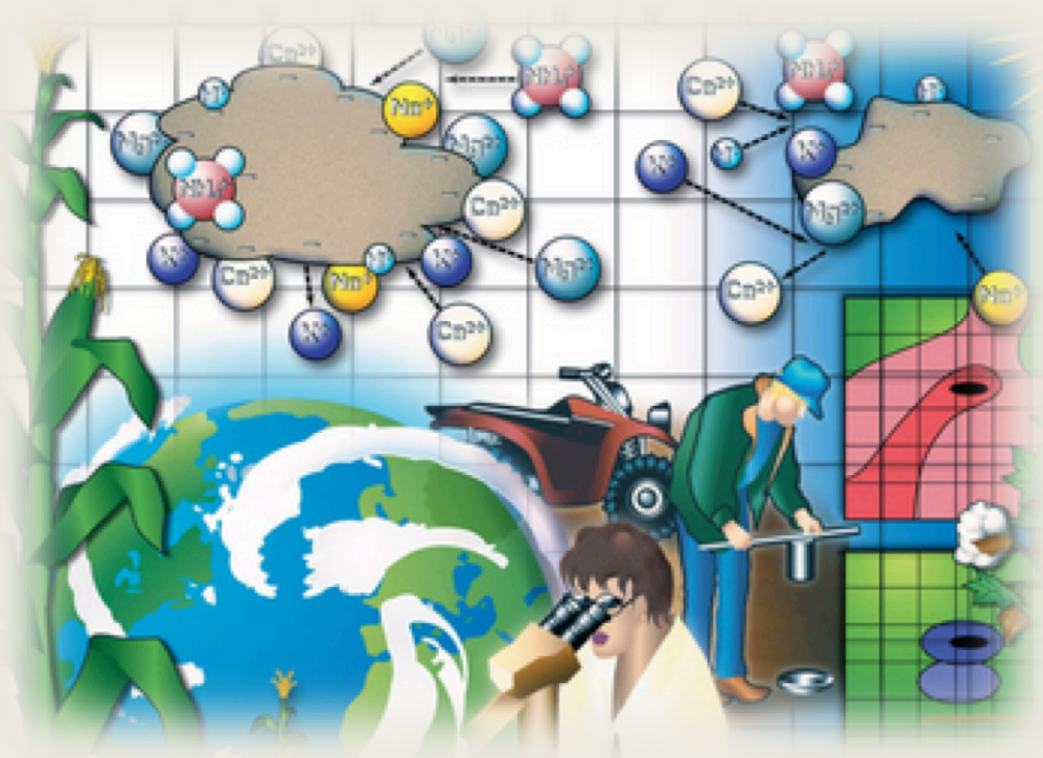
Transitioning Cereal Systems to Adapt to Climate Change

November 13-14, 2015

Funded through Award #2011-68002-30191 from USDA National Institute of Food and Agriculture

Nutrient stewardship innovations for increased cereal system resilience

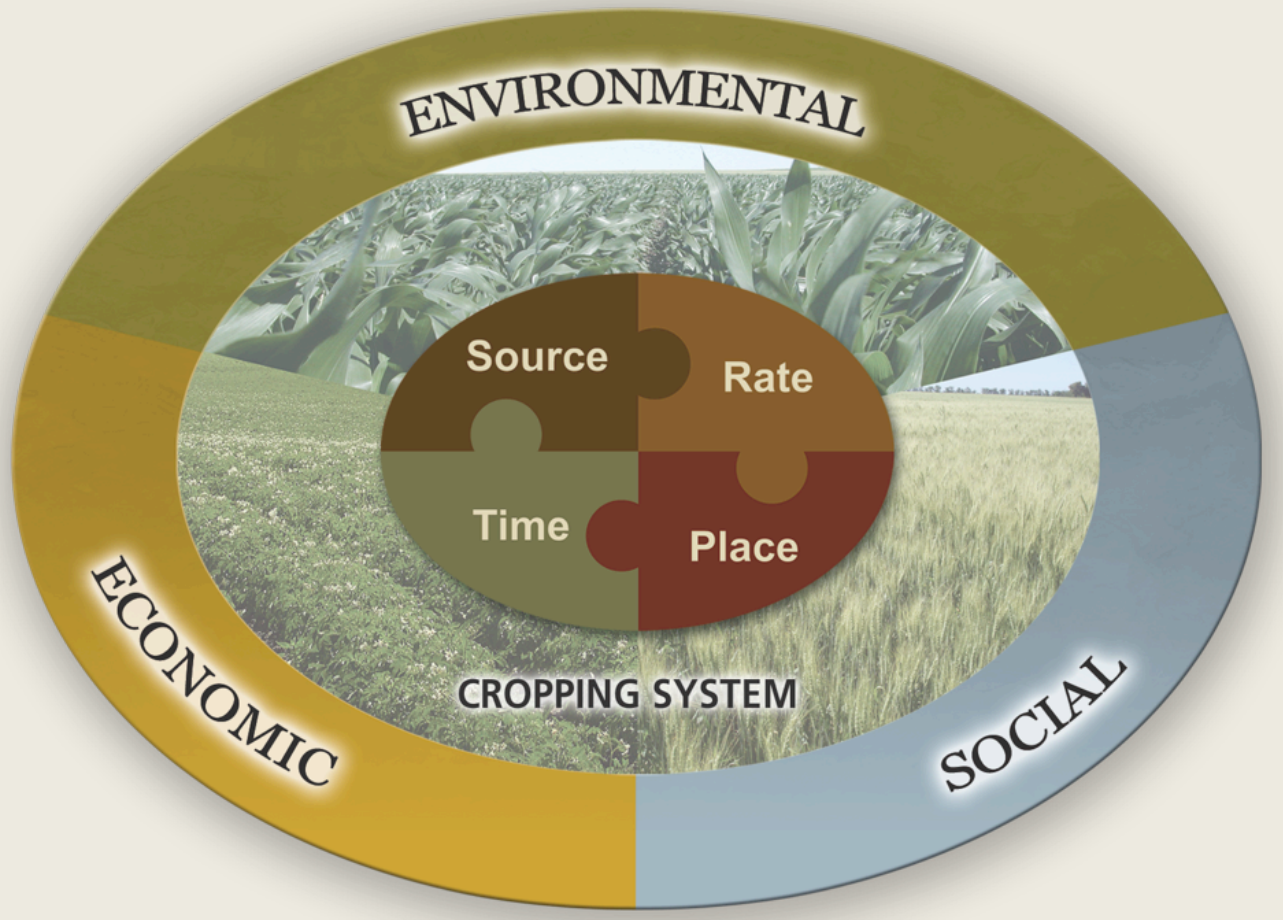
Paul Fixen
Senior VP
International Plant Nutrition Institute and 2016 ASA President



