PANEL: Making a resource into the right source

Moderator:

Tom Bruulsema, International Plant Nutrition Institute

Panelists:

Karl Wyant, Helena Chemical Company

Galen Mooso, J.R. Simplot Company

Chris Peot, DC Water

Making a resource into the right source

Tom Bruulsema, IPNI

- 4R phosphorus & legacy phosphorus

Karl Wyant, Helena Chemical Company

- Agri-retail delivery of mineral and organic sources
- What drives grower choices?

Galen Mooso, J.R. Simplot Company

- Manufacturing, wholesale and distribution

Chris Peot, DC Water

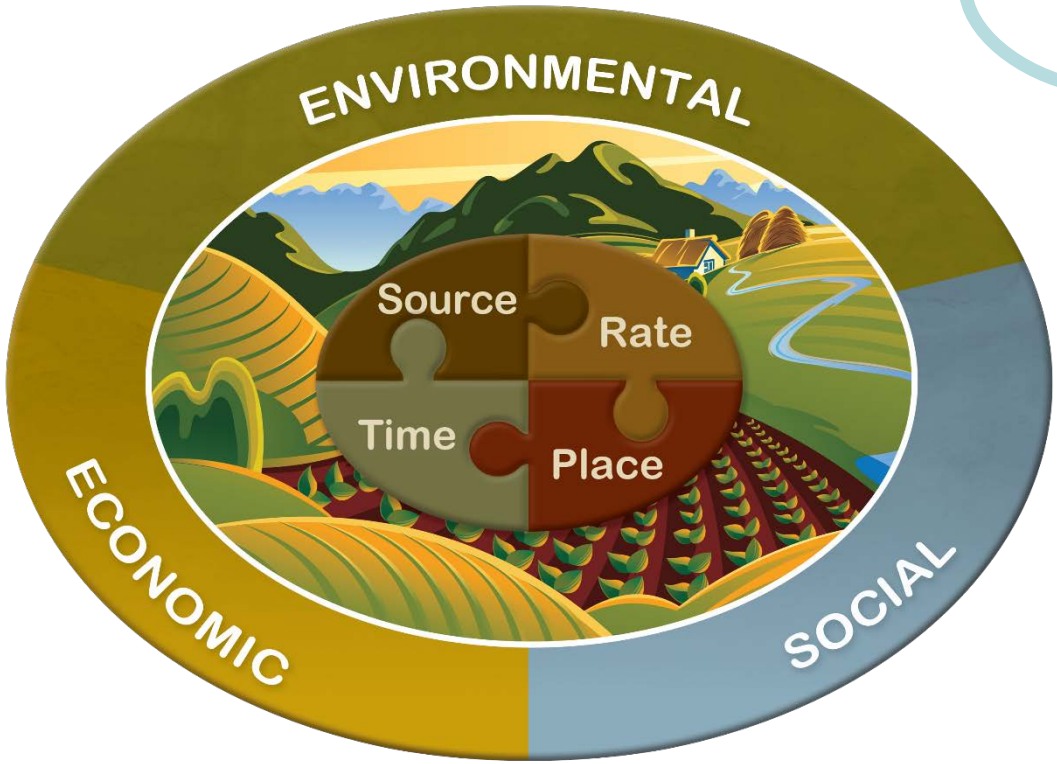
- Wastewater treatment, sustainable end use, P availability in biosolids

IPNI

4R Phosphorus for Sustainable Crop Nutrition

nutrient stewardship

Actions (adoption metrics)



