

Crop Nutrient Application Scenarios

Chris Brosch, DE Nutrient Management Commission

8.17.23

Today's discussions:

- AMT Tested CAST scenarios:
 - Making all manure eligible crops on manure eligible land uses 100% eligible for manure applications and remove the timing component to create a single annual average application
- Delmarva change for CAST23
 - Turned on manure eligibility for crops that had low limits (% of total need)
 - Made timing of those applications in DE match MD ES. (perhaps no effect)

Yield goal to establish nutrient need

Step 1.

- Calculate the acres of crop

Step 2.

- Separate acres into nutrient management (NM) acres and non-nutrient management acres

Step 3.

- Determine the yield for each crop

Step 4.

- Calculate the mass of nutrients required to produce the yields

Step 5.

- Determine timing and land use application eligibility

Step 6.

- Distribute biosolids then manure then inorganic fertilizer to meet crop need

Yield data sources

NASS surveys

Annual data

Acres and yields

Census of Agriculture

Every five years

Acres and yields

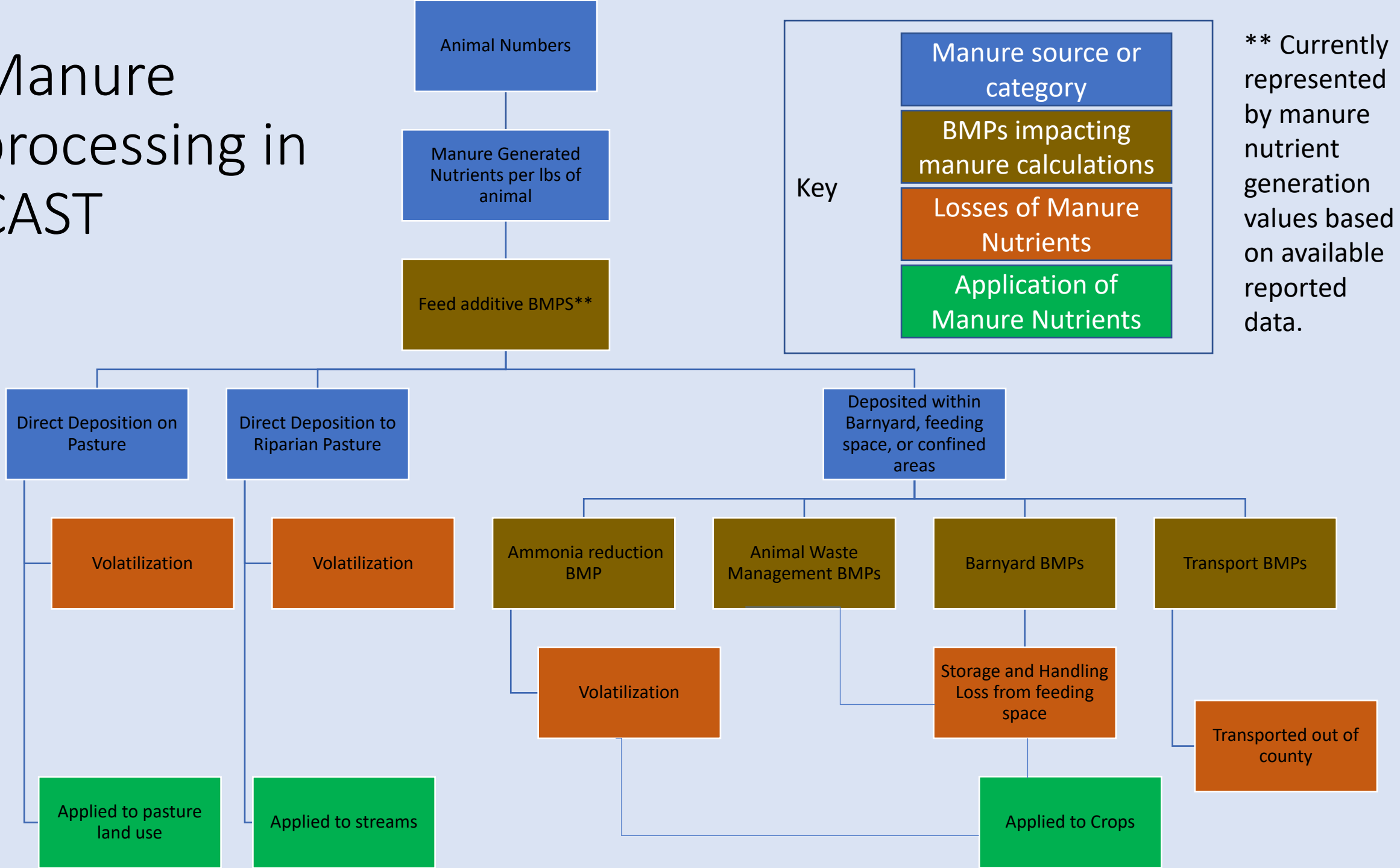
Scenario builder max yields

No yield data

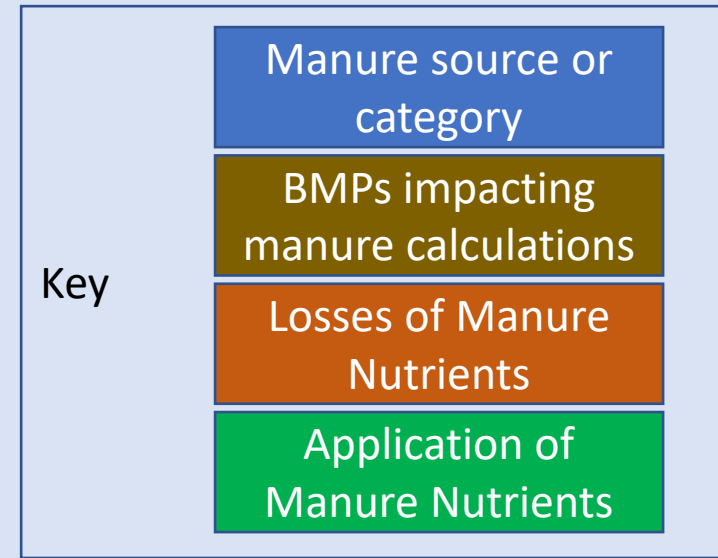
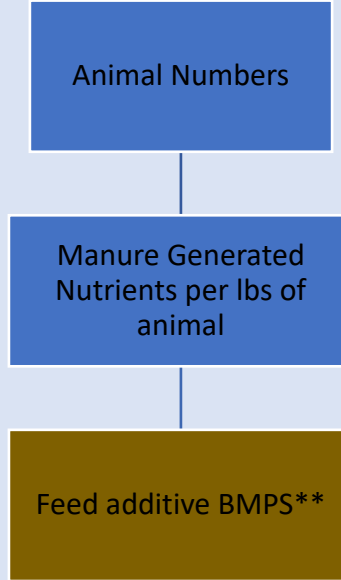
90 crops

Max yields from literature values

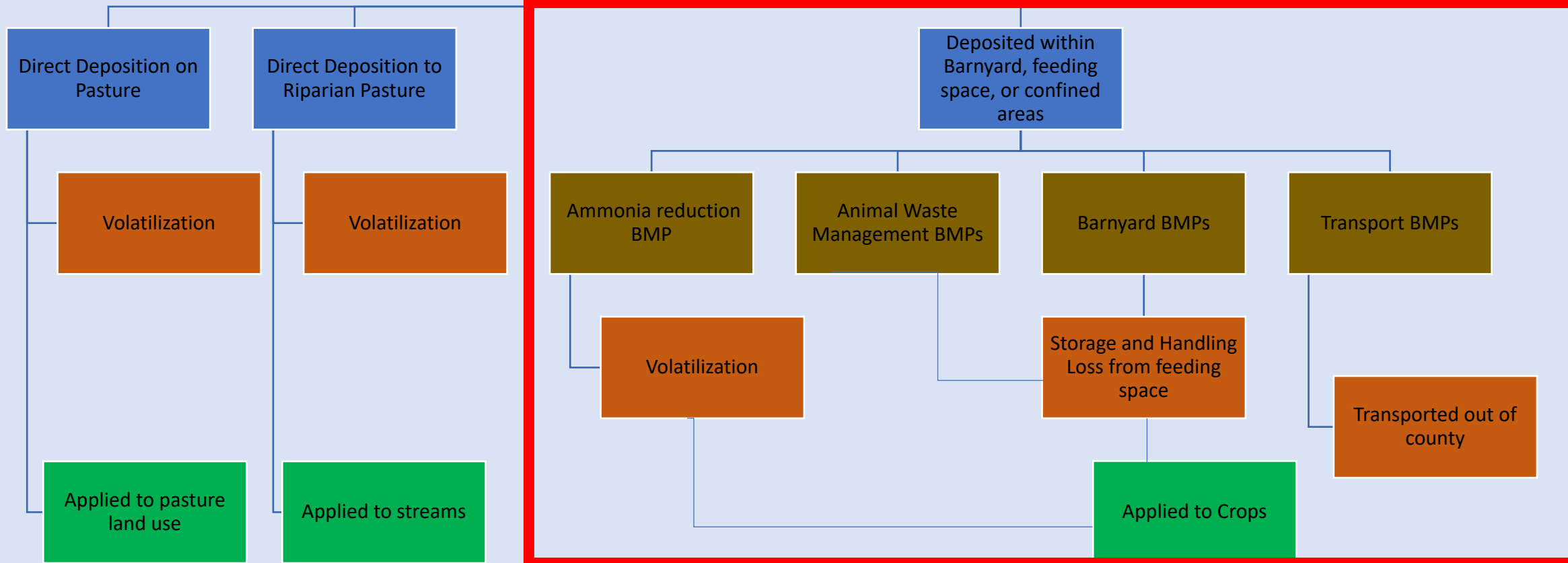
Manure processing in CAST



Manure processing in CAST

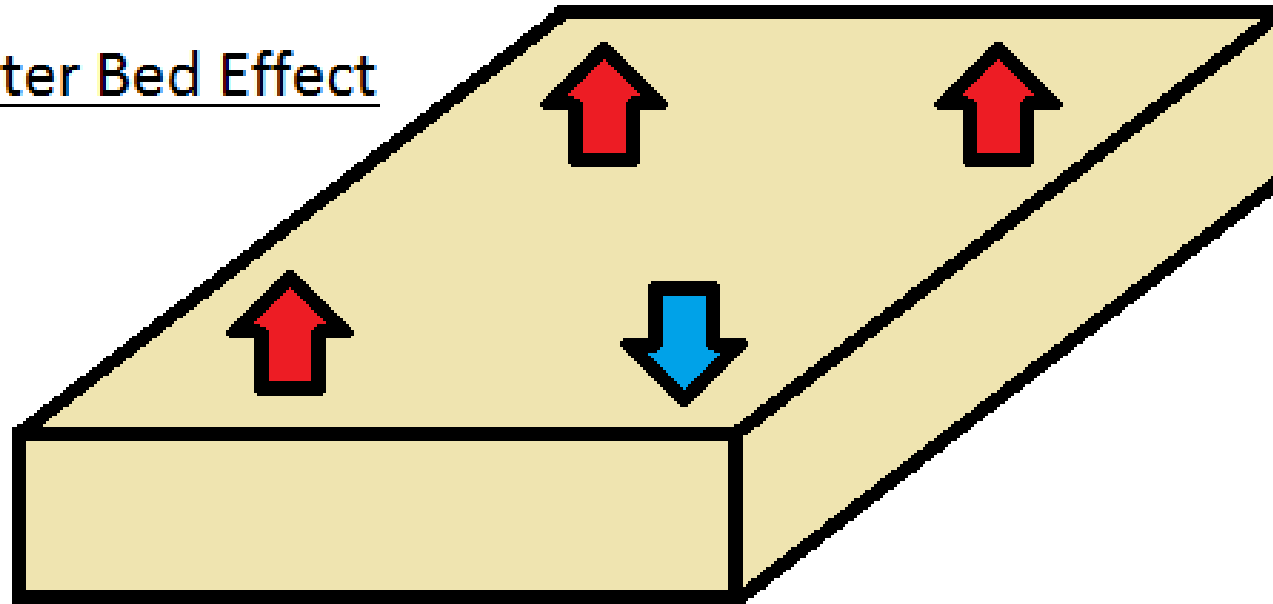


** Currently represented by manure nutrient generation values based on available reported data.



Trade-offs: The Water Bed Effect

Water Bed Effect



Optimizations are not always free. Making changes to increase one thing may have negative trade-offs in other areas.

