Manure generation and acres

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1/12/24

The Question:

How are manure and manure acres calculated in CAST?

Outline:

- Manure generation
- Manure acres

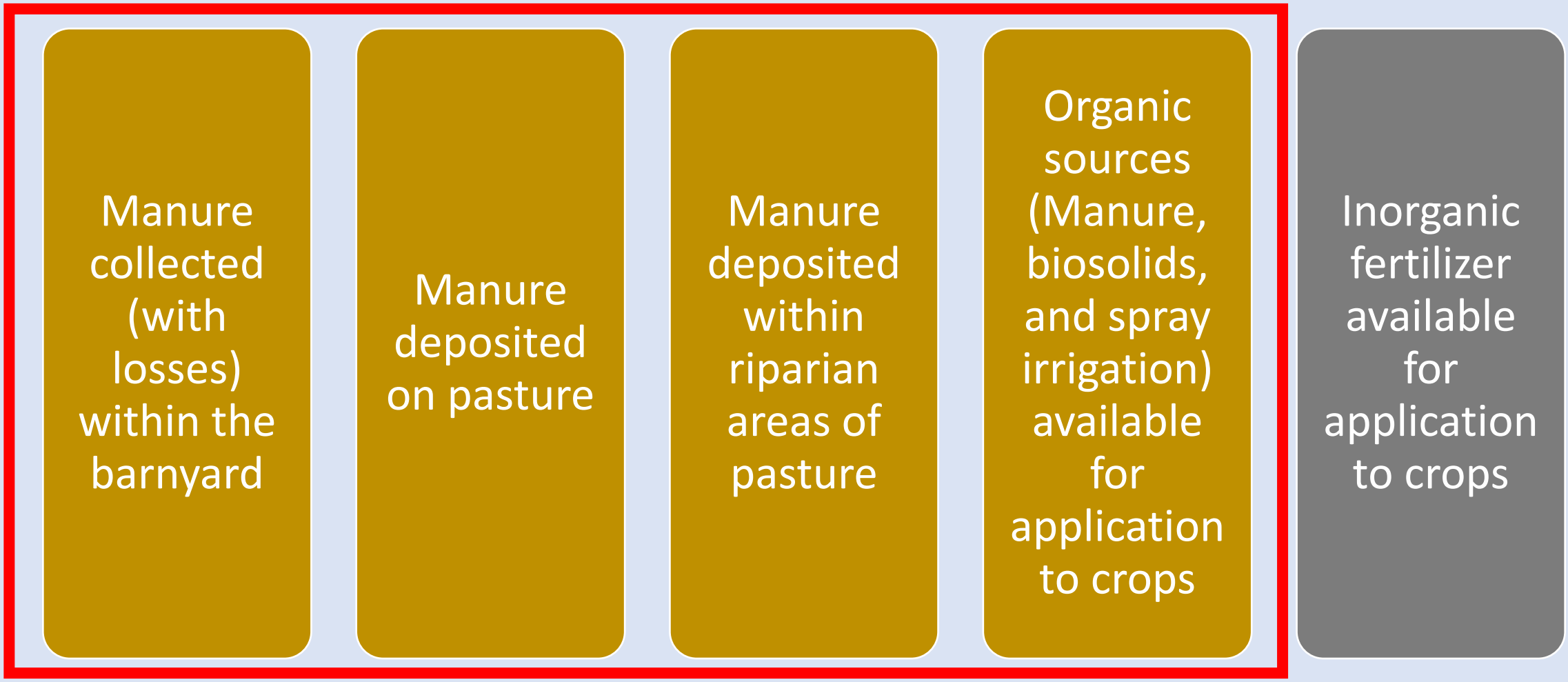
Manure Generation

- Cast Documentation Terrestrial Inputs 3.2.1

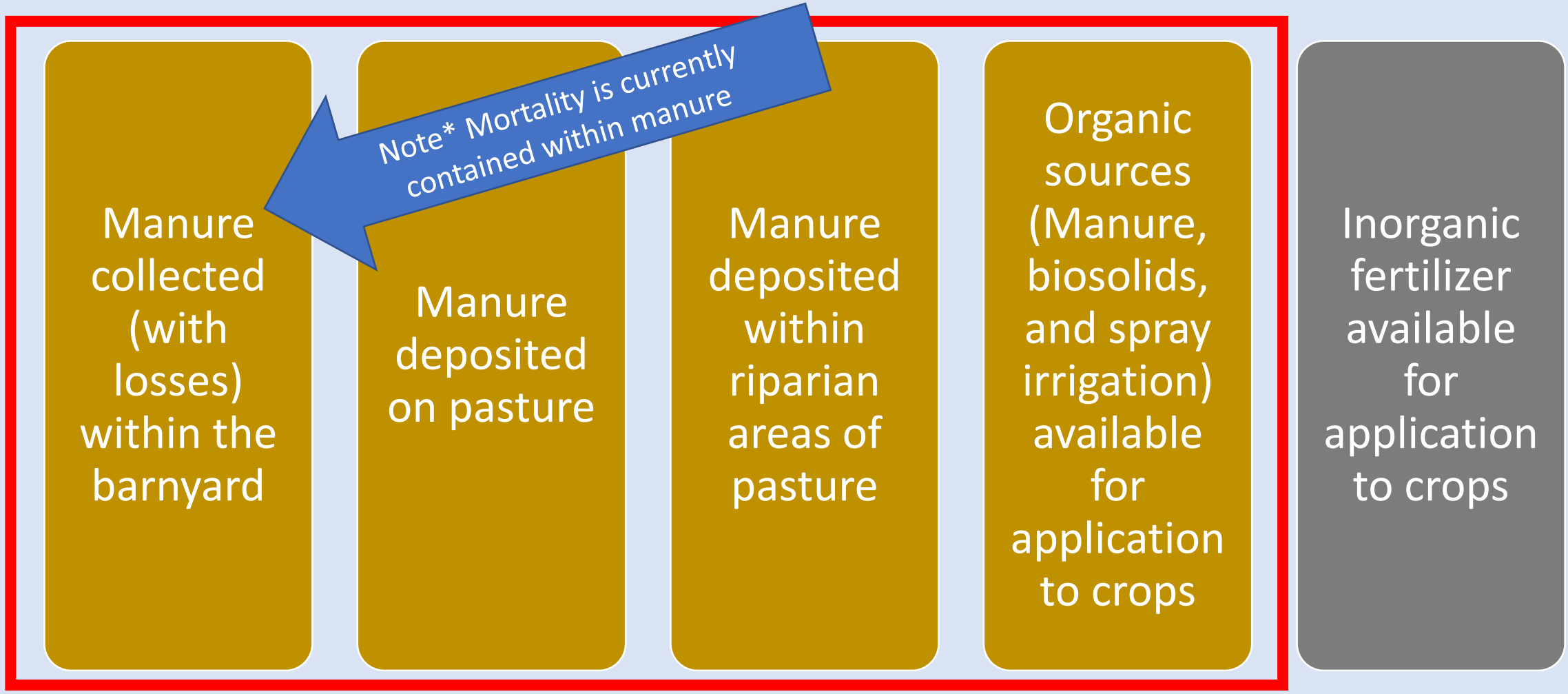
Agriculture nutrient categories

- Manure collected (with losses) within the barnyard
- Manure deposited on pasture
- Manure deposited within riparian areas of pasture
- Organic sources (Manure, biosolids, and spray irrigation) available for application to crops
- Inorganic fertilizer available for application to crops

