Chesapeake Bay Program Phase 6 Watershed Model Inputs Webinar

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5/25/2017

Process

- Today – Review slides and visual data inputs at: https://mpa.chesapeakebay.net/Phase6DataVisualization.html
- Tomorrow – July 31 (preferably July 15) – provide comments to Matt Johnston mjohnston@chesapeakebay.net and Gary Shenk at gshenk@chesapeakebay.net
- June 1 – Documentation Released – Chapter 3 describes inputs





Phase 6 Model Structure

Average Load + Δ Inputs * Sensitivity

*

Land Use Acres

*

BMPs

*

Land to Water

*

Stream Delivery

*

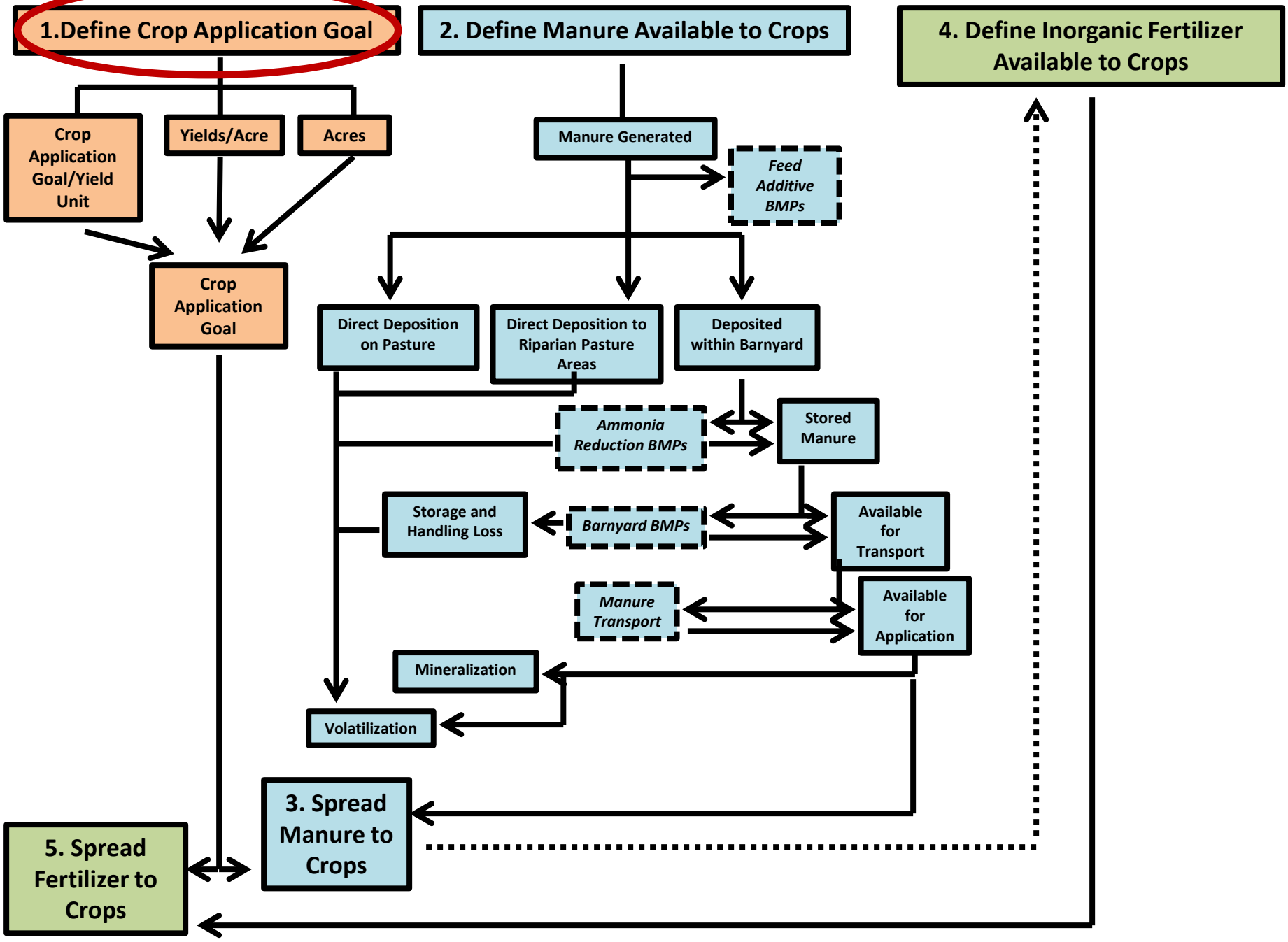
River Delivery

Direct Loads

Phase 6

Nutrient Spread Components

- 1) Define Crop Application Goal
- 2) Define Manure Available to Crops
- 3) Spread Manure to Crops
- 4) Define Inorganic Fertilizer Available to Crops
- 5) Spread Inorganic Fertilizer to Crops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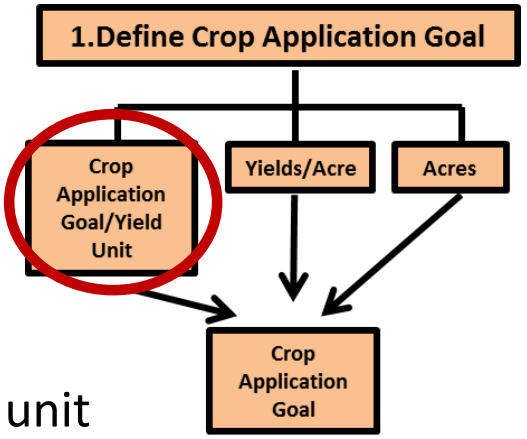
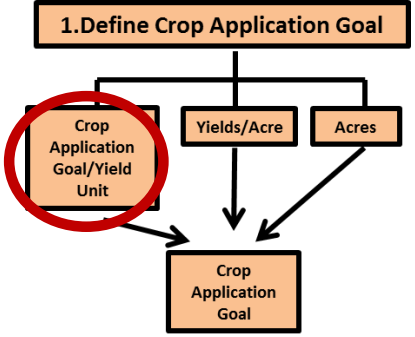
2. Define Manure Available to Crops
4. Define Inorganic Fertilizer Available to Crops
Crop Application Goal/Yield Unit
Yields/Acre
Acres
Crop Application Goal
Manure Generated
Feed Additive BMPs
Direct Deposition on Pasture
Direct Deposition to Riparian Pasture Areas
Deposited within Barnyard
Ammonia Reduction BMPs
Stored Manure
Storage and Handling Loss
Barnyard BMPs
Available for Transport
Manure Transport
Available for Application
Mineralization
Volatilization
3. Spread Manure to Crops
5. Spread Fertilizer to Crops

Crop Application Goal



- States provided the following for each crop:
  - Total N and P application goals per acre or yield unit
    - Example: 0.92 lb of N/bushel of corn for grain yield
  - Fraction of total application goal which should be met by applications in each month
    - Example: 0.4 of yearly total N on corn for grain should be applied in April
  - Indication of which applications are eligible to be met by only inorganic fertilizer, or by any kind of nutrient in each month
    - Example: April applications are eligible to be met by inorganic and organic fertilizer. June applications are eligible to be met by only inorganic fertilizer.

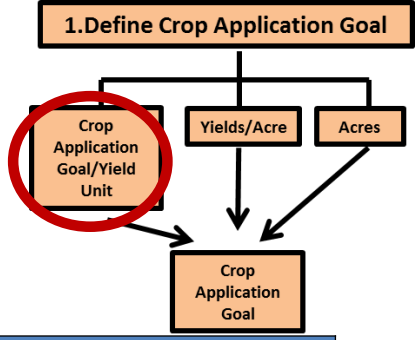
Crop Application Goal on Major Crops



Crop	DoubleCrop	Nutrient	Yield Unit	DE_1	MD_1	NY_1	PA_1	VA_1	WV_1
Alfalfa Hay Harvested Area	N	TN	dry tons	1	1	1	1	1	1
Alfalfa Hay Harvested Area	N	TP	dry tons	5	5	5	6	5	5
Corn for Grain Harvested Area	N	TN	bushels	0.92	0.92	0.92	0.92	0.92	0.92
Corn for Grain Harvested Area	N	TP	bushels	0.12	0.12	0.12	0.12	0.12	0.12
Corn for Grain Harvested Area	Y	TN	bushels	0.92	0.92	0.92	0.92	0.92	0.92
Corn for Grain Harvested Area	Y	TP	bushels	0.12	0.12	0.12	0.12	0.12	0.12
Wheat for Grain Harvested Area	N	TP	bushels	0.31	0.31	0.31	0.31	0.31	0.31
Wheat for Grain Harvested Area	N	TN	bushels	1.25	1.25	1	1	1.25	1.25
Wheat for Grain Harvested Area	Y	TP	bushels	0.465	0.465	0.465	0.465	0.465	0.465
Wheat for Grain Harvested Area	Y	TN	bushels	1.25	1.25	1	1	1.25	1.25
Pastureland and rangeland other than cropland and woodland pastured Area	N	TN	acres	15	15	15	15	15	15
Pastureland and rangeland other than cropland and woodland pastured Area	N	TP	acres	4	4	4	4	4	4
Soybeans for beans Harvested Area	N	TN	bushels	0.12	0.12	0.12	0.12	0.12	0.12
Soybeans for beans Harvested Area	N	TP	bushels	0.33	0.33	0.33	0.33	0.33	0.33
Soybeans for beans Harvested Area	Y	TN	bushels	0	0	0	0	0	0
Soybeans for beans Harvested Area	Y	TP	bushels	0	0	0	0	0	0

- Data provided by states after consultation with nutrient management program staff.

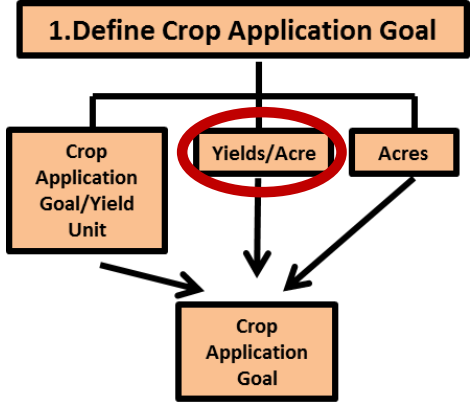
Non-Nutrient Management Application Goal Multipliers



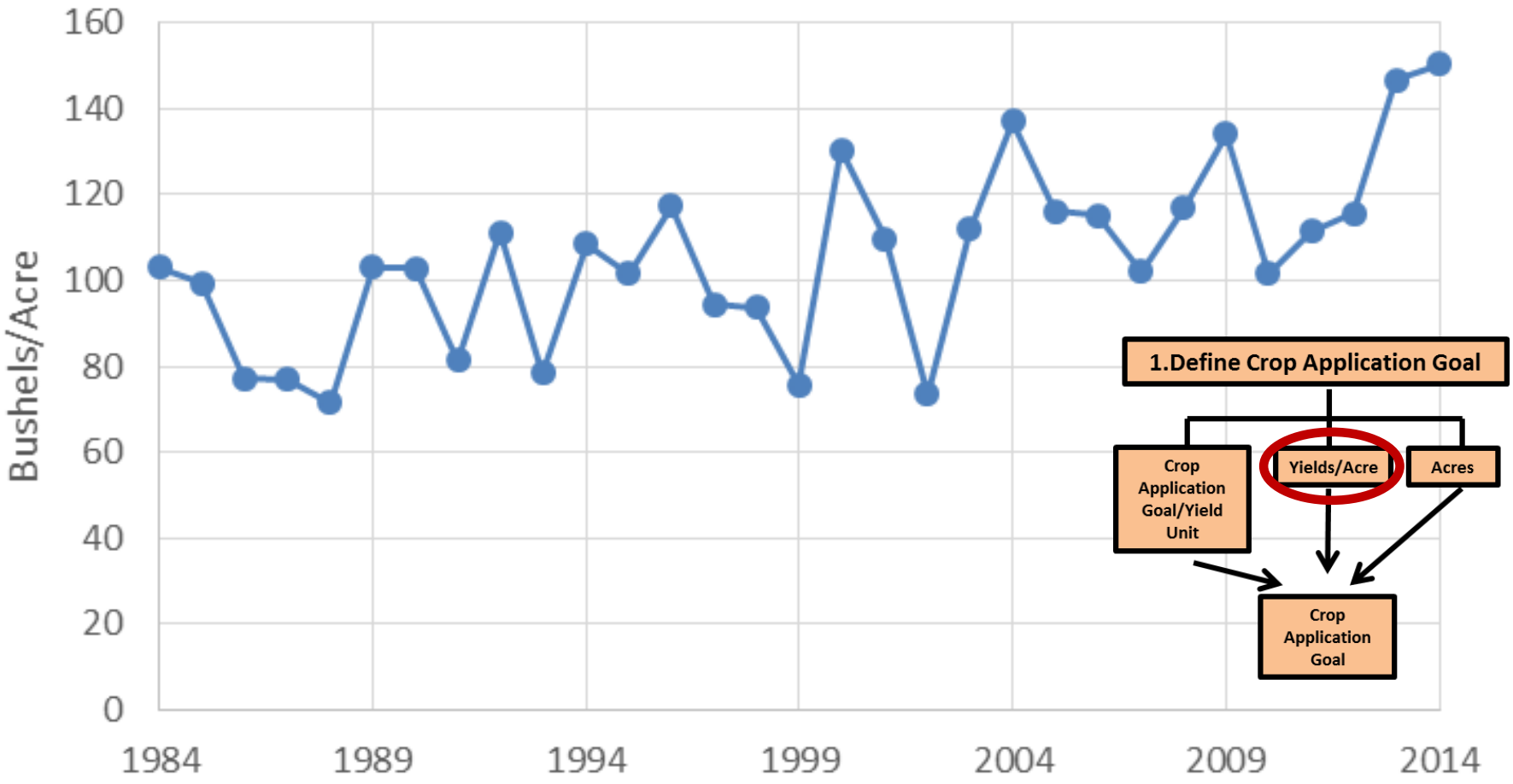
Land Use	Non NM N Multiplier	Non NM P Multiplier
Full Season Soybeans	1.2	1.5
Grain with Manure	1.3	3
Grain without Manure	1.2	1.5
Legume Hay	1.2	1
Silage with Manure	1.4	3
Silage without Manure	1.2	1.5
Small Grains and Grains	1.2	1.5
Small Grains and Soybeans	1.2	1.5
Specialty Crop High	1.3	2
Specialty Crop Low	1.2	2
Other Agronomic Crops	1.1	1.5
Other Hay	1	1
Pasture	1	1

- Data provided by Nutrient Management Panel.