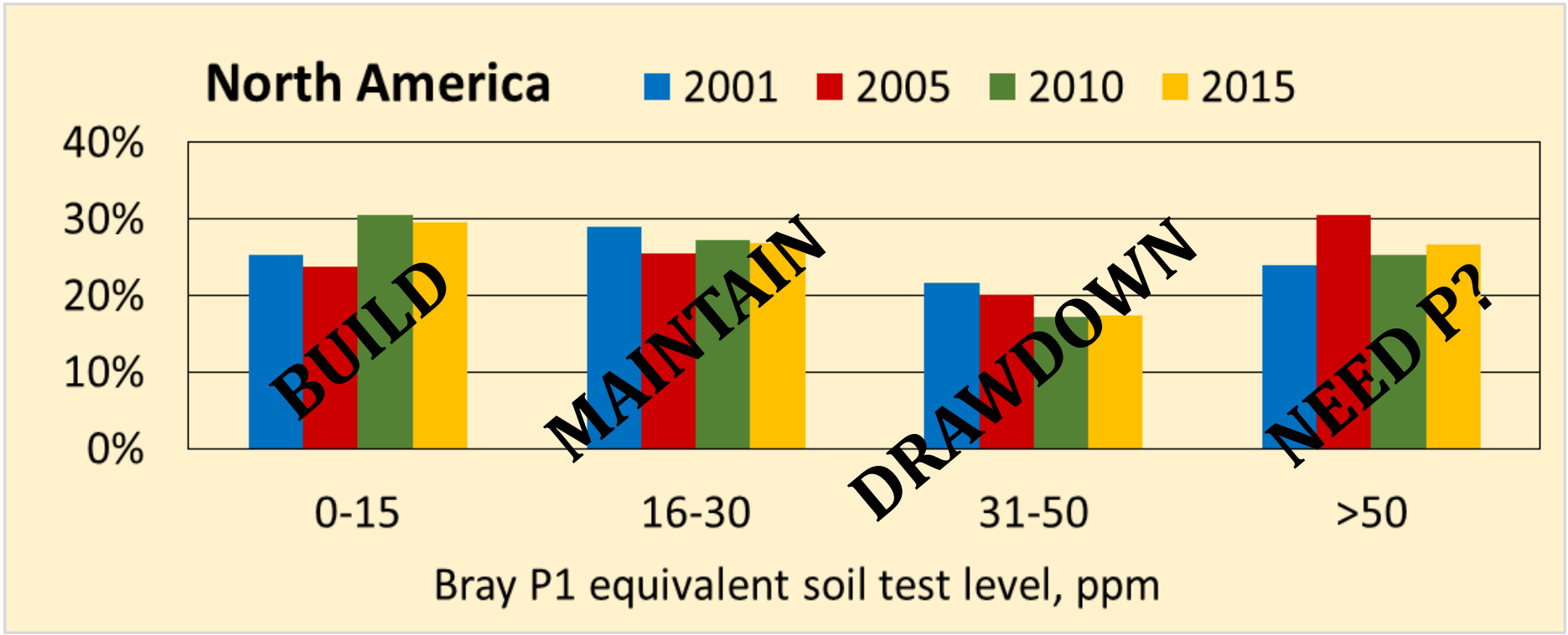
Key Outcomes (impact metrics)

1. **Farmland productivity**
2. **Soil health**
3. **Nutrient use efficiency**
4. **Water quality**

IPNI

Legacy Phosphorus

Distribution of soil test P levels, %

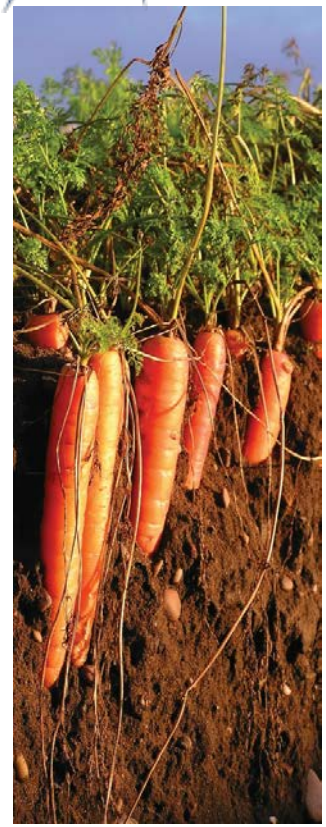


- Soil test P reflects the legacy of past P management.
- Soil test P determines right rate and source.

http://soiltest.ipni.net

P Challenges in Agriculture

Dr. Karl A. Wyant
Lead Agronomist – Western Division (AZ and CA)
Helena Chemical Company



Phosphate Use in Agriculture

- **Liquid** – ortho vs. polyphosphate
- **Dry** – DAP, MAP, SSP, TSP
- Conventional vs. Organic
- Custom Blends
- Flexibility is key!

