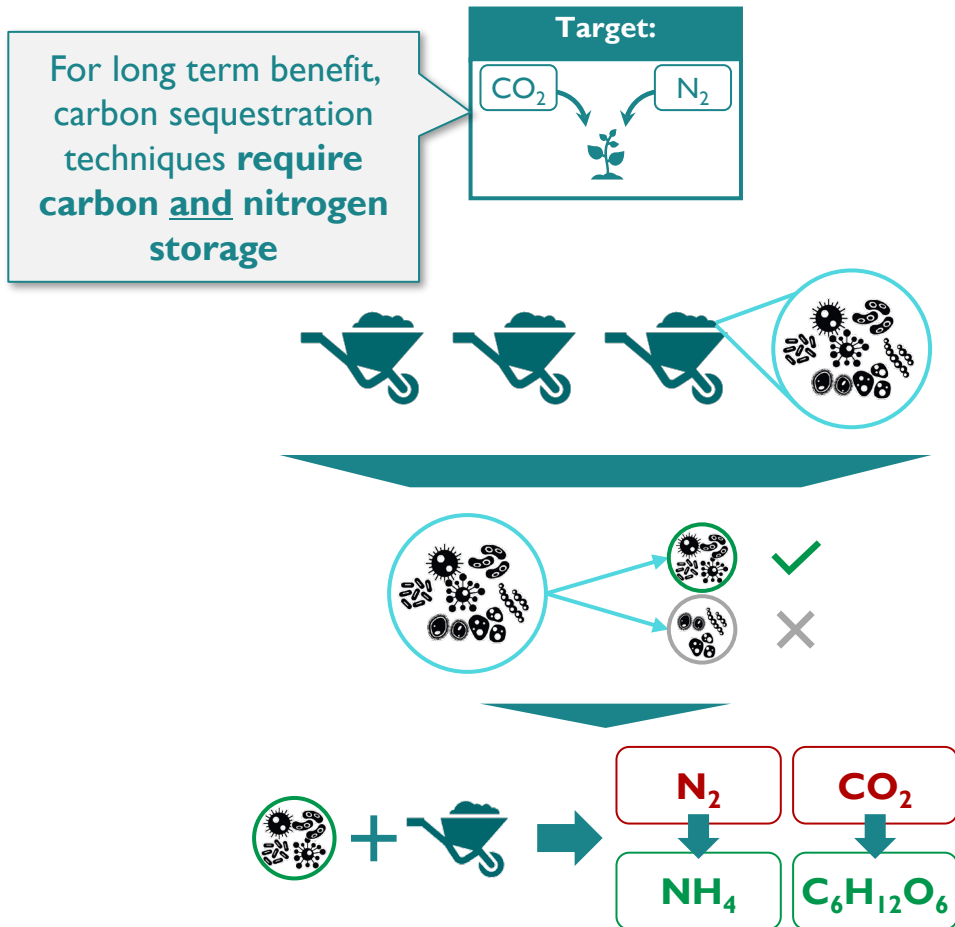


Querying Pluton's database of organisms identifies related actives to expand the candidate pool for specific commercial applications

Enrichment of candidate pool through leveraging genomic data



Pluton is developing a carbon sequestration product to capture carbon and improve soil health