Incorporating Yields into Crop Application Goals

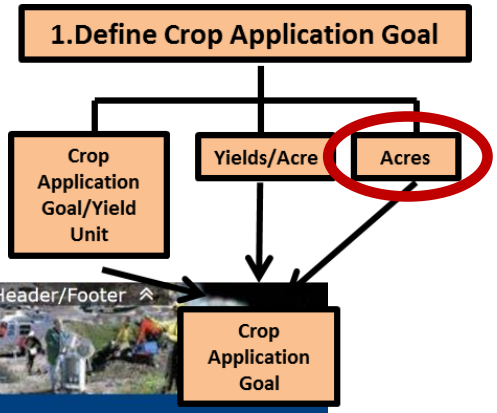


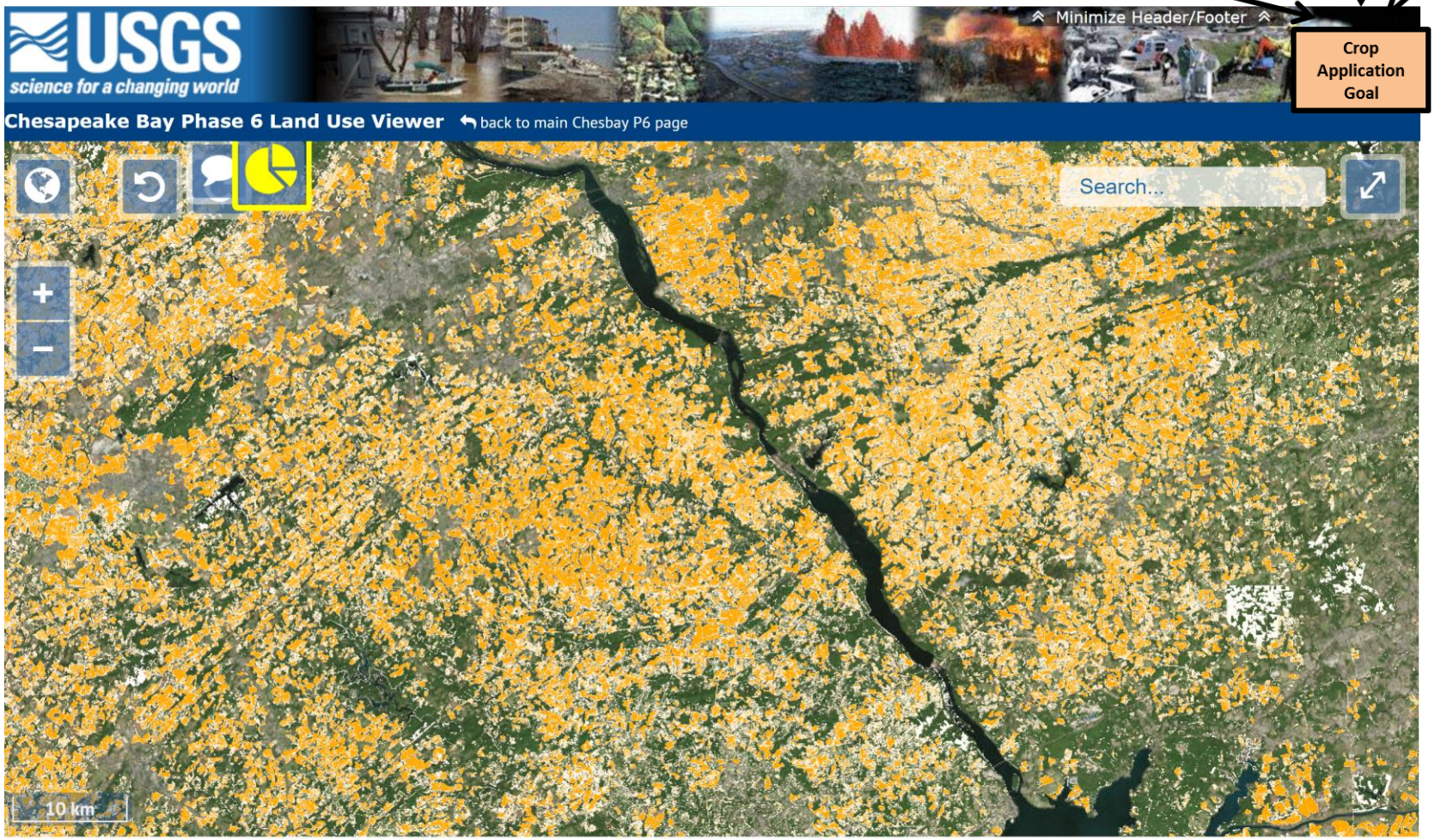
- Crop Application Goal Equation:
  - *Lbs of N/Year = State-Supplied Lbs of N/Application Goal Yield Unit/Year X Yield/Year X 1*
- Application goals are yield-based for the following major crops:
  - Alfalfa Hay; Barley; Buckwheat; Corn for Grain; Corn for Silage; Oats for Grain; Rye for Grain; Sorghum for Grain; Sorghum for Silage; Soybeans for Beans; and Wheat for Grain
- Application goals are per acre for all other crops, and do not vary across the years.
- Yearly yields provided by NASS for major crops.



- Yields provided by county.
- Yield goal = best three out of last five data points.
- Missing data points filled in based upon data from surrounding years, or surrounding growth regions.

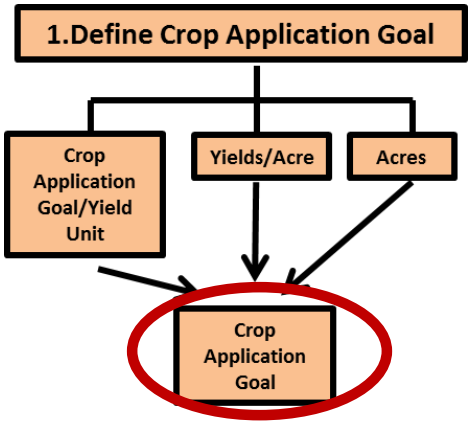
Acres of Crops





- https://chesapeake.usgs.gov/phase6/map/#map=10/-8505301.01/4836629.4/0.0/1,20

Example of County Corn Application Goal

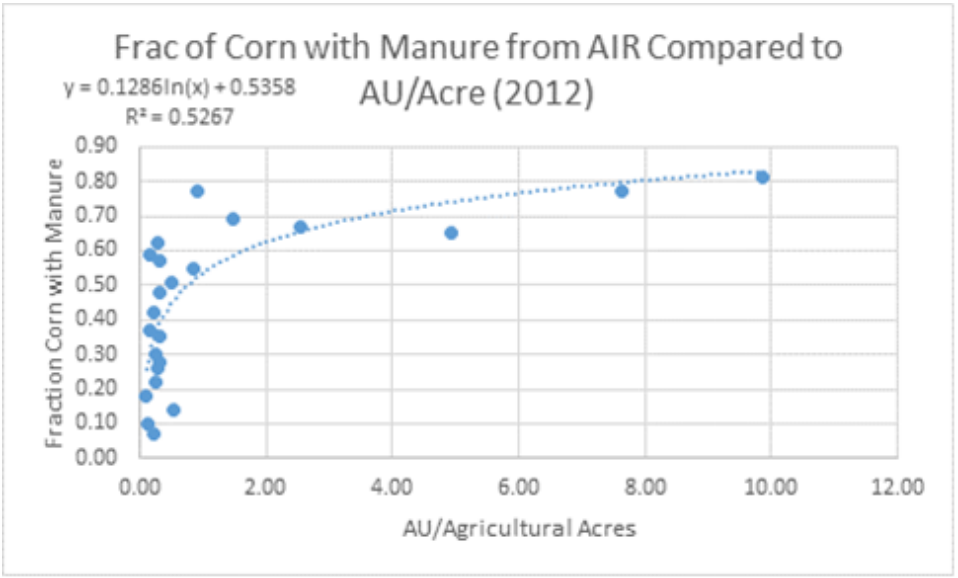


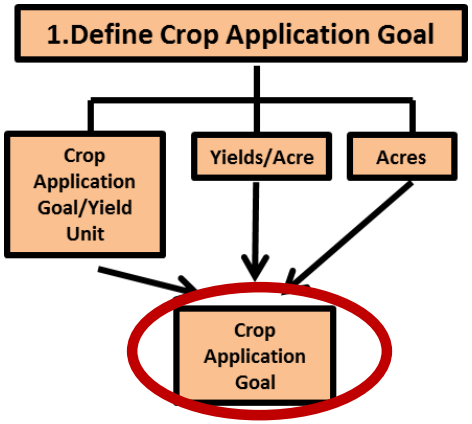
- Yield = 100 bushels/acre
- Acres = 1,000
- Application Goal = 0.92 Lbs N/Bushel
  - Assumption is 100% Core N Nutrient Management

- Corn Application Goal = 100 X 1,000 X 0.92 = 92,000 Lbs N
  - Further broken down into monthly goals, and manure/fertilizer goals

- Application may be higher or lower than 92,000 Lbs N based upon available manure and fertilizer within county.

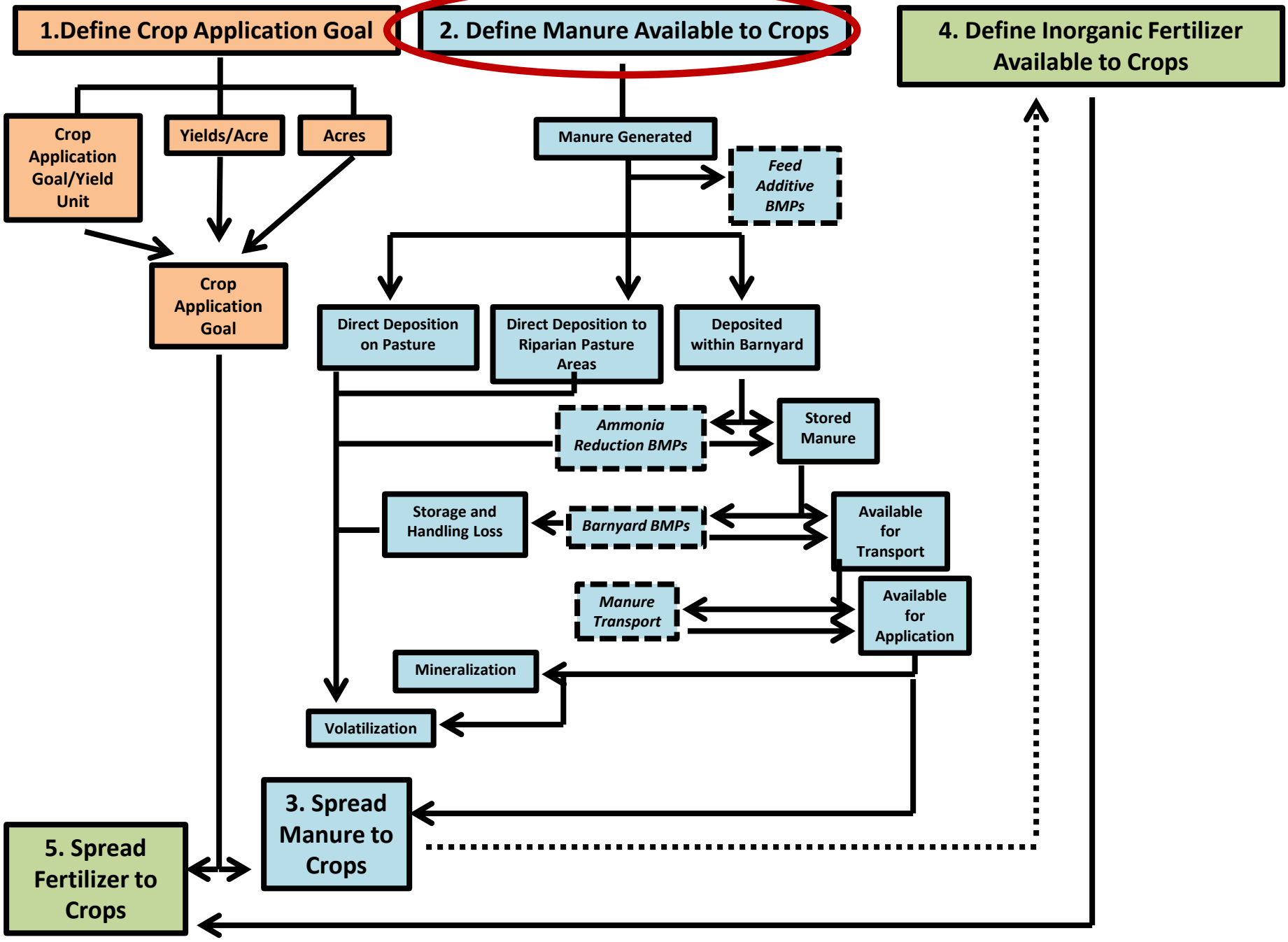
Acres of Crops Receiving Manure





Hypothetical AU/Acre	Resulting % Acres Corn for Grain Eligible for Manure
0.01	18%
0.1	22%
0.25	34%
0.5	43%
1	52%
2	61%
4	70%
8	79%
16	81%

- AU/Acre used to set percent of corn that can receive manure.
- MD 2012 AIR data also indicated nearly all corn silage received manure.
- Ag Workgroup approved 85% corn silage would receive manure.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Manure Generation - Nutrients