Can’t manage what we can’t measure

A global focus of fertilizer management on 4R Nutrient Stewardship

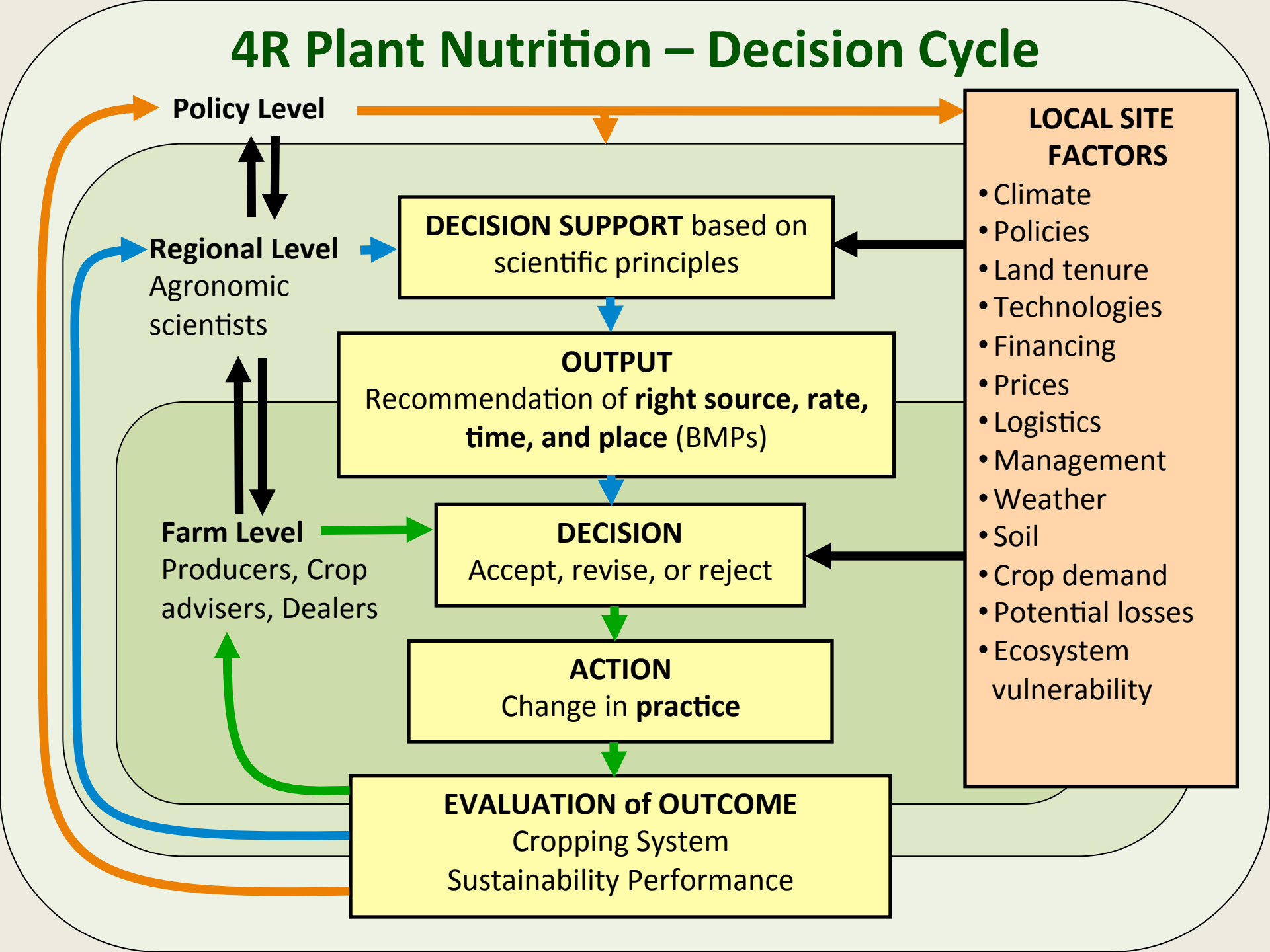
Right Source @ Right Rate, Right Time, Right Place