Manure processing in CAST

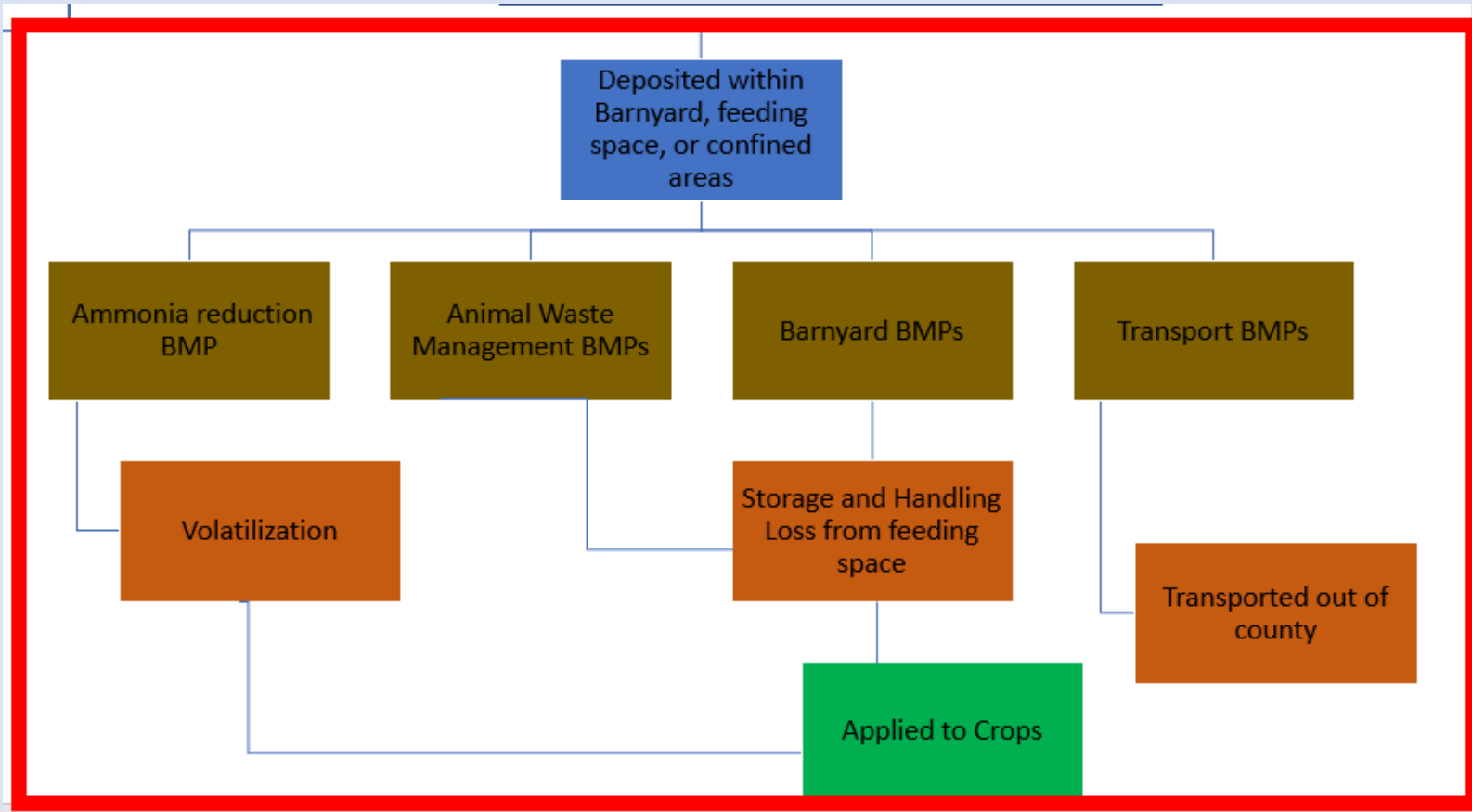
Key

Manure source or category

BMPs impacting manure calculations

Losses of Manure Nutrients

Application of Manure Nutrients



Nutrient eligibility

- All can get nutrient application
- 11 can get manure application

Land Uses eligible to receive nutrient application

Double Cropped Land

Full Season Soybeans

Grain with Manure

Grain without Manure

Leguminous Hay

Other Agronomic Crops

Other Hay

Pasture

Silage with Manure

Silage without Manure

Small Grains and Grains

Specialty Crop High

Specialty Crop Low

Manure eligibility

- States supply these eligibility requirements
 - Even if a land use can accept manure that does not mean that it will.
 - Even if a crop is on a land use that can accept manure does not mean it does
 - Even a crop that can accept manure does not mean that 100% of it's need is manure eligible
- “disposal” manure is applied beyond the need in ~10 counties with over abundance.
- <https://cast.chesapeakebay.net/Home/SourceData>



- BMP Definitions
- Efficiency BMPs
- Load Source Conversion BMPs
- Load Reduction BMPs

- BMP Units
- BMP Load Source Group
- Load Source Group Components
- BMP Animal Group

- Geographic References
- Geographic Scale and Names
- Agencies
- Delivery Factors

Download Source Data

Download data tables including the tables listed below. Note that actual crop nutrient applications vary depending on acres of the crop, application yield goal, nutrient management, and monthly timing, and type and amount of nutrients available. The tables provide the factors used to determine the nutrient application amounts that may be applied depending on the specific conditions in any scenario.

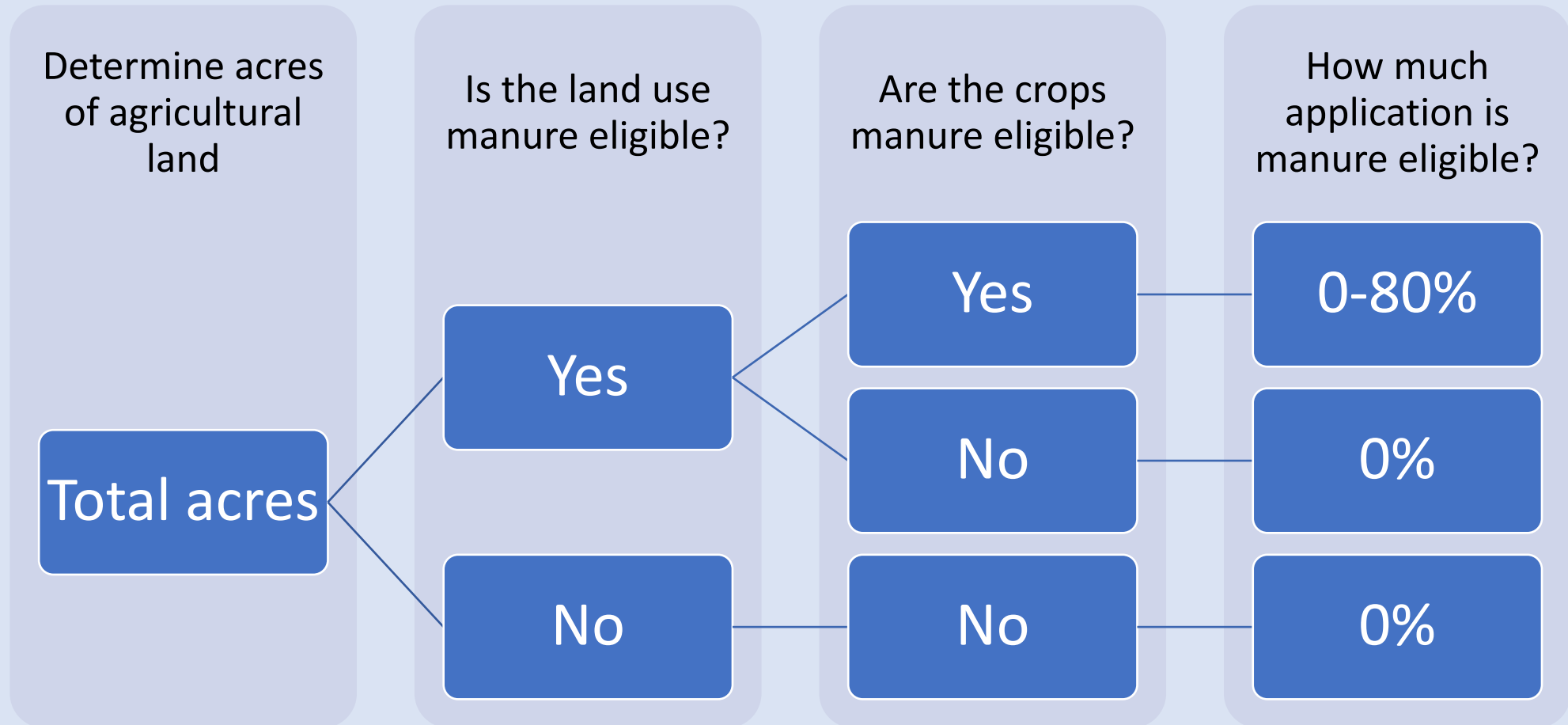
- Double cropped crops
- Crop and load source relationship
- Plant and harvest dates
- Developed land (turfgrass) nutrient pounds per yield
- Agricultural crop nutrient pounds per yield
- Crop nutrient application by month
- Crop nutrient uptake, removal, and nitrogen fixation
- Crop cover factor
- Crop cover fraction
- Sediment tons available to erode due to plowing, by crop type