Manure Generated

Data Needed: Populations; Manure Generation; Nutrient Concentrations

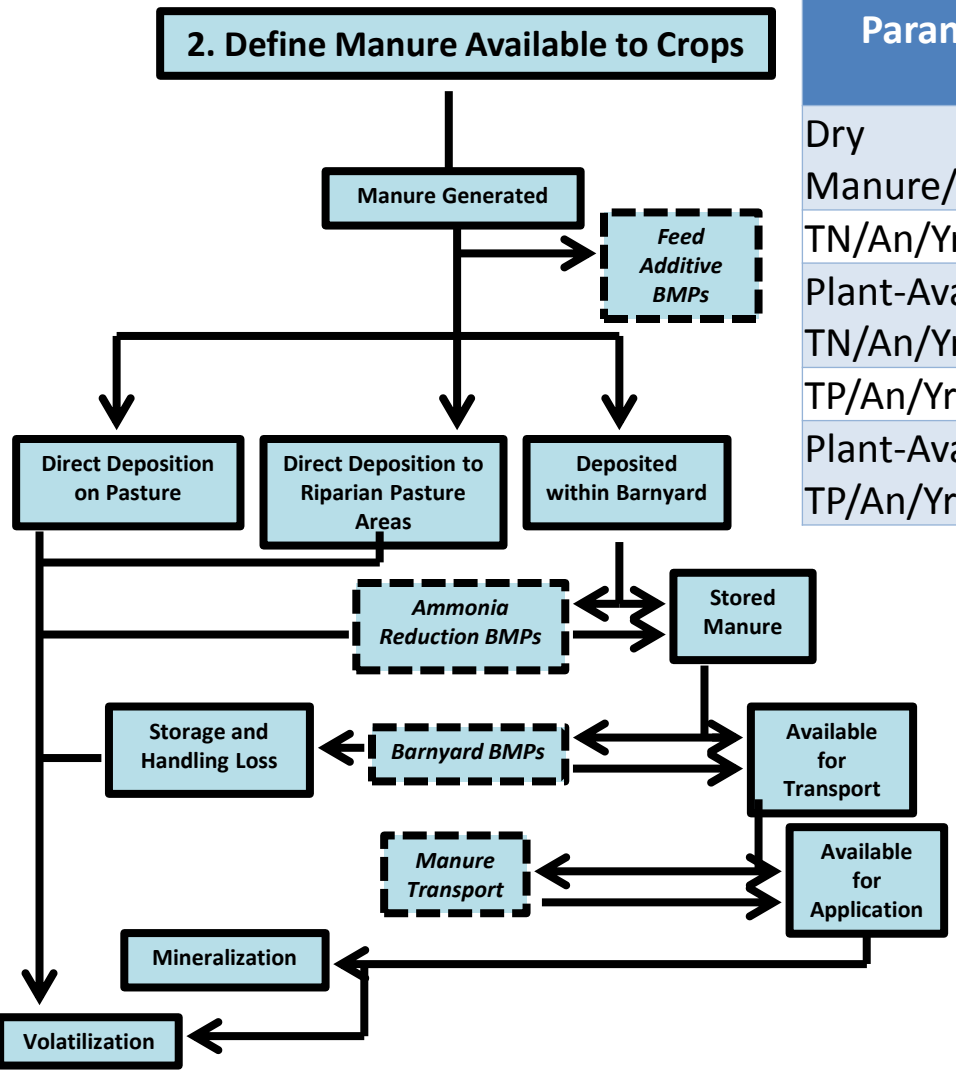
Animal Type	Manure Source	Lbs Dry Manure/Animal/Yr	Lbs TN/Lb Dry Manure	LbsTP/Lb Dry Manure
Beef	Use Beef - Cow (confinement) from ASAE 2005 for manure values	5,475.00	0.028788	0.006467
Dairy	Use Lactating Cow, Dry Cow and Heifer from ASAE 2005 for manure values	4,404.33	0.042221	0.006764
Other Cattle	Estimated based upon weighted average combination of Beef and Dairy from Census of Agriculture	1,605.07	0.035504	0.006616
Horses	Use average of Horse- Sedentary and Horse - Intense Exercise from ASAE 2005 for manure values	3,102.50	0.031672	0.005941
Hogs for Breeding	Swine Characterization Report;	220.62	.294653	Varies
Hogs for Slaughter	Swine Characterization Report;	97.09	0.106841	Varies
Sheep and Lambs	Use ASAE 2003 for manure values	240.9	0.038182	0.007909
Goats	Use ASAE 2003 for manure values	680.91	0.034615	0.008462
Pullets	PLS Report; See Appendix A	12.95	Varies	Varies
Layers	PLS Report; See Appendix A	17.89	Varies	Varies
Broilers	PLS Report; See Appendix A	Varies	Varies	Varies
Turkeys	Turkey Characterization Report;	7.62	Varies	Varies

Manure Generation – Animal Populations

Manure Generated

- Swine = Census of Agriculture
  - Inventory and Sales
- Layers and Pullets = Census of Agriculture
  - Inventory and Sales
- Broilers and Turkeys = NASS Annual Poultry Production Survey
- All Other Livestock = Census of Agriculture

Example Manure Calculation for Dairy



Parameter	Lbs Generated	Lbs Applied to Crops	% Reduction in Example
Dry Manure/An/Yr	4,404.33	1,437.24	-67%
TN/An/Yr	185.96	25.37	-86%
Plant-Available TN/An/Yr	130.85	11.70	-91%
TP/An/Yr	29.79	7.30	-75%
Plant-Available TP/An/Yr	29.79	7.30	-75%

- Example includes 0.5 T of dry manure transport for this dairy animal.
- Values for ALL processes on the left impact this result.
  - BMP efficiencies
  - Confinement fractions
  - Volatilization assumptions
  - Storage and Handling Loss assumptions
  - Mineralization Assumptions

Example Manure Calculation for Dairy

Parameter	Lbs	Source
Dry Manure/An/Yr	**4,404.33**	ASAE 2005
TN/Lb Dry Manure	0.04	ASAE 2005
TP/Lb Dry Manure	0.01	ASAE 2005
TN/An/Yr	**185.96**	Calculated from ASAE 2005
TP/An/Yr	**29.79**	Calculated from ASAE 2005

- Manure generation data comes from ASAE, 2005 or from PLS.
- Values are calculated on dry weight basis.

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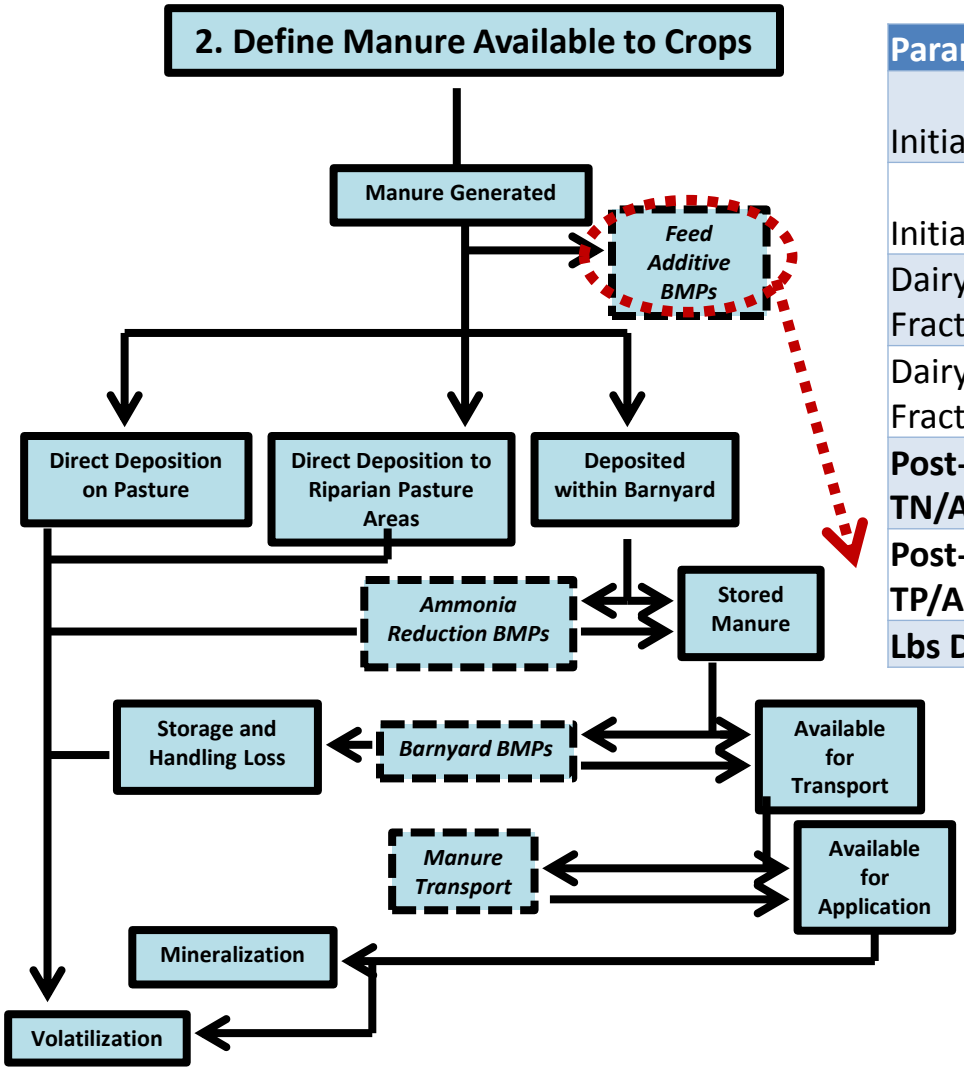
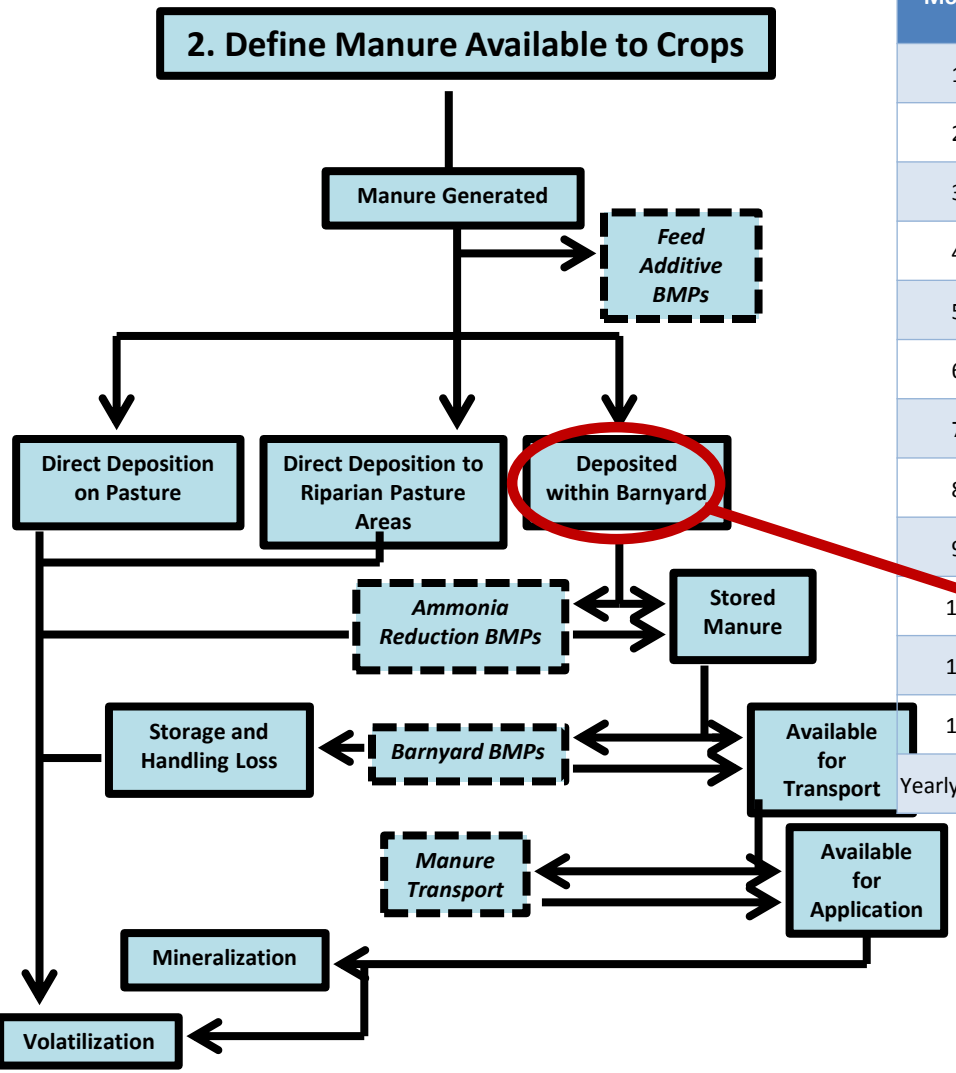


Parameter	Units	Source
Initial Lbs TN/An/Yr	185.96	Calculated from ASAE 2005
Initial Lbs TP/An/Yr	29.79	Calculated from ASAE 2005
Dairy Precision Feed Fraction N Reduction	0.24	CBP BMP
Dairy Precision Feed Fraction P Reduction	0.25	CBP BMP
Post-Feed Additive Lbs TN/An/Yr	**141.33**	CBP Calculation
Post-Feed Additive Lbs TP/An/Yr	**22.34**	CBP Calculation
Lbs Dry Manure/An/Yr	**4,404.33**	ASAE 2005

- Feed Additive BMPs are submitted by states, and can reduce nutrient concentrations within manure.

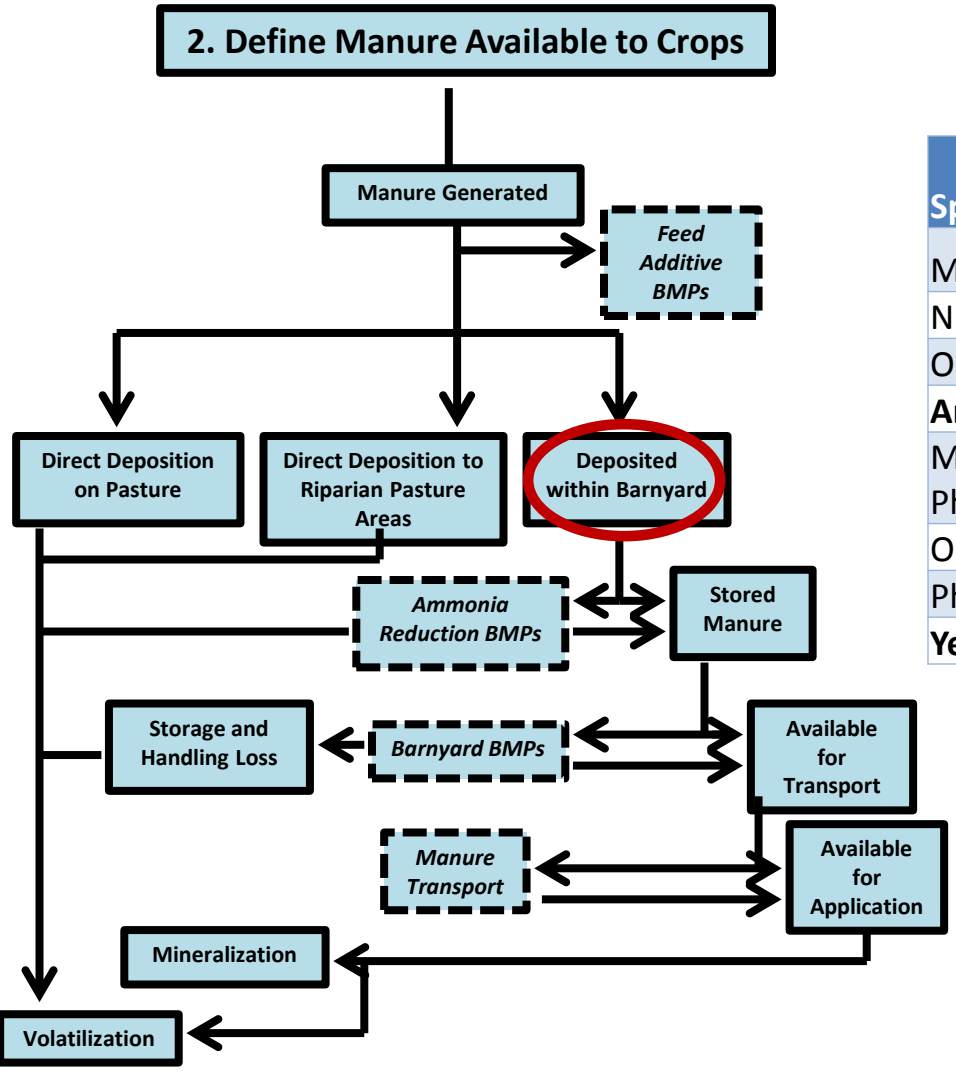
Example Manure Calculation for Dairy



Month	Total Lbs N/An	Total Lbs P/An	Total Lbs Dry Manure/An	Fraction Confinement	Confined Lbs N/An	Confined Lbs P/An	Confined Dry Lbs Manure/An
1	11.78	1.86	367.03	0.76	8.95	1.42	278.94
2	11.78	1.86	367.03	0.76	8.95	1.42	278.94
3	11.78	1.86	367.03	0.62	7.30	1.15	227.56
4	11.78	1.86	367.03	0.55	6.48	1.02	201.87
5	11.78	1.86	367.03	0.53	6.24	0.99	194.52
6	11.78	1.86	367.03	0.51	6.01	0.95	187.18
7	11.78	1.86	367.03	0.50	5.89	0.93	183.51
8	11.78	1.86	367.03	0.50	5.89	0.93	183.51
9	11.78	1.86	367.03	0.50	5.89	0.93	183.51
10	11.78	1.86	367.03	0.50	5.89	0.93	183.51
11	11.78	1.86	367.03	0.55	6.48	1.02	201.87
12	11.78	1.86	367.03	0.71	8.36	1.32	260.59
Yearly Total	141.33	22.34	4,404.33	NA	**82.32**	**13.01**	**2,565.52**

- Yearly manure is broken out into monthly manure, and separated between pasture (direct deposit or access area deposit) and barnyard (or confined).
- States provided fractions for time spent in each of the three areas.