"Right" is influenced by contribution to sustainability goals

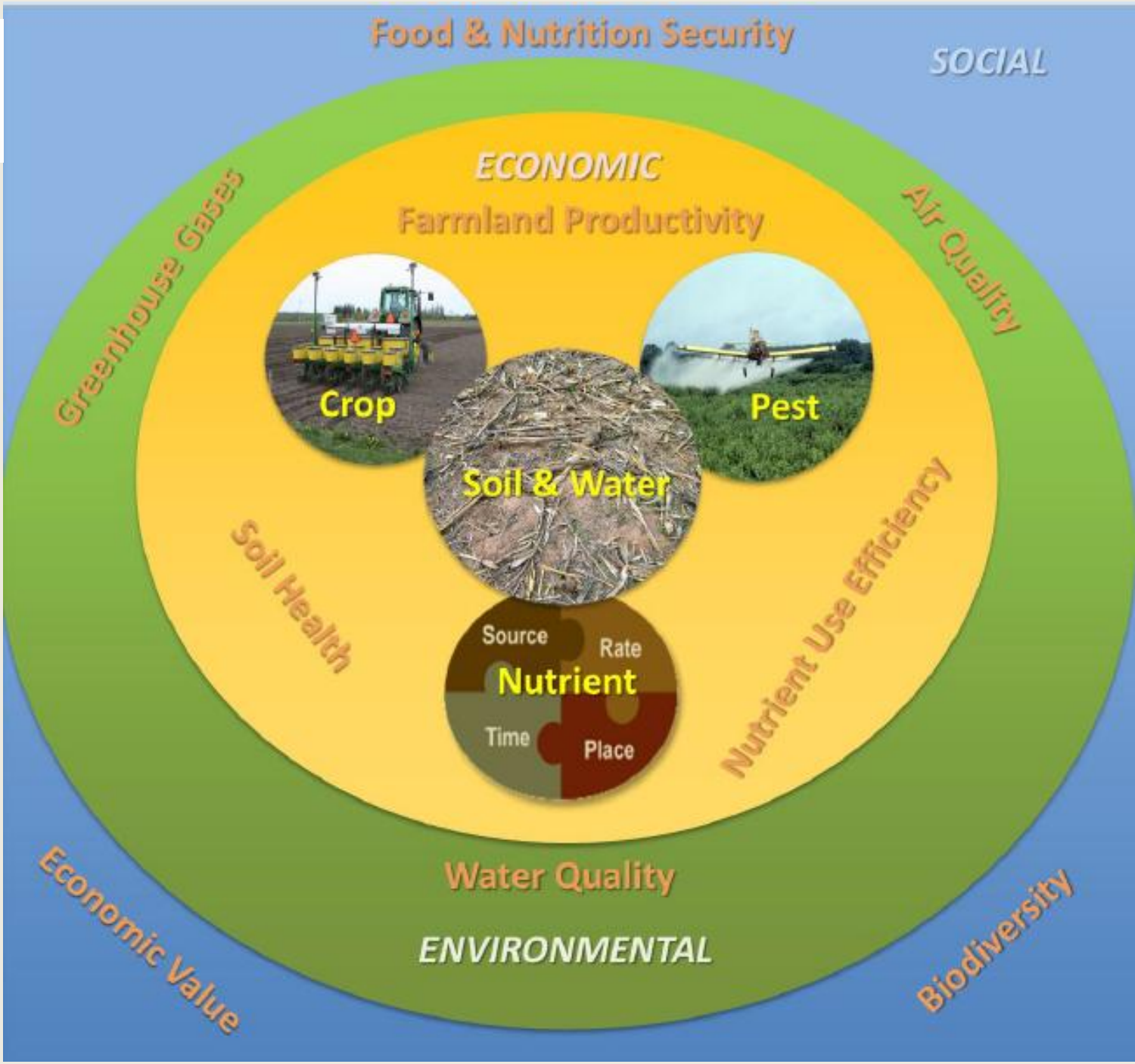
Knowing the contribution requires **scalable performance indicators**

4R Plant Nutrition – Decision Cycle



nutrient stewardship

Outcomes resulting from **nutrient management practices** are greatly influenced by **crop and pest management** and by **soil and water conservation practices**



Nutrient use efficiency – a key indicator
Defined and calculated in many ways … examples

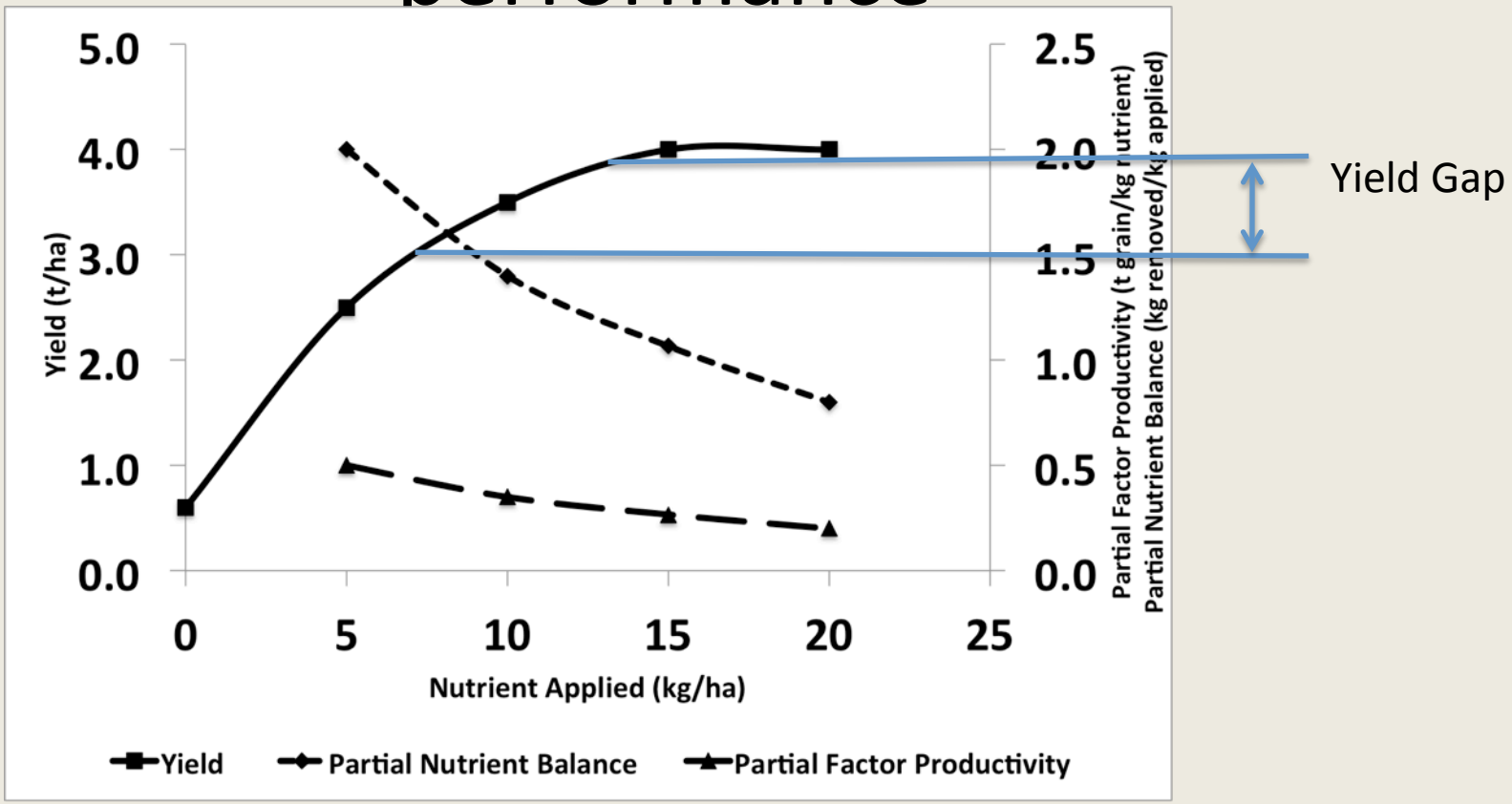
NUE term	Calculation
Partial factor productivity	**PFP = Y/F**
Agronomic efficiency	**AE = $(Y-Y_0)/F$**
Partial nutrient balance	**PNB = R/F**
Recovery efficiency	**RE = $(U-U_0)/F$**