Grower and Market Logistics Drives Fertilizer Choice

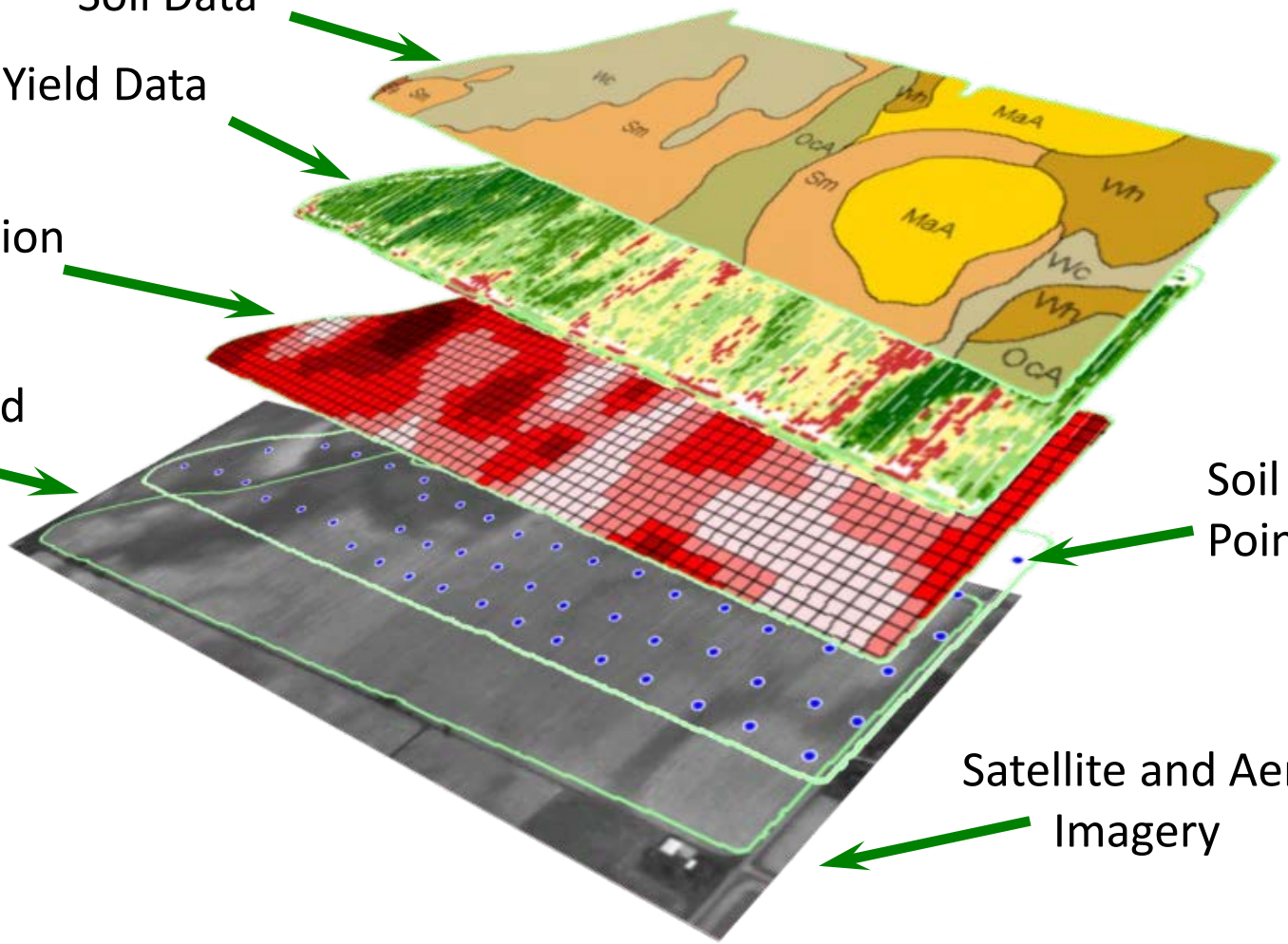
- **Crop type** – annual vs. permanent vs. semi-permanent
- **Planning** – soil testing and crop removal rates
- **Application equipment** – *broadcast, band, injection*
- **Liquid Application** – Fertigate or dryland application
- Local practices and retailer inventory

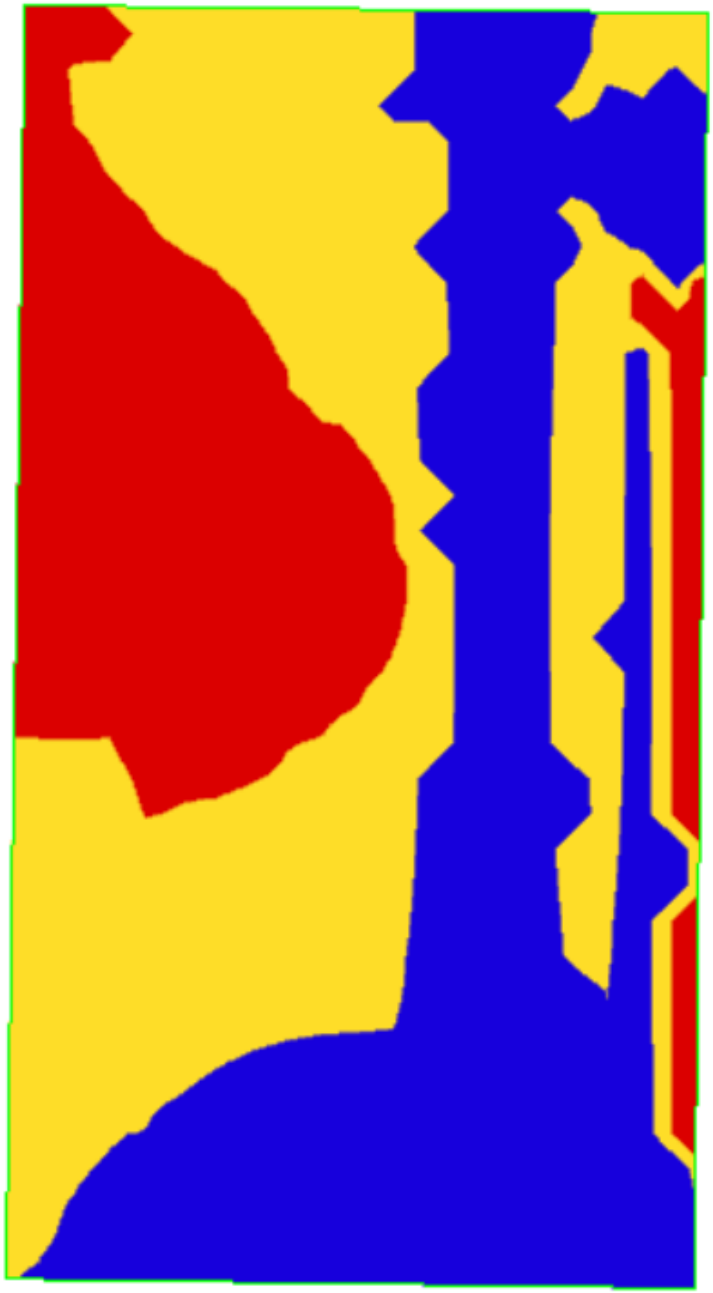
Variable Rate Fertilizer

- VR technology and digitization of the farm
- Connect field variability → prescription → application technology
- **Case study** – Cotton – AZ/CA
- **4Rs** (right source, rate, time, place)