Detailed Crop and Turfgrass Source Data

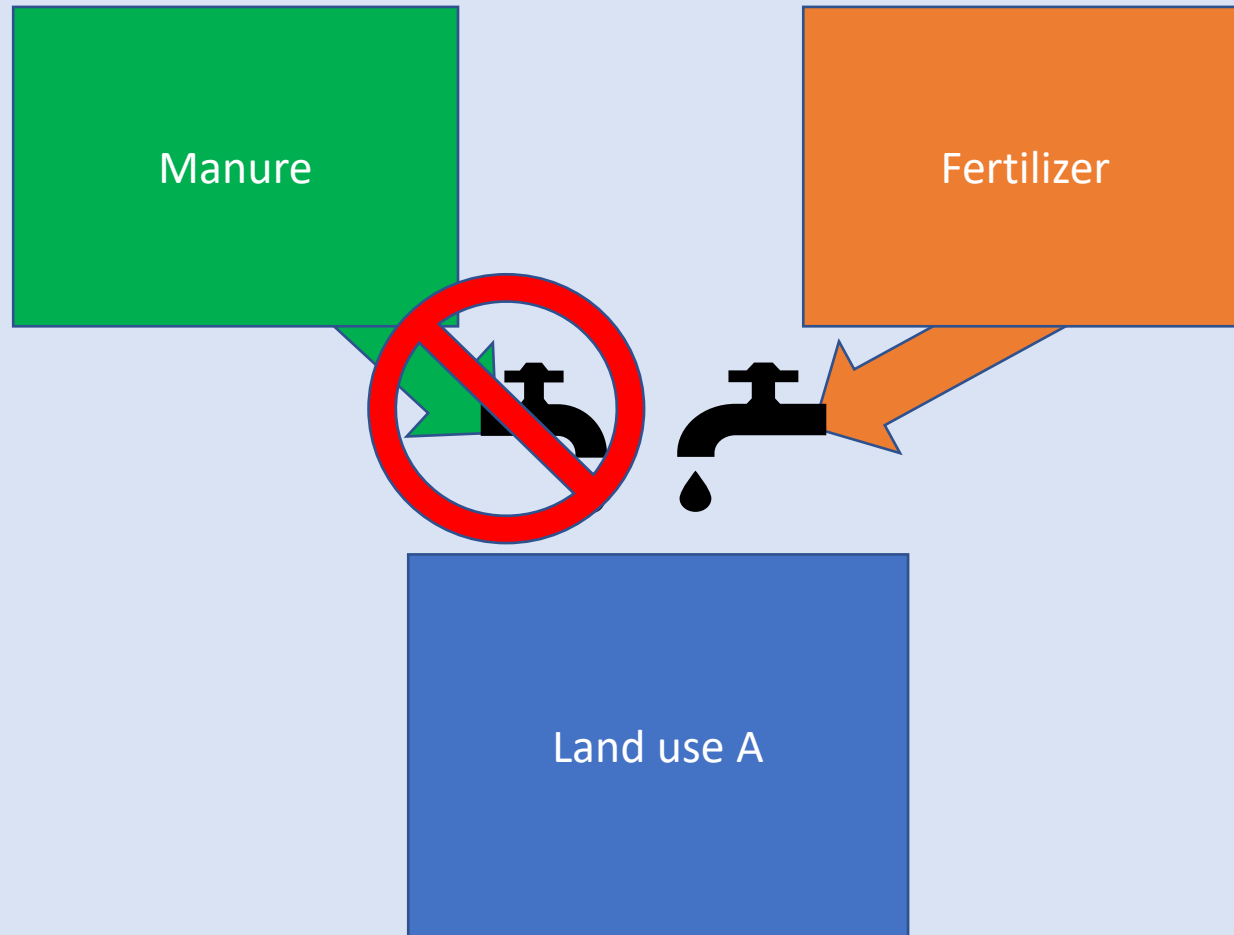
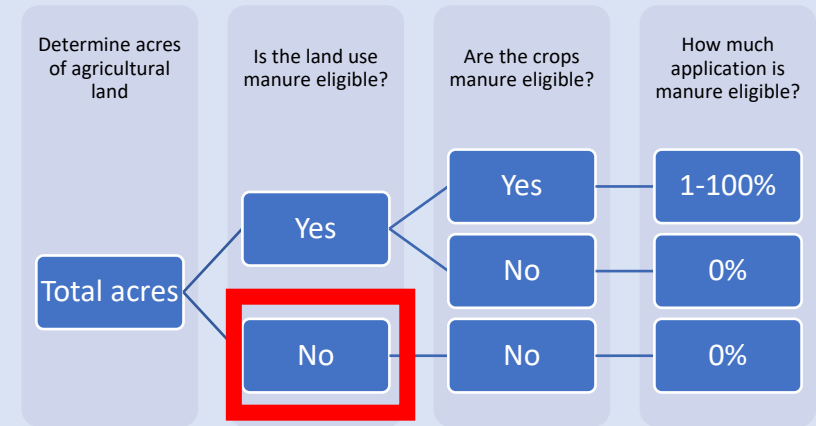
Download data tables including the following tables:

A1	FIPS	CountyName	StateAbb	CropName	LoadSource	Nutrient	DaysAfterHarvest	FractionApplied	FertilizerType	BiosolidEligible
1	42043	Dauphin PA	PA	turfgrass	Non-Regul	Phosphoru	105	0.500000	Y	N
2	51163	Rockbridge VA	VA	collards	Specialty C	Phosphoru	0	1.000000	Y	N
3	51079	Greene VA	VA	potted flow	Specialty C	Nitrogen	30	0.500000	N	N
4	51057	Essex VA	VA	cut flowers	Specialty C	Nitrogen	30	0.500000	N	N
5	4065	Morgan WV	WV	cropland u	Pasture	Nitrogen	30	0.500000	N	Y
6	24003	Anne Arun MD	MD	wheat for	Small Grain	Nitrogen	5	0.100000	N	Y
7	42043	Dauphin PA	PA	mustard gr	Specialty C	Phosphoru	20	1.000000	Y	N
8	51097	King And C VA	VA	aquatic pla	Specialty C	Nitrogen	240	0.083333	N	N
9	36053	Madison NY	NY	parsley	Specialty C	Nitrogen	0	1.000000	Y	N
10	51045	Craig VA	VA	sorghum fc	Grain with	Nitrogen	0	0.750000	Y	N
11	24047	Worcester MD	MD	carrots	Specialty C	Phosphoru	0	1.000000	Y	N
12	36007	Broome NY	NY	bulbs; corn	Specialty C	Phosphoru	0	1.000000	Y	N
13	42113	Sullivan PA	PA	cropland in	Other Agro	Nitrogen	20	1.000000	Y	N
14	51710	Norfolk City VA	VA	mushrooms	Specialty C	Nitrogen	300	0.083333	N	N
15	24021	Frederick MD	MD	broccoli	Specialty C	Nitrogen	30	0.250000	Y	N
16	42087	Mifflin PA	PA	small grain	Other Hay	Phosphoru	210	0.500000	N	Y
17	51091	Highland VA	VA	sorghum fc	Double Cro	Nitrogen	0	0.750000	N	Y
18	51095	James City VA	VA	other mana	Other Hay	Phosphoru	58	0.500000	N	Y
19	51540	Charlottes VA	VA	aquatic pla	Specialty C	Nitrogen	0	0.083333	Y	N
20	51087	Henrico VA	VA	mustard gr	Specialty C	Nitrogen	0	1.000000	Y	N
21	24031	Montgomer MD	MD	broccoli	Specialty C	Phosphoru	20	1.000000	Y	N
22	42035	Clinton PA	PA	wild hay	Ag Open S	Phosphoru	60	0.500000	N	Y
23	51790	Staunton C VA	VA	corn for sil	Silage with	Phosphoru	30	1.000000	Y	N
24	54031	Hardy WV	WV	tobacco	Other Agro	Nitrogen	5	0.400000	Y	N
25	51045	Craig VA	VA	herbs - fre	Specialty C	Nitrogen	30	0.500000	N	N
26	36051	Livingston NY	NY	rye for gra	Small Grain	Phosphoru	20	1.000000	N	Y
27	54077	Preston WV	WV	turfgrass	MS4 Tree C	Phosphoru	105	0.500000	Y	N
28	51193	Westmorel VA	VA	carrots	Specialty C	Phosphoru	0	1.000000	Y	N
29	51135	Nottoway VA	VA	beets	Specialty C	Nitrogen	0	1.000000	Y	N
30	42035	Clinton PA	PA	snap bean	Specialty C	Nitrogen	0	1.000000	Y	N
31	4010	Bedford VA	VA	turpin root	Specialty C	Phosphoru	20	1.000000	Y	N

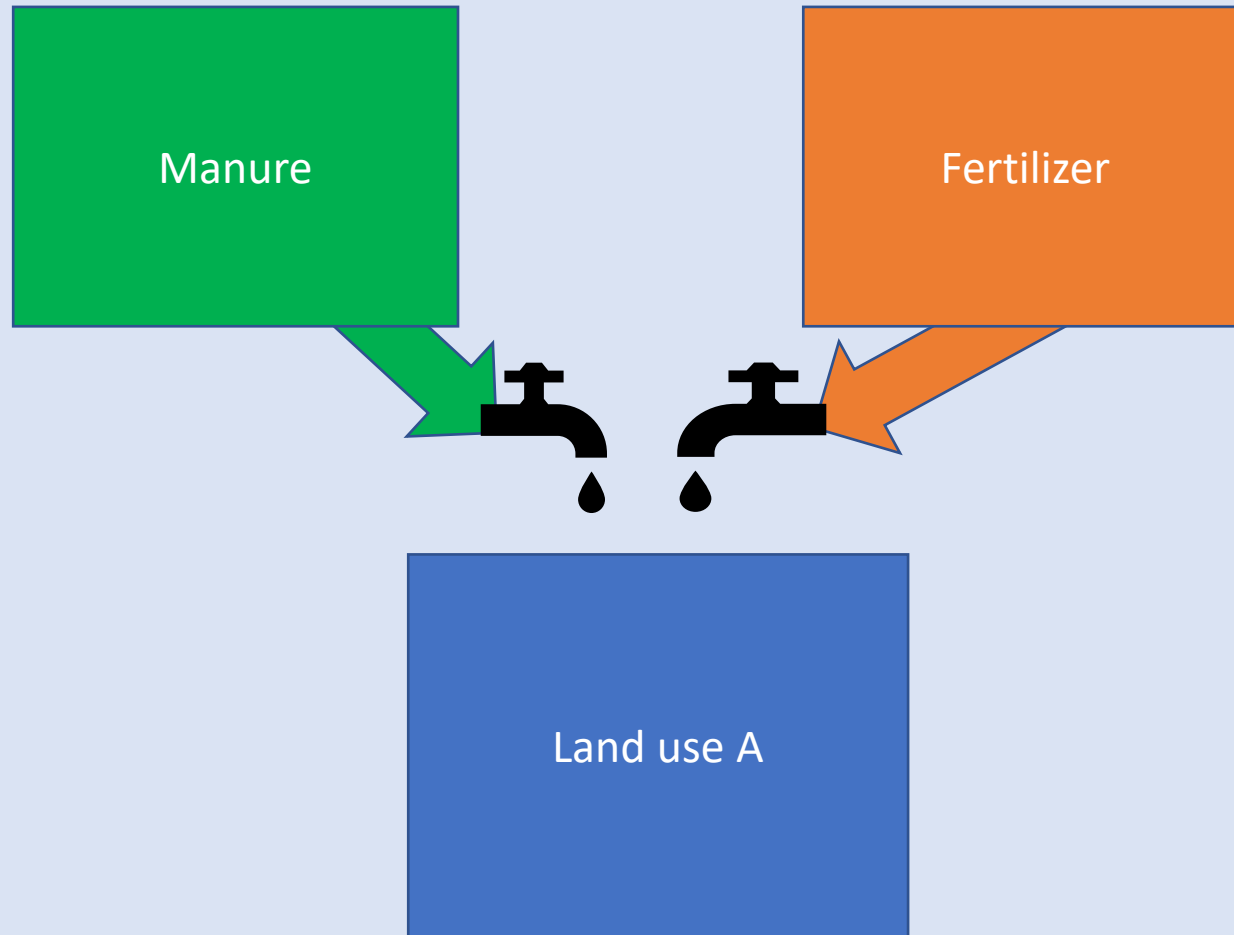
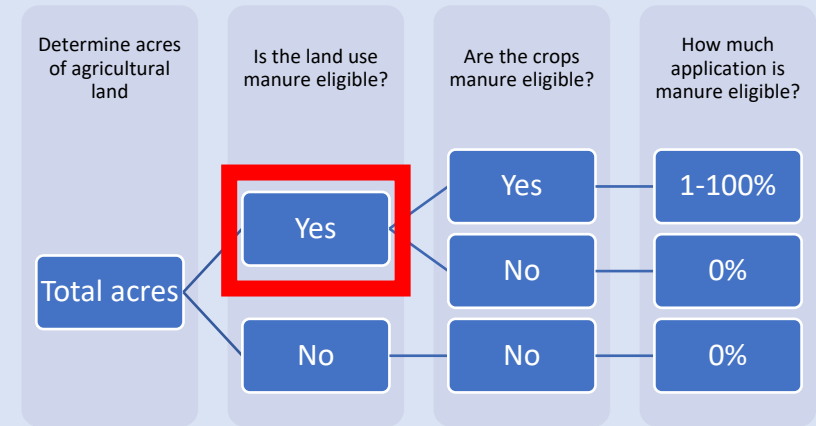
Manure eligibility visualization



