



Nutrient stewardship innovations for increased cereal system resilience



**Transitioning Cereal Systems
to Adapt to Climate Change**

November 13-14, 2015

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Senior VP

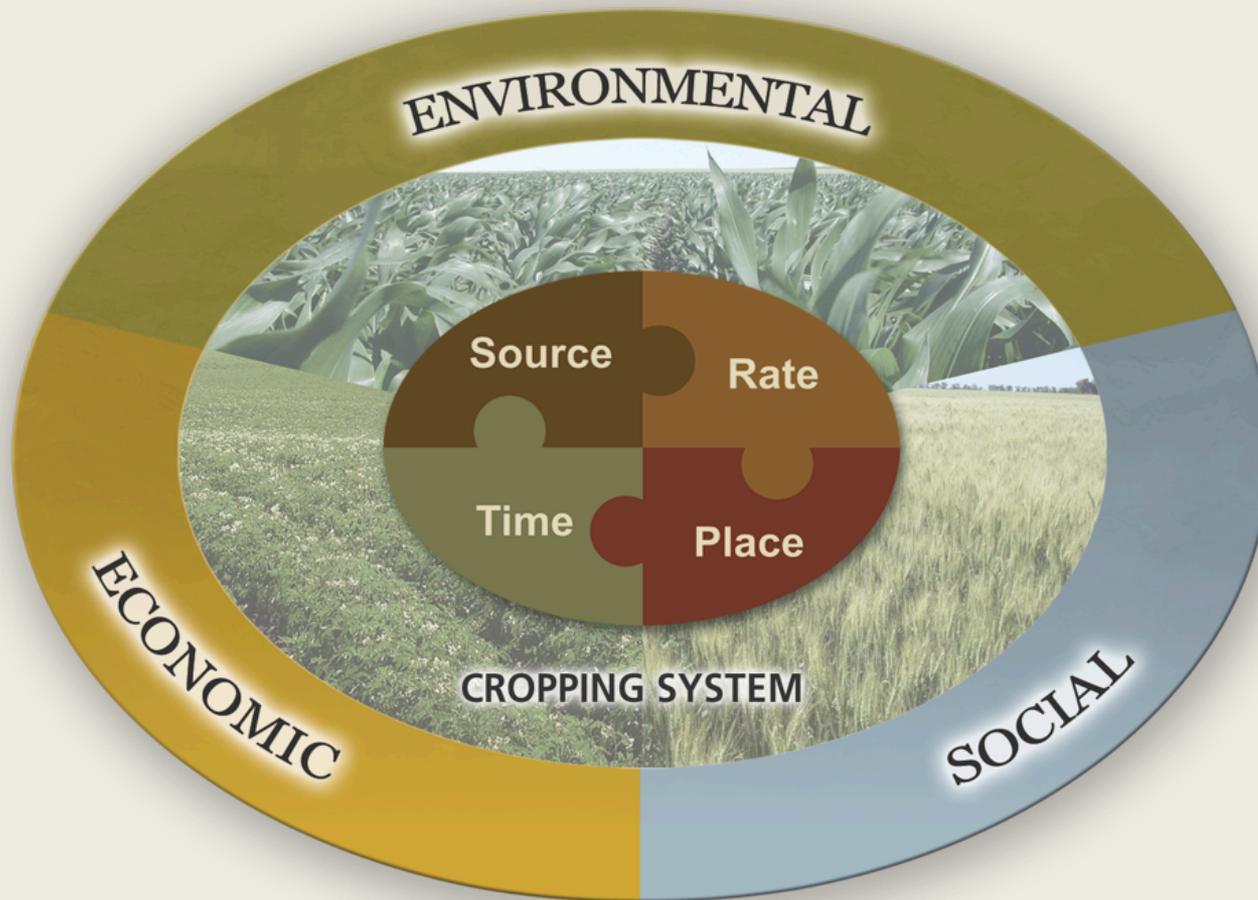
International Plant Nutrition
Institute and 2016 ASA President