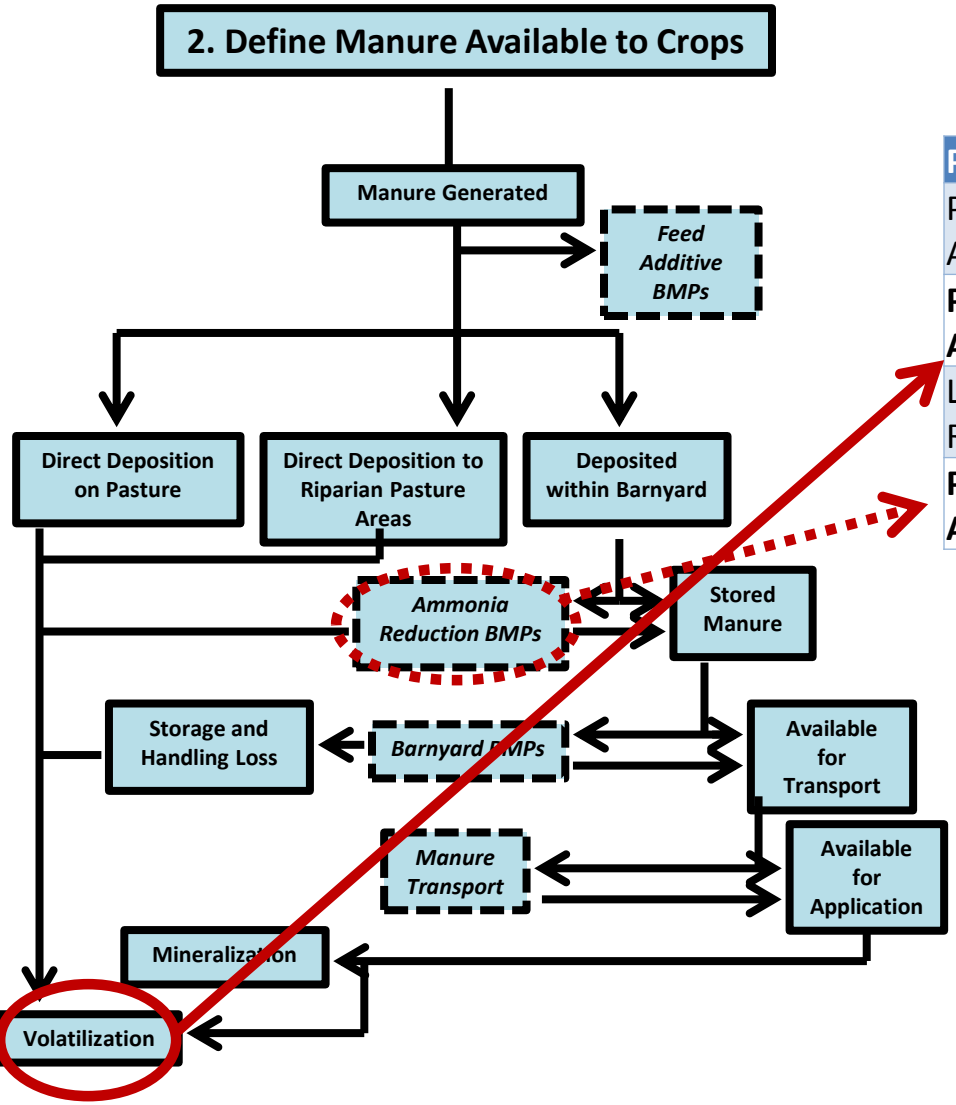
Example Manure Calculation for Dairy



Species	Lbs N Species/An /Yr	Lbs P Species/An /Yr
Mineralized Nitrogen	10.46	NA
Nitrate Nitrogen	0.00	NA
Organic Nitrogen	24.40	NA
Ammoniacal Nitrogen	**47.47**	NA
Mineralized Phosphorus	NA	0.42
Organic Phosphorus	NA	0.00
Phosphate	NA	12.60
Yearly Total Elemental	**82.32**	**13.01**

- At this point, the TN and TP can be broken into species to account for volatilization and future mineralization.

Example Manure Calculation for Dairy



Parameter	Units
Pre-Volatilization Lbs Ammoniacal N	47.47
Post-Volatilization Lbs Ammoniacal N	**25.24**
Lagoon Cover Volatilization Reduction Fraction	0.15
Post-Lagoon Cover Lbs Ammoniacal N	**29.69**

- A fraction of ammoniacal N is volatilized from the barnyard manure.
- Ammonia reduction BMPs are submitted by states, and can conserve ammonia N in the barnyard manure.

Volatilization of N

Animal Type	Fraction Excreted N Lost in Barnyard*	Fraction Excreted N Lost in Field**	Fraction Exctreted N Lost from Excretion to Field
Beef	0.35	0.04	0.39
Other Cattle	0.35	0.04	0.39
Dairy	0.27	0.18	0.45
Hogs for Slaughter	0.3	0.27	0.57
Hogs for Breeding	0.3	0.27	0.57
Broilers	0.4	0.06	0.46
Turkeys	0.4	0.06	0.46
Layers	0.4	0.06	0.46
Pullets	0.4	0.06	0.46
Horses	0.35	0.04	0.39
Sheep	0.35	0.06	0.41
Goats	0.35	0.06	0.41

*Average calculated from Rotz, 2003 values.

** Calculated from UMD, 2009 values for fraction of ammonium-nitrogen conserved after application with no incorporation. Values adjusted based upon fraction of ammonium-nitrogen estimated within manure following application.

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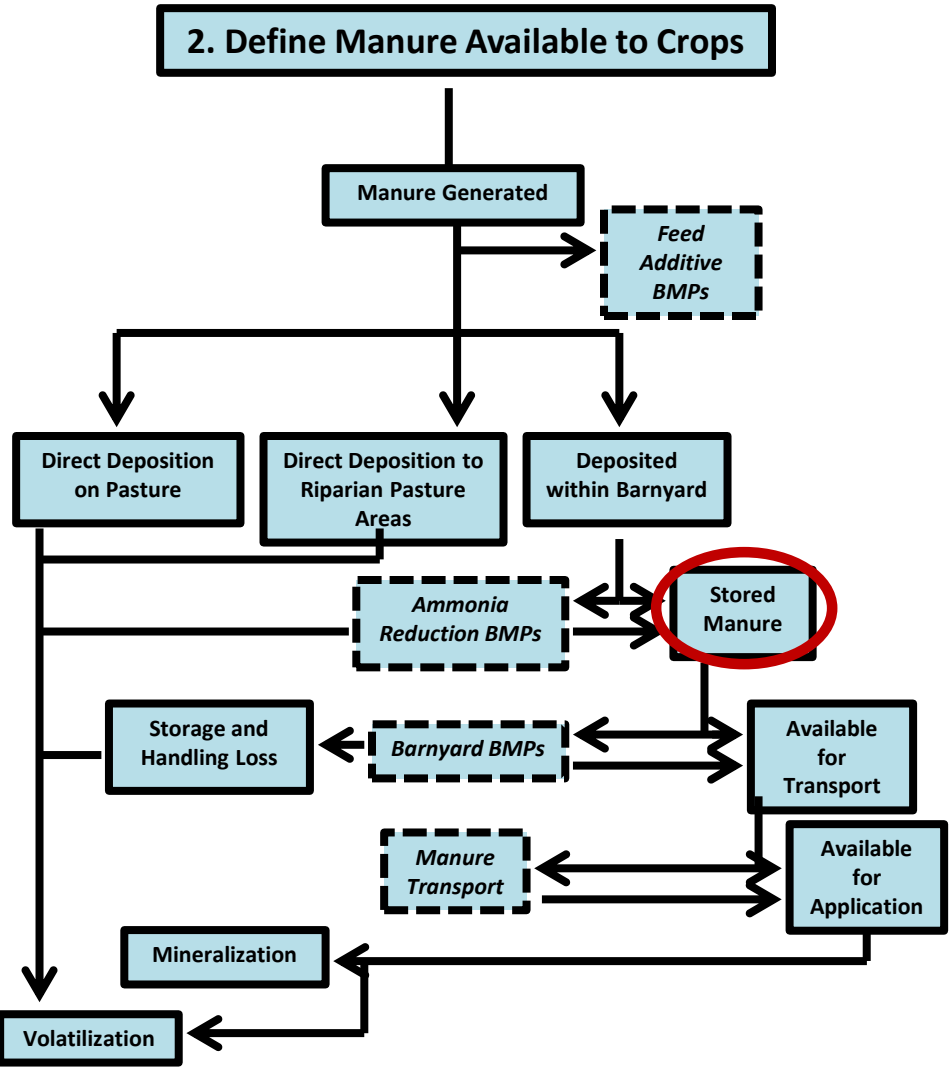
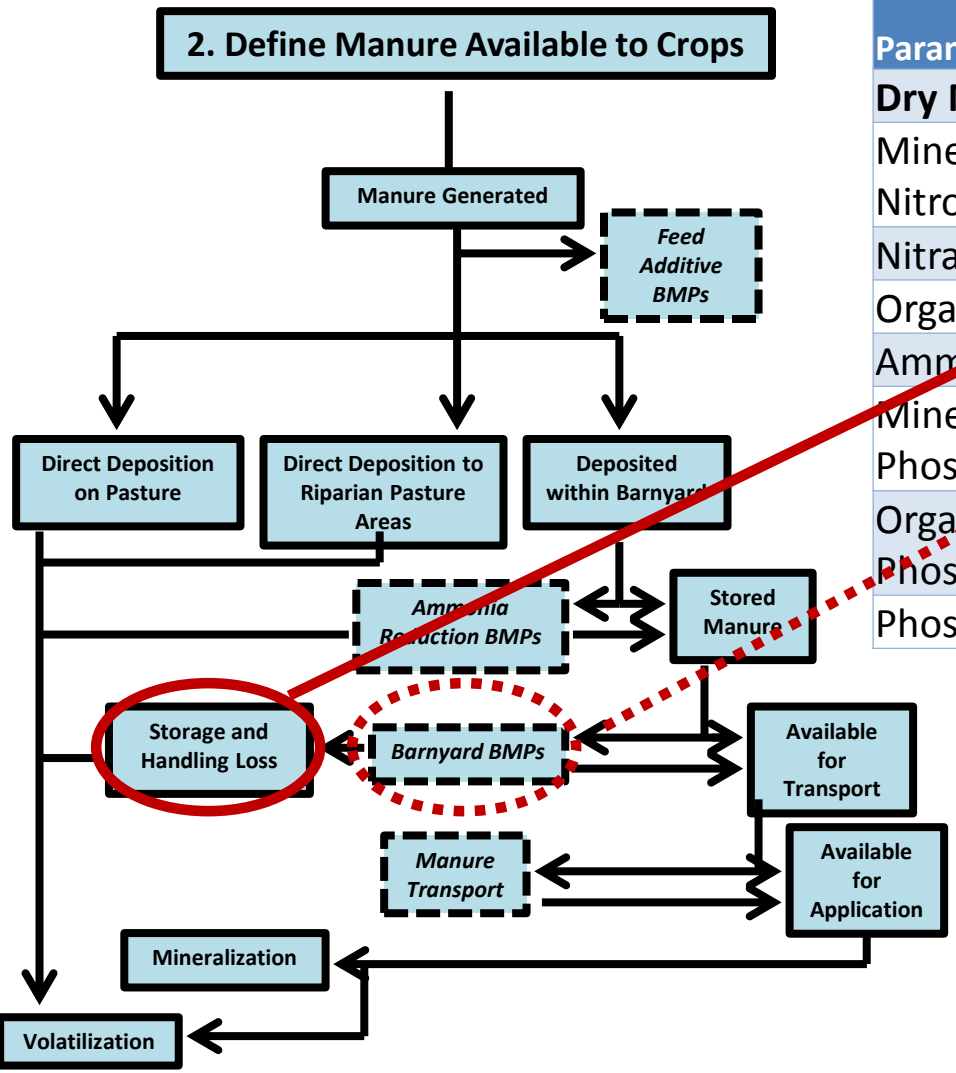


Parameter	Lbs/An/Yr
Dry Manure	2,565.52
Mineralized Nitrogen	10.46
Nitrate Nitrogen	0.00
Organic Nitrogen	24.4
Ammoniacal Nitrogen	25.24
Mineralized Phosphorus	0.42
Organic Phosphorus	0.00
Phosphate	12.60

- After volatilization and ammonia reduction BMPs, SB prepares to assess how much manure and nutrients within the barnyard are lost or transported prior to application to crops.

Example Manure Calculation for Dairy



Parameter	Lbs/An/Yr (Pre-Storage and Handling Loss)	Lbs/An/Yr (Post-Storage and Handling Loss)	Lbs/An/Yr (Post-AWMS)
Dry Manure	**2,565.52**	**1,924.14**	**2,437.24**
Mineralized Nitrogen	10.46	7.84	9.93
Nitrate Nitrogen	0.00	0.00	0.00
Organic Nitrogen	24.4	18.30	23.18
Ammonia Nitrogen	25.24	18.93	23.98
Mineralized Phosphorus	0.42	0.32	0.40
Organic Phosphorus	0.00	0.00	0.00
Phosphate	12.60	9.45	11.97

- Storage and handling loss values taken from expert panel report.
- AWMS BMPs are submitted by states, and can conserve manure within the barnyard.

