



# **Animal Module: From Feed Back to Manure**

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**RUFAS ANNUAL MEETING 2020**

# Outline

Feed Management

Animal Module

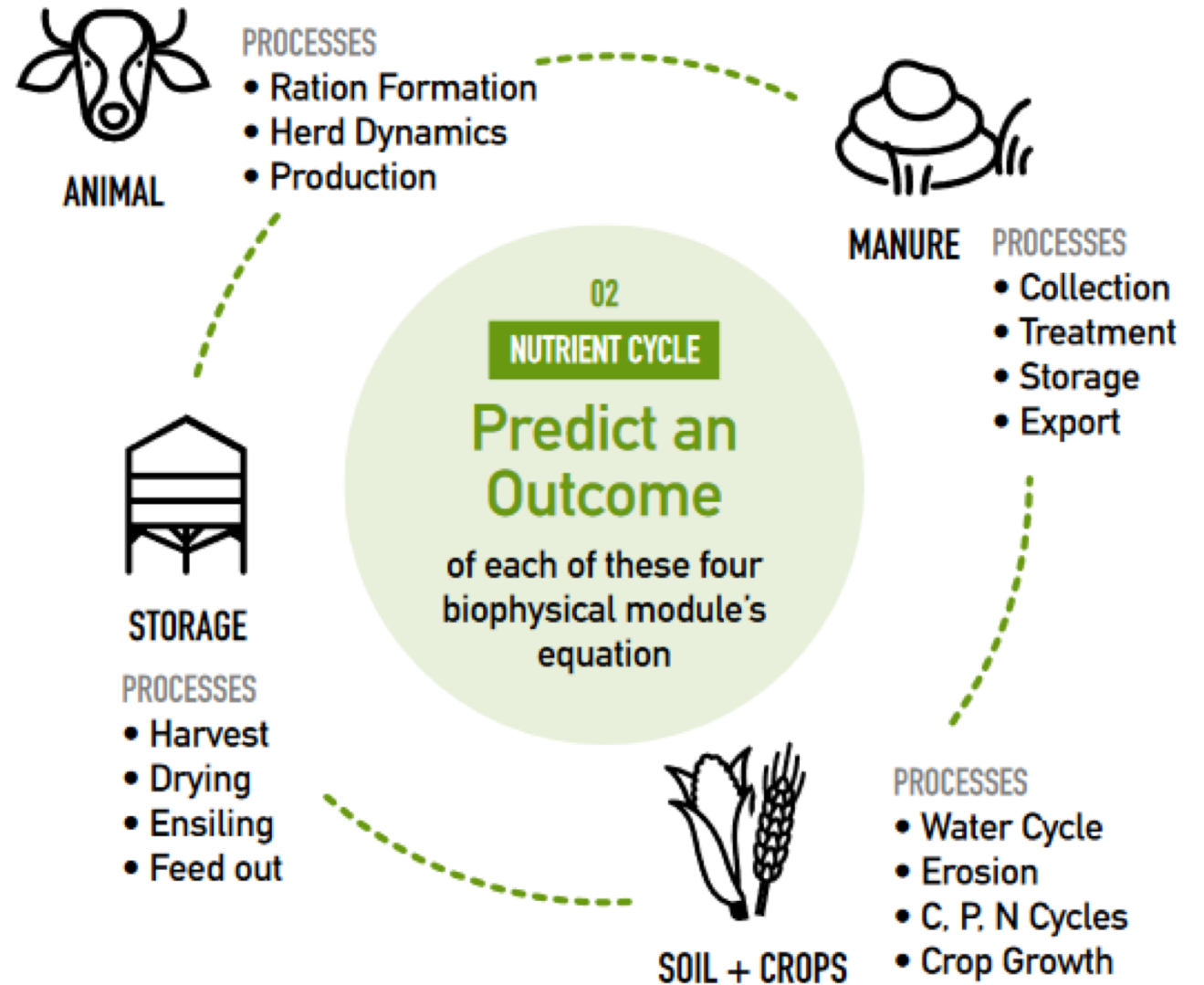
Ration Formulation

Animal Life Cycle

Manure Excretion

Mass Balance

Next Steps



# Connecting Feed to Animal Rations

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**Senior, Operations Research and  
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**Cornell University**