Can't manage what we
can't measure

A global focus of fertilizer management on 4R Nutrient Stewardship

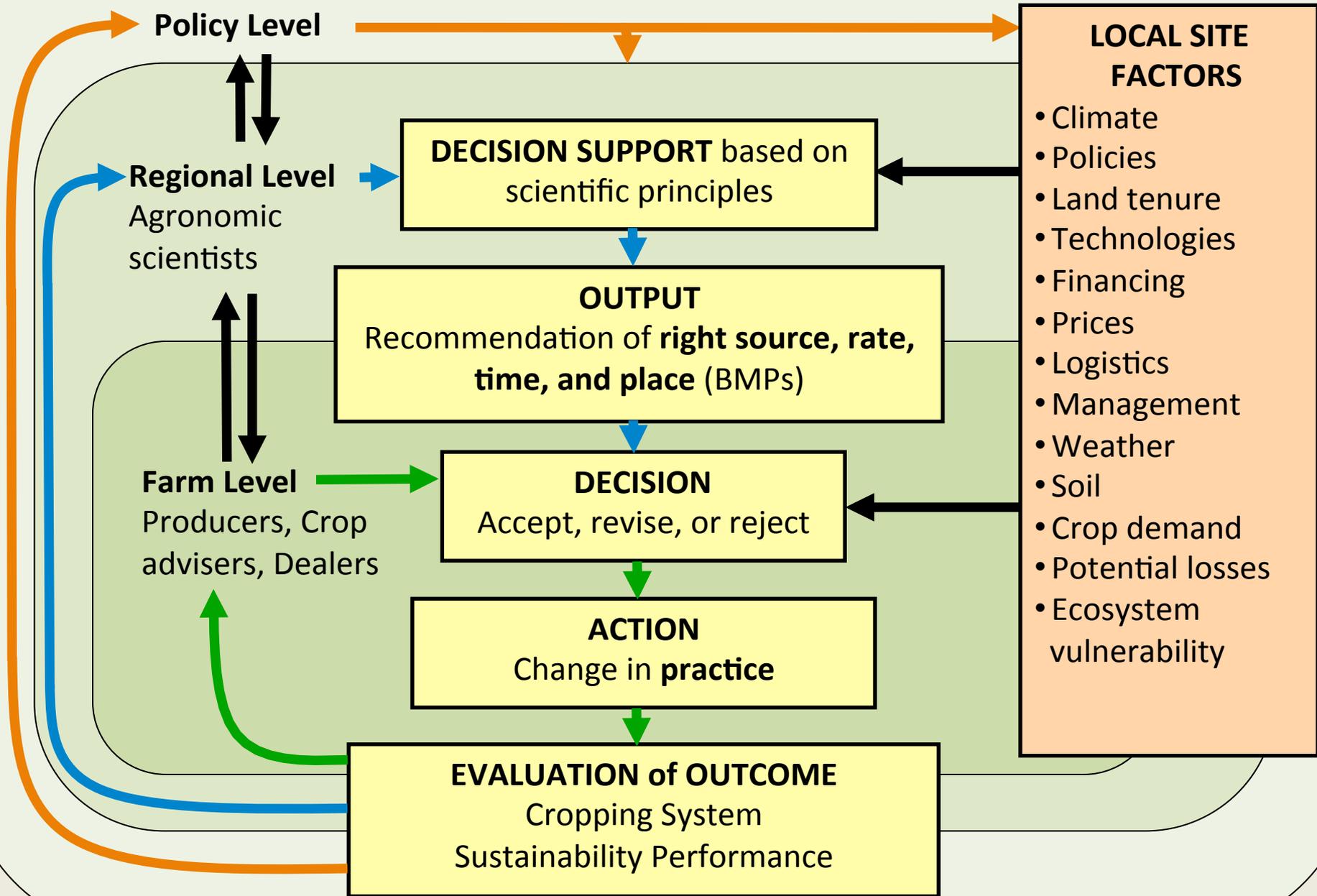
Right Source @ Right Rate, Right Time, Right Place