% Recoverability

Animal	% Recoverable Without AWMS	% Recoverable with AWMS
Beef	60	99
Dairy	75	95
Other Cattle	60	99
Hogs for Slaughter	90	99
Hogs for Breeding	90	99
Broilers	90	99
Layers	90	99
Turkeys	90	99
Pullets	90	99
Sheep	95	98
Horses	95	98
Goats	95	98

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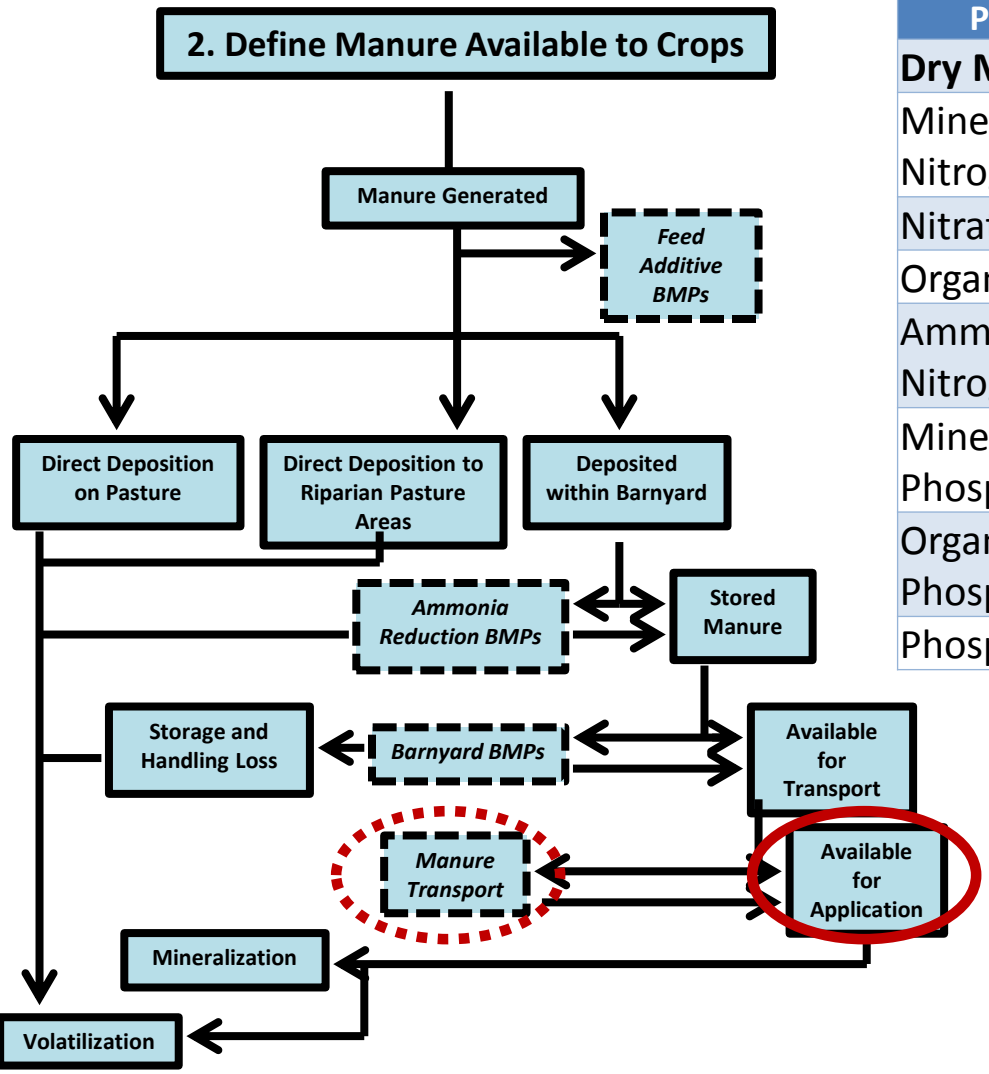

Parameter	Lbs/Yr (Post-AWMS)	Lbs/Yr (Post 0.5 T Manure Transport)
Dry Manure	**2,437.24**	**1,437.24**
Mineralized Nitrogen	9.93	5.86
Nitrate Nitrogen	0.00	0.00
Organic Nitrogen	23.18	13.67
Ammoniacal Nitrogen	23.98	14.14
Mineralized Phosphorus	0.40	0.24
Organic Phosphorus	0.00	0.00
Phosphate	11.97	7.06

- States submit manure transport by animal type and county.
- Manure may be transported into and out of counties, changing the associated nutrients available for application.

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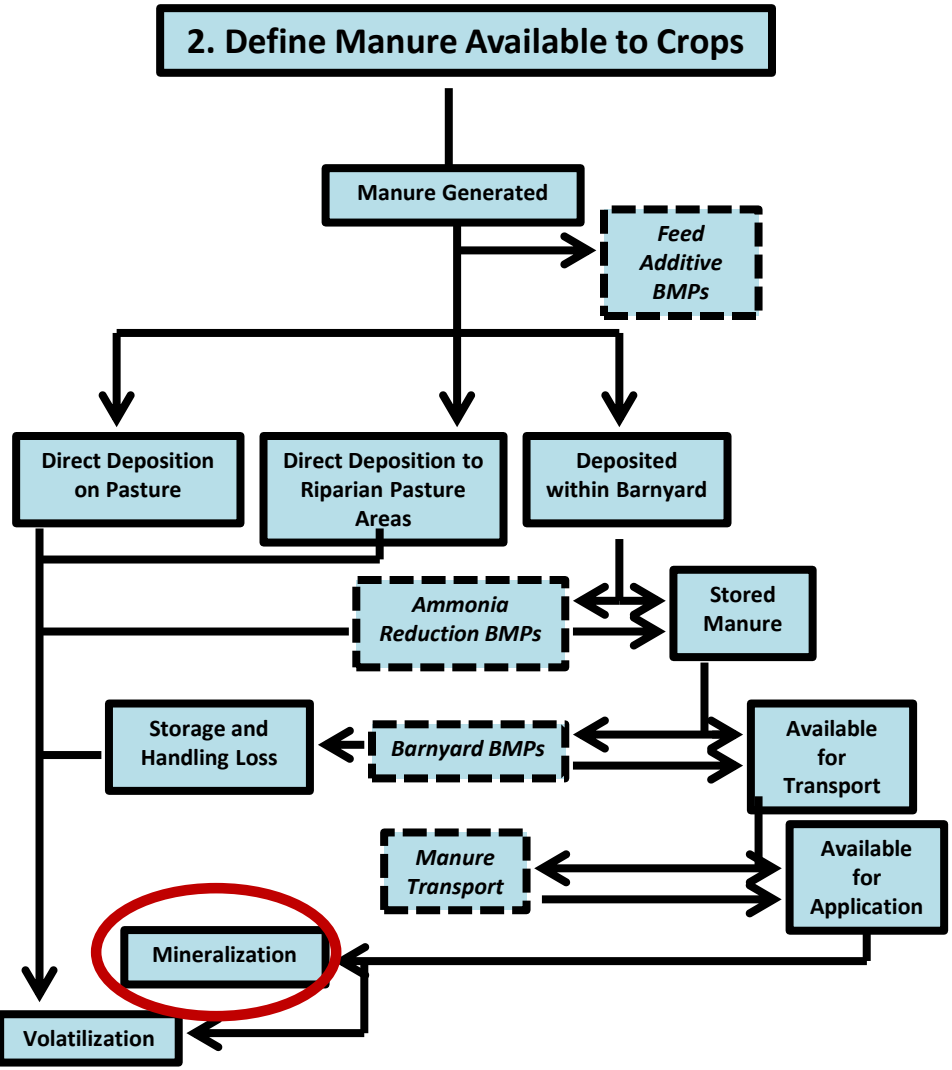

- Mineralization factors provided by Maryland's Nutrient Management Manual 2011 and Mid-Atlantic Water Program's Nutrient Management Handbook, 2013.

- 3-year mineralization factors chosen to represent 2000s, single-year for 1980s, and interpolated for 1990s.

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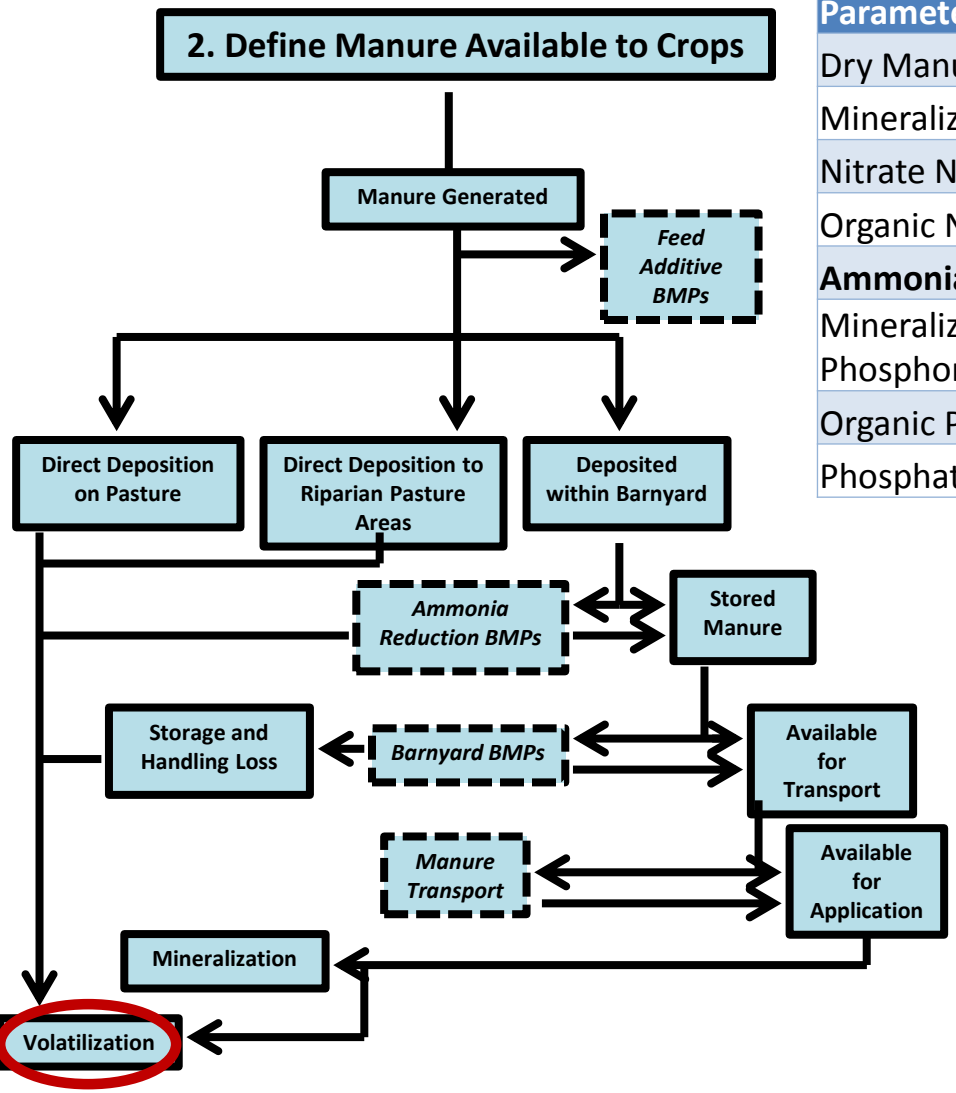


Parameter	Lbs/Yr (Pre-In-Field Vol)	Lbs/Yr (Post In-Field Vol)
Dry Manure	1,437.24	1,437.24
Mineralized Nitrogen	5.86	5.86
Nitrate Nitrogen	0.00	0.00
Organic Nitrogen	13.67	13.67
Ammoniacal Nitrogen	**14.14**	**5.84**
Mineralized Phosphorus	0.24	0.24
Organic Phosphorus	0.00	0.00
Phosphate	7.06	7.06

- In-field volatilization losses were assumed to equal no incorporation within 72 hours
- Only Mineralized N and Ammoniacal N are available for plants.

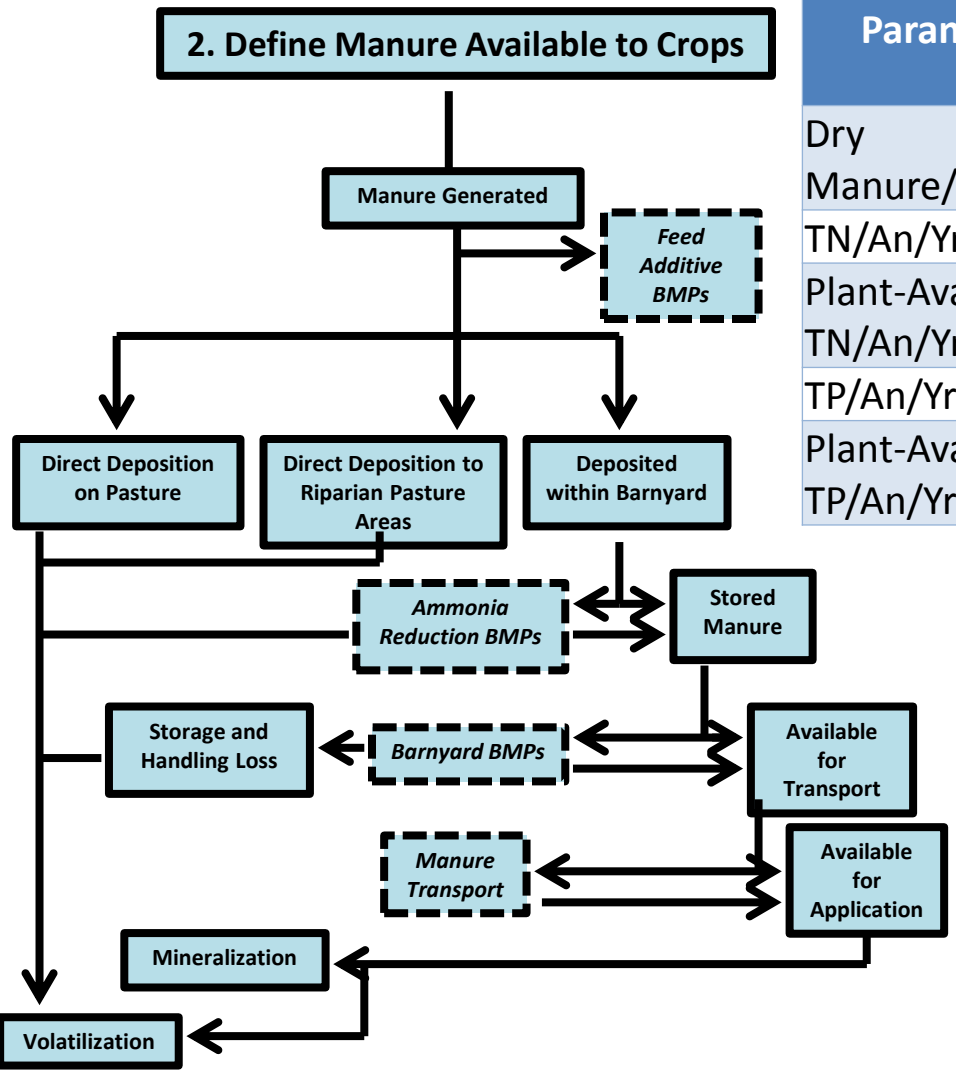
Volatilization of N

Animal Type	Fraction Excreted N Lost in Barnyard*	Fraction Excreted N Lost in Field**	Fraction Exctreted N Lost from Excretion to Field
Beef	0.35	0.04	0.39
Other Cattle	0.35	0.04	0.39
Dairy	0.27	0.18	0.45
Hogs for Slaughter	0.3	0.27	0.57
Hogs for Breeding	0.3	0.27	0.57
Broilers	0.4	0.06	0.46
Turkeys	0.4	0.06	0.46
Layers	0.4	0.06	0.46
Pullets	0.4	0.06	0.46
Horses	0.35	0.04	0.39
Sheep	0.35	0.06	0.41
Goats	0.35	0.06	0.41

*Average calculated from Rotz, 2003 values.

