



CABBI

CENTER FOR ADVANCED BIOENERGY
AND BIOPRODUCTS INNOVATION

Steve Long and Evan DeLucia
November 2, 2017

I ILLINOIS



U.S. DEPARTMENT OF
ENERGY



DOE Bioenergy
Research Centers



CABBI

CENTER FOR ADVANCED BIOENERGY
AND BIOPRODUCTS INNOVATION

OUR TEAM



Berkeley
UNIVERSITY OF CALIFORNIA

BROOKHAVEN
NATIONAL LABORATORY



Lawrence Berkeley
National Laboratory



Colorado State
University



PRINCETON
UNIVERSITY

Institute for
Systems Biology 



**Agricultural
Research
Service**



MISSISSIPPI STATE
UNIVERSITY™

UF UNIVERSITY of
FLORIDA

UNIVERSITY OF
Nebraska
Lincoln®



WEST VIRGINIA
UNIVERSITY

University of Idaho

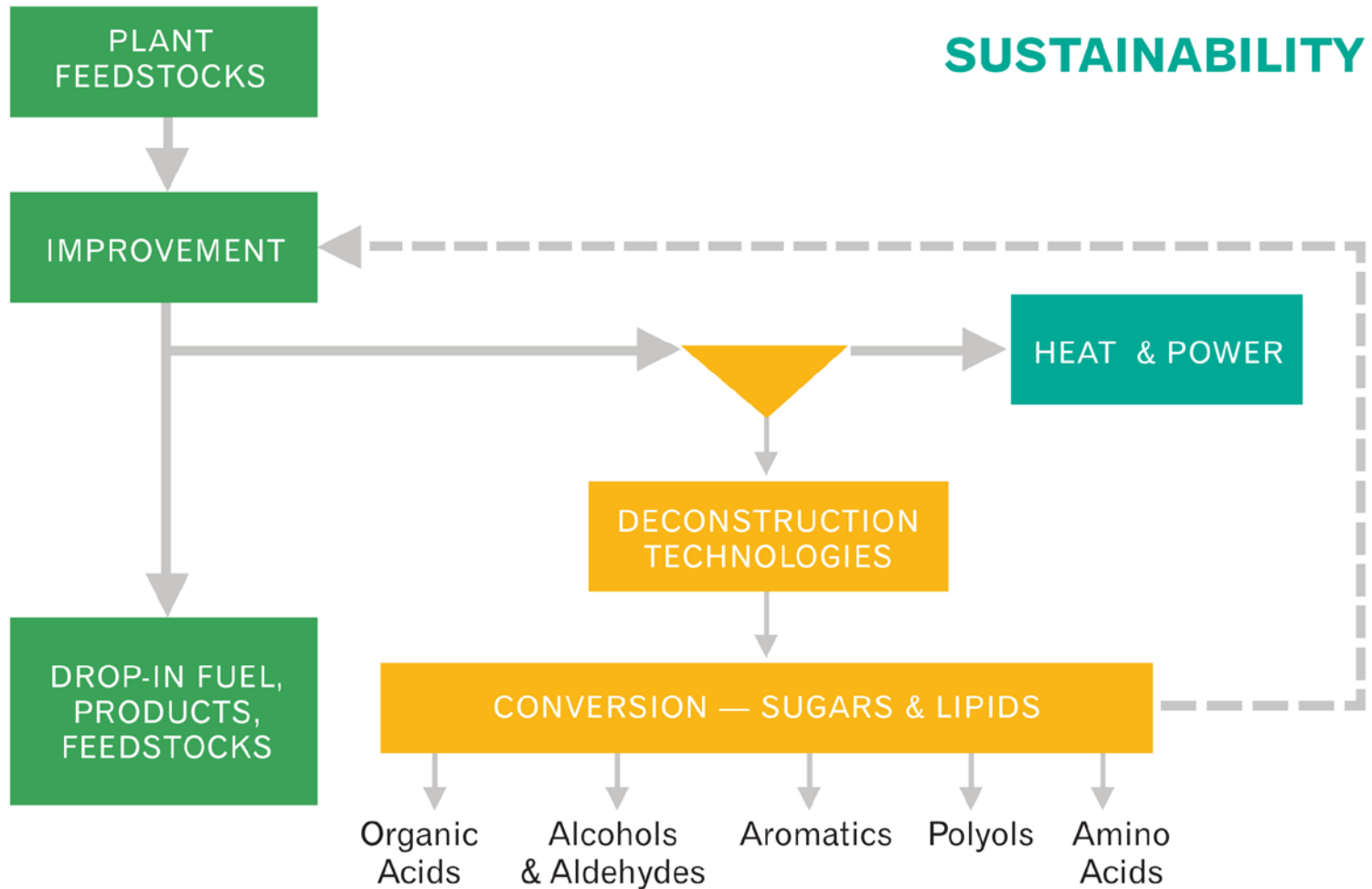
IOWA STATE
UNIVERSITY



HUDSONALPHA
INSTITUTE FOR BIOTECHNOLOGY



CABBI: AN INTEGRATION OF FEEDSTOCK DEVELOPMENT, CONVERSION, AND SUSTAINABILITY

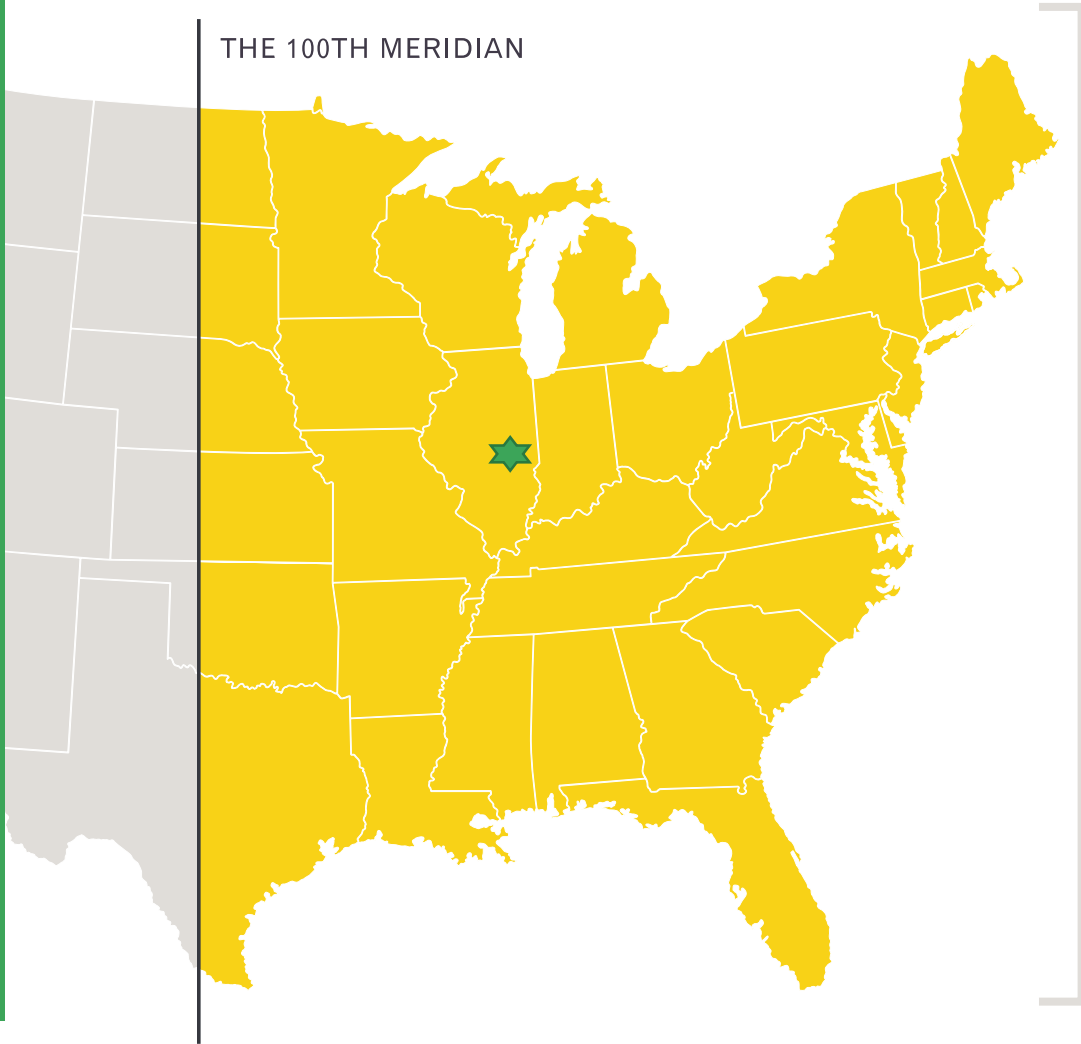




WHY DOES CABBI GROW GRASSES?

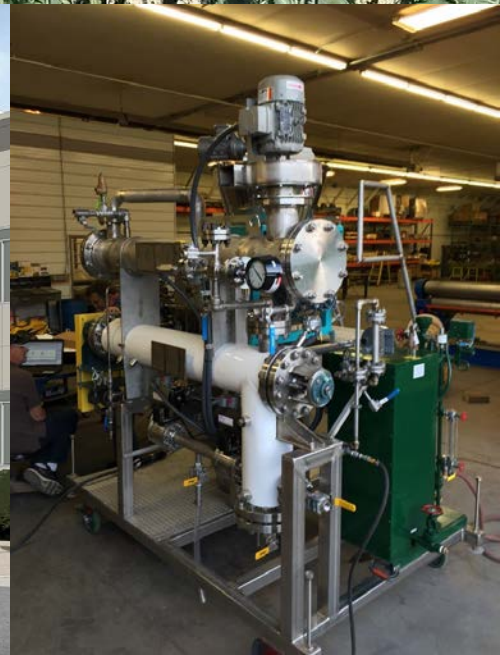
CABBI WILL FOCUS ON GRASSES IN THE ANDROPOGONEAE GROWN EAST OF THE 100TH MERIDIAN

THE 100TH MERIDIAN



- high-yielding grasses including Sorghum and sugarcane
- the Eastern U.S. provides abundant land where crops are predominantly rain fed
- the close genetic relatedness of target grass crops ensures that genetic discovery will be transferable among species
- grasses restore ecosystem services to degraded land

ILLINOIS HUB





THE SCIENTIFIC CHALLENGE...