# Ration Examples

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**Ph.D. Candidate, Department of Animal Science**

**University of California Davis**

# Animal Life Cycle Submodule

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**University of Wisconsin – Madison**

- **Herd Initialization: Katrina Wang**
- **Bodyweight Changes: Jinghui Li**

# Animal Module Wrap Up

Manure Excretion

Mass Balance

# Manure Excretion

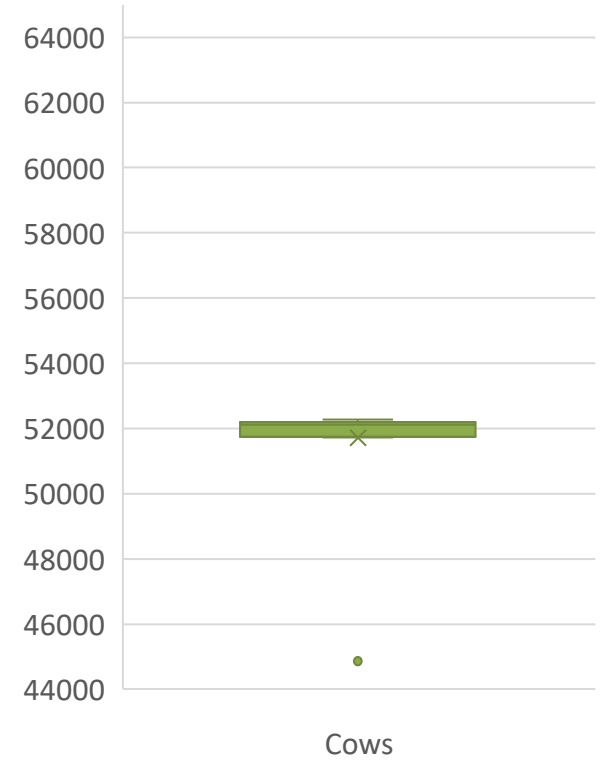
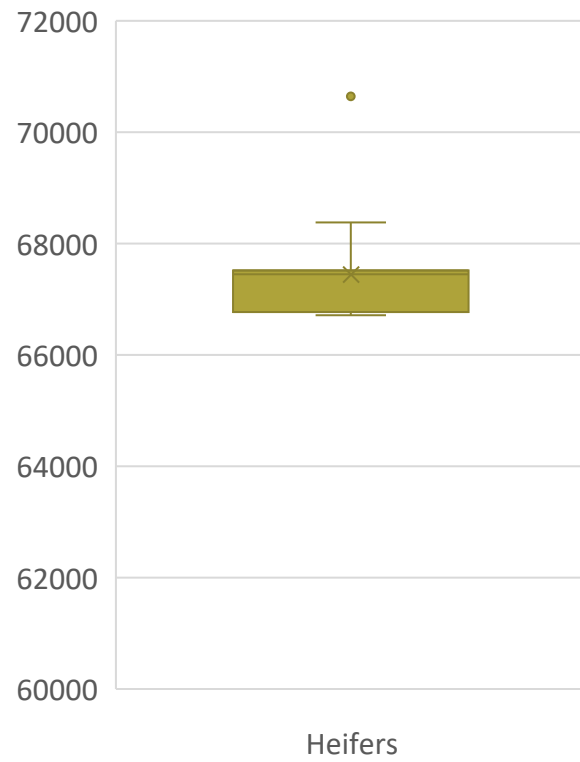
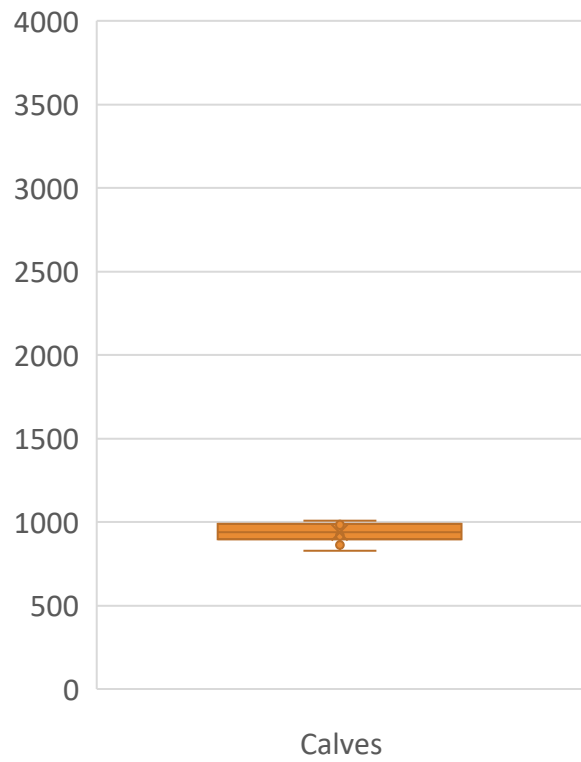
A large, well-lit dairy barn with a high ceiling and wooden support beams. Several black and white cows are visible, some standing and some lying down. The floor is made of wooden planks. In the foreground, a cow with a white body and black patches is looking towards the camera. It has an orange ear tag with the number 2819. Other cows are scattered throughout the barn, some in the background and some in the middle ground. The lighting is bright, coming from windows or skylights on the roof.