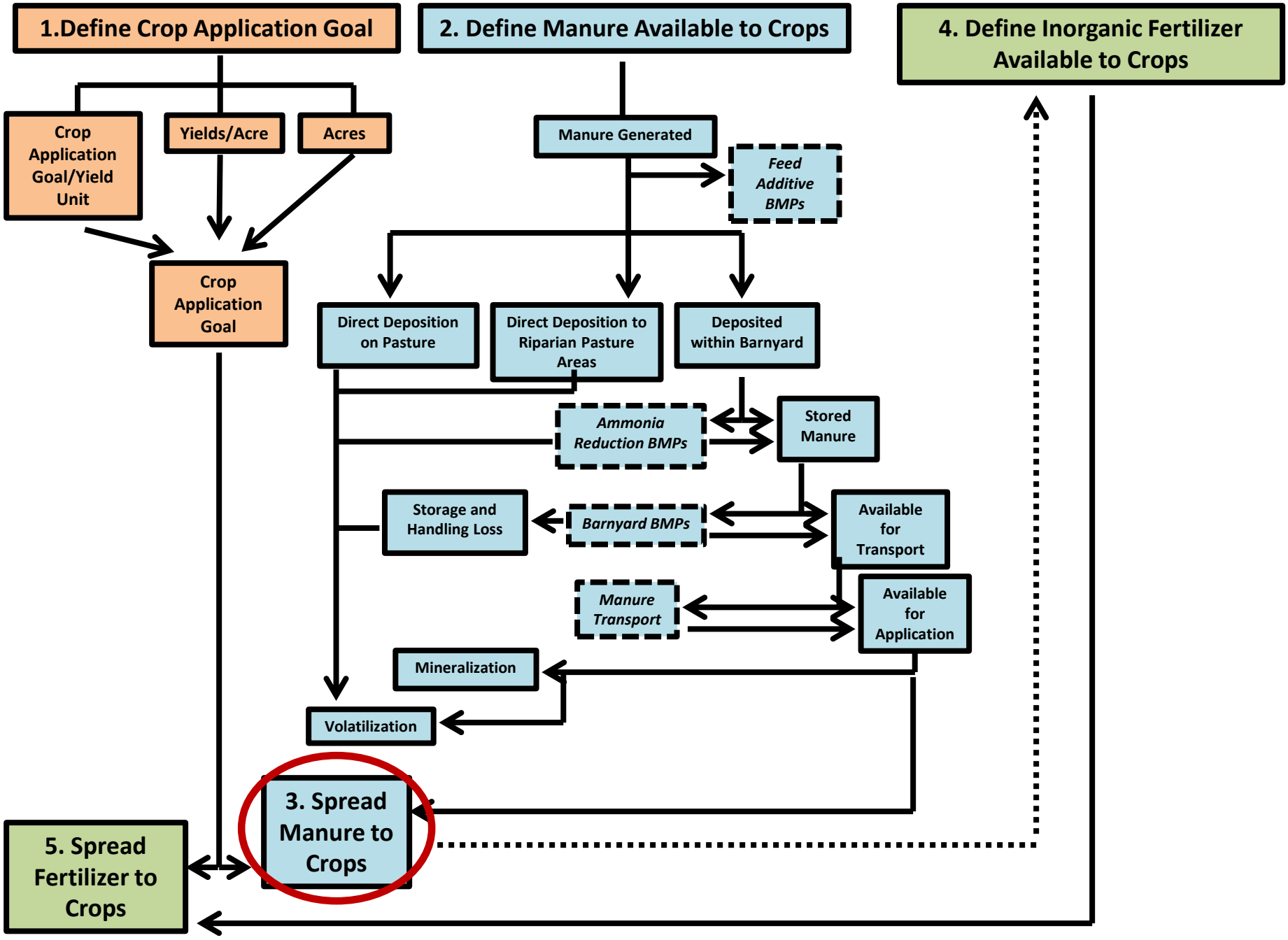
** Calculated from UMD, 2009 values for fraction of ammonium-nitrogen conserved after application with no incorporation. Values adjusted based upon fraction of ammonium-nitrogen estimated within manure following application.

Example Manure Calculation for Dairy



Parameter	Lbs Generated	Lbs Applied to Crops	% Reduction in Example
Dry Manure/An/Yr	4,404.33	1,437.24	-67%
TN/An/Yr	185.96	25.37	-86%
Plant-Available TN/An/Yr	130.85	11.70	-91%
TP/An/Yr	29.79	7.30	-75%
Plant-Available TP/An/Yr	29.79	7.30	-75%

- Example includes 0.5 T of dry manure transport for this dairy animal.
- Values for ALL processes on the left impact this result.
  - BMP efficiencies
  - Confinement fractions
  - Volatilization assumptions
  - Storage and Handling Loss assumptions
  - Mineralization Assumptions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2. Define Manure Available to Crops
4. Define Inorganic Fertilizer Available to Crops
Crop Application Goal/Yield Unit
Yields/Acre
Acres
Crop Application Goal
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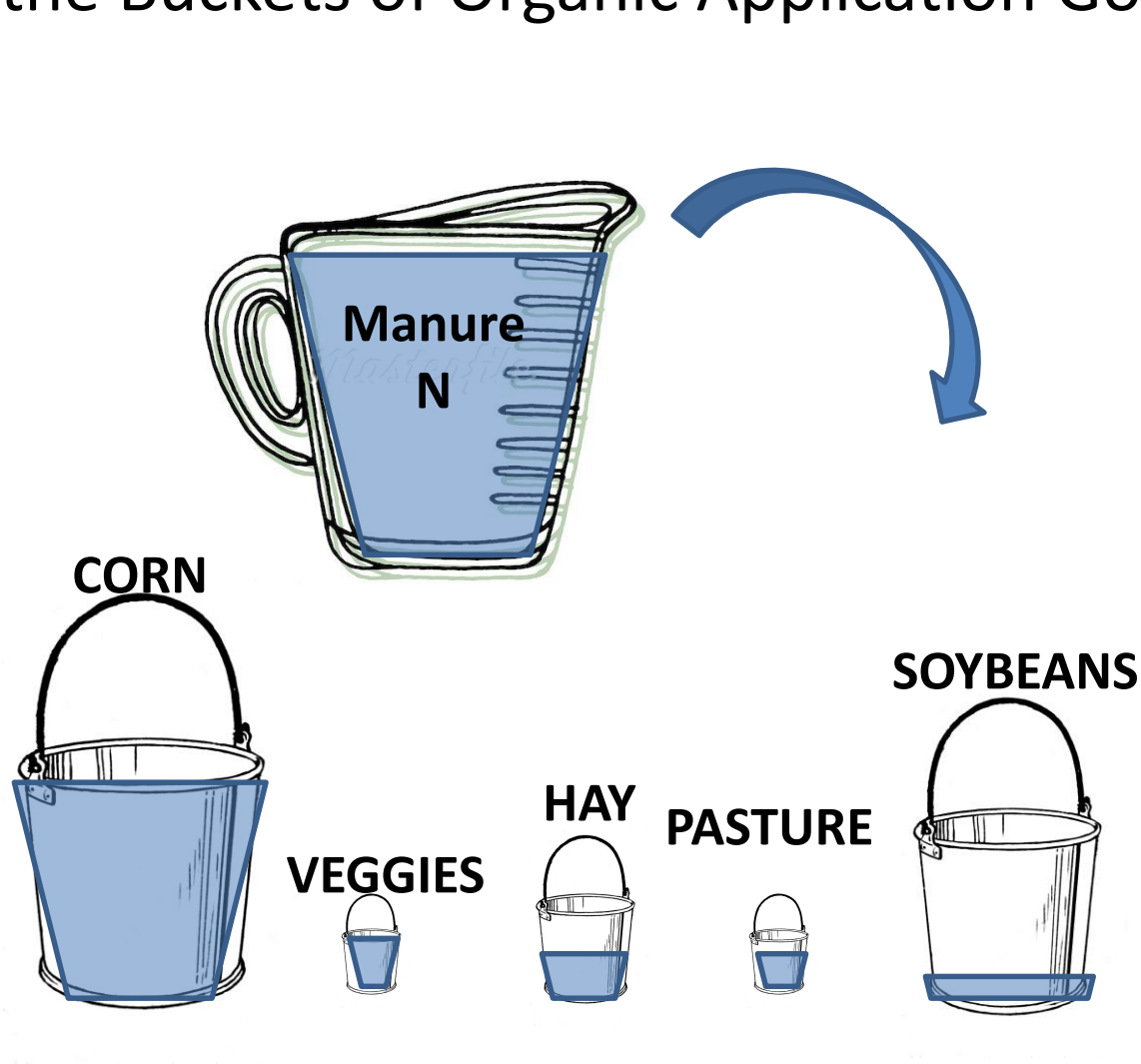
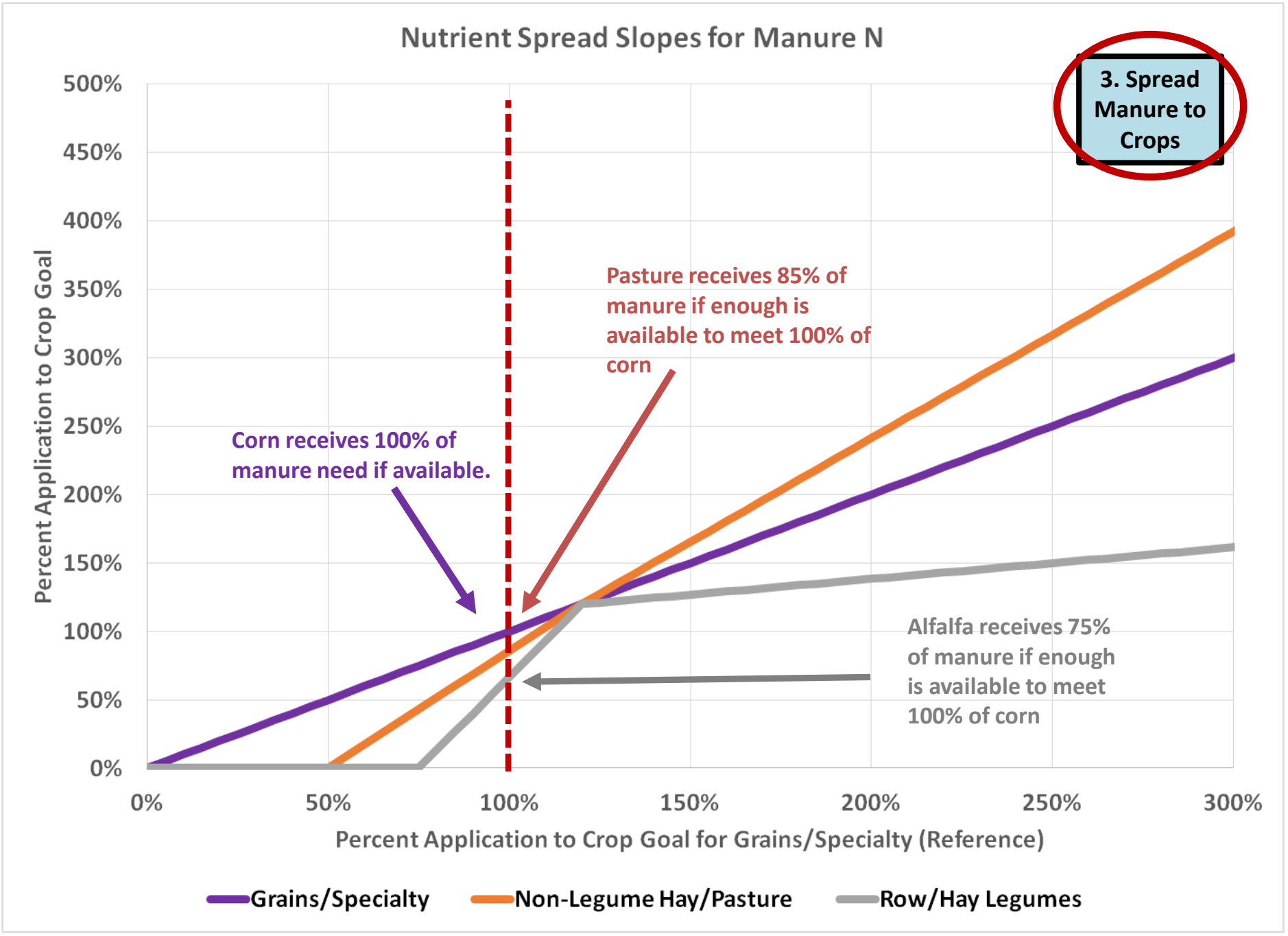
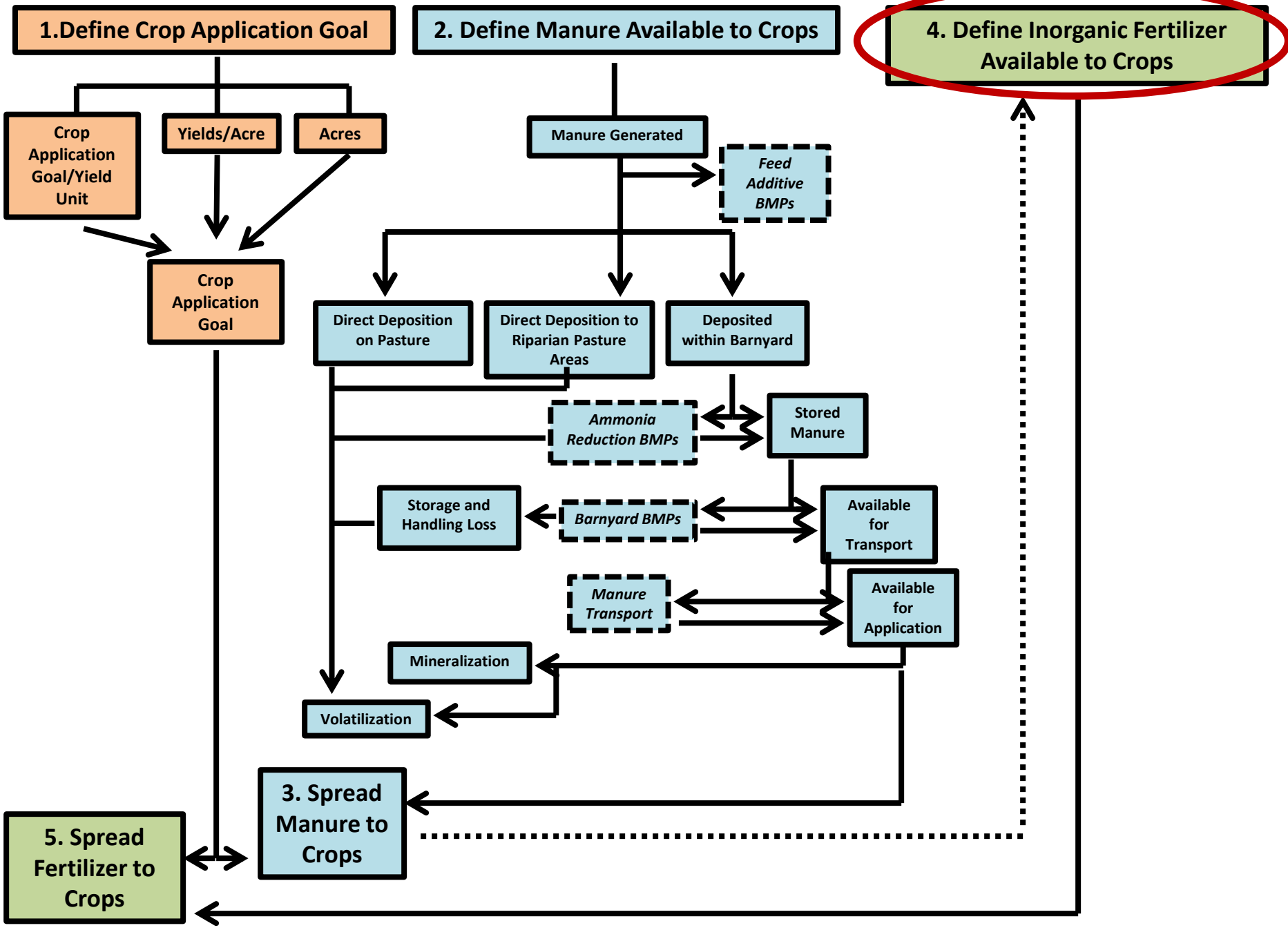
Direct Deposition to Riparian Pasture Areas
Deposited within Barnyard
Ammonia Reduction BMPs
Stored Manure
Storage and Handling Loss
Barnyard BMPs
Available for Transport
Manure Transport
Available for Application
Mineralization
Volatilization
3. Spread Manure to Crops
5. Spread Fertilizer to Crops