Y=yield, F=fertilizer, R=removal, U=uptake

In all cases a ratio of output/input

Dobermann, 2007

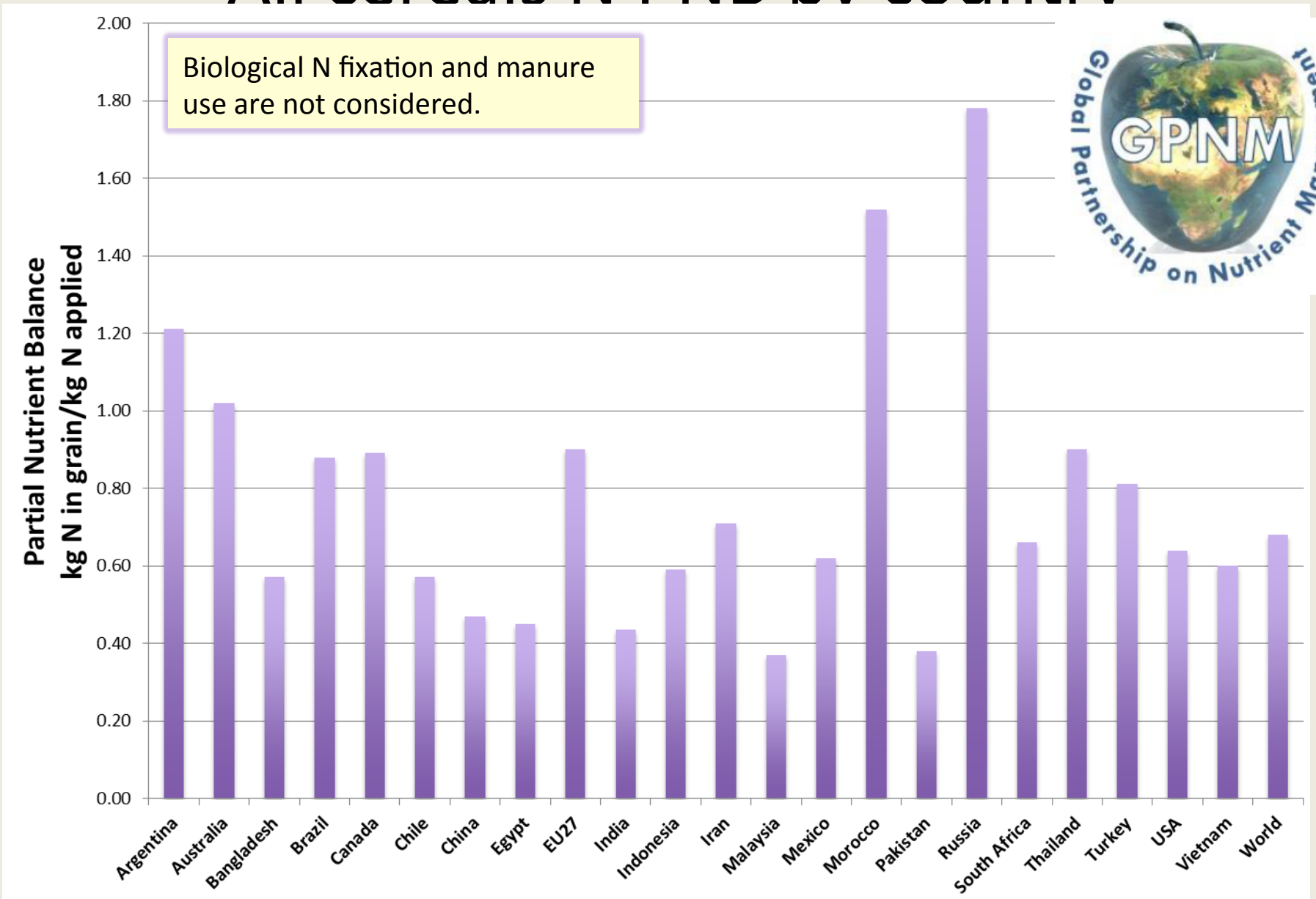
Efficiency & effectiveness … Nutrient performance



- Efficiency is one aspect of performance; effectiveness drives farmer decisions
- Nutrient performance encompasses impacts on:
  - productivity, potential losses to the environment, change in soil nutrient status