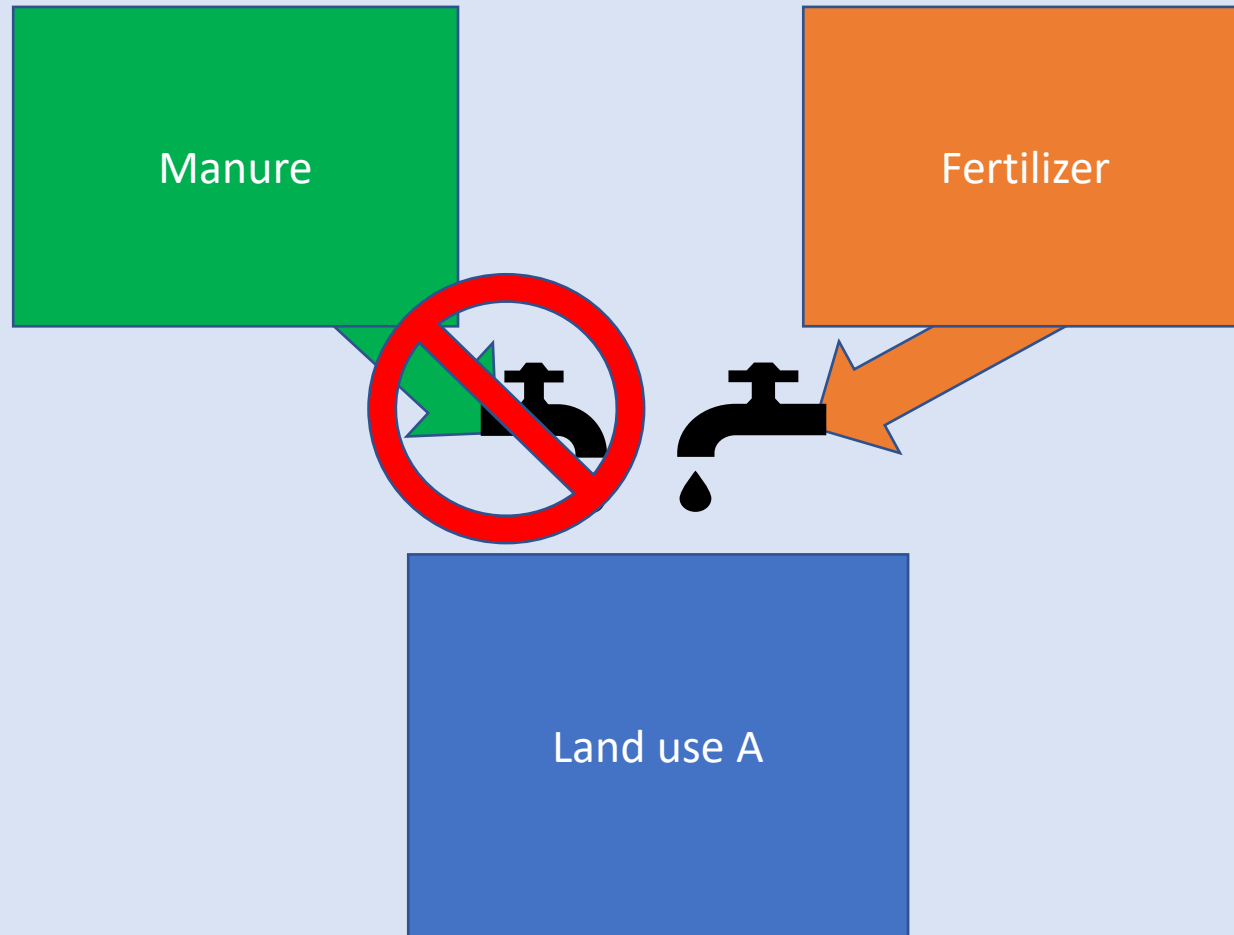
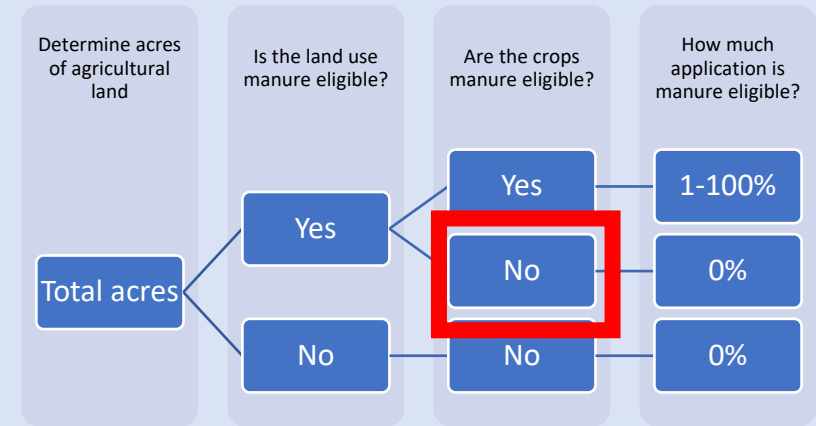
Manure eligibility visualization



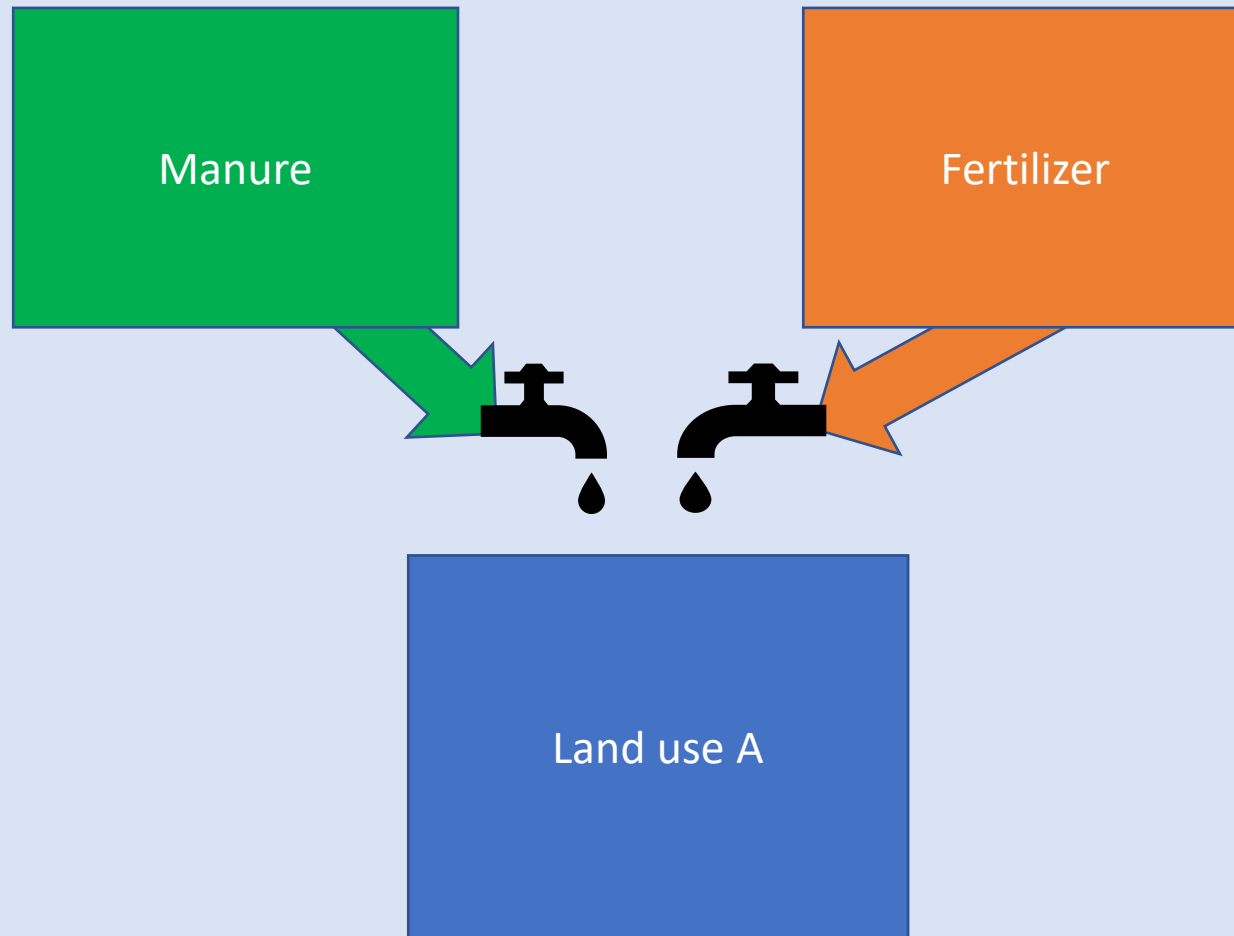
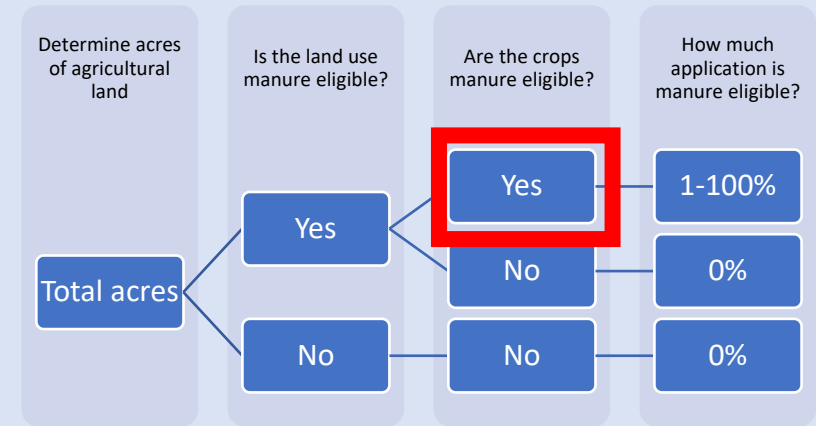
Manure eligibility visualization