Agriculture nutrient categories



Agriculture nutrient categories



How do Ag Nutrients cycle through CAST?

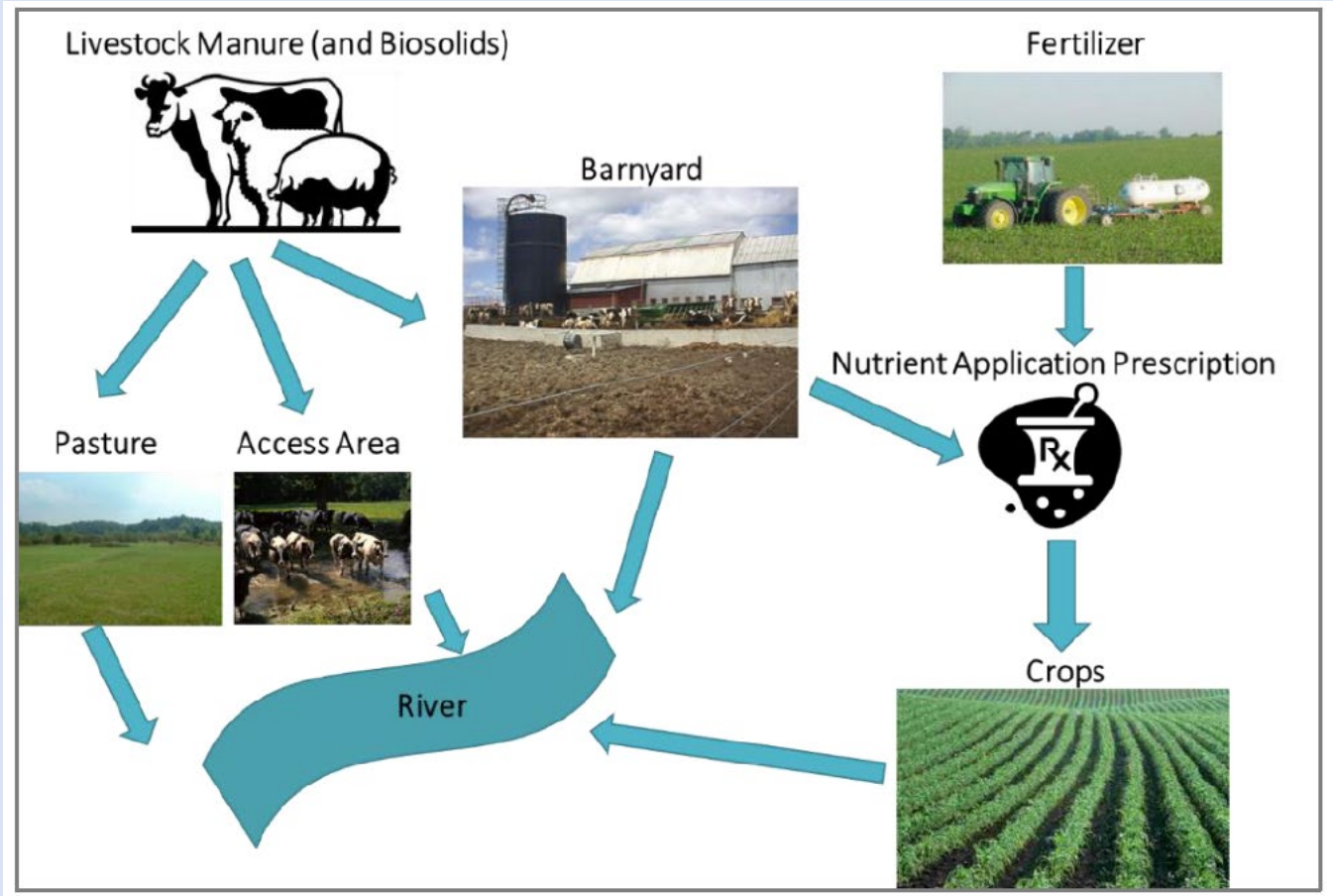
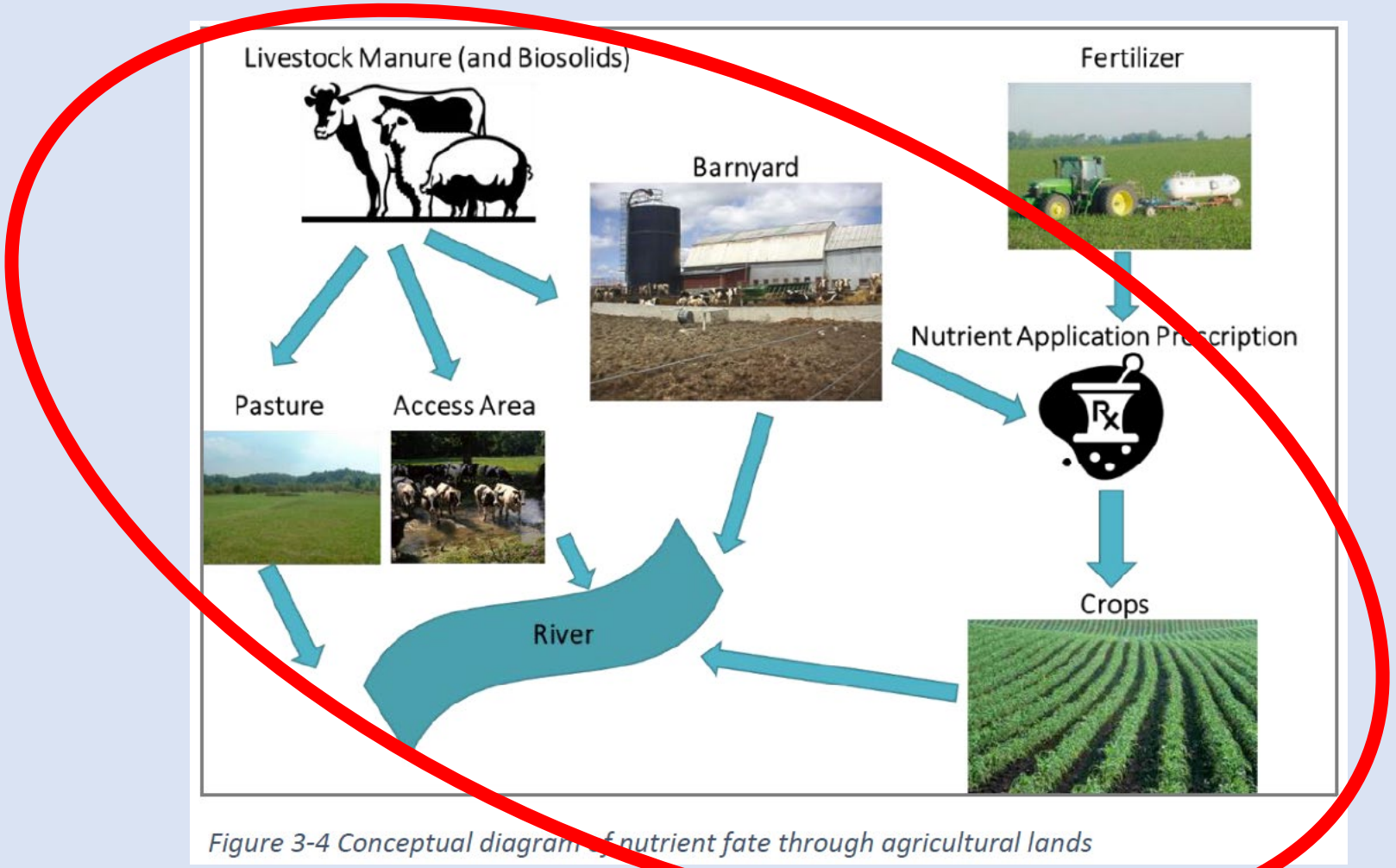