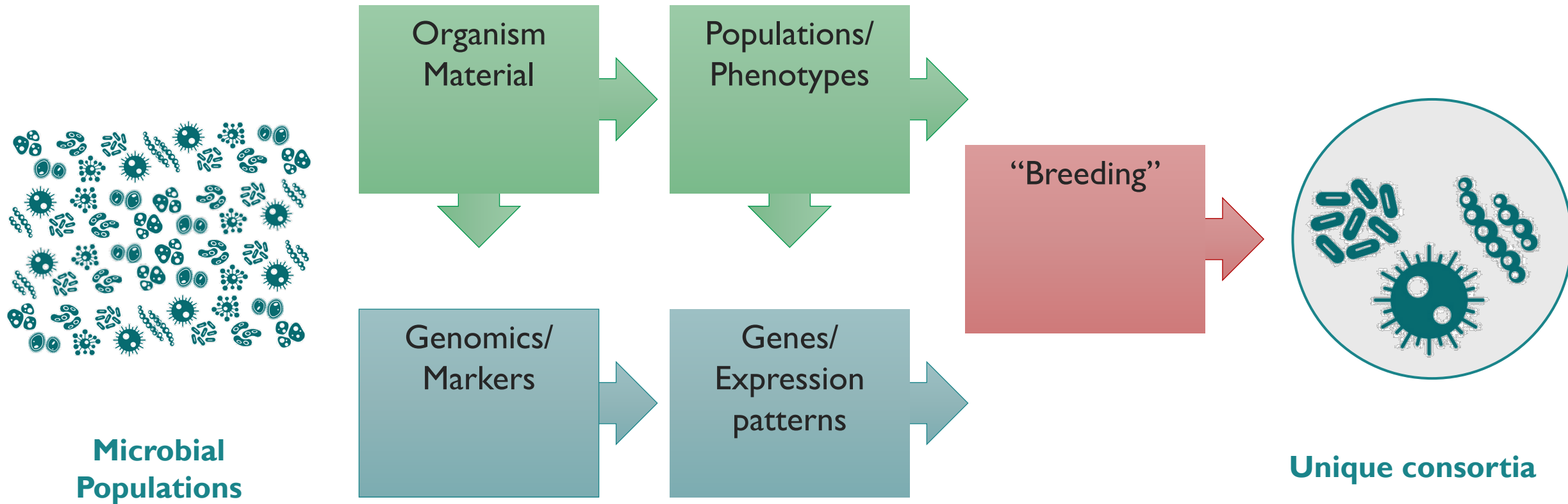
Target the two key *requirements* of long-term carbon sequestration: **carbon and nitrogen soil storage**

Test microbial populations in high organic matter soil

Select & develop microbial consortia that fix nitrogen and carbon

Use consortia to increase soil carbon and nitrogen to sequester 1.7 tons carbon dioxide per acre

Breeding populations of microbes



Concerns in Cropping Systems

Resistance

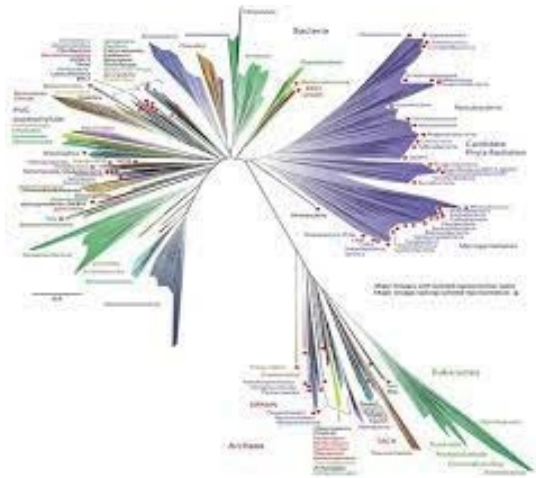


Weeds



Insects

Greater novelty generates greater Diversity



Biodiversity

Diversity in crop varieties, grazing animals, wildlife and pollinators supports resilient ecosystems can better withstand disease, pests and climate shocks.



Healthy soil

Soil is a complex ecosystem that forms the base of the food chain for humans and land animals. It plays an essential role in cleaning and storing water, supporting biodiversity and regulating the climate.



Farmer economic resilience

Regenerative agricultural practices reduce the need for more expensive inputs by fostering natural nutrient cycling. These practices can strengthen whole farm profitability and resilience over time.



Water

Regenerative agriculture helps maximize water use efficiency in rain-fed and irrigated systems, and can reduce agriculture's impact on water quality, helping to protect and restore clean water in nearby streams, rivers and lakes.

Novelty/
Diversity



Sustainability