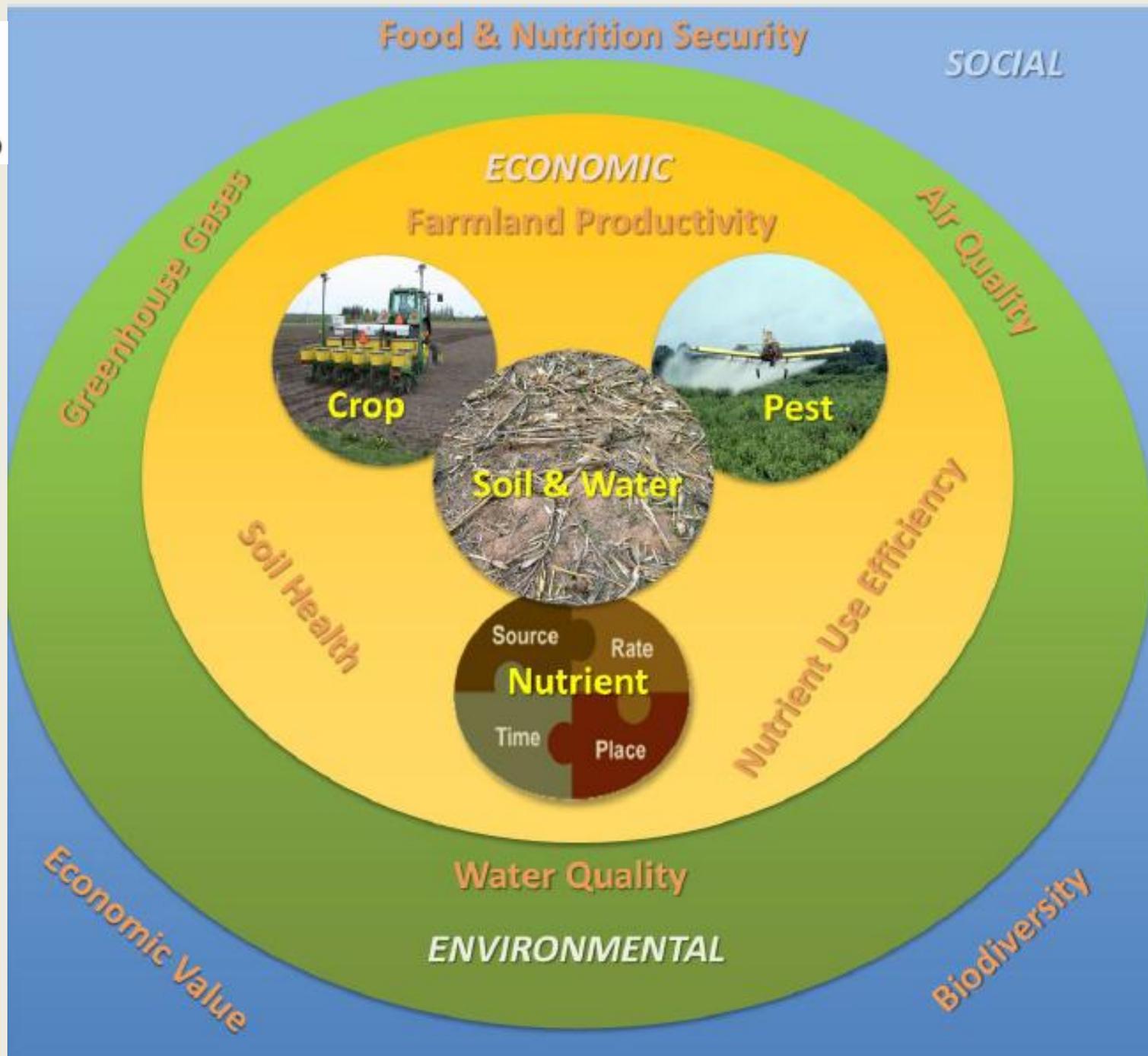
“Right” is influenced by contribution to sustainability goals

Knowing the contribution requires **scalable performance indicators**