Figure 3-4 Conceptual diagram of nutrient fate through agricultural lands

How do Ag Nutrients cycle through CAST?



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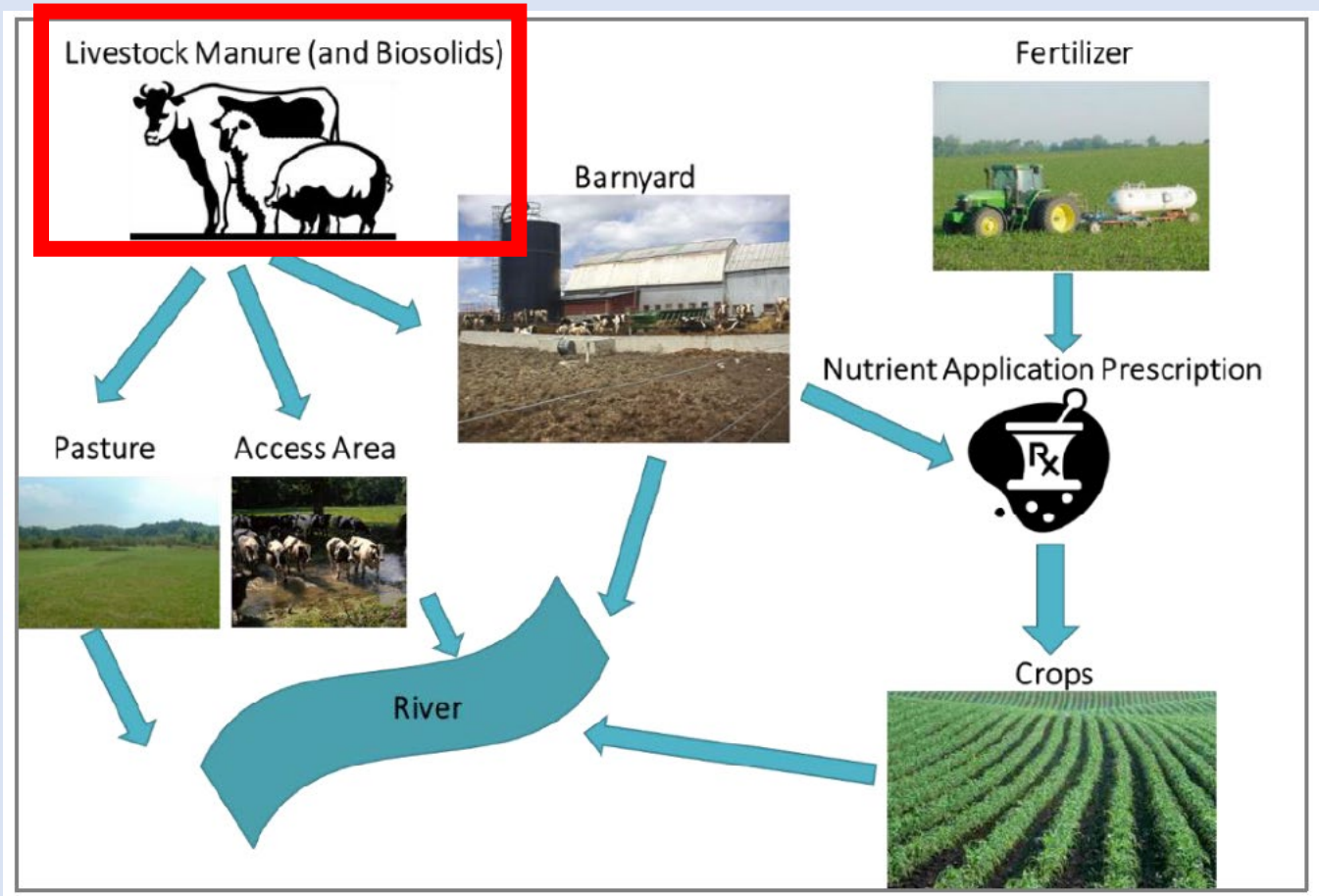


Figure 3-4 Conceptual diagram of nutrient fate through agricultural lands

CAST Manure Data

- County scale
- Based on animal populations
  - Ag Census
  - American Society of Agricultural Engineers (ASAE)
  - Poultry Litter Subcommittee (PLS)
  - Swine characterization report
- Lbs. dry excreted