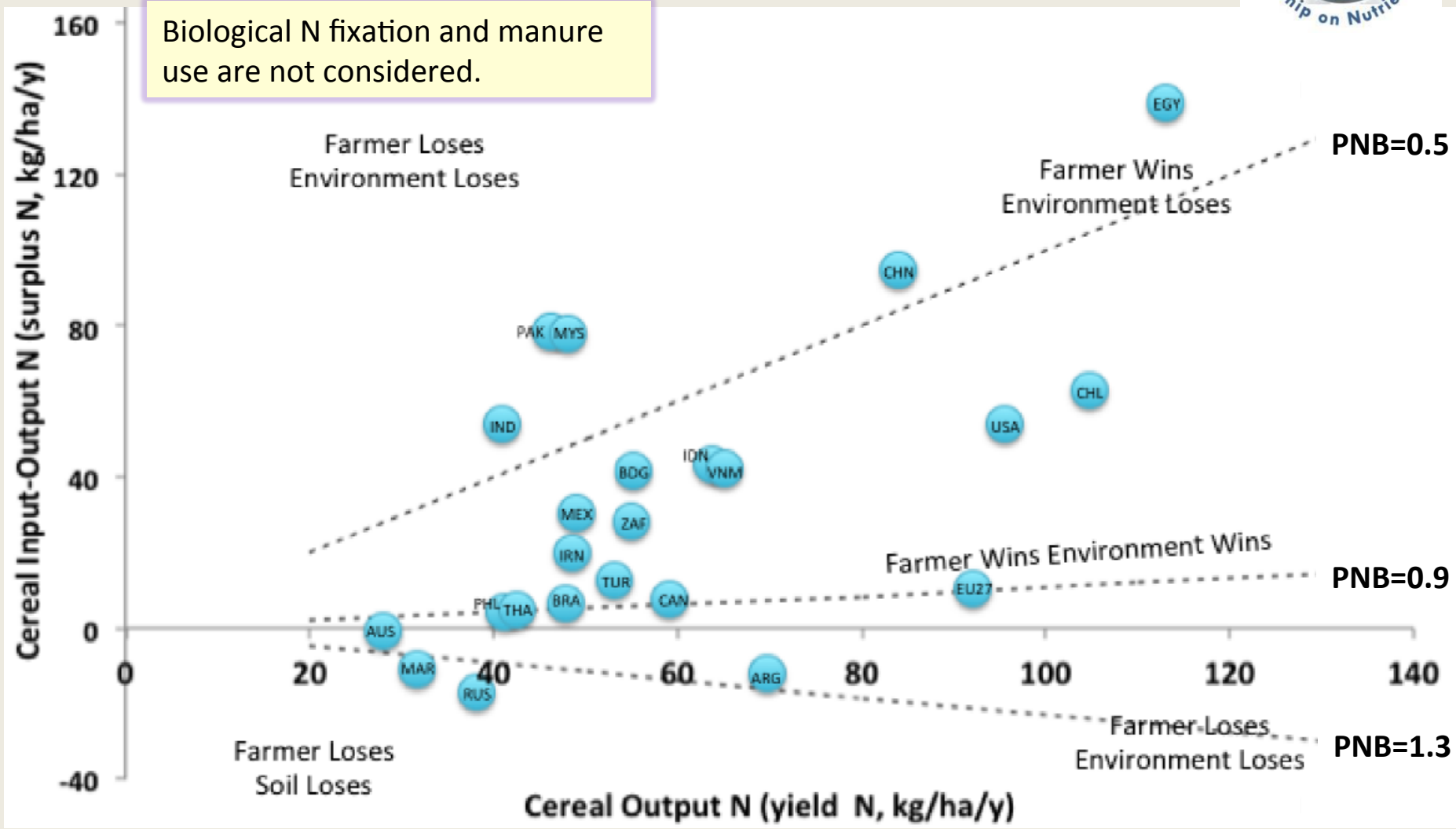
IPNI Issue Review Ref #14061, August 2014