DEDICATED BIOMASS CROPS TYPICALLY HAVE ONLY ONE MAJOR END USE (BIOENERGY), WHICH **DECREASES MARKET FLEXIBILITY**



THE **LOW ECONOMIC VALUE** OF PLANT BIOMASS, WHICH INCREASES ECONOMIC RISK ON THE FARM

INEFFICIENT CONVERSION OF LIGNOCELLULOSE TO BIOFUELS OR BIOPRODUCTS



THE CABBI SOLUTION

SHIFT STEM CARBON
TO MORE VERSATILE
AND EASILY CONVERTED
CARBON FORMS THAN
RECALCITRANT LIGNIN

**INCREASE YIELD
EFFICIENCY AND
RESILIENCY** TO
MINIMIZE
ENVIRONMENTAL
IMPACTS

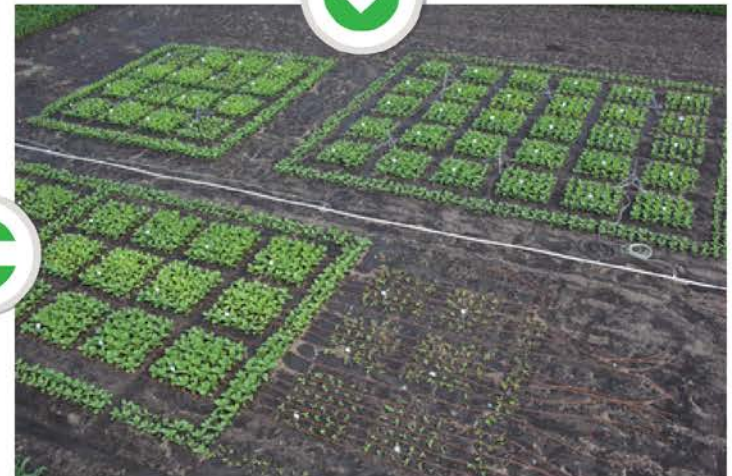
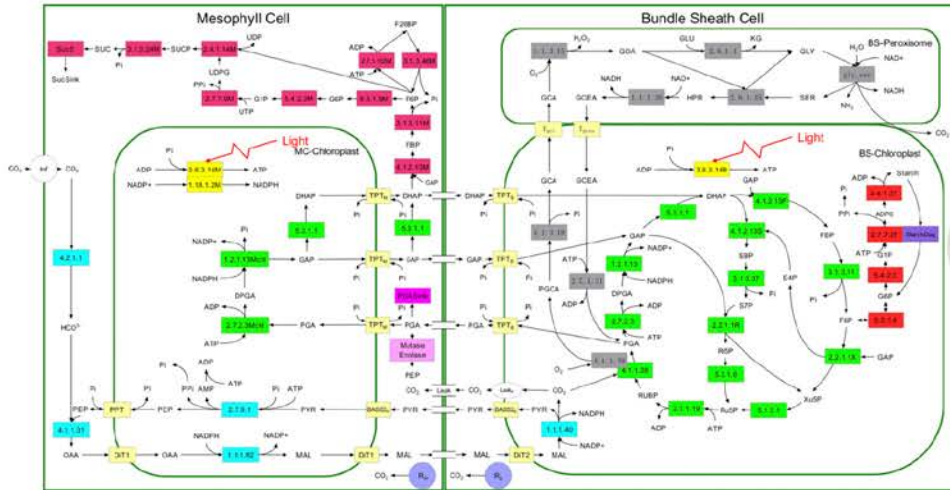


**INCREASE THE VALUE
OF BIOMASS** FROM
BEST YIELDING
GRASSES AND THE
DIVERSITY OF
COMPOUNDS THAT CAN
BE PRODUCED IN THEIR
STEMS

**BUILD HIGH LEVELS OF
OILS AND SPECIALTY
FATTY ACIDS** IN
VEGETATIVE TISSUES



MAKING THE PLANT FACTORY MORE EFFICIENT



Kromdijk et al. 2016. Science



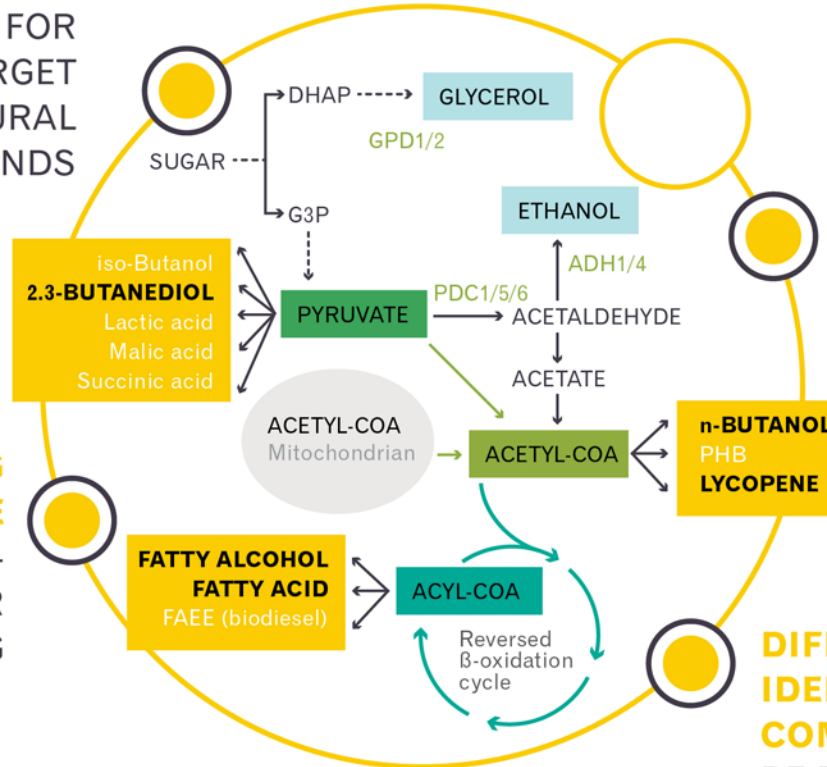
THE SCIENTIFIC CHALLENGE...