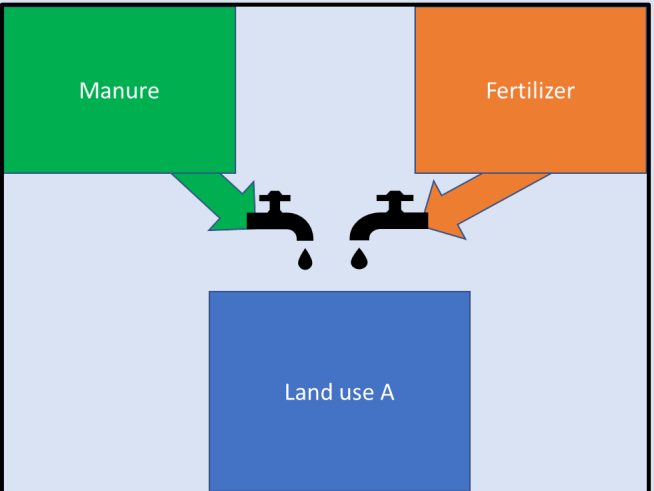
Manure eligibility visualization



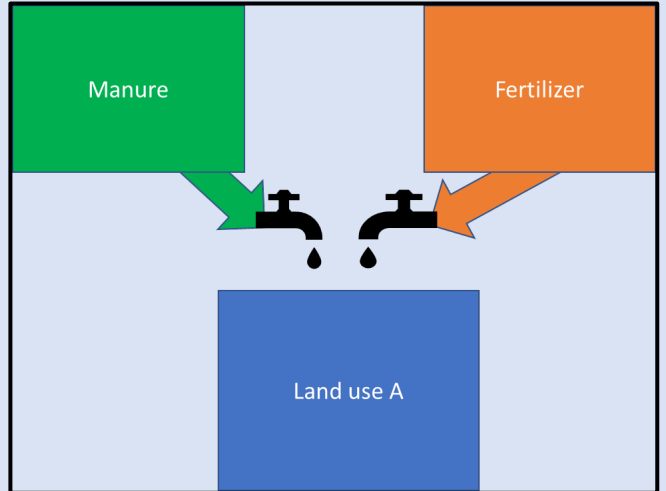
Manure eligibility visualization



Decision tree happens at each “timing”

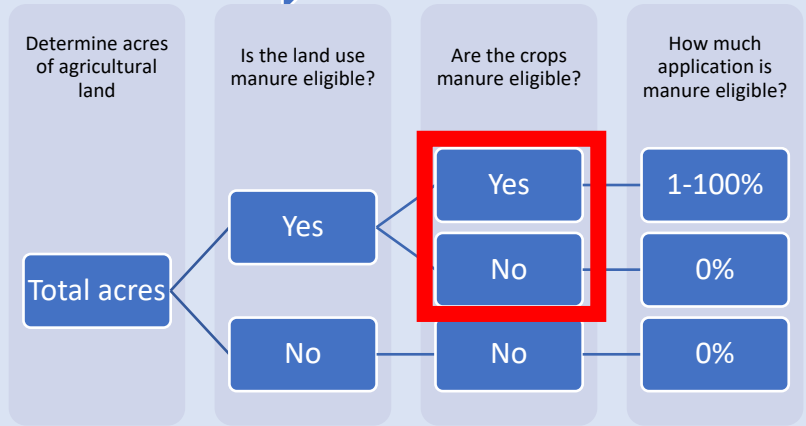
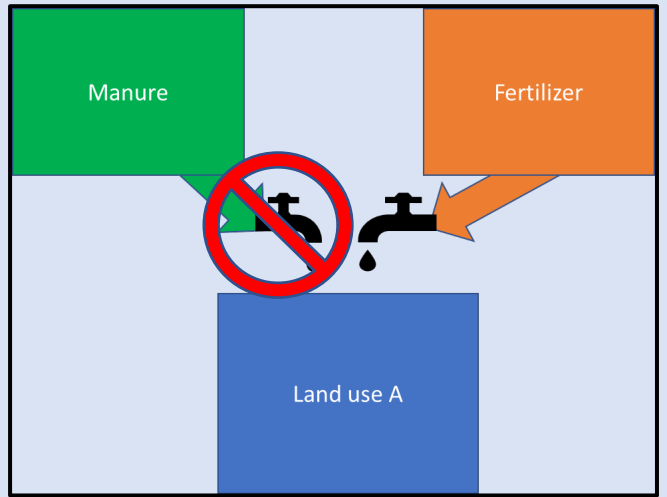


-30 days before planting



60 days after planting

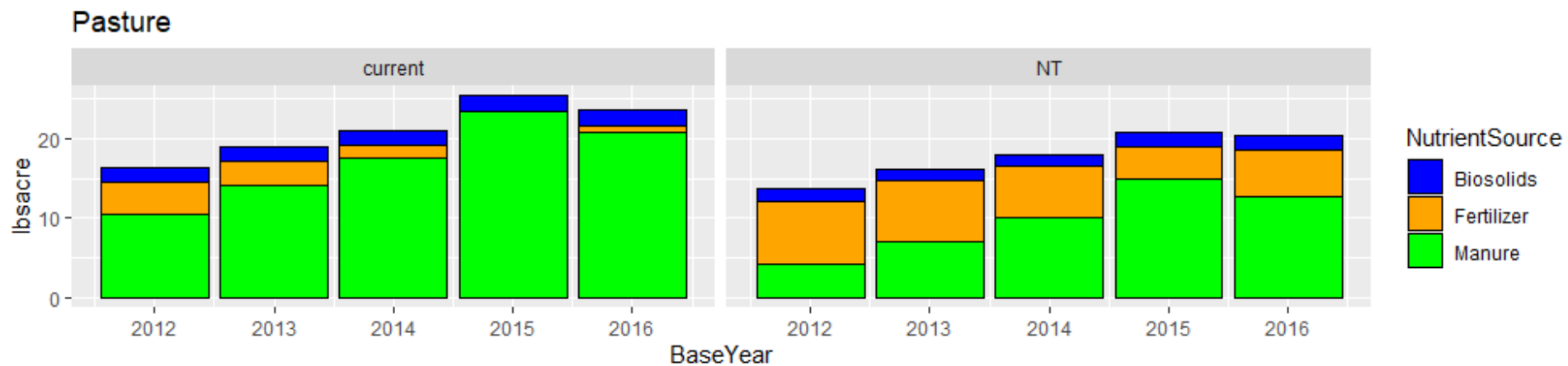
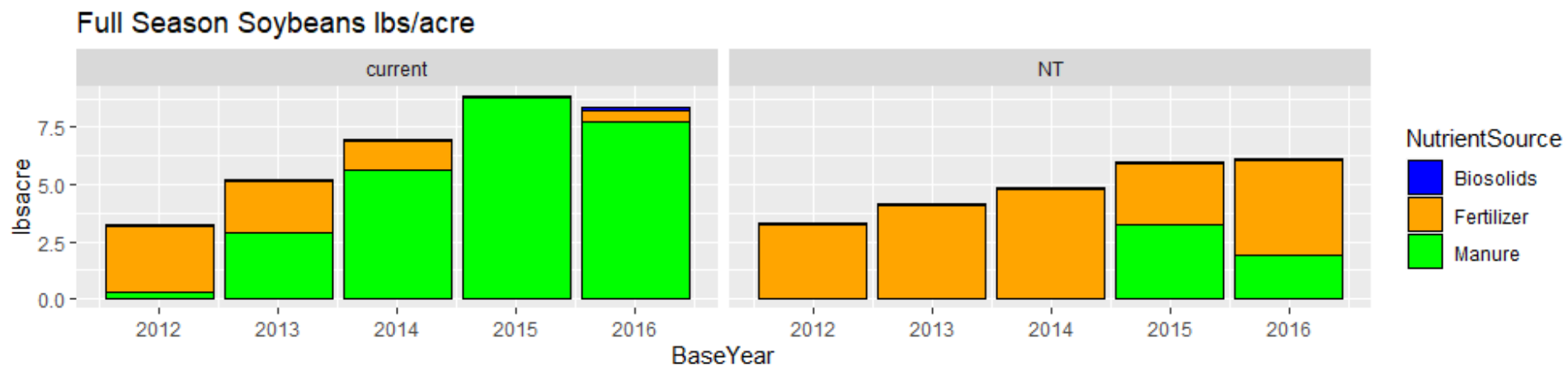
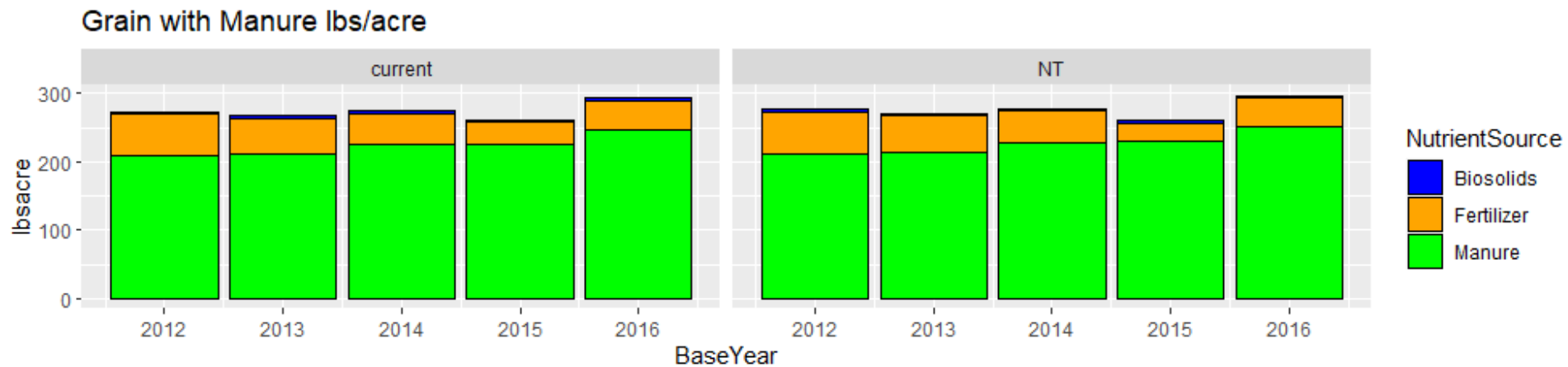
Planting