All cereals N PNB by country



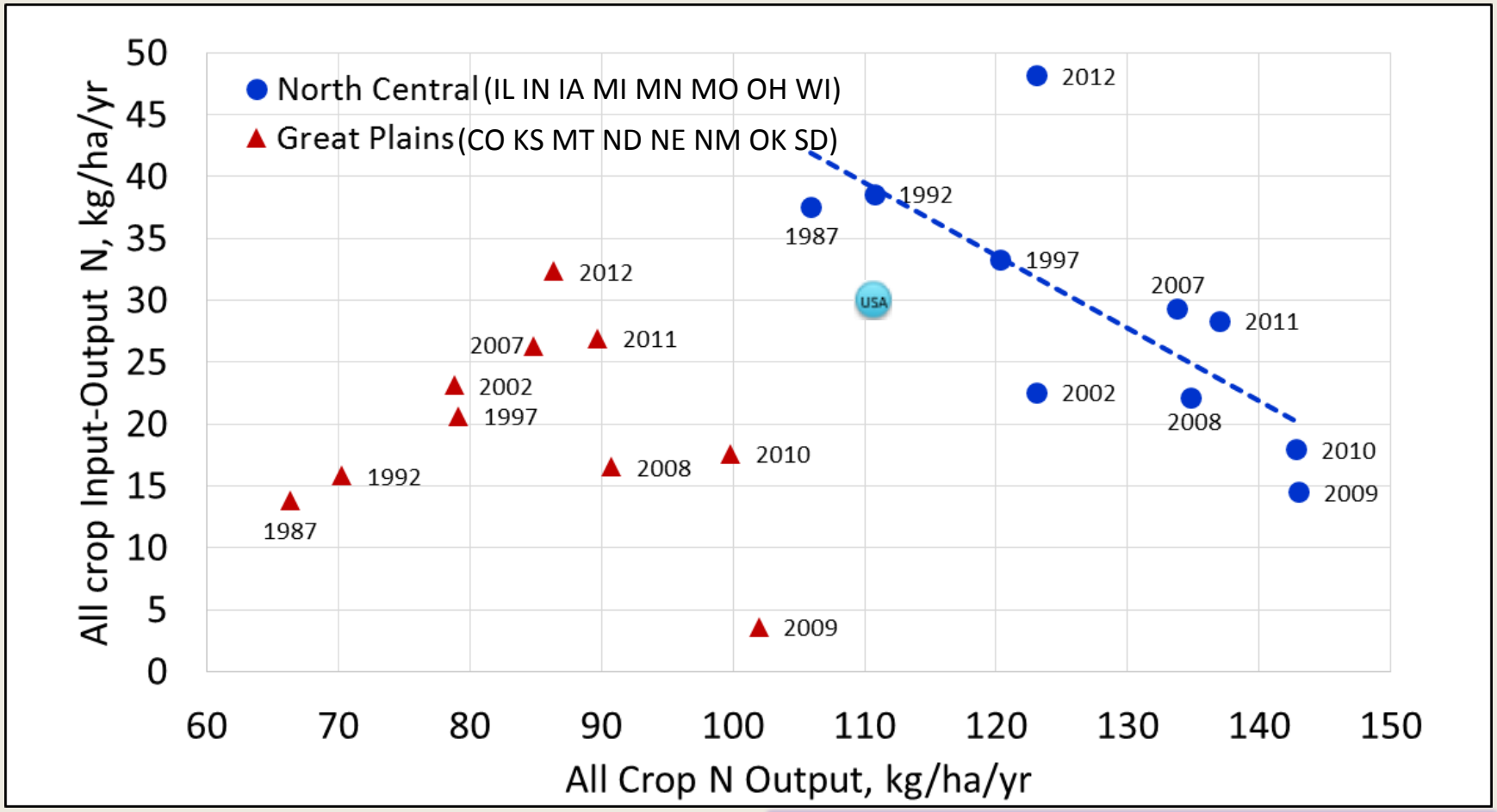
GPNM Task Team Tech Paper 01/2015.

N output versus N surplus (input-output) for cereals in selected countries



GPNM Task Team Tech Paper 01/2015.

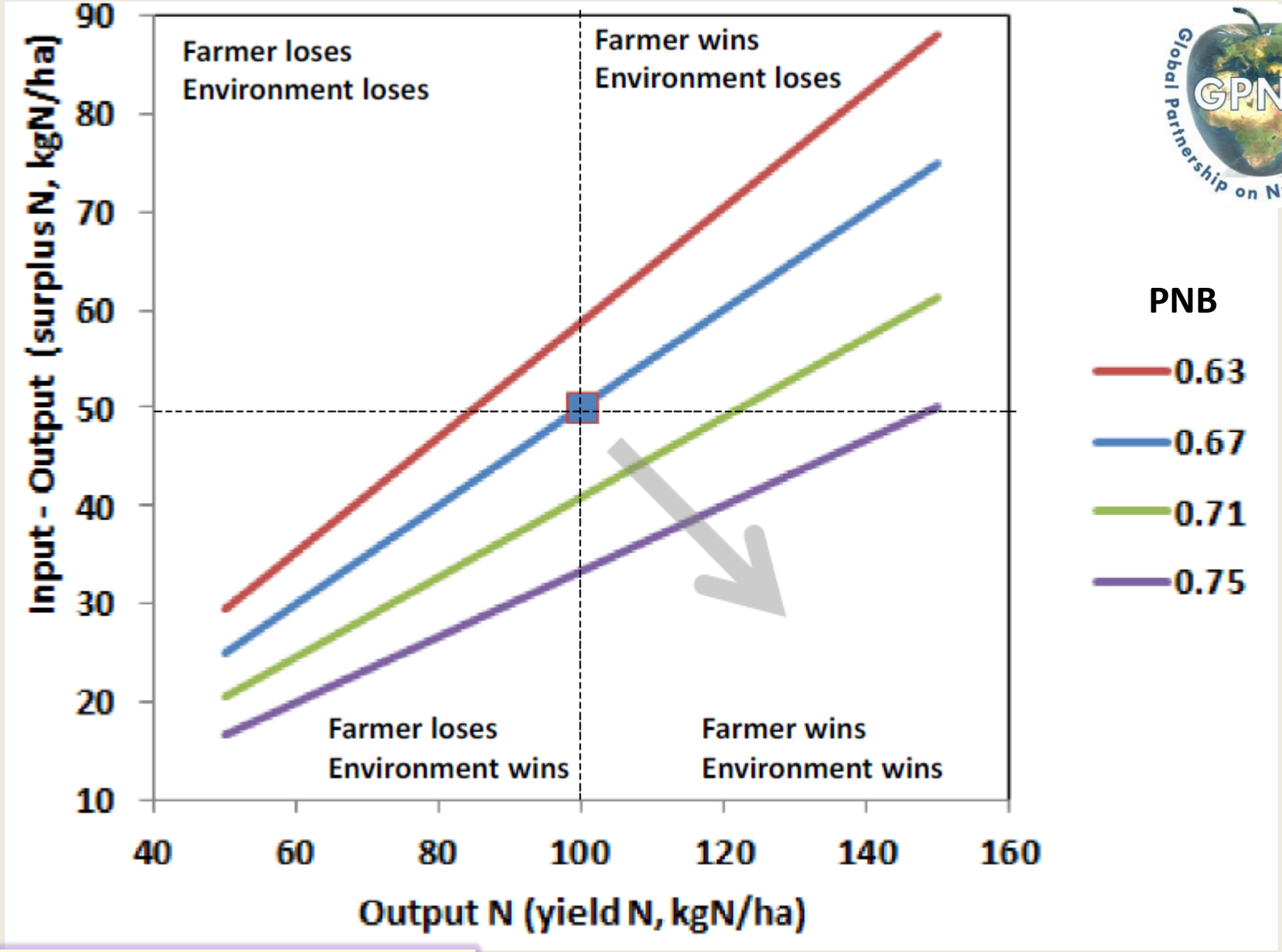
Regional and yearly variation in N output versus N surplus (input-output) in the US



USA US average for these same years.