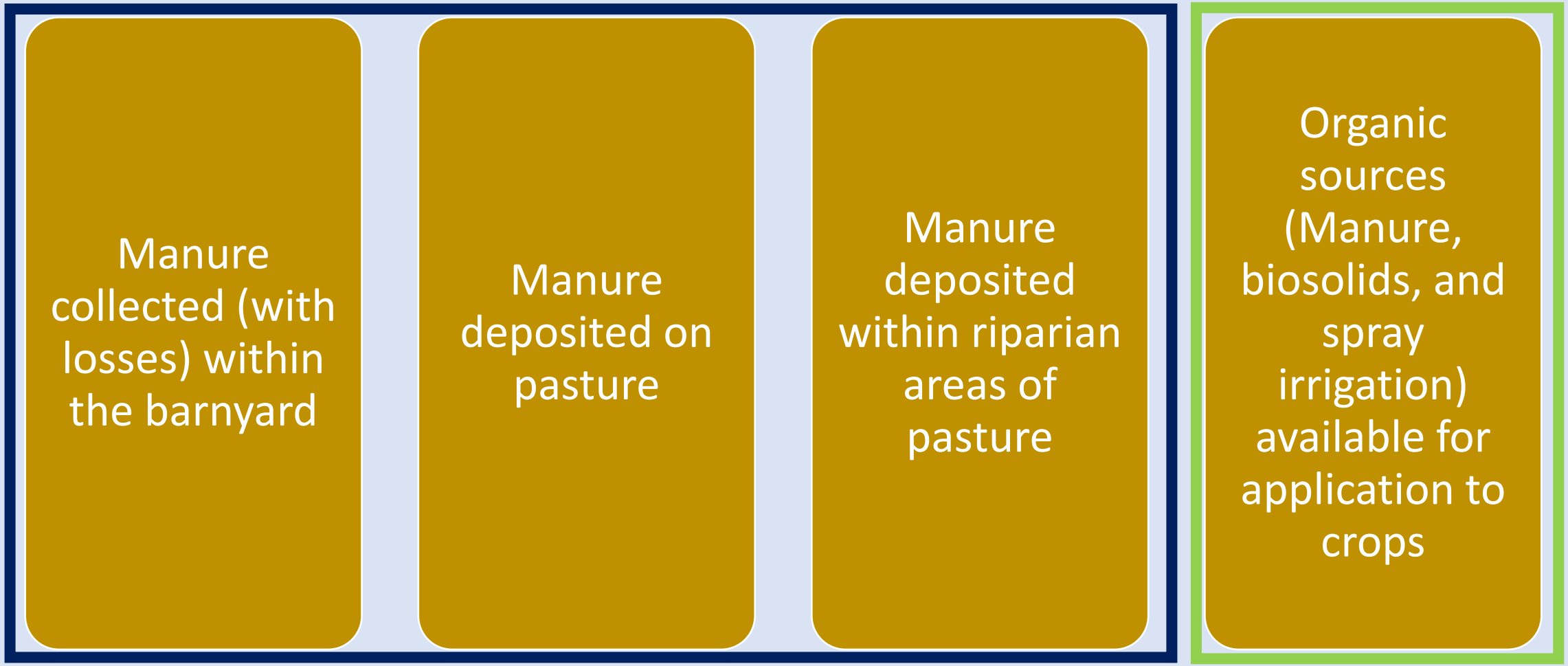
Table 3-4: Total nutrient manure characteristics for livestock

Animal Type	Manure Source
Beef	Beef - Cow (confinement) from ASAE 2005 for manure values
Dairy	Lactating Cow, Dry Cow and Heifer from ASAE 2005 for manure values
Other Cattle	Estimated based upon weighted average combination of Beef and Dairy from Census of Agriculture; See Appendix D
Horses	Average of Horse- Sedentary and Horse - Intense Exercise from ASAE 2005 for manure values
Hogs for Breeding	Swine Characterization Report; See Appendix E
Hogs for Slaughter	Swine Characterization Report; See Appendix E
Sheep and Lambs	ASAE 2003 for manure values
Goats	ASAE 2003 for manure values
Pullets	PLS Report; See Appendix A
Layers	PLS Report; See Appendix A
Broilers	PLS Report; See Appendix A
Turkeys	Turkey Characterization Report; See Appendix F

Agriculture nutrient categories

Manure deposition categories

Crop available nutrients



Manure depositional categories example: Beef

Manure collected (with losses) within the barnyard

Manure deposited on pasture

Manure deposited within riparian areas of pasture

Animal Type	Month	Barnyard Percent	Pasture Percent	Access Area Percent
beef	1	6	91	3
beef	2	6	91	3
beef	3	0	96	4
beef	4	0	94	6
beef	5	0	94	6
beef	6	0	90	10
beef	7	0	90	10
beef	8	0	90	10
beef	9	0	94	6
beef	10	0	96	4
beef	11	0	96	4
beef	12	6	91	3

Note* - State provided

How do Ag Nutrients cycle through CAST?