Information Management

Data Layers





Custom Fertilizer Rate

15 - 16.25	**Gal/acre**	(13.96 ac)
16.25 - 17.5		(0.00 ac)
17.5 - 18.75		(22.39 ac)
18.75 - 20		(21.09 ac)

Variable Rate Rx Results

- 12.5% US$ savings over conventional P application
- 150 gallons of fertilizer saved
- ~460 lbs. P_2O_5 saved

Challenges for Recycled Products

- Recycled P is already used in agriculture – **manures and composts**
- Analysis is not consistent
- Manures and composts carry *E. coli* and salinity risks
- Struvite needs to match **$/lbs. P** found in marketplace
- Struvite needs to fit existing **delivery and application** equipment

Galen Mooso Ph.D., CPAg, CCA

Agronomy Manager

JR Simplot Company

Boise, Idaho

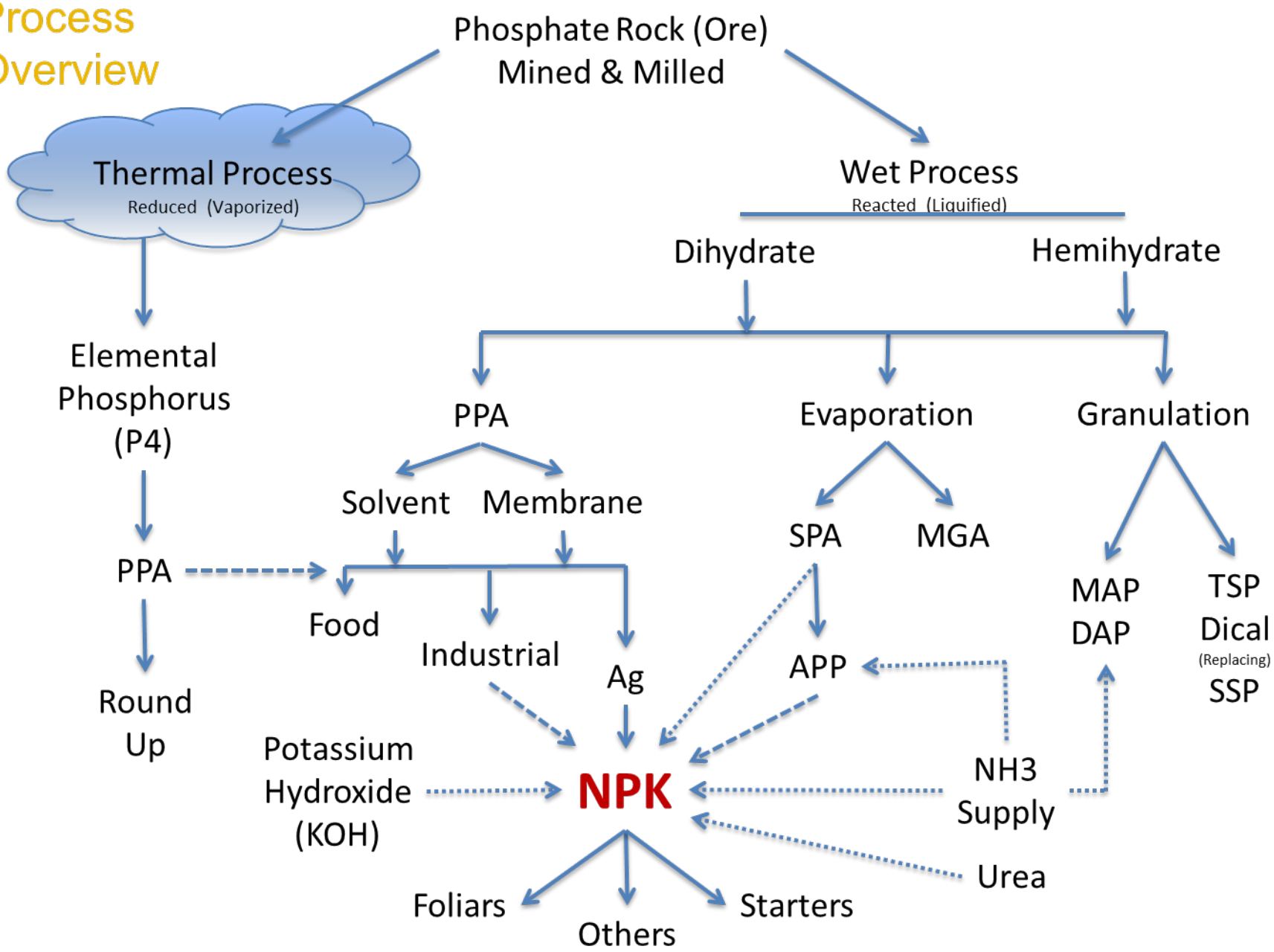
Simplot AGRIBUSINESS

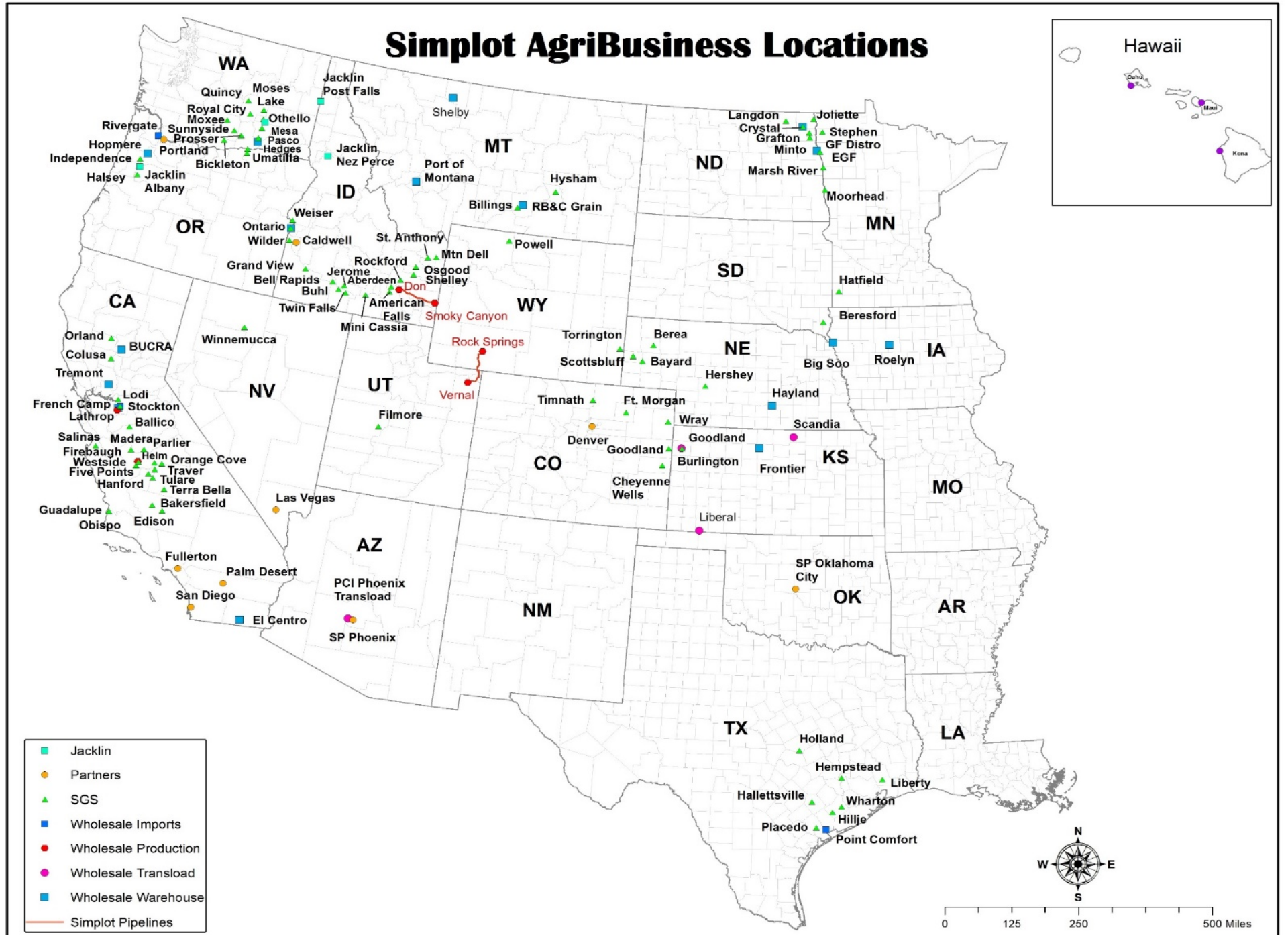
Simplot Phosphate Mining and Manufacturing