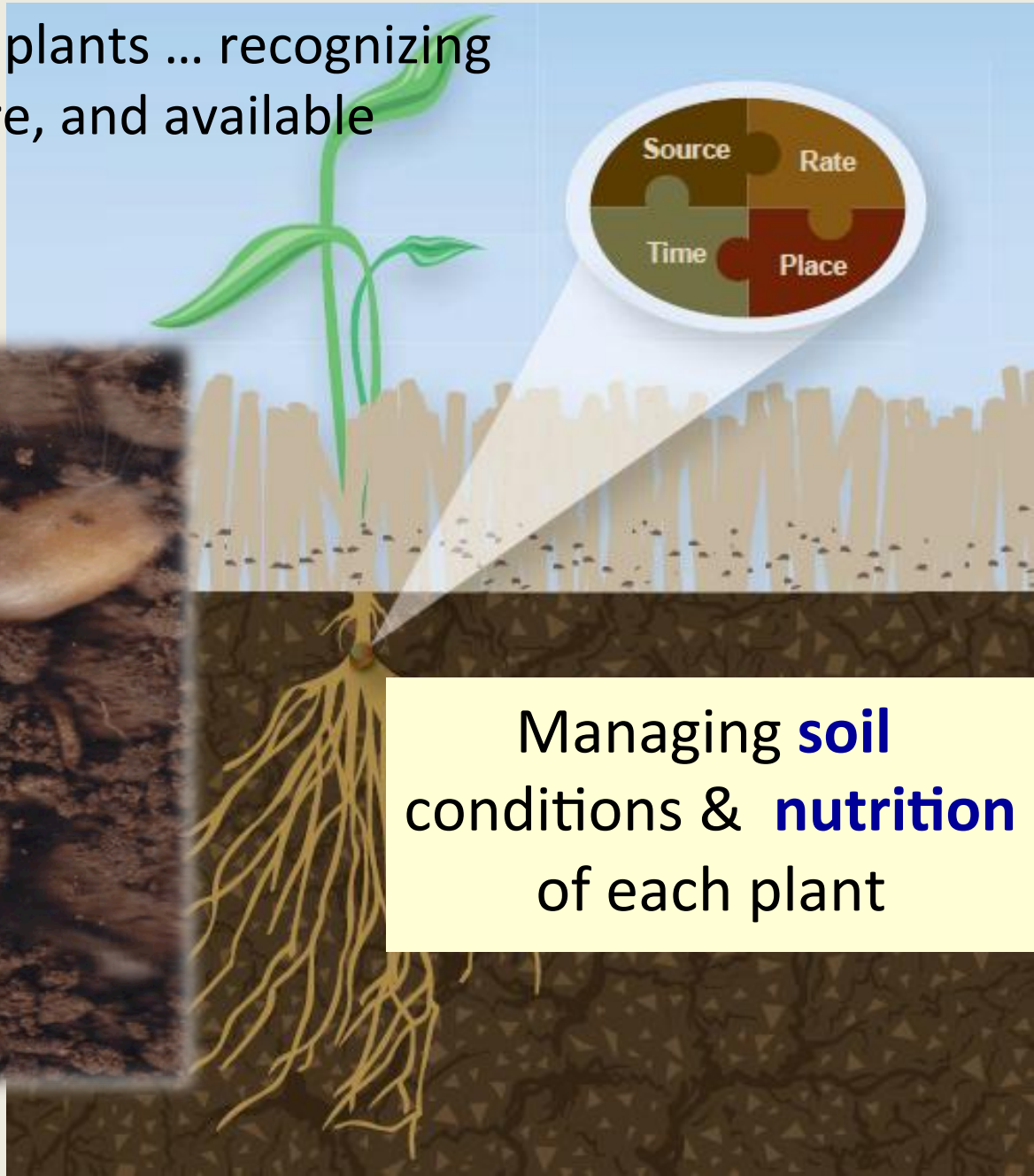
Input-Output = Fertilizer N + Recoverable manure N + BNF – Harvest removal.

Tracking efficiency and productivity relative to a benchmark … approaching performance