Filling the Buckets of Organic Application Goal




Nutrient Spread Slopes for Manure N
3. Spread Manure to Crops
Percent Application to Crop Goal
500%
450%
400%
350%
300%
250%
200%
150%
100%
50%
0%
Pasture receives 85% of manure if enough is available to meet 100% of corn
Corn receives 100% of manure need if available.
Alfalfa receives 75% of manure if enough is available to meet 100% of corn
0%
50%
100%
150%
200%
250%
300%
Percent Application to Crop Goal for Grains/Specialty (Reference)
Grains/Specialty
Non-Legume Hay/Pasture
Row/Hay Legumes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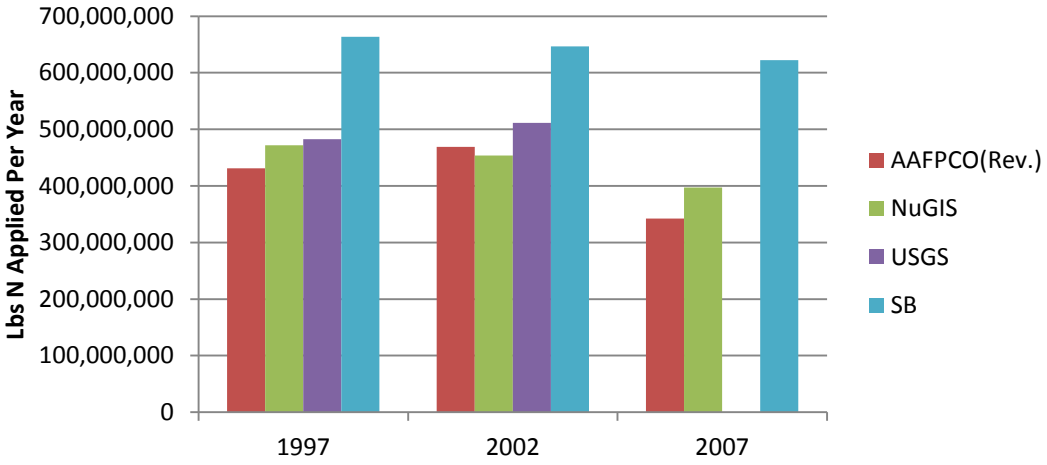
Comparing Across Methods

4. Define Inorganic Fertilizer Available to Crops

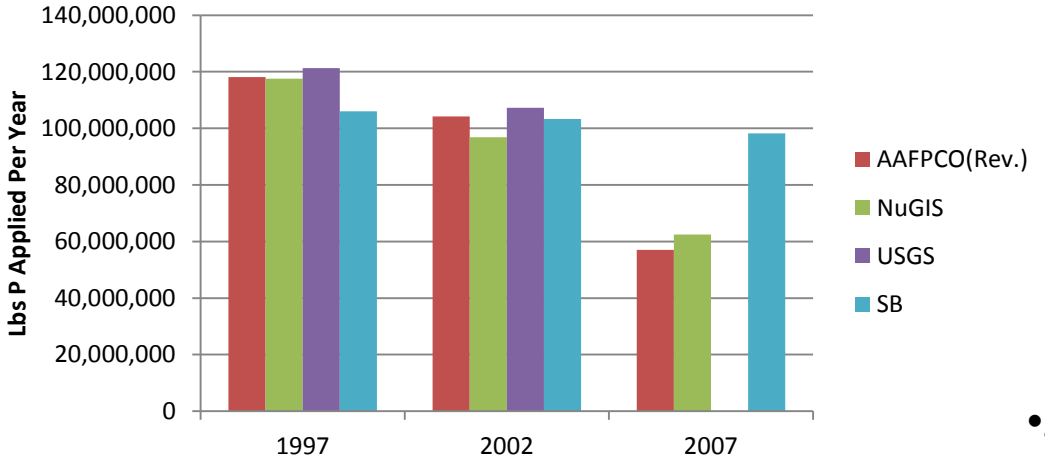
N Fertilizer Use Across Watershed



Differences in N Fertilizer Use Between AAFPCO Revised Method and Others

Year	NuGIS	USGS	SB
1997	-8.6%	-10.7%	-35.0%
2002	3.4%	-8.3%	-27.4%
2007	-13.8%	NA	-45.0%

P Fertilizer Use Across Watershed



Differences in P Fertilizer Use Between AAFPCO Revised Method and Others

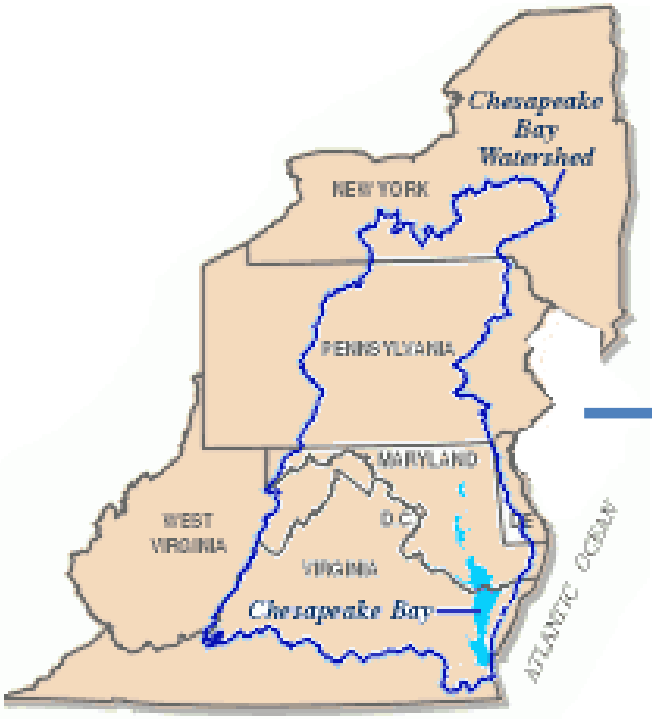
Year	NuGIS	USGS	SB
1997	0.4%	-2.6%	11.5%
2002	7.6%	-2.8%	1.0%
2007	-8.7%	NA	-41.9%

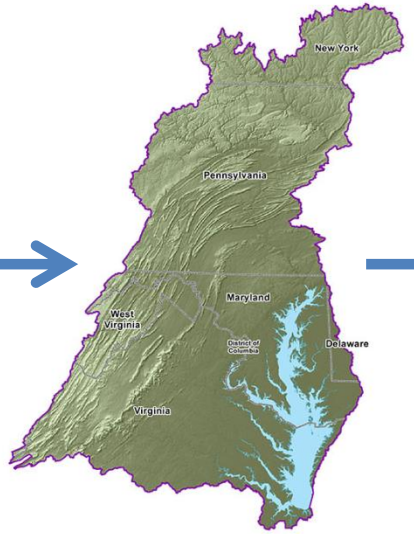
•Slide taken from May 14, 2014 presentation to AMS.

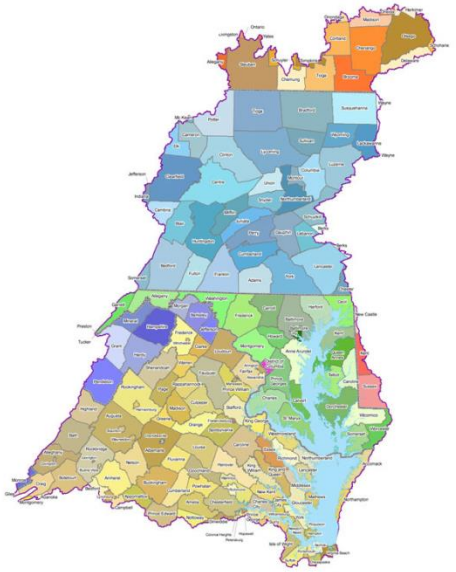
Inorganic: Going from Sales to Use

4. Define Inorganic Fertilizer Available to Crops

- Begin with regional-level sales, break those down to watershed-level sales, and break those down to county-level







•Sum AAPFCO sales across 6 states, and estimate sales used by farms.

•Calculate dollars spent on fertilizer from Ag Census in counties inside and outside watershed to "clip" watershed-only sales.

•Calculate fertilizer need by county as a fractional fertilizer need after manure is applied. Use value to distribute fertilizer to each county.

Example of Fertilizer Distribution Method for Nitrogen in 2012

4. Define Inorganic Fertilizer Available to Crops

- **Regional Farm Sales = 603,579,944 lbs N** or
  - *(Sum of lbs N sold across 6 states) X (3-year rolling average fraction of Farm Sales)*

- **Watershed-Wide Farm Sales = 413,741,002 lbs N** or
  - *(Regional Farm Sales)X (Fraction of Ag Census Expenditures on Fertilizer and Soil Amendments that occurred within the Watershed)*

- **Fertilizer Available for Hypothetical County = 8,274,820 lbs N** or **2%** of Watershed-Wide Farm Sales or
  - *(Watershed-Wide Farm Sales) X (Fraction of Fertilizer Goal within County)*

Fertilizer Comparisons

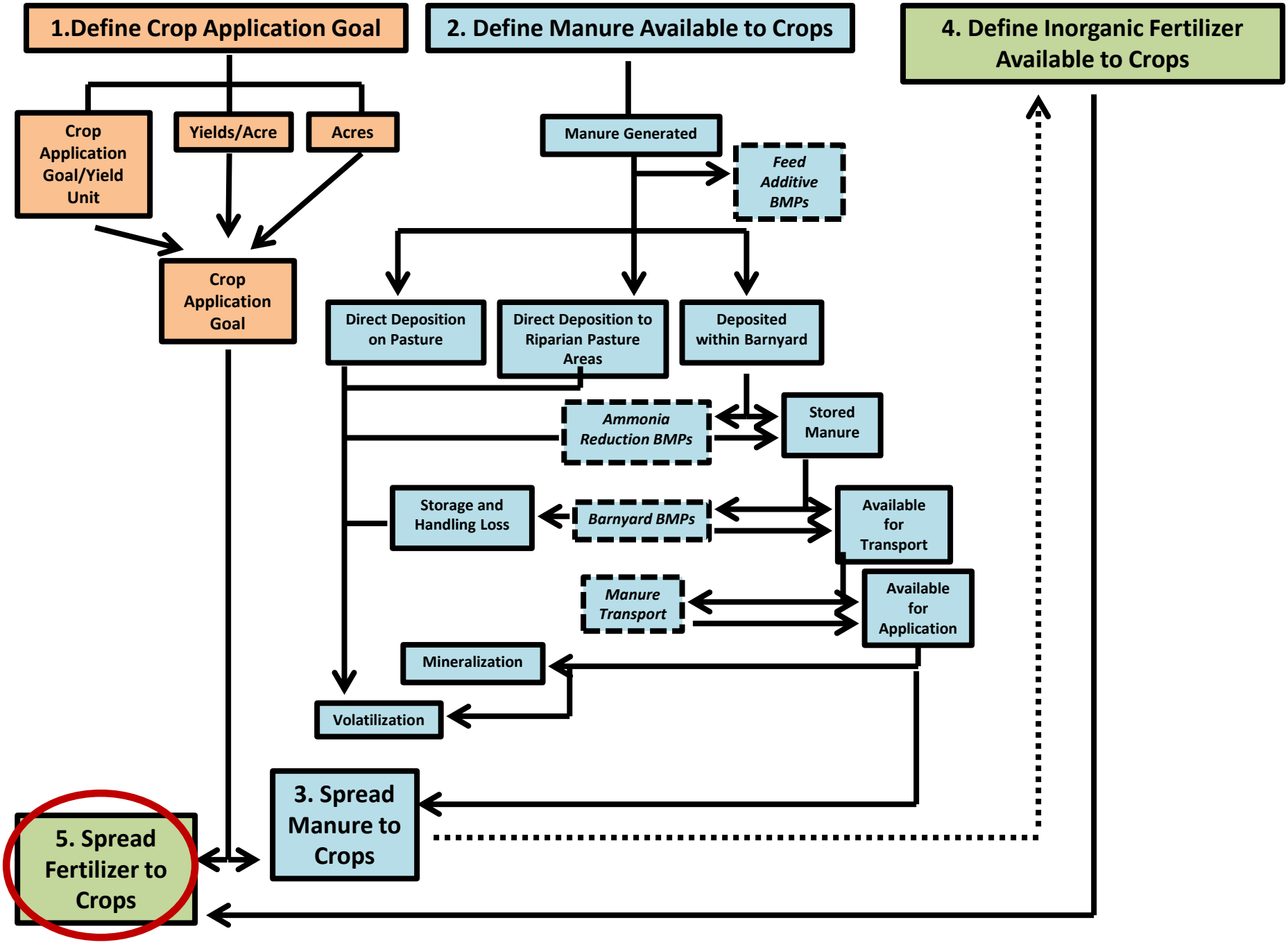
- Compared fertilizer inputs to CEAP and MD-farmer reported AIR data.