Simplot

Bringing Earth's Resources to Life

Process Overview




Simplot AgriBusiness Locations
Hawaii
Oahu
Maui
Kona
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
Jacklin
Post Falls
Quincy
Moses Lake
Royal City
Moxee
Othello
Rivergate
Sunnyside
Mesa
Prosser
Pasco
Hopmere
Portland
Hedges
Independence
Bickleton
Umatilla
Halsey
Jacklin
Albany
Jacklin
Nez Perce
Shelby
Port of Montana
Hysham
Billings
RB&C Grain
Weiser
Ontario
Wilder
Caldwell
St. Anthony
Mtn Dell
Powell
Grand View
Rockford
Jerome
Osgood
Bell Rapids
Aberdeen
Shelley
Buhl
Don
Twin Falls
American Falls
Smoky Canyon
Mini Cassia
Orland
BUCRA
Winnemucca
Colusa
Tremont
Rock Springs
Torrington
Berea
Scottsbluff
Bayard
Vernal
Hershey
Lodi
French Camp
Stockton
Lathrop
Ballico
Timnath
Ft. Morgan
Hayland
Filmore
Wray
Salinas
Madera
Parlier
Denver
Goodland
Scandia
Firebaugh
Helm
Orange Cove
Westside
Traver
Burlington
Frontier
Five Points
Tulare
Cheyenne Wells
Hanford
Terra Bella
Las Vegas
Bakersfield
Guadalupe
Edison
Obispo
Liberal
Fullerton
Palm Desert
PCI Phoenix Transload
San Diego
SP Oklahoma City
El Centro
SP Phoenix
Holland
Hempstead
Liberty
Hallettsville
Wharton
Hillje
Placedo
Point Comfort
Langdon
Joliette
Crystal
Stephen
Grafton
GF Distro
Minto
EGF
Marsh River
Moorhead
Hatfield
Beresford
Big Soo
Roelyn
Jacklin
Partners
SGS
Wholesale Imports
Wholesale Production
Wholesale Transload
Wholesale Warehouse
Simplot Pipelines
N
W
E
S
0
125
250
500 Miles


Simplot
PRIVATE PROPERTY
NO TRESPASSING

Biosolids and Nutrient Recovery: Finding the Right Balance

Sustainable Phosphorus Alliance, **May 19th, 2017**

District of Columbia Water and Sewer Authority

NUTRIENTS and CARBON RECYCLING

FARMING

Provides carbon and nutrients valued at $300.00 per acre.

SILVICULTURE

Increases yield and improves understory.

RECLAMATION

Restoring mines to their natural state and providing wildlife habitats.

URBAN RESTORATION

Grow trees and reduce runoff.

dc water is life

BLUE PLAINS ADVANCED WASTEWATER TREATMENT PLANT: A RESOURCE RECOVERY FACILITY

water • nutrients • carbon • energy

dcwater.com/biosolids

GREEN ENERGY BIORENEWABLES

THERMAL HYDROLYSIS PROCESS (THP) AND DIGESTION FACILITY

DC Water will be the first in North America to use thermal hydrolysis for wastewater treatment. When completed, this facility will be the largest plant of its kind in the world.

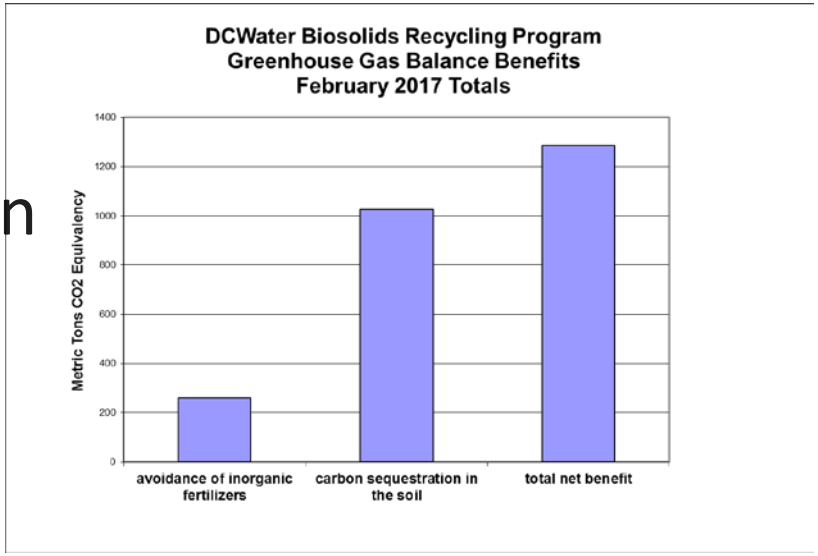
GREEN BENEFITS:

- Produce combined heat and power, generating 13 MW of electricity
- Save DC Water $10 million annually cutting grid demand by a third (DC Water is the largest consumer of electricity in the District)
- Reduce carbon emissions by approximately 50,000 metric tons of CO_2e per year.
- Reduce trucking by 1.7 million miles per year.
- Save $10 million in biosolids trucking costs
- Produce Class A biosolids to grow trees, sequester carbon and reduce runoff.