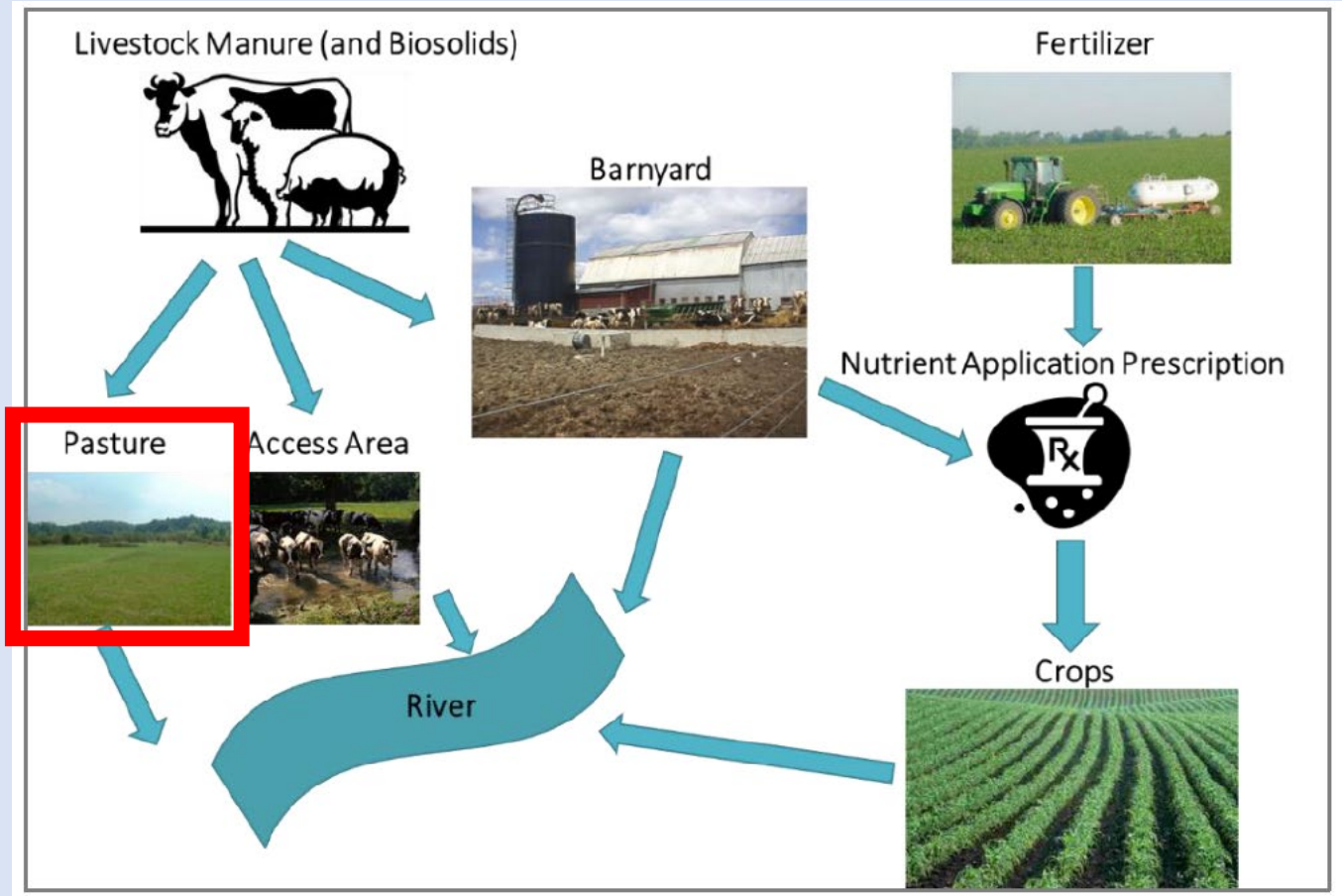


Figure 3-4 Conceptual diagram of nutrient fate through agricultural lands

Manure Direct Deposition to Pasture

- Does NOT count towards pasture crop application goal
  - Can always receive supplemental fertilizer later
- Again, data are provided by each state.

Animal Type	Month	Barnyard Percent	Pasture Percent	Access Area Percent
beef	1	6	91	3
beef	2	6	91	3
beef	3	0	96	4
beef	4	0	94	6
beef	5	0	94	6
beef	6	0	90	10
beef	7	0	90	10
beef	8	0	90	10
beef	9	0	94	6
beef	10	0	96	4
beef	11	0	96	4
beef	12	6	91	3

How do Ag Nutrients cycle through CAST?

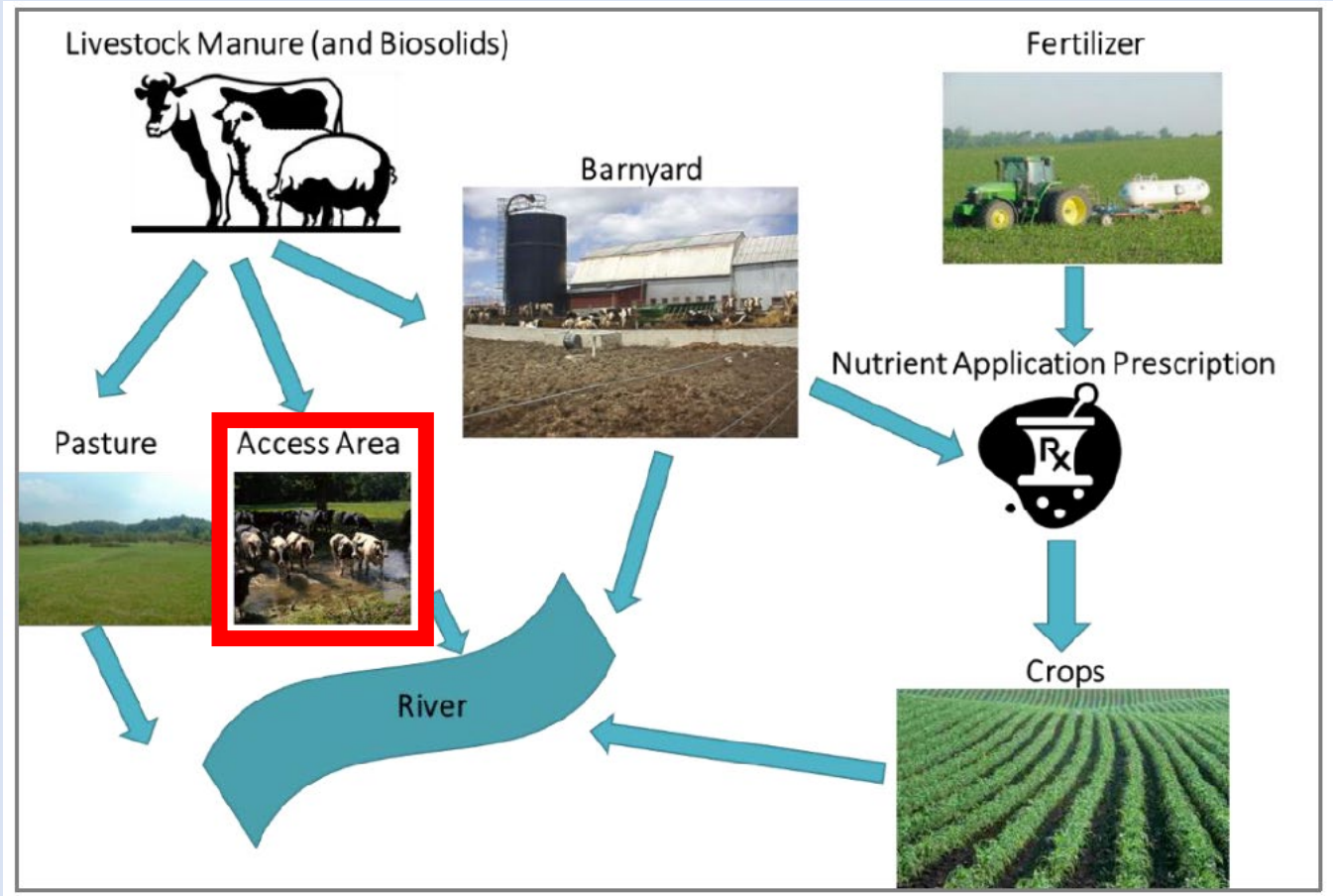
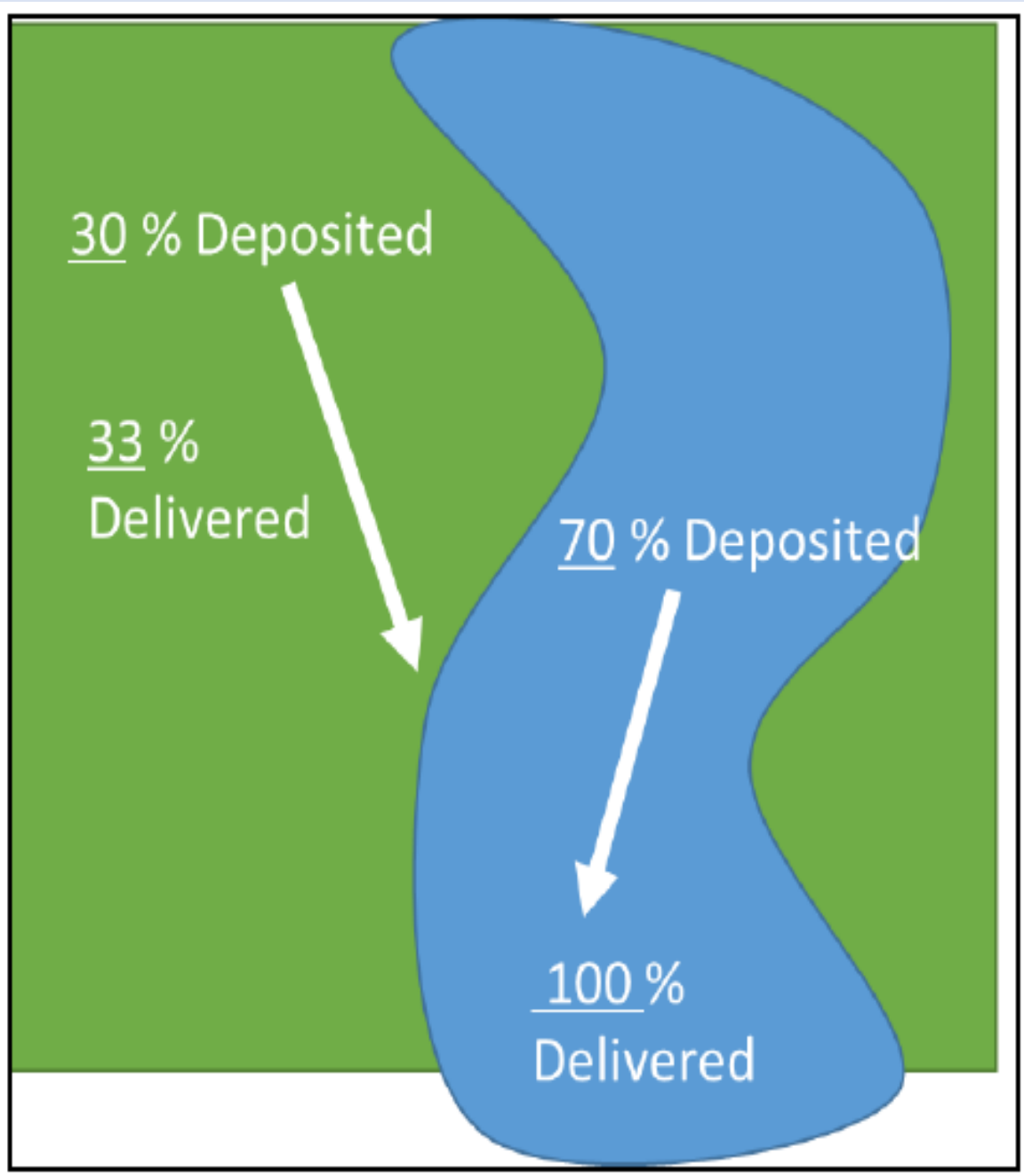