Comparing Total Inorganic Applications to Agriculture in Watershed

Data Source	Lbs Inorganic PAN	Lbs Inorganic P	% Delta from CEAP N	% Delta from CEAP P
CEAP	406,020,000	80,870,000	NA	NA
Phase 6 (Avg. 2001-2006)	405,179,787	80,359,516	**-0.2%**	**-0.6%**

Comparing Total Inorganic Applications to Agriculture in Maryland in 2012

Scenario	Lbs Inorganic PAN	Lbs Inorganic P	% Delta from AIR for N	% Delta from AIR for P
MD AIR	76,946,211	8,087,974	NA	NA
Phase 6	76,057,166	8,624,024	**-1.2%**	**+6.6%**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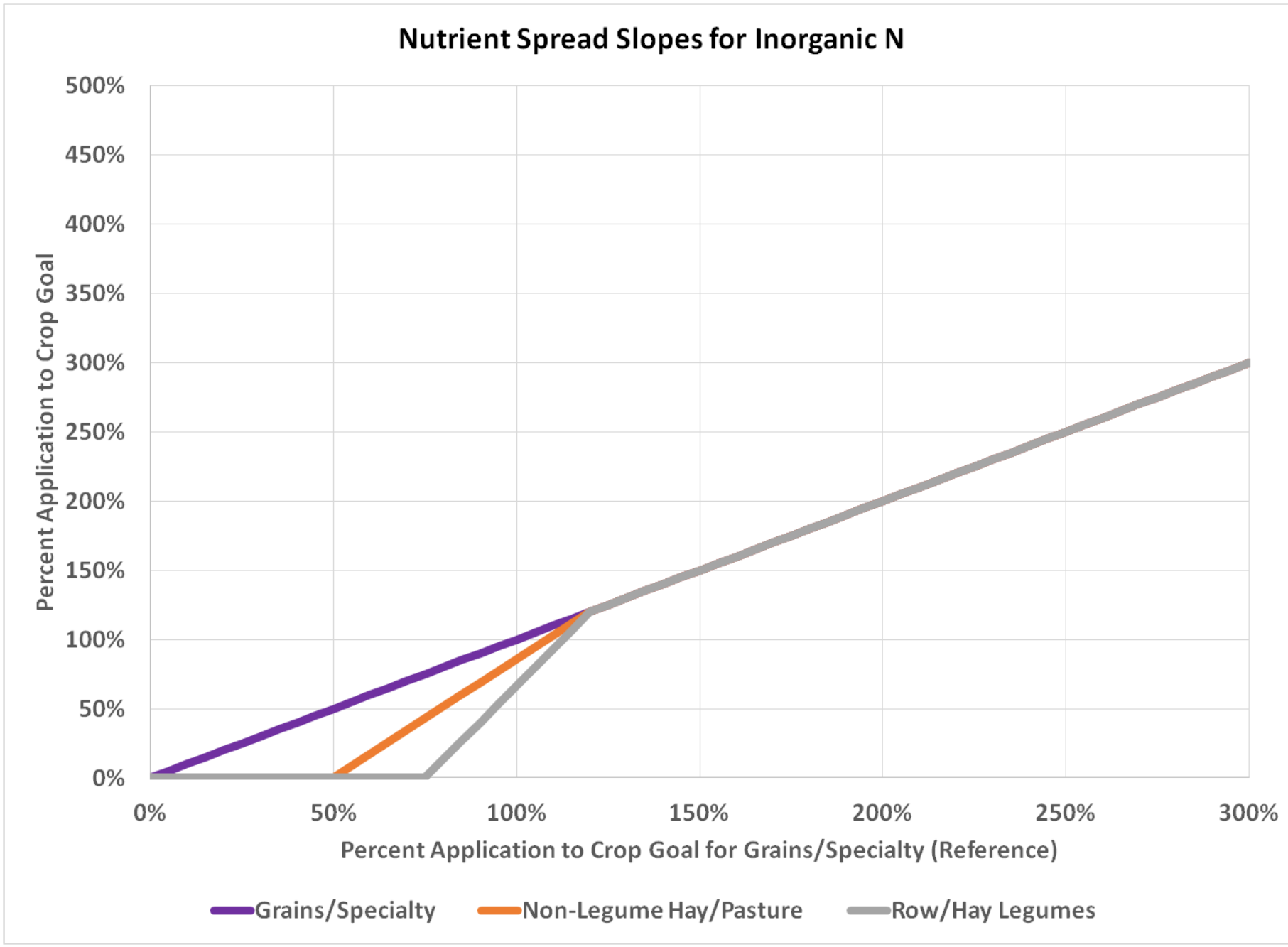
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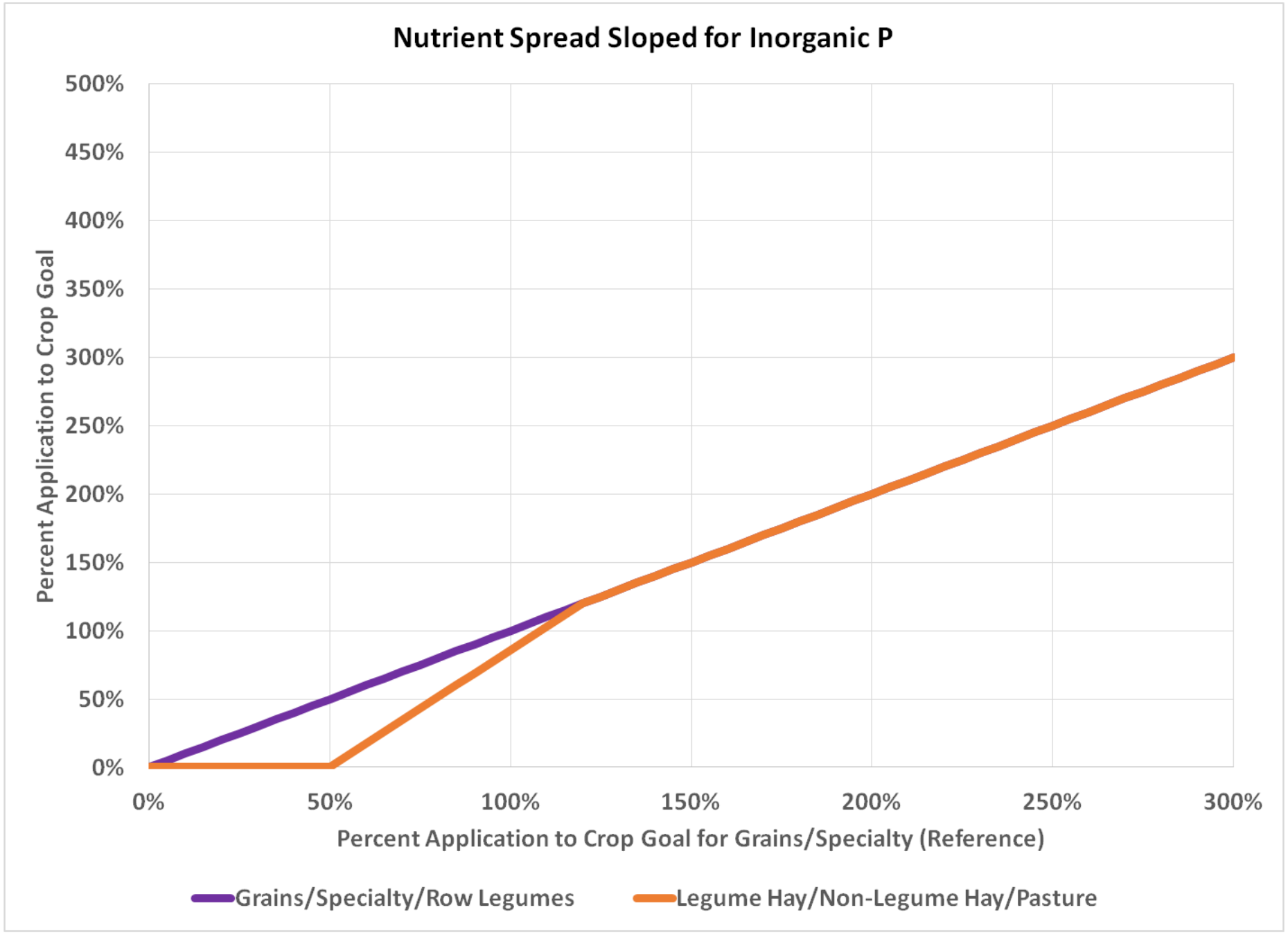
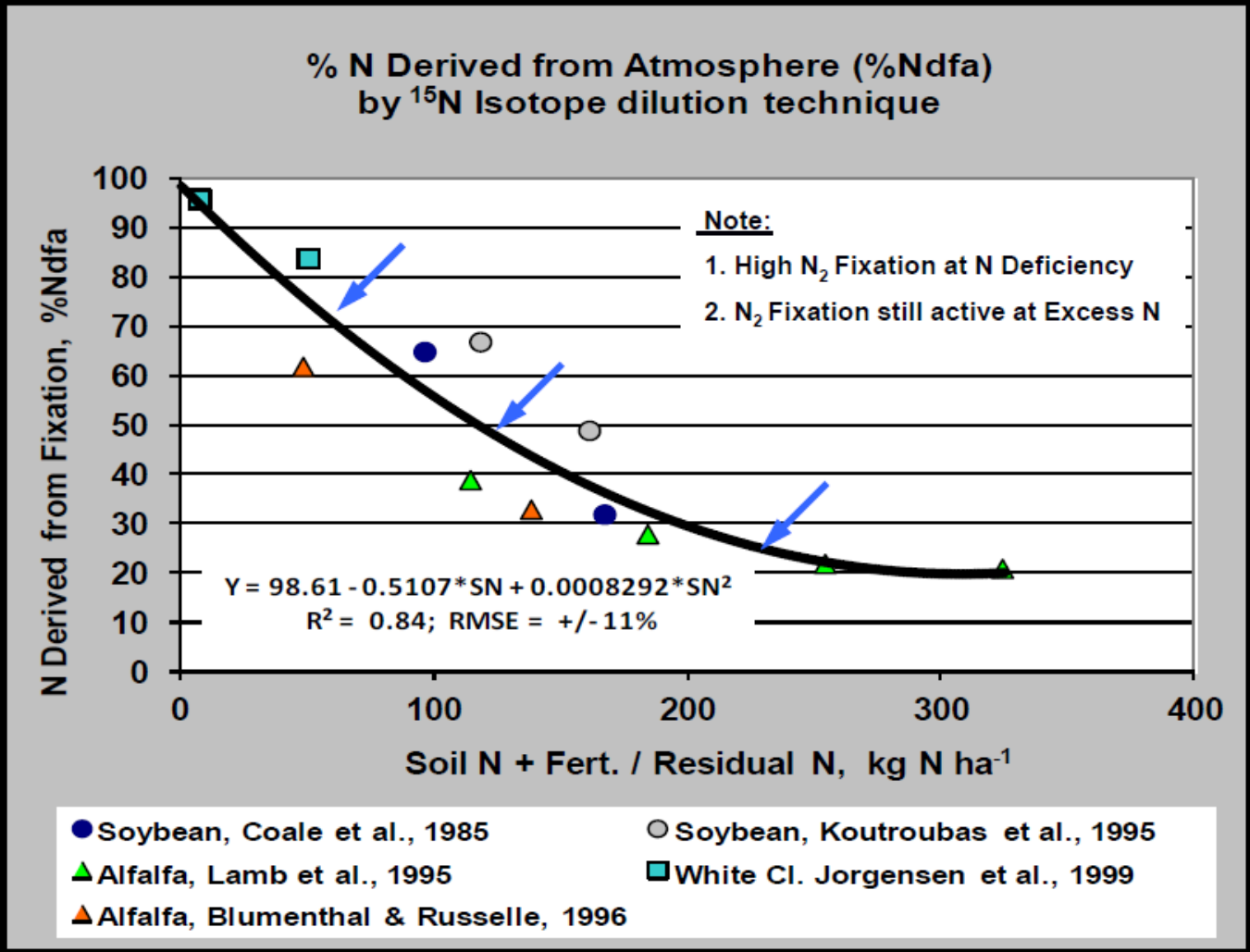
500%
450%
400%
350%
300%
250%
200%
150%
100%
50%
0%
Percent Application to Crop Goal
0%
50%
100%
150%
200%
250%
300%
Percent Application to Crop Goal for Grains/Specialty (Reference)
Grains/Specialty
Non-Legume Hay/Pasture
Row/Hay Legumes


Nutrient Spread Sloped for Inorganic P
500%
450%
400%
350%
300%
250%
200%
150%
100%
50%
0%
Percent Application to Crop Goal
0%
50%
100%
150%
200%
250%
300%
Percent Application to Crop Goal for Grains/Specialty (Reference)
Grains/Specialty/Row Legumes
Legume Hay/Non-Legume Hay/Pasture

What do we need to calculate Legume Fixation?

- Crop Removal
- Estimated contribution of PAN from soil
  - Assumed to be 45 lbs PAN/acre based upon an assumption of 1.5% organic matter and Meisinger, Randall, 1991 equation
- Estimated applications of PAN from manure and inorganic fertilizer
- % N Fixation based upon Meisinger, Randall 1991 regression

Estimating N_2 Fixation: Percent of Crop N Yield from N_2 Fixation and Influence of Soil N



Slide adopted from Meisinger, 2016; source – Meisinger, Randall, 1991

Legume Fixation with 0 applications of PAN from manure and fertilizer

Crop Name	Avg Lbs N Fixed/Acre
Alfalfa Hay Harvested Area	240
Alfalfa seed Harvested Area	158
Birdsfoot trefoil seed Harvested Area	88
Cropland used only for pasture or grazing Area	16
Dry edible beans, excluding limas Harvested Area	69
Green Lima Beans Harvested Area	106
Haylage or greenchop from alfalfa or alfalfa mixtures Harvested Area	81
Other haylage, grass silage, and greenchop Harvested Area	16
Pastureland and rangeland other than cropland and woodland pastured Area	16
Peanuts for nuts Harvested Area	141
Peas, Chinese (sugar and Snow) Harvested Area	106
Peas, Green (excluding southern) Harvested Area	106
Peas, Green Southern (cowpeas) – Black-eyed, Crowder, etc. Harvested Area	106
Red clover seed Harvested Area	110
Snap Beans Harvested Area	106
Soybeans for beans Harvested Area	152
Vetch seed Harvested Area	195