4R Plant Nutrition – Decision Cycle



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

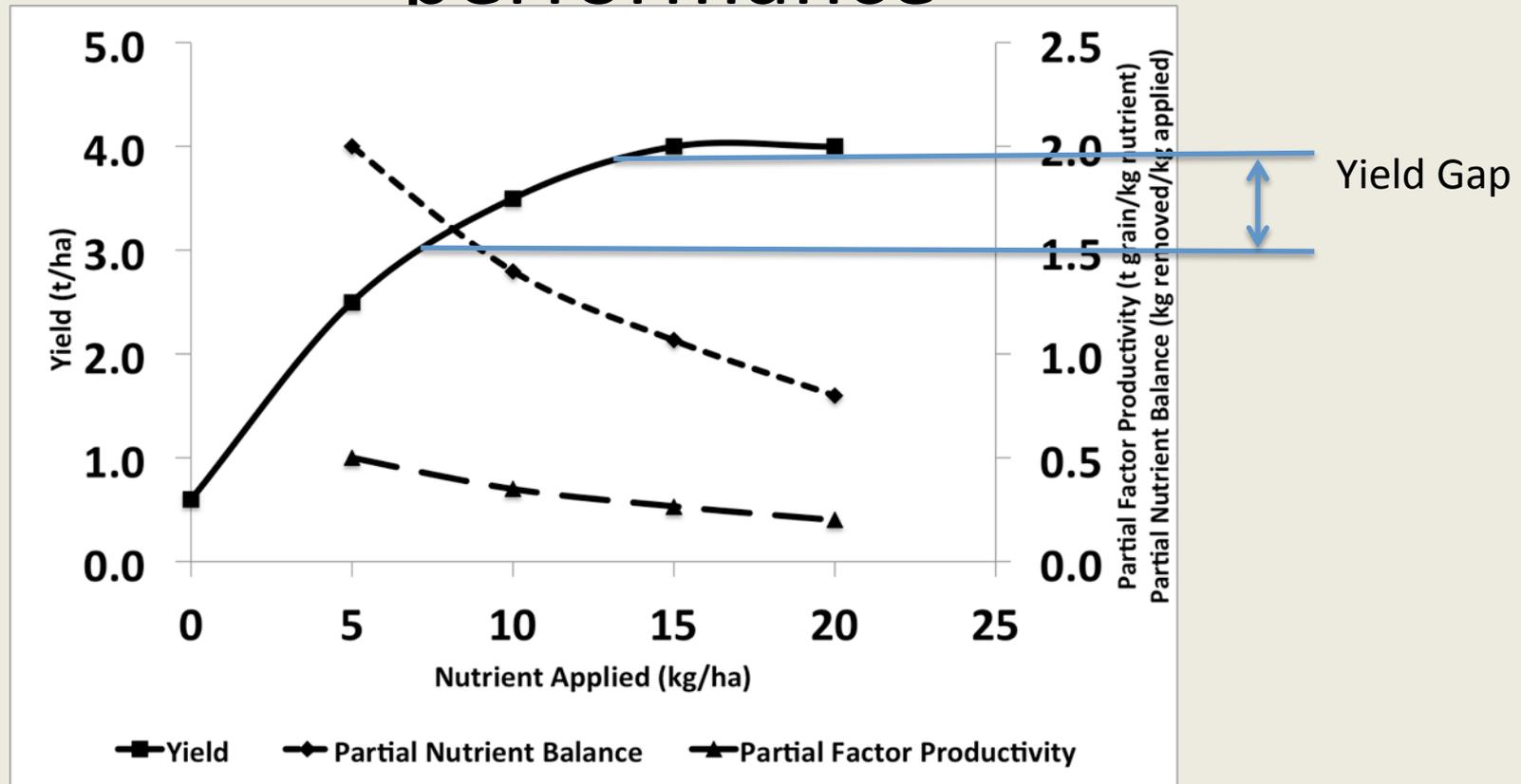
Defined and calculated in many ways ... examples