Figure 3-4 Conceptual diagram of nutrient fate through agricultural lands

Direct Deposition to Riparian

- Unavailable for application or transport
- 80% deposited reaches streams
- State provided

Animal Type	Month	Barnyard Percent	Pasture Percent	Access Area Percent
beef	1	6	91	3
beef	2	6	91	3
beef	3	0	96	4
beef	4	0	94	6
beef	5	0	94	6
beef	6	0	90	10
beef	7	0	90	10
beef	8	0	90	10
beef	9	0	94	6
beef	10	0	96	4
beef	11	0	96	4
beef	12	6	91	3



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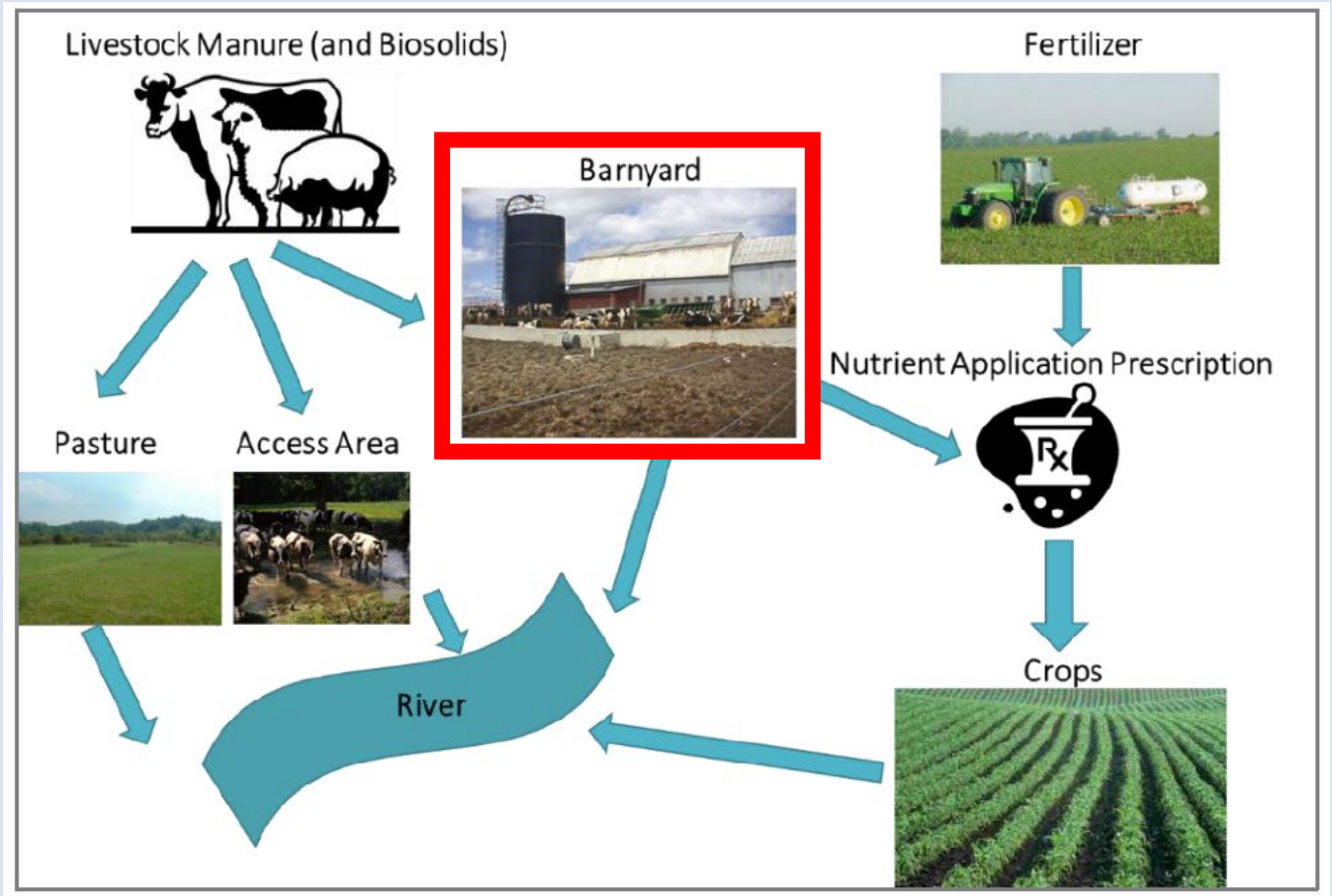