Test in AMT eliminated all manure control

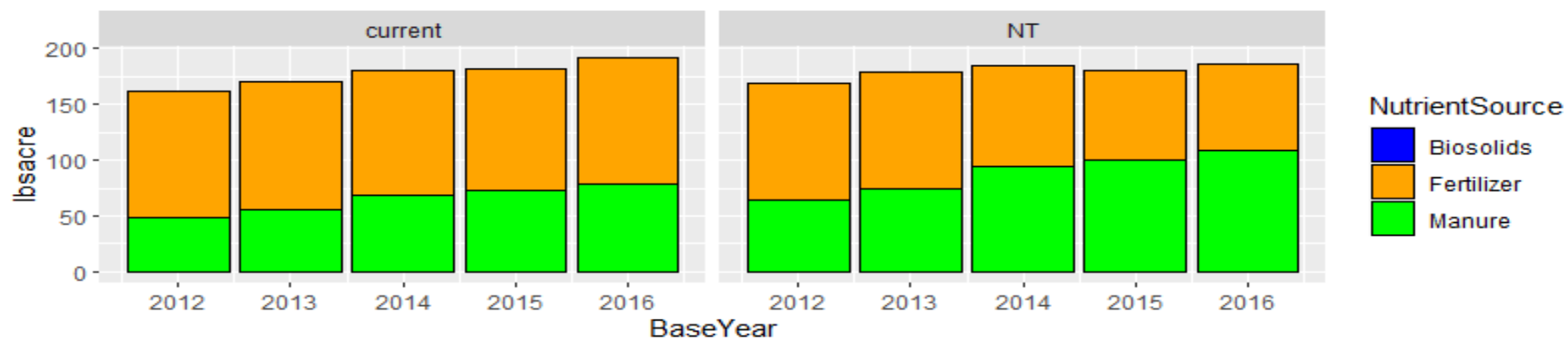
- Sequences on crops were eliminated
- Manure eligibility was set to “yes,” but control fractions remained.

N lbs/acre in Lancaster, PA

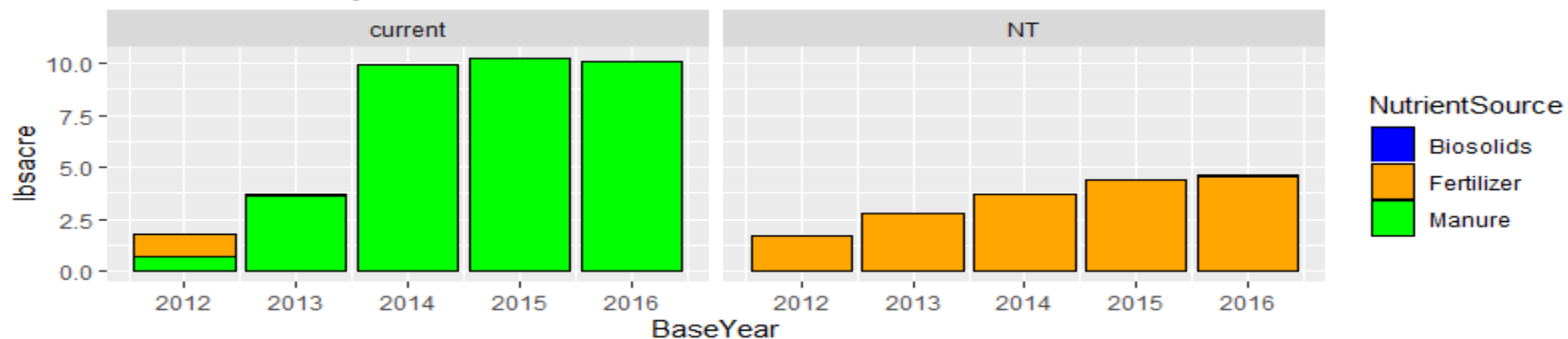


N lbs/acre in Kent, DE

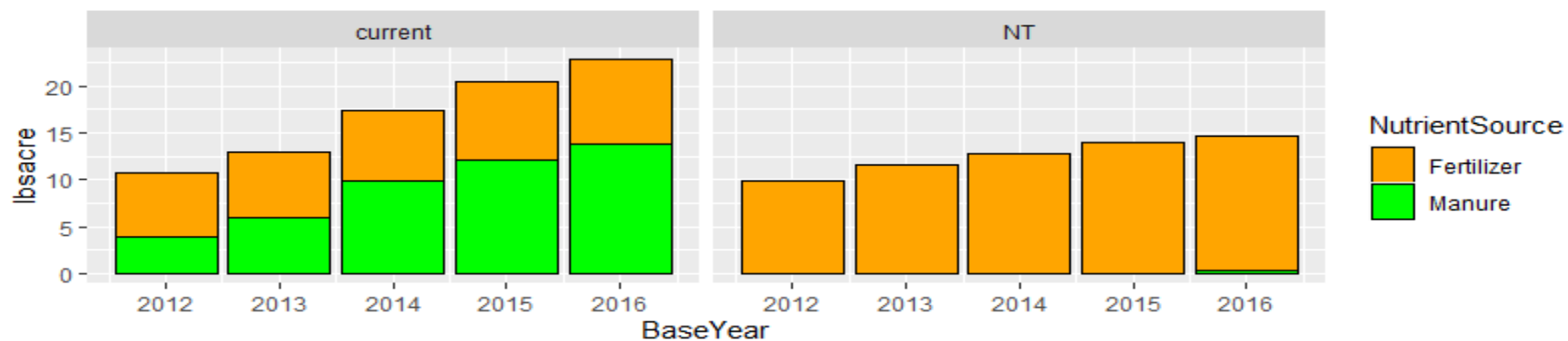
Grain with Manure lbs/acre



Full Season Soybeans lbs/acre

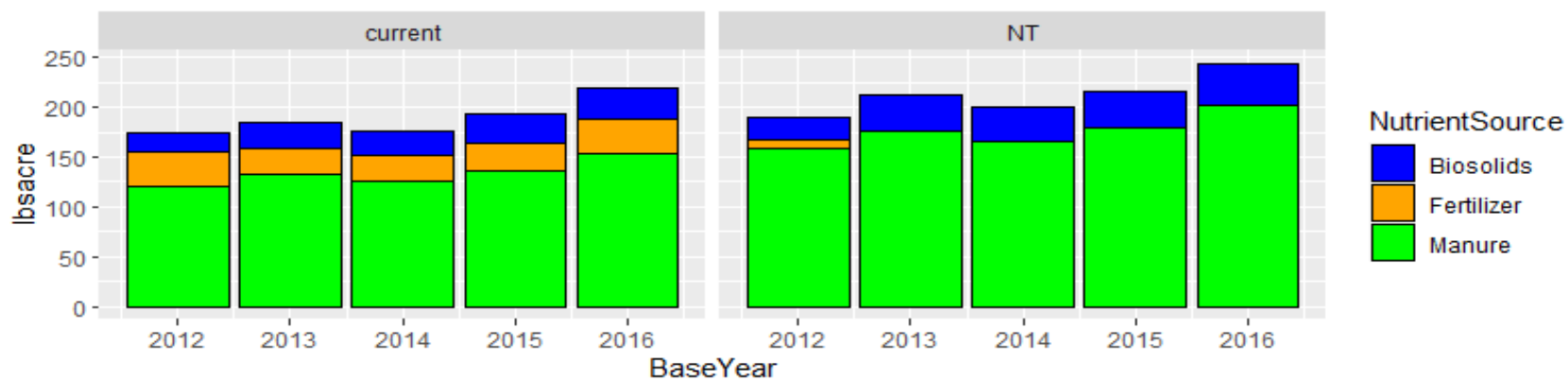


Pasture

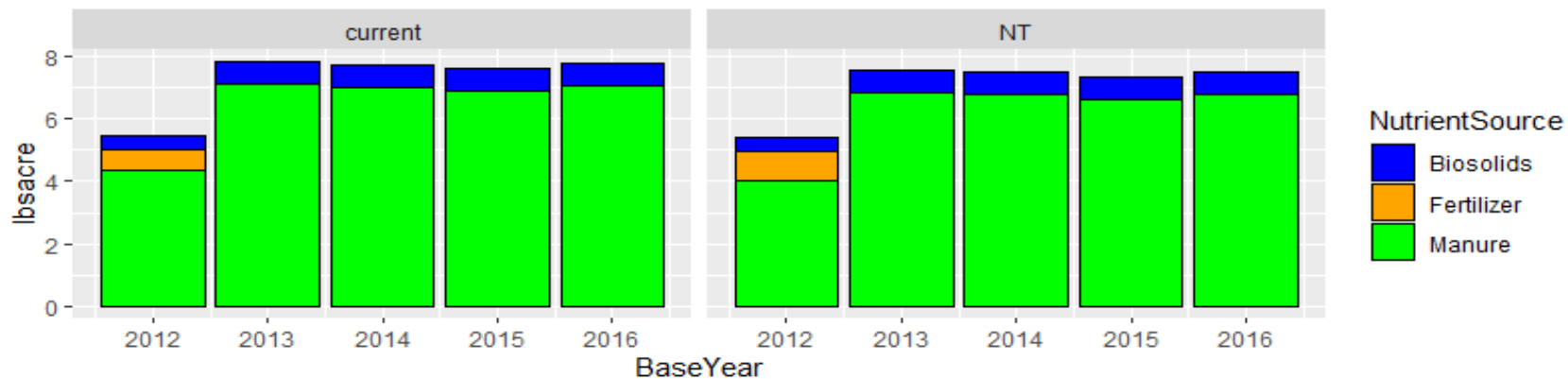


N lbs/acre in Buckingham, VA

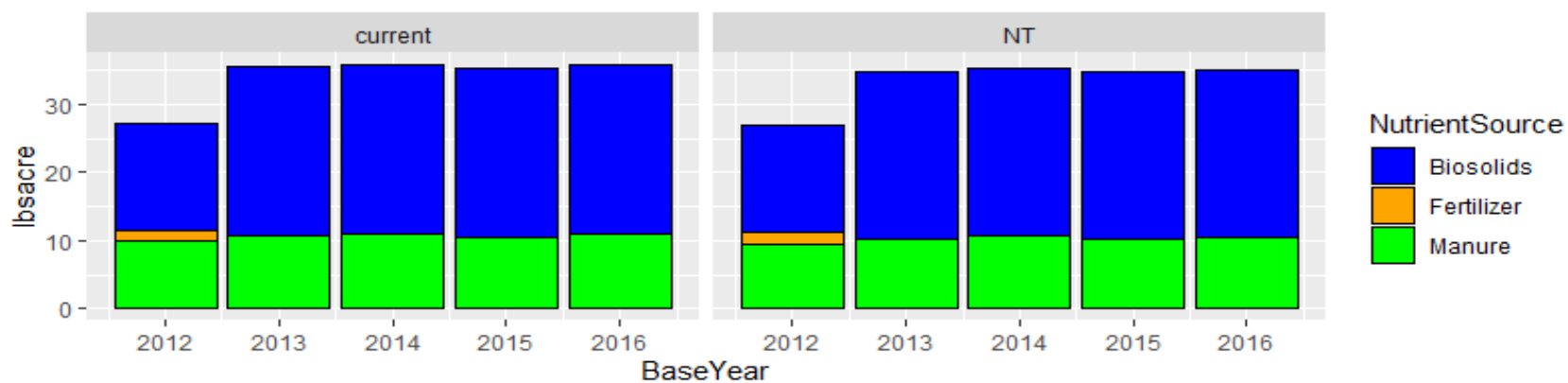
Grain with Manure lbs/acre



Full Season Soybeans lbs/acre



Pasture



Eligibility change on Delmarva

Timing change in DE to match MD ES Counties

What did we do?