Agriculture

WWTP and P

- WWTP's keep P out of sensitive waters
- 9.1M tons of biosolids generated annually in the US
- P levels in biosolids (1 – 6%)
- 350,000 tons of P, half of which is landfilled
- Biosolids benefits
  - Slow release nutrients
  - Carbon footprint reduction
  - Crop drought resistance



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WWTPs prime directive – keep nutrients out of sensitive receiving waters

- P removed with chemical, biological, and physical processes
- Issues related to each
  - Chemical - P gets bound in biosolids creating a nutrient imbalance
  - Biological - P can get re-released in digestion process
  - Struvite removal – difficult to meet stringent effluent standards economically

DC Water Blue Plains example

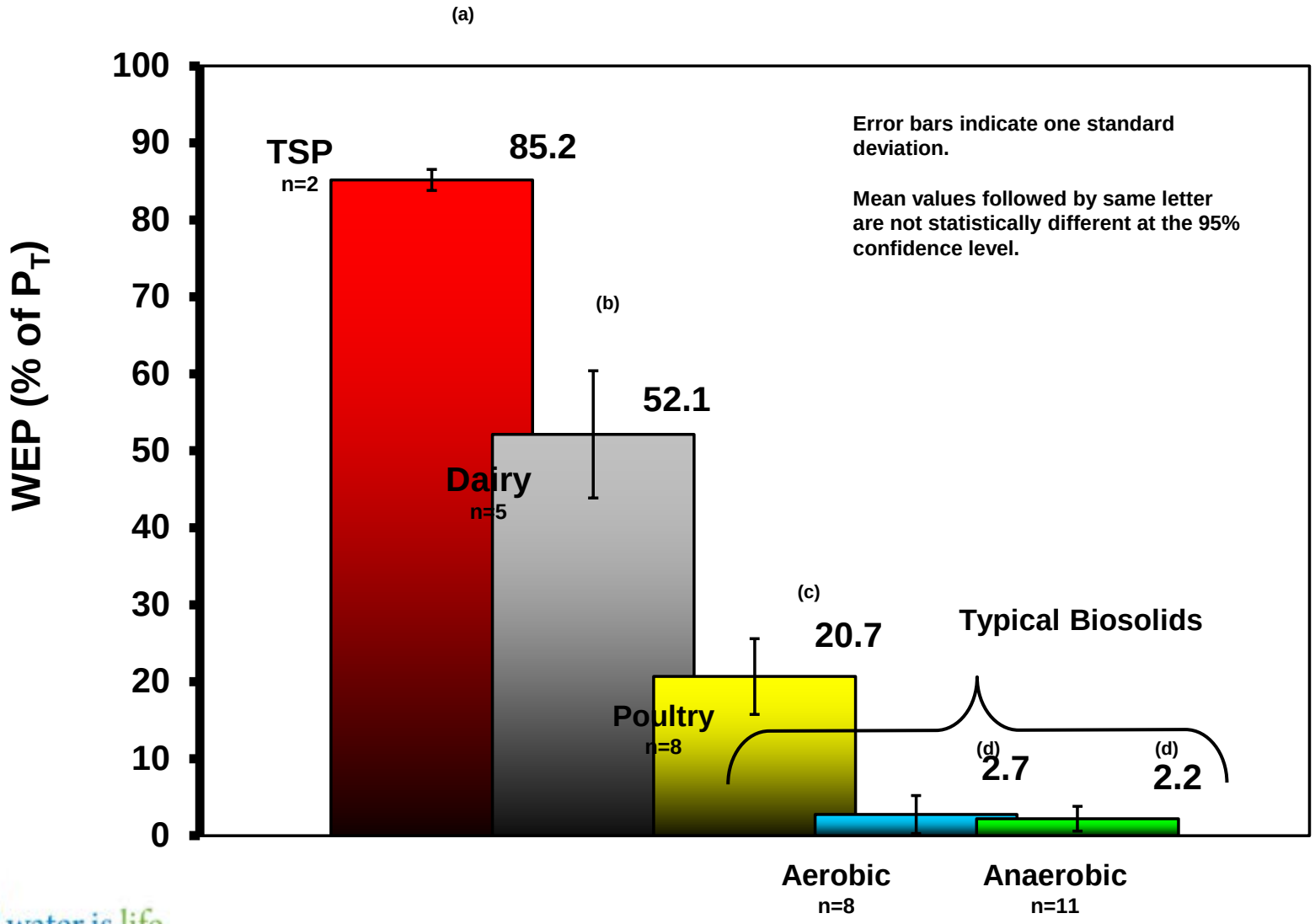
- The DC Water Blue Plains WWTP (290 MGD) uses iron salts (ferric chloride) for P removal. P is bound in the biosolids
- P reduced from 9 million pounds in 1985 to 3 million pounds in 2009, a 67% reduction.
- Chesapeake Bay's overall phosphorus pollution that is attributed to wastewater dropped from 35 percent in 1985 to 17 percent in 2009
- DC Water Blue Plains WWTP: P discharge limit of 0.18 mg/l
- Blue Plains Biosolids: P = 6.4% dry weight basis
- Iron content 7.5%, WEP 4% of total P

dc water is life

State Regulations

- Many states treat all P equally, assuming all is available and extractable
- PA and MD allow use of WEP to determine a site specific P index
- WI – recognizes P in biosolids is often bound by metal salts addition
  - In addition, the department is following new research assessing the relative environmentally available phosphorus between biosolids, manure, and commercial fertilizer**.** Early indications show that the water extractable phosphorus in most biosolids is much less than that found in manure or commercial fertilizer. Further the iron, aluminum, and oxides that are commonly found in biosolids serve to form strong and long-lasting bonds with the phosphorus. To aid in this research and to gather more relevant information, all municipal biosolids and industrial sludge producers are requested to begin testing for water extractable phosphorus (WEP) in addition to the total phosphorus testing already required in permits. The recommended test method as developed by researchers at Penn State University is attached.