Figure 3-4 Conceptual diagram of nutrient fate through agricultural lands

Confined Deposition (Barnyard)

- Lost to the environment
- Collect and transport to another area
- Storage
- Remainder is applied to crops in the county

Animal Type	Month	Barnyard Percent	Pasture Percent	Access Area Percent
beef	1	6	91	3
beef	2	6	91	3
beef	3	0	96	4
beef	4	0	94	6
beef	5	0	94	6
beef	6	0	90	10
beef	7	0	90	10
beef	8	0	90	10
beef	9	0	94	6
beef	10	0	96	4
beef	11	0	96	4
beef	12	6	91	3

Manure nutrient losses

Volatilization

- Confined
- Pasture
- Riparian

Storage and Handling

- Confined

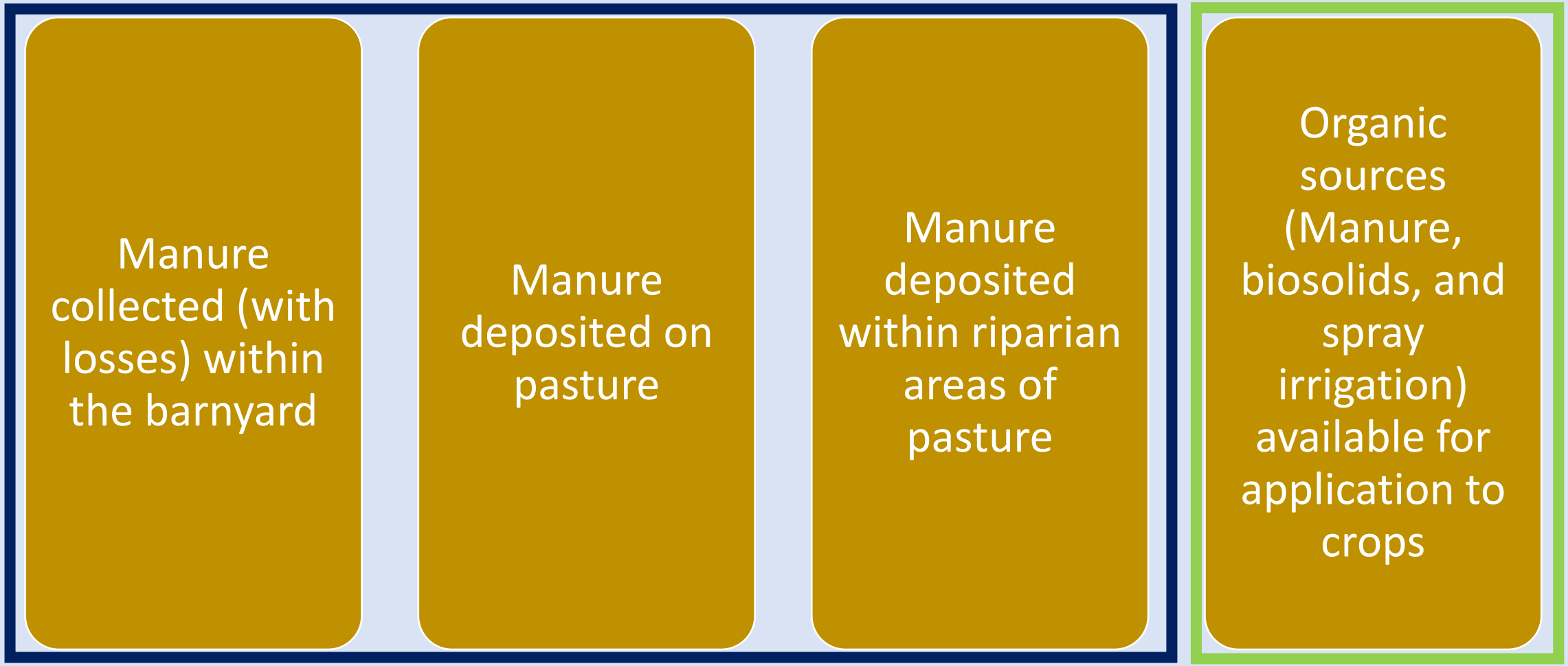
Transport

- Confined
- Moved across county lines
  - Estimate the percent moisture to calculate the nutrients transported
  - States have also reported as a dry weight

Agriculture nutrient categories

Manure deposition categories

Crop available nutrients



Plant Available nutrients after applications

Volatilization	Happens in the field after application
Mineralization	If its not mineralized it is removed
	Organic Nitrogen mineralization fraction
	Phosphate and mineralized phosphorus concentration