Ran two versions of CAST

One with the existing timing and eligibility

One with UPDATED timing and eligibility



Calculated the difference between these two versions

(Updated version – Existing version)

What is in the versions??

Ran two versions of CAST:

Existing Version

1) An updated BMP history, including the most up to date BMP history there is so any other version will have a less recent BMP history. This a C21 based on a BMP history pulled from NEIEN after the 2022 progress submissions were completed.

2) Updated fertilizer to account for any omitted data. This is the fertilizer issue identified by the PSC where a portion of ag fertilizer was omitted in CAST 19.

3) This uses the corrected AAPFCO dataset from 1985-2016 + the state submitted data from 2017-2020 with option A used for non-submitted states

Option A is the use of state data with non-reporting states information being filled with a percentage difference based on the data from reporting states.

What is in the versions??

NOTE* Difference
between versions is in the
red box

Ran two versions of CAST:

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3) This uses the corrected AAPFCO dataset from 1985-2016 + the state submitted data from 2017-2020 with option A used for non-submitted states

4) The timing and eligibility data which was updated based on DE and MD's recent submission.

Option A is the use of state data with non-reporting states information being filled with a percentage difference based on the data from reporting states.

What is in the versions??

NOTE* Difference
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Option A is the use of state data with non-reporting states information being filled with a percentage difference based on the data from reporting states.

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Option A is the use of state data with non-reporting states information being filled with a percentage difference based on the data from reporting states.

4) The timing and eligibility data which was updated based on DE and MD's recent submission.

Changes in Corn

FIPS	CountyName	StateAbbreviation	CropName	LoadSource	Nutrient	DaysAfterPlanting	FractionApplied	FertilizerOnly	BiosolidEligible	NEW FertilizerOnly	NEW_BiosolidEligible
10001	Kent	DE	corn for grain	Grain with Manure	Nitrogen	-20	0.25	N	Y		
10001	Kent	DE	corn for grain	Grain with Manure	Nitrogen	45	0.75	Y	N		
42071	Lancaster	PA	corn for grain	Grain with Manure	Nitrogen	-15	0.8	N	Y		
42071	Lancaster	PA	corn for grain	Grain with Manure	Nitrogen	0	0.1	Y	N		
42071	Lancaster	PA	corn for grain	Grain with Manure	Nitrogen	45	0.1	Y	N		
51029	Buckingham	VA	corn for grain	Grain with Manure	Nitrogen	0	0.75	N	Y		
51029	Buckingham	VA	corn for grain	Grain with Manure	Nitrogen	60	0.25	Y	N		
10001	Kent	DE	corn for grain	Grain with Manure	Nitrogen	-5	0.2	N	Y	N	N
10001	Kent	DE	corn for grain	Grain with Manure	Nitrogen	0	0.2	Y	N	N	N
10001	Kent	DE	corn for grain	Grain with Manure	Nitrogen	45	0.6	Y	N	N	N

Changes for FS soy & hay

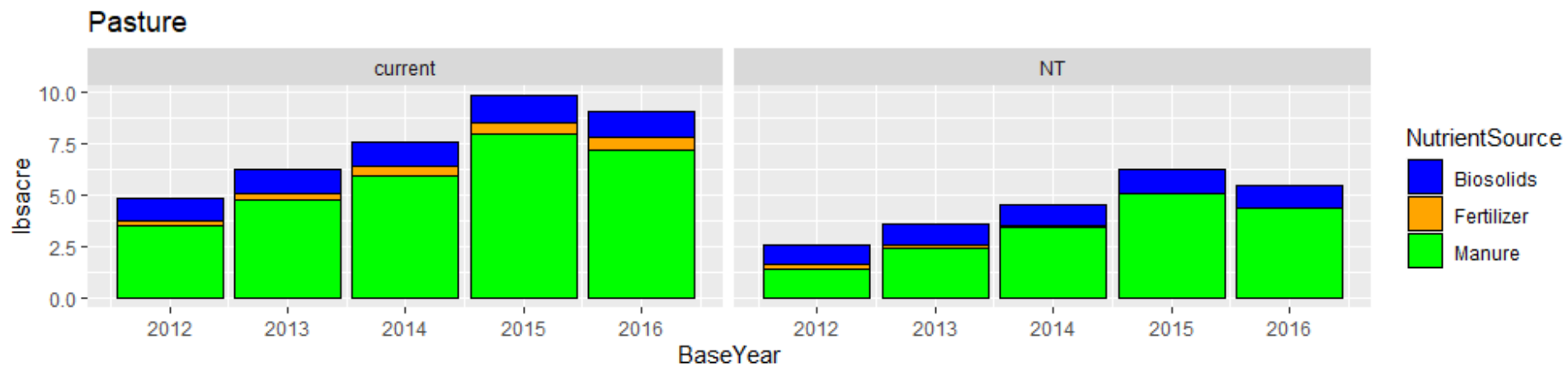
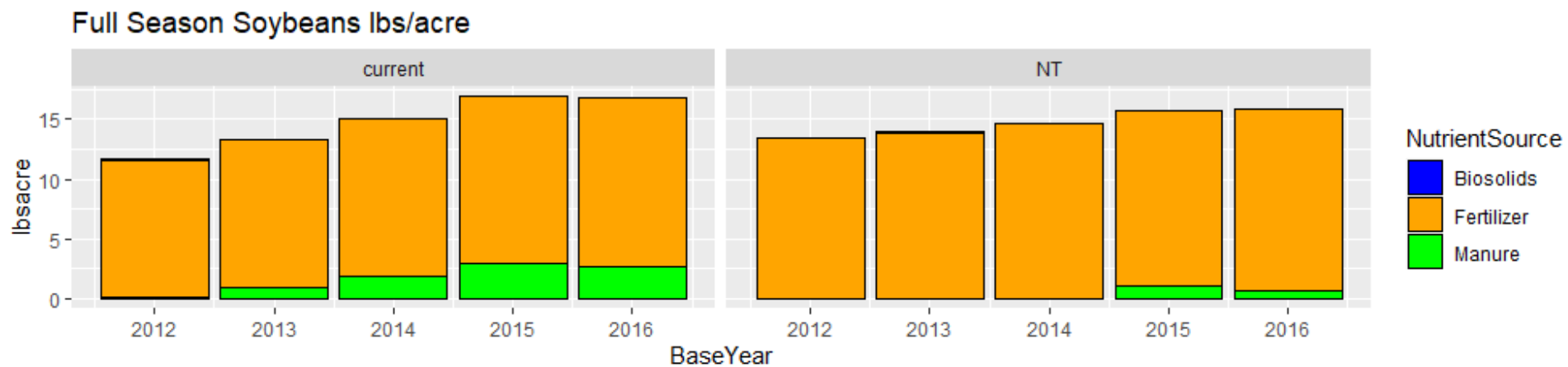
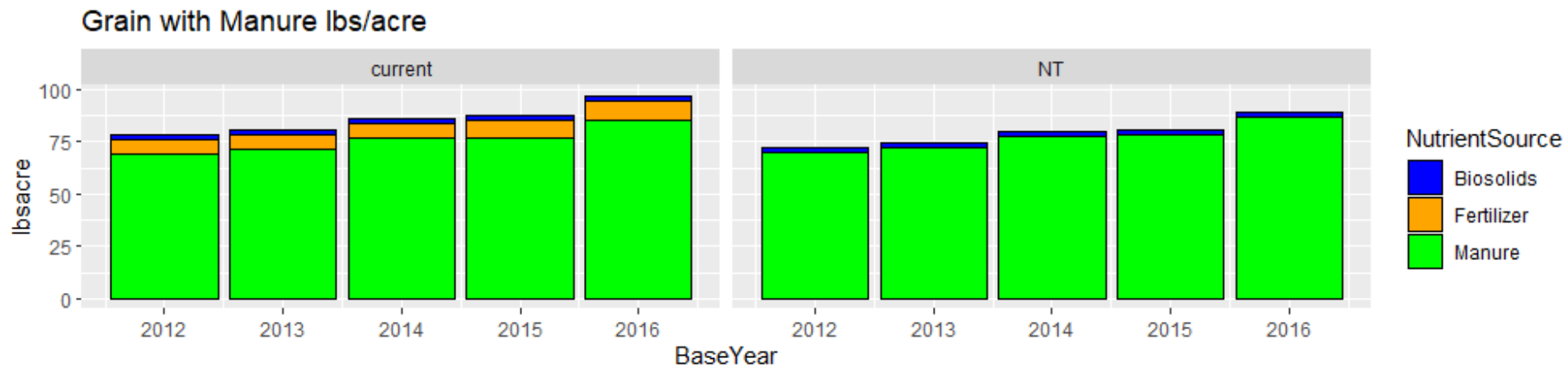
FIPS	CountyName	StateAbbreviation	CropName	LoadSource	Nutrient	DaysAfterPlanting	FractionApplied	FertilizerOnly	BiosolidEligible
10001	Kent	DE	soybeans for beans	Full Season Soybeans	Nitrogen	0	1 N	Y	
42071	Lancaster	PA	soybeans for beans	Full Season Soybeans	Nitrogen	-20	1 N	Y	
51029	Buckingham	VA	soybeans for beans	Full Season Soybeans	Nitrogen	-20	1 N	Y	

FIPS	CountyName	StateAbbreviation	CropName	LoadSource	Nutrient	DaysAfterPlanting	FractionApplied	FertilizerOnly	BiosolidEligible
10001	Kent	DE	other managed hay	Other Hay	Nitrogen	58	0.5 N	Y	
10001	Kent	DE	other managed hay	Other Hay	Nitrogen	210	0.5 N	Y	
42071	Lancaster	PA	other managed hay	Other Hay	Nitrogen	58	0.5 N	Y	
42071	Lancaster	PA	other managed hay	Other Hay	Nitrogen	210	0.5 N	Y	
51029	Buckingham	VA	other managed hay	Other Hay	Nitrogen	-20	1 N	Y	