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

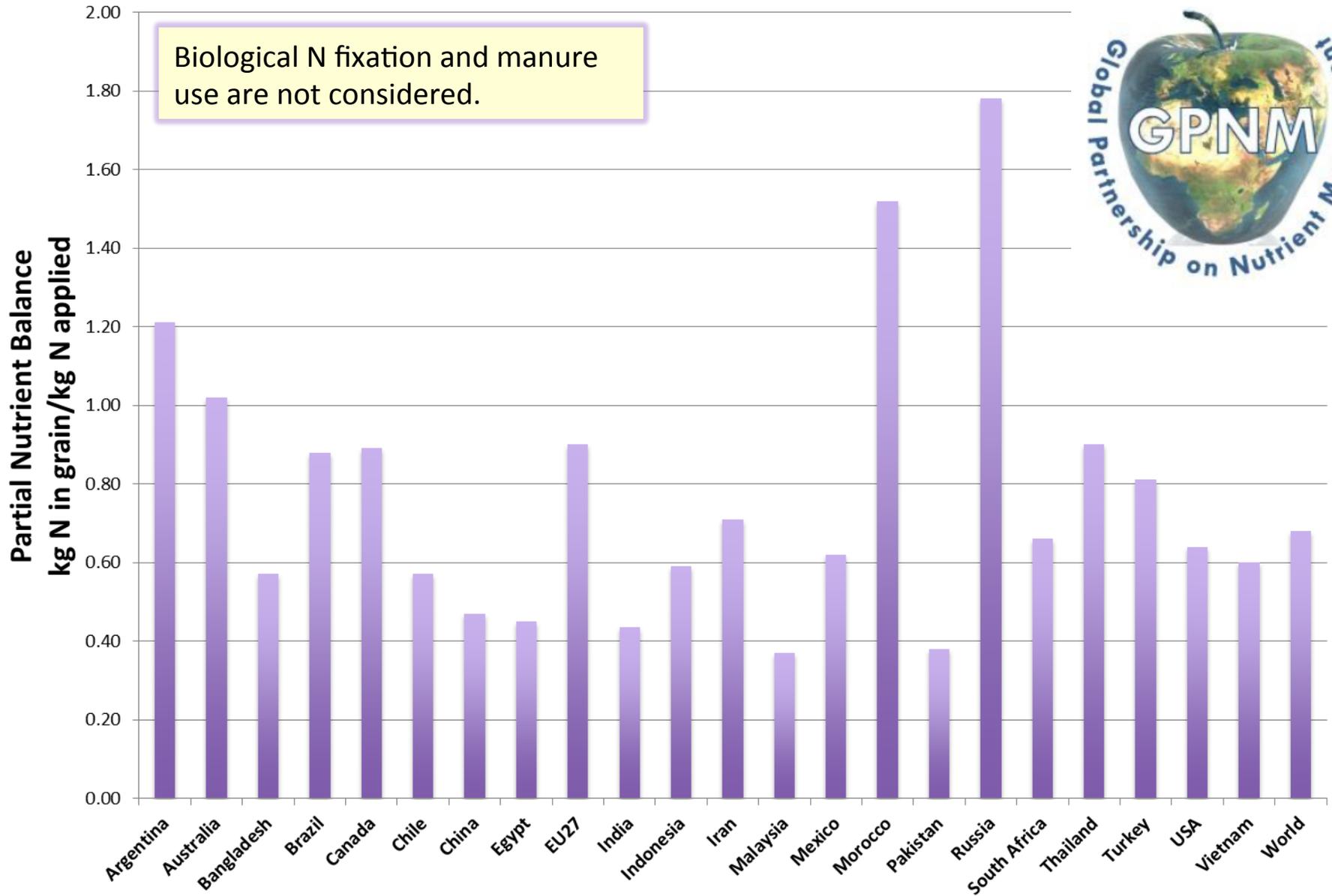
In all cases a ratio of output/input

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

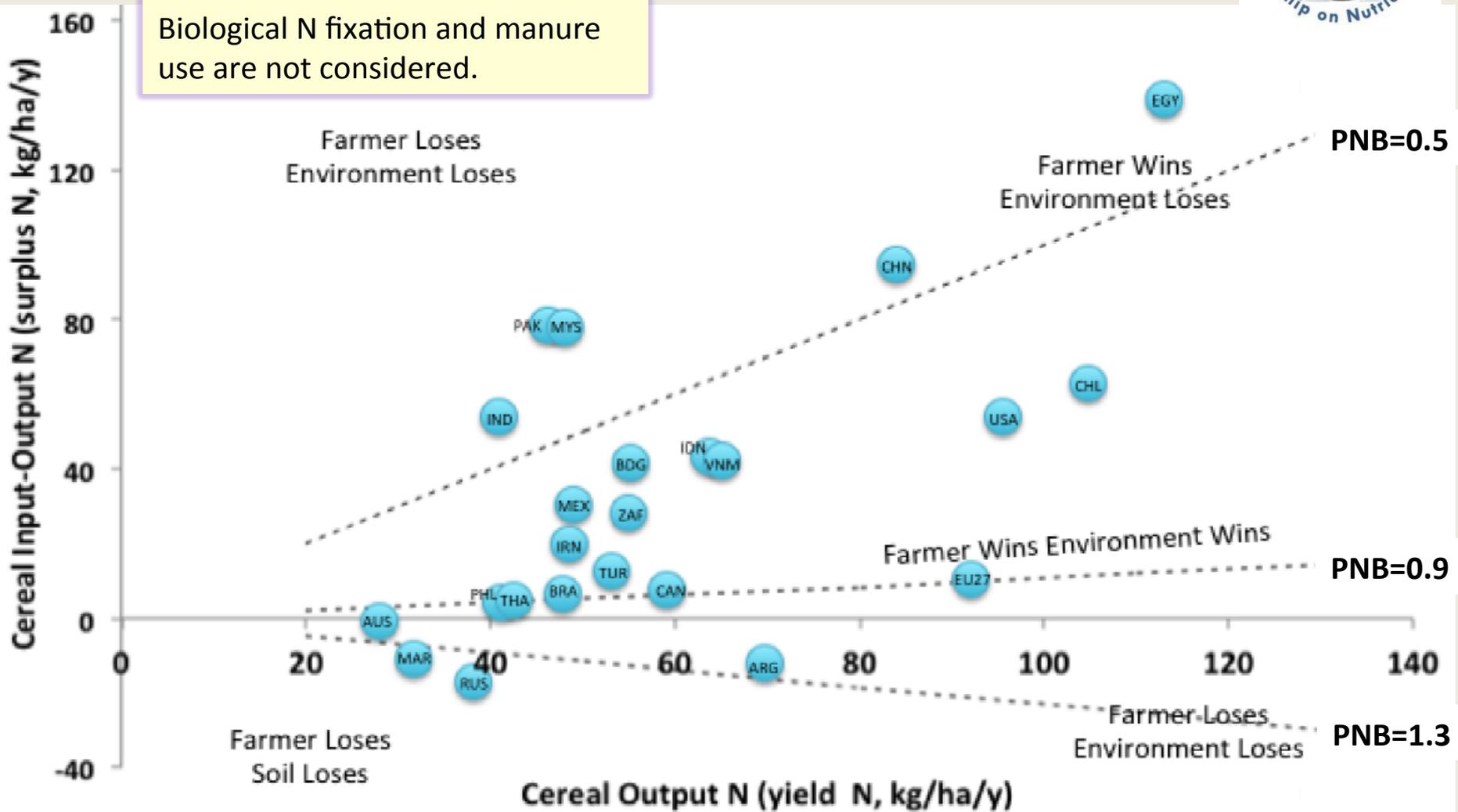