Table 3-10: Mineralization fraction of organic nitrogen

Animal Type	1985	1990	1995	2000	2005	2010	2013
hogs and pigs for breeding**	0.3	0.3	0.4375	0.575	0.575	0.575	0.575
beef**	0.3	0.3	0.415	0.53	0.53	0.53	0.53
dairy**	0.3	0.3	0.415	0.53	0.53	0.53	0.53
hogs for slaughter**	0.3	0.3	0.4375	0.575	0.575	0.575	0.575
horses*	0.2	0.2	0.275	0.35	0.35	0.35	0.35
other cattle**	0.3	0.3	0.415	0.53	0.53	0.53	0.53
sheep and lambs*	0.3	0.3	0.4	0.5	0.5	0.5	0.5
goats*	0.3	0.3	0.4	0.5	0.5	0.5	0.5
broilers**	0.55	0.55	0.65	0.75	0.75	0.75	0.75
pullets**	0.55	0.55	0.65	0.75	0.75	0.75	0.75
turkeys**	0.55	0.55	0.65	0.75	0.75	0.75	0.75
layers**	0.55	0.55	0.65	0.75	0.75	0.75	0.75

Calculating Manure Acres

- Cast Documentation Land Use 5.4.2

Background

- Desire to separate major crops into manure vs non manure acres
  - Corn for grain
  - Silage
- Some producers don’t have access to manure or other organic sources
- Census of Agriculture does not break out acres receiving manure or no manure

How does CAST determine acres with manure?

Fraction of Silage acres with Manure =

- 0.85

Fraction of Grain acres with Manure =

- [(0.1311) X (Natural Log of(Total Animal Units/Total Acres Harvested Cropland))] + 0.5196

Note* If the fraction of this results in a value below 0.18 it should equal 0.18, and any result above 0.81 should equal 0.81

How does CAST determine acres with manure?

Acres of Silage with Manure =

- Acres of total silage crops X 0.85

Acres of Grain with Manure =

- Acres of total grain crops X [(0.5196) + (0.1311) X (Natural Log of(Total Animal Units/Total Acres Harvested Cropland))]

How does CAST determine acres with manure?

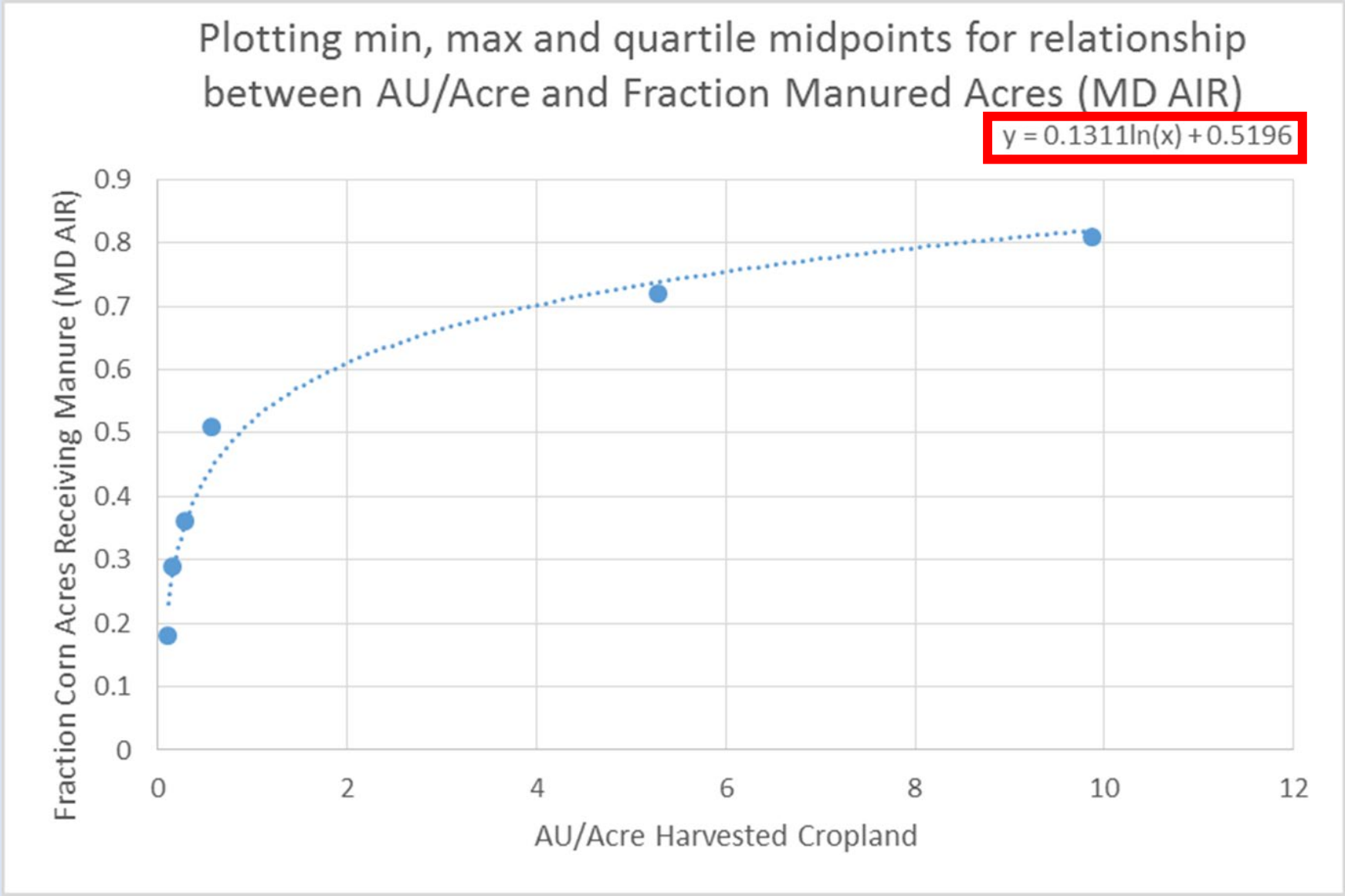
Annual Implementation Report Data provides Maryland specific data for acres with manure application (2012 data)

- Fraction of Corn receiving manure is constrained between 0.18 and 0.81
- Fraction of silage receiving manure was set at 0.85 (AgWG)

NOTE* Recent changes in manure eligibility does NOT change manure acres.

Why is there a range for corn?

- 2012 Maryland Annual Implementation Report data
- Number of animals influence the percent of corn acres receiving manure within a county



Example of manure acres

- 2022 Progress
- CAST Base conditions report
- Shows manure acres vs non-manure acres
- Pre-BMP
- Chesapeake Bay Watershed

CAST Watershed Ratio of Pre-BMP acres with and without manure applications

Sum of 2022 Progress PreBMP Acres				
Land Use	Grain with Manure	Grain without Manure	Silage with Manure	Silage without Manure
Total Acres in the CBW	876747	914163	373834	65971
Ratio of manure acres to non-manure acres	0.96		5.67	

Questions?