LACK OF KNOWN ENZYMES

WITH DESIRED ACTIVITY AND SUBSTRATE SPECIFICITY FOR THE SYNTHESIS OF TARGET NATURAL OR NON-NATURAL COMPOUNDS

POOR UNDERSTANDING OF HOW NATIVE **METABOLISM AND PHYSIOLOGY** CONSTRAINS THE PRODUCTION OF NON-NATURAL COMPOUNDS

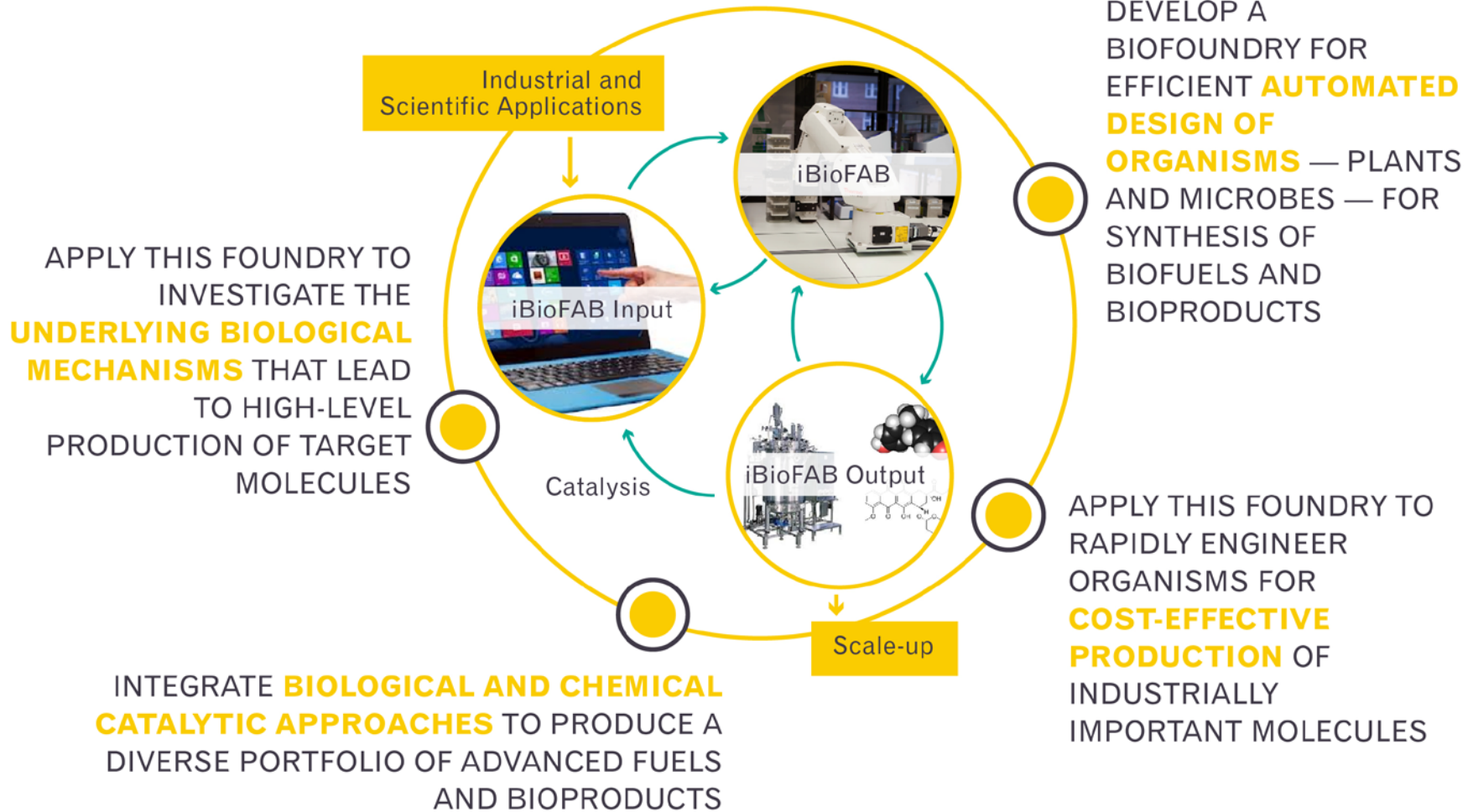
TIME-CONSUMING AND EXPENSIVE DESIGN-BUILD-TEST-LEARN CYCLE FOR METABOLIC ENGINEERING