All cereals N PNB by country



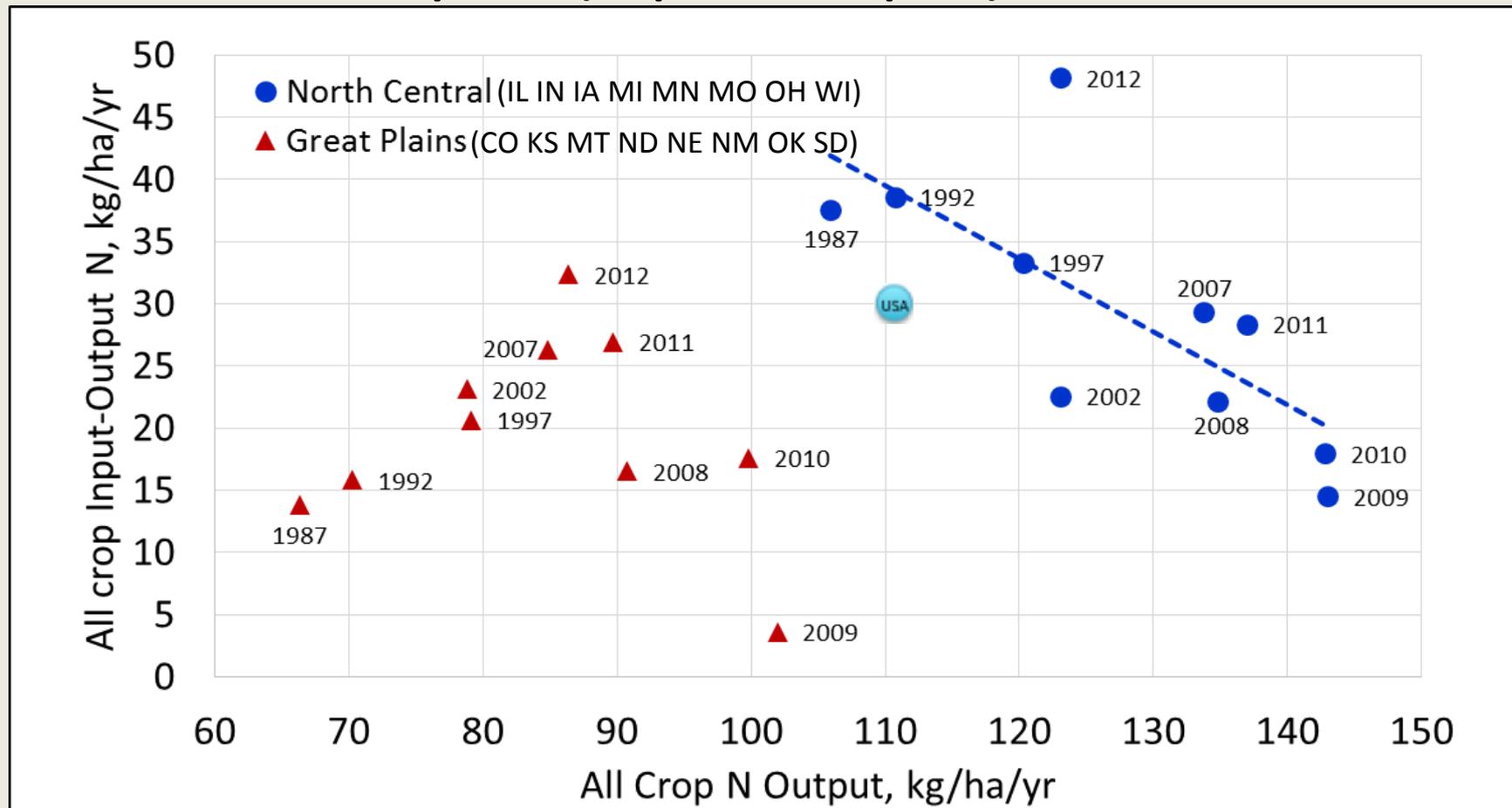
N output versus N surplus (input-output) for cereals in selected countries



Biological N fixation and manure use are not considered.