Comparison of WEP for TSP, Manures, and Typical Biosolids



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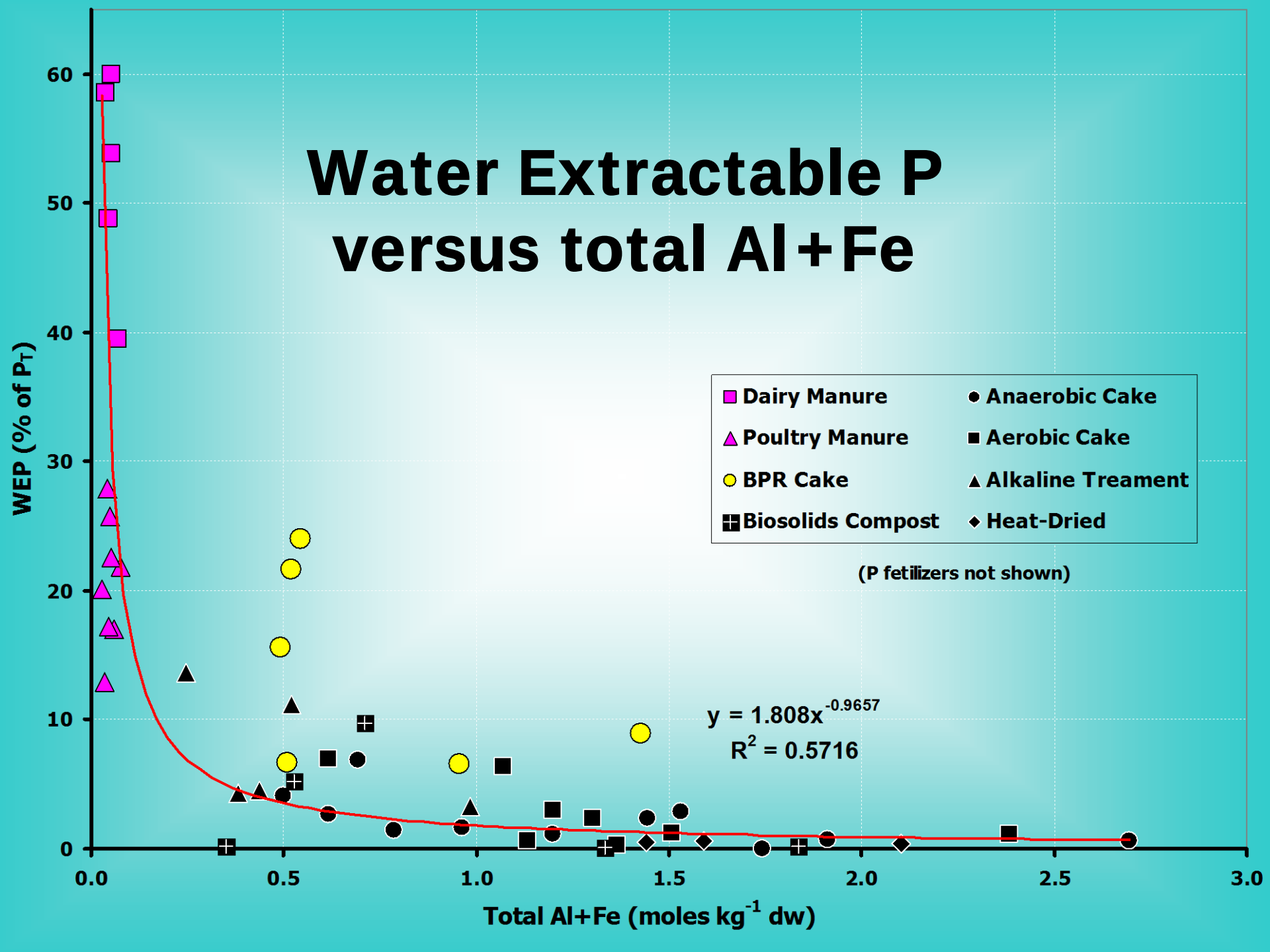
Water Extractable P versus total Al+Fe
WEP (% of P_T)
Total Al+Fe (moles kg^{-1} dw)
0
10
20
30
40
50
60
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Dairy Manure
Poultry Manure
BPR Cake
Biosolids Compost
Anaerobic Cake
Aerobic Cake
Alkaline Treament
Heat-Dried
(P fetilizers not shown)
$y = 1.808x^{-0.9657}$
$R^2 = 0.5716$

Summary

- Considerable quantities of P in US generated biosolids
- Half ends up in landfills
- Much of the other half is bound in the land applied biosolids
- Discharge permit limits and economics drive decisions at WWTPs
- Current low P permit limits favor economical solutions to keeping P out of sensitive waterways
- Need an innovative and economical solution to P recovery at plants with low discharge limits