DIFFICULTY IDENTIFYING COMPOUNDS THAT CAN BE EFFICIENTLY PRODUCED IN LIVING ORGANISMS



THE CABBI SOLUTION





THE SCIENTIFIC CHALLENGE...

LIMITED UNDERSTANDING OF ECOSYSTEM PROCESSES

RELATED TO C, N, AND WATER CYCLING TO ENABLE PREDICTIONS OF ECOSYSTEM SERVICES AND YIELD



POOR UNDERSTANDING OF LAND AVAILABLE TO OPTIMIZE FEEDSTOCK PRODUCTIVITY

POOR UNDERSTANDING OF THE ECONOMIC VIABILITY AND RESILIENCE OF BIOMASS PRODUCTION

LIMITED REFINERY-SCALE TECHNO-ECONOMIC UNDERSTANDING OF THE FEEDSTOCK CONVERSION PROCESS



THE CABBI SOLUTION



DEVELOP NEW TEA AND LCA APPROACHES TO EXAMINE ECONOMIC AND ECOLOGICAL TRADEFFS

HUB-AND-SPOKE MODEL OF **EXPERIMENTAL SITES** COMBINED WITH **DATA-MODEL SYNTHESIS** TO EXAMINE G x E x M

IMPROVE MODEL PREDICTIONS REPRESENTING A RANGE OF BIOMASS CROP SPECIES AND VARYING PHENOTYPES

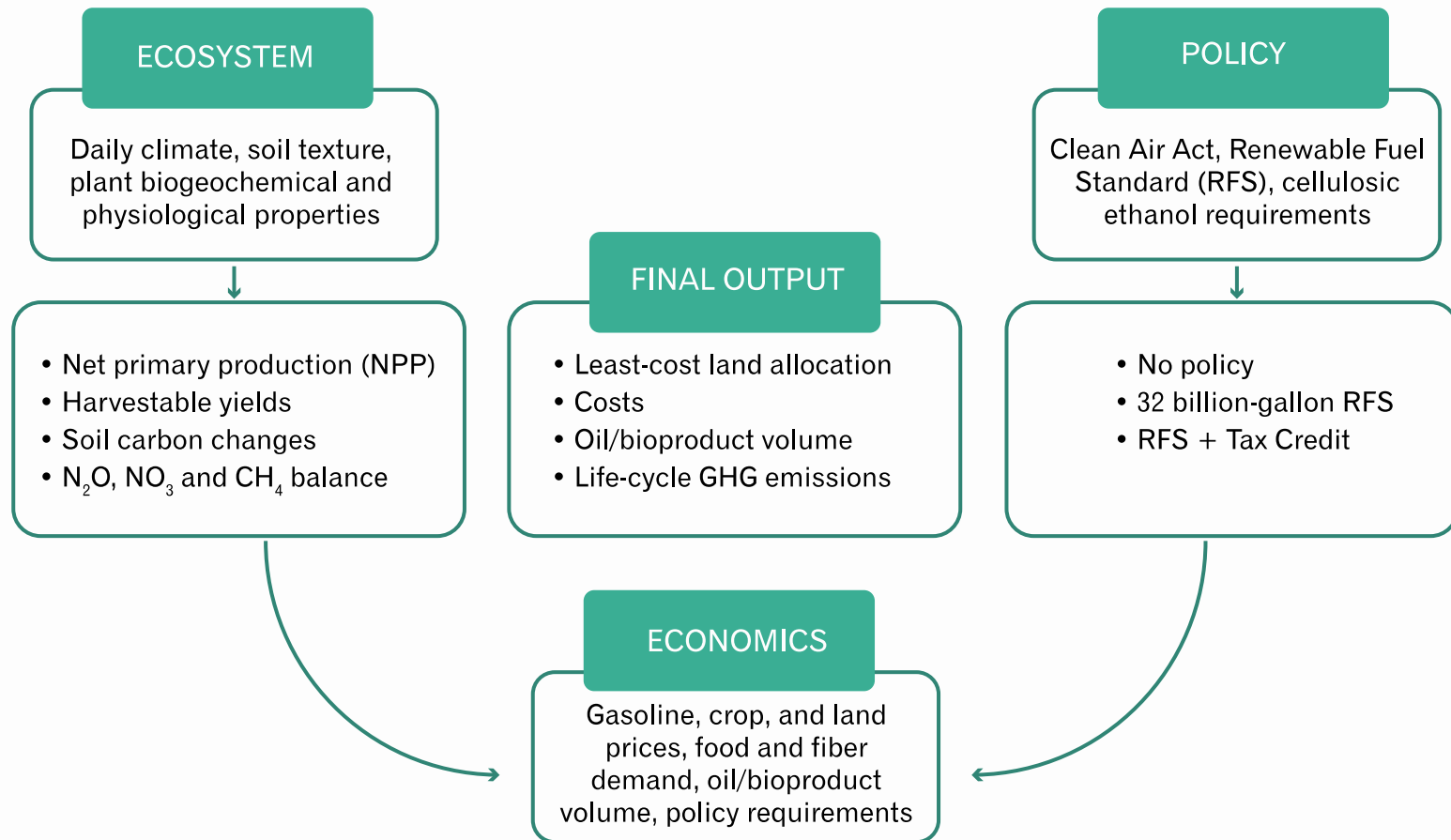
'BIG DATA' APPROACH TO QUANTIFYING LAND AVAILABILITY

INTEGRATED MEASUREMENT-MODELING APPROACHES TO UNDERSTAND COORDINATION OF ABOVE- AND BELOW-GROUND PHYSIOLOGY (ROOT-SOIL-MICROBIOME)



LINKING BIOGEOCHEMICAL AND ECONOMIC MODELS

REVEALS THAT WE CAN MEET BIOFUEL MANDATES AND REDUCE GHGS WITHOUT REDUCING FOOD





THE CABBI LEGACY

A regionally adaptive yet national-scale platform for grass-based biorefining based on feedstocks with improved yield and resource-use efficiency

A broad set of platform microorganisms, and automated tools to build these microorganisms, to produce value-added products from plant-produced feedstocks or substrates

An integrated economic and environmental framework for determining feedstock supply and its sustainability



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[DISCUSSION AND QUESTIONS]

<https://www.cabbi.bio>