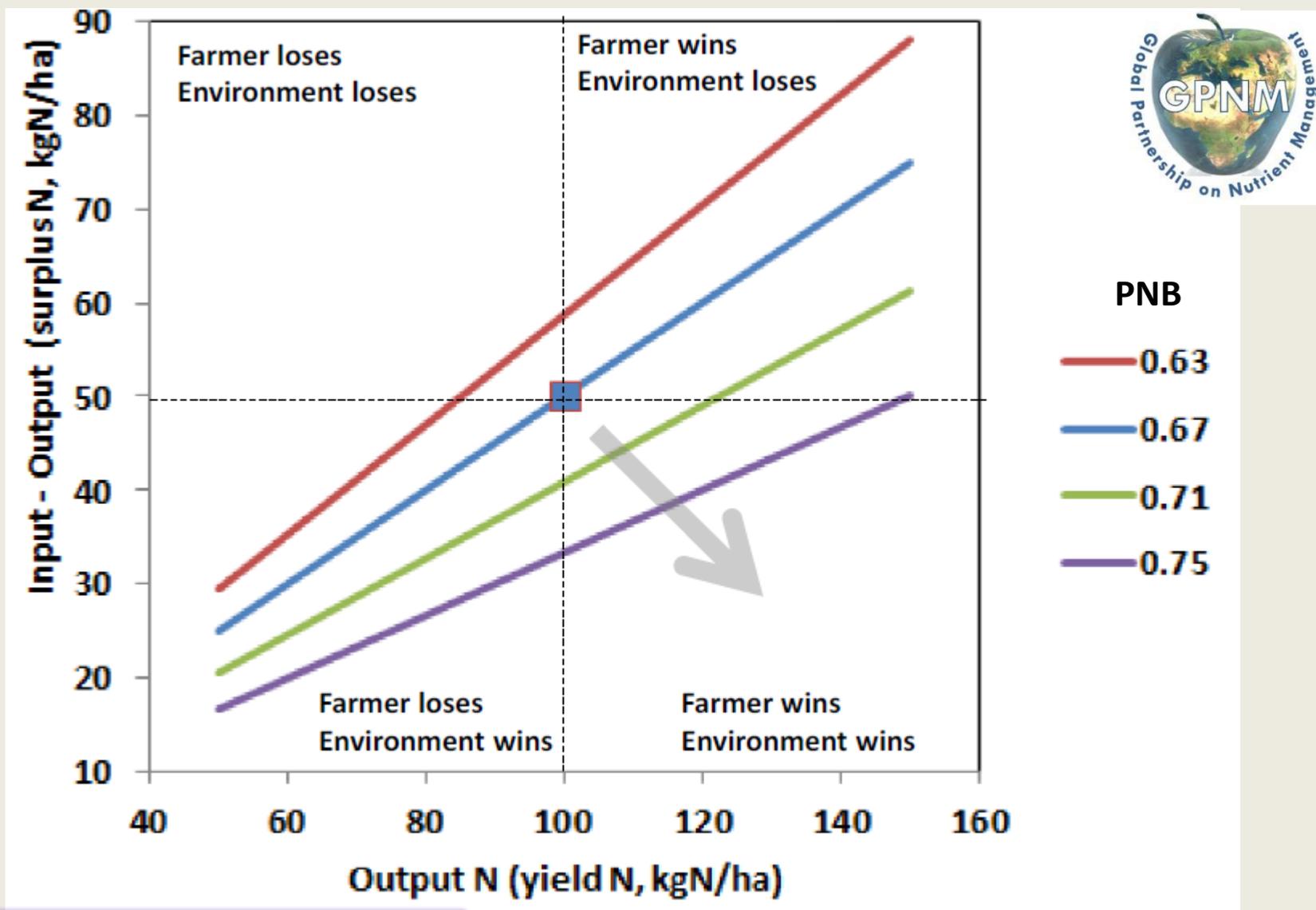
Regional and yearly variation in N output versus N surplus (input-output) in the US



USA US average for these same years.

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

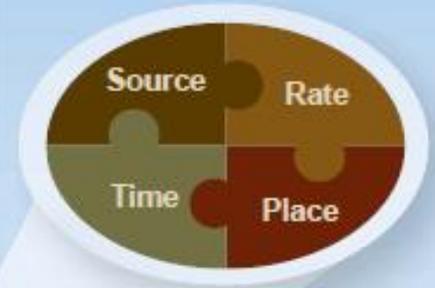
Tracking efficiency and productivity relative to a benchmark ... approaching performance