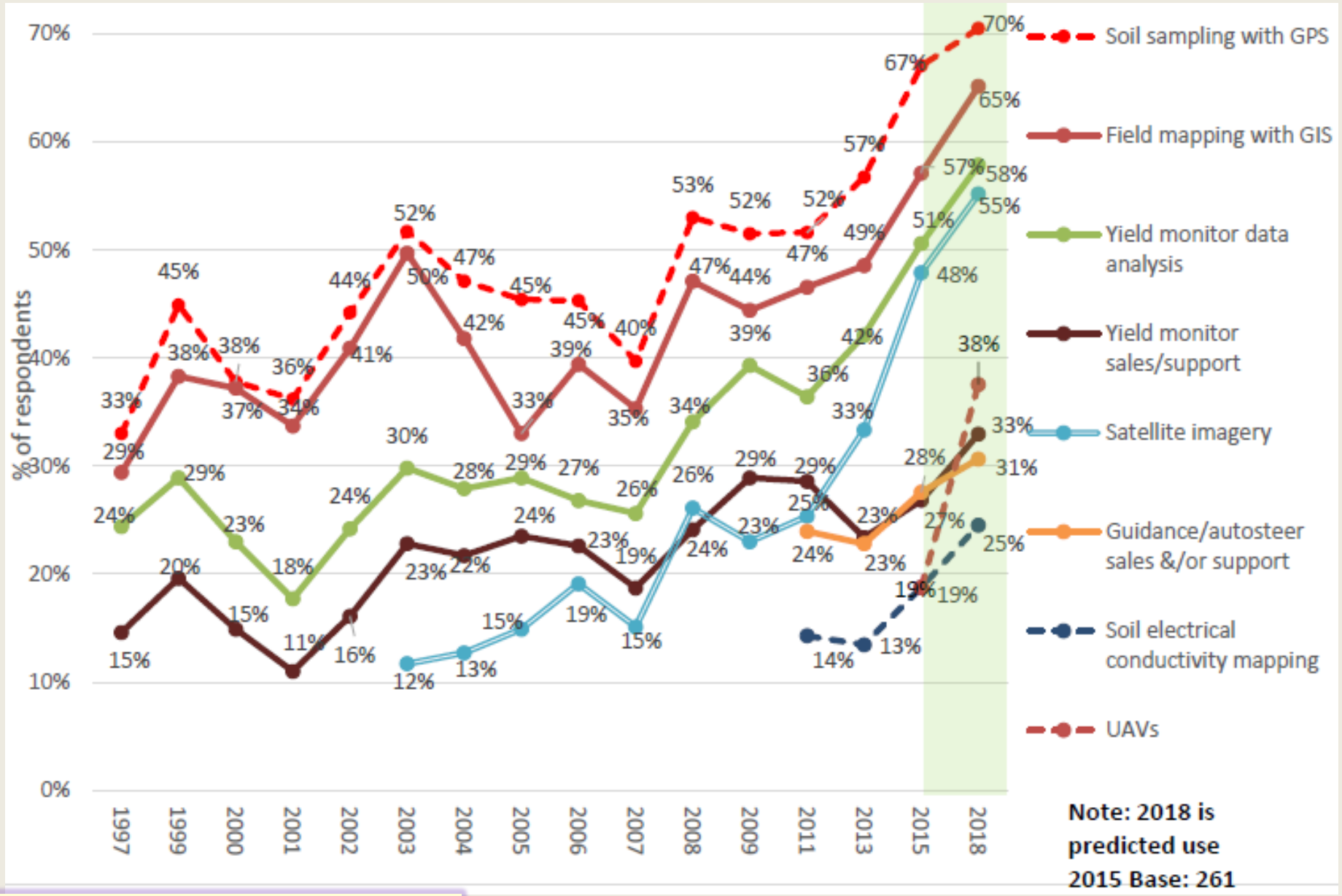
GPNM Task Team Tech Paper 01/2015.

The ultimate is to scale down to the environment of individual plants … recognizing the role of genetics, culture, and available technology



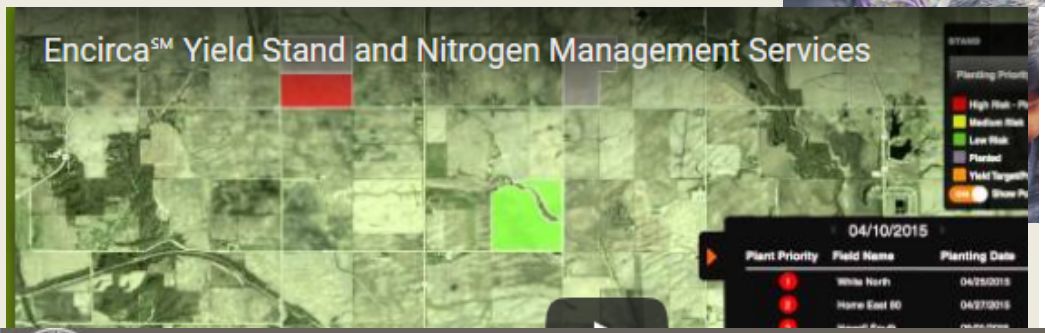
Managing **soil** conditions & **nutrition** of each plant

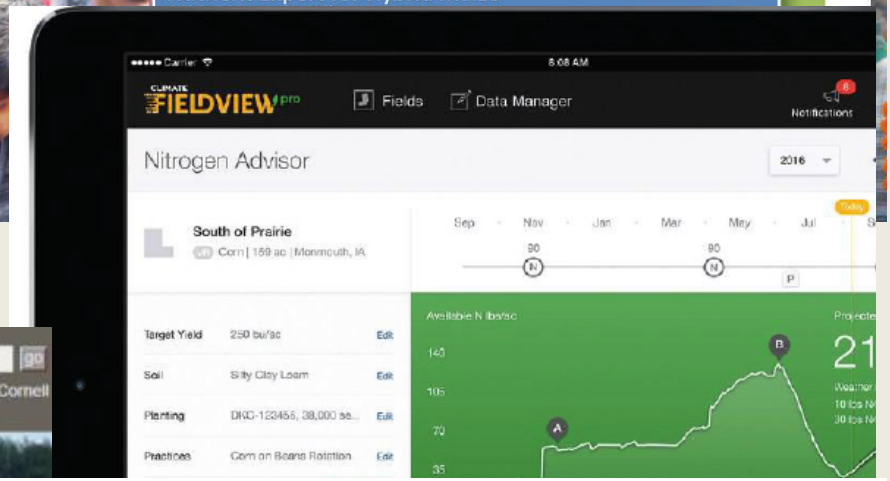
Precision services offered by US input suppliers



Purdue Univ. and Crop Life, 2015.

Adapting nutrient management to climate change





Transitioning Cereal Systems to Adapt to Climate Change

November 13-14, 2015

Funded through Award #2011-68002-30191 from USDA National Institute of Food and Agriculture

Scalable performance metrics can facilitate adoption of nutrient management practices with the potential for adapting cereal systems to climate change

Transitioning Cereal Systems to Adapt to Climate Change

REACCH
Regional Approaches to Climate Change –
PACIFIC NORTHWEST AGRICULTURE

Thank you!

University of Idaho

Washington State University

USDA NIFA

United States Department of Agriculture
National Institute of Food and Agriculture

Oregon State University OSU

Pacific Northwest Farmers Cooperative

CHS

Monsanto