Absolute change in load

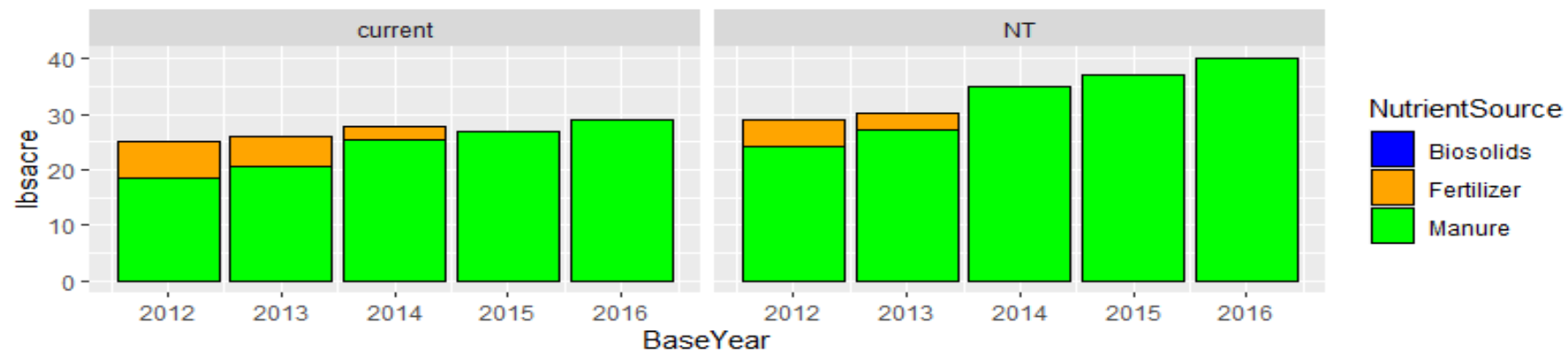
State	Phos (EOT) change	Nit (EOT) change
Delaware (CBWS Portion Only)	(1,659)	(116,284)
Maryland (CBWS Portion Only)	(10,270)	(265,620)
New York (CBWS Portion Only)	(91)	15,193
Pennsylvania (CBWS Portion Only)	1,456	97,590
Virginia (CBWS Portion Only)	5,284	24,062
West Virginia (CBWS Portion Only)	583	2,261

P lbs/acre in Lancaster, PA

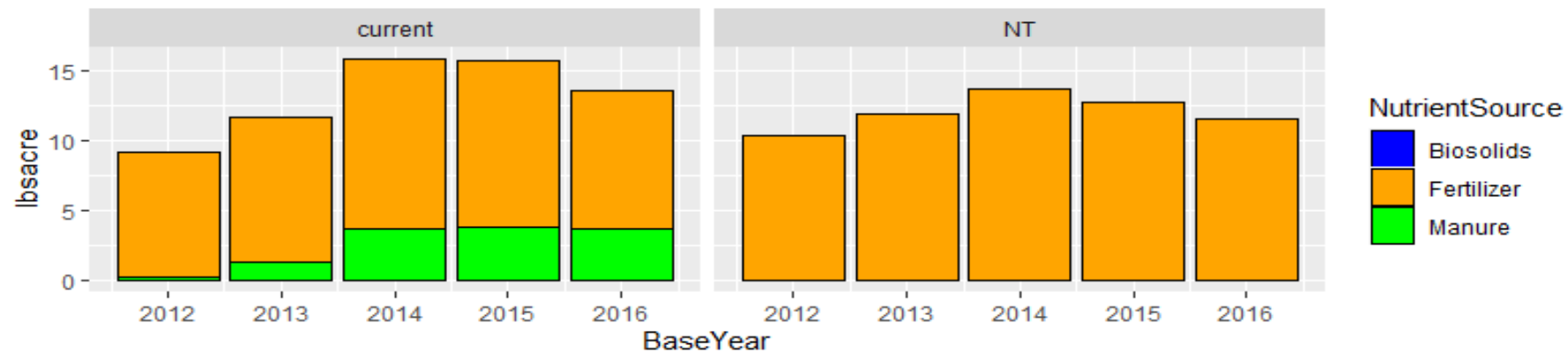


P lbs/acre in Kent, DE

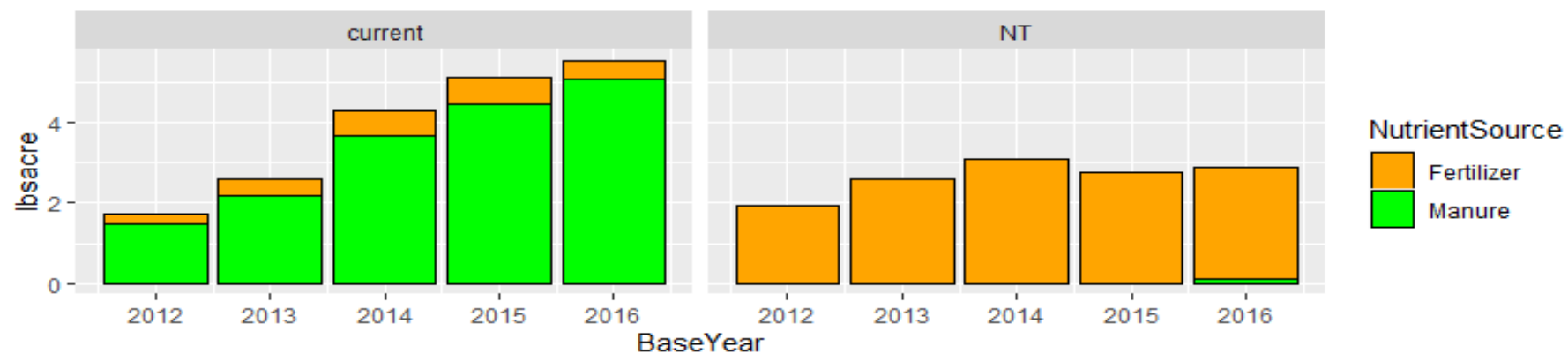
Grain with Manure lbs/acre



Full Season Soybeans lbs/acre

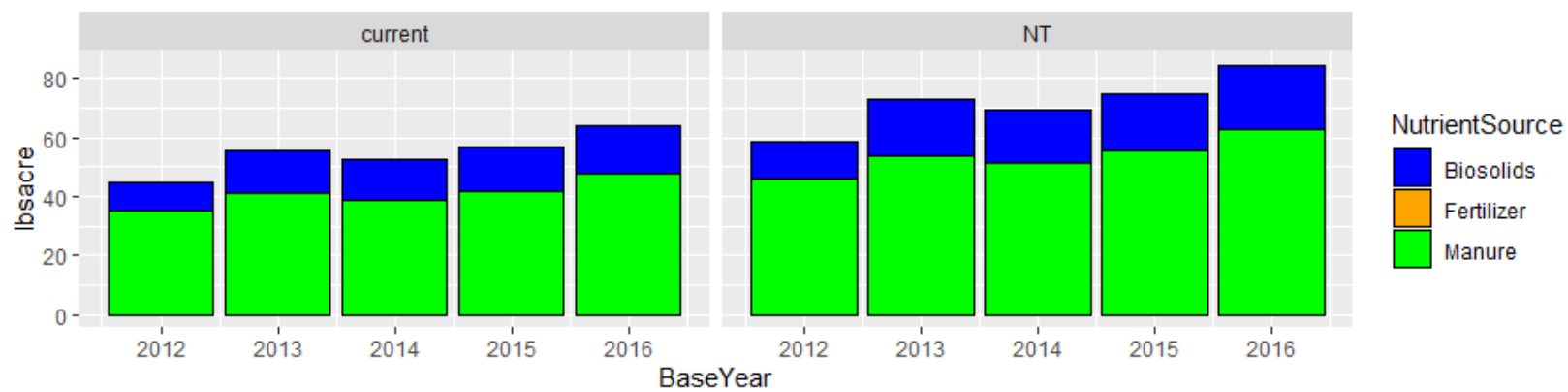


Pasture

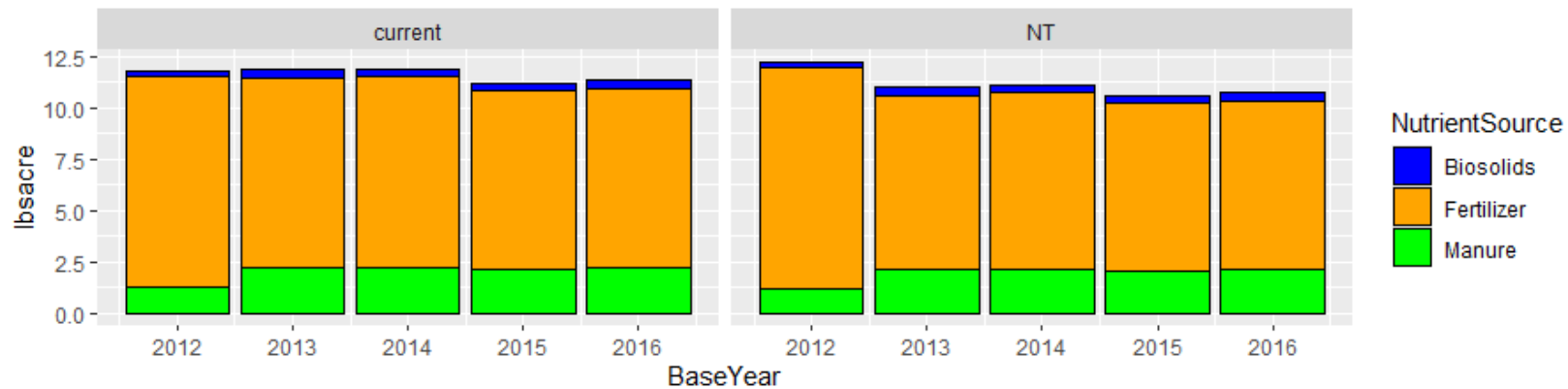


P lbs/acre in Buckingham, VA

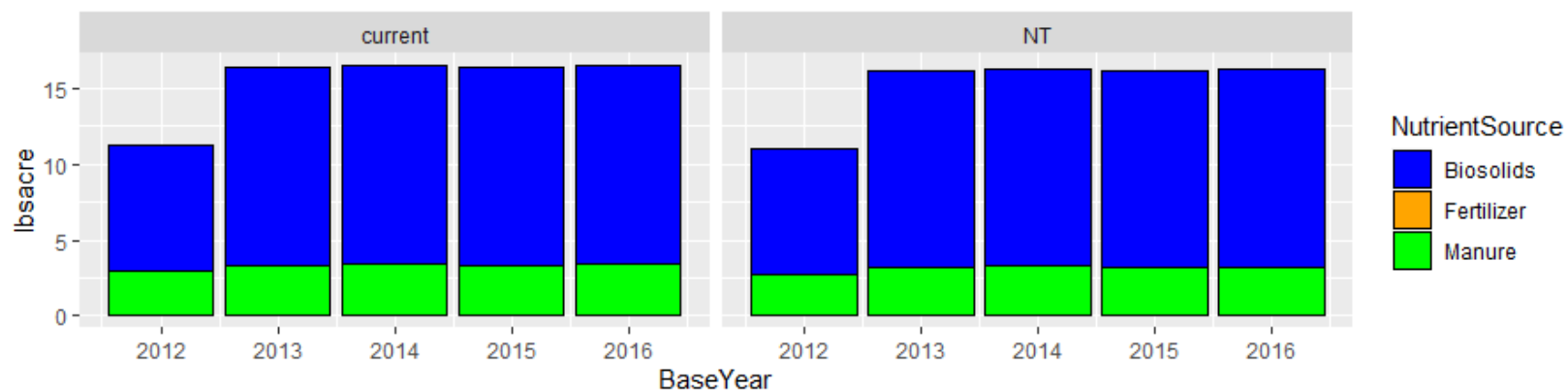
Grain with Manure lbs/acre



Full Season Soybeans lbs/acre



Pasture



P EOT Loads difference in lbs