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

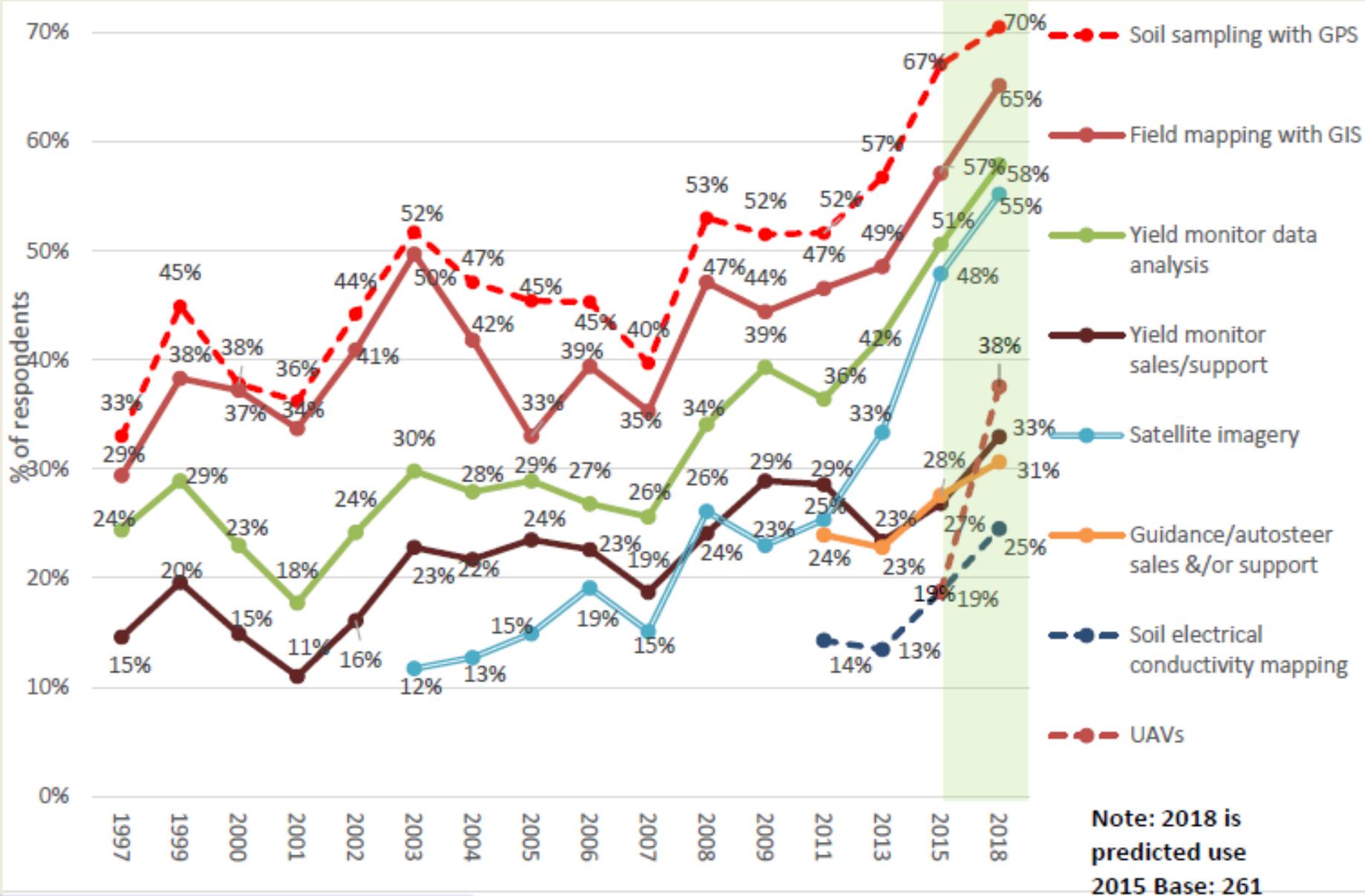


Photo by Bill Pan



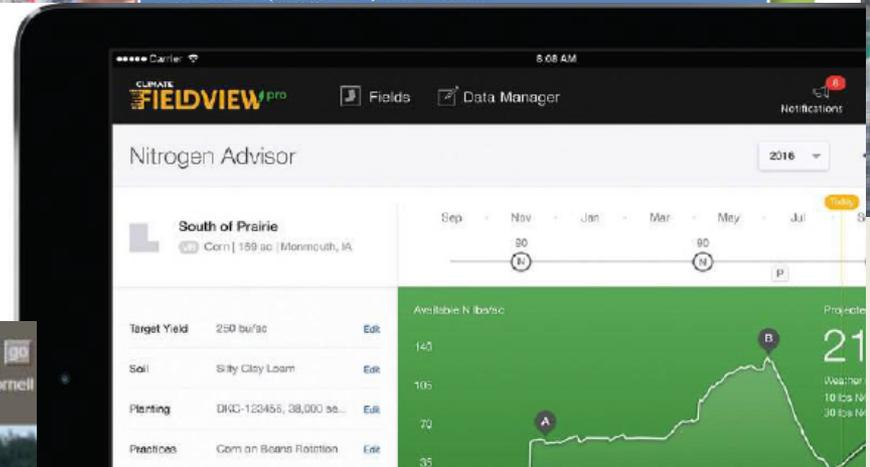
Managing **soil** conditions & **nutrition** of each plant

Precision services offered by US input suppliers



Adapting nutrient management to climate change

Nutrient Expert® - A Decision Support Tool for Site-Specific Nutrient Management



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A tool for adaptive nitrogen management in corn

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News and events

News from the blog

Adapt-N chosen 2012 Top Product of the Year

Adapt-N was selected as the Best New Product of the Year 2012 by AgProfessional magazine, a publication related to agronomic and business management for agricultural retailers/distributors, farm managers and crop consultants. Adapt-N took a huge 52 percent of the vote, and it is the first commercial organization to receive the award. "The [...]"

Adapt-N is now available for the 2013 season

Hello Adapt-N Users, The conversion to 2013 was completed over the weekend, and is now available for the 2013 season. Retrospective runs for 2012 remain available as well. As always, please contact us with any questions and feedback. Bianca Moebius-Clune bnm5@cornell.edu



Top Product of the Year, 2012 – Ag Professional



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



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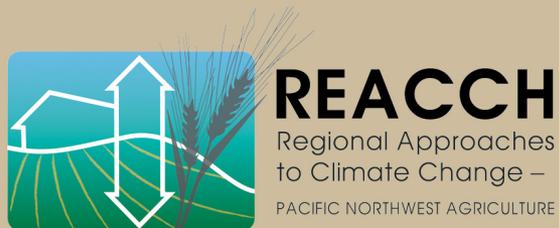


Thank you!

University
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United States Department of Agriculture
National Institute of Food and Agriculture



Pacific Northwest
Farmers Cooperative



Monsanto