Integrate ration and animal production to determine individual animal manure excretion

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# Manure Excretion in Pens (kg)

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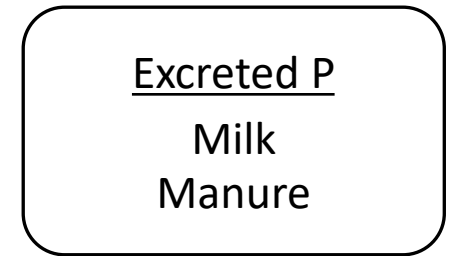
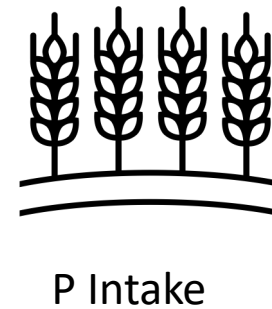
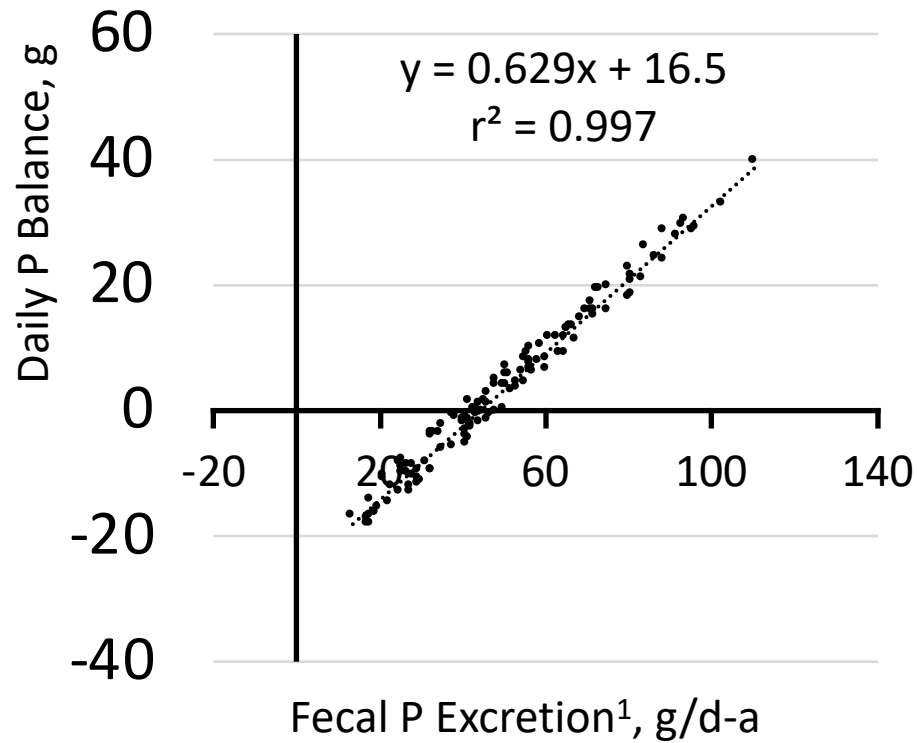
# ASABE Excretion (kg/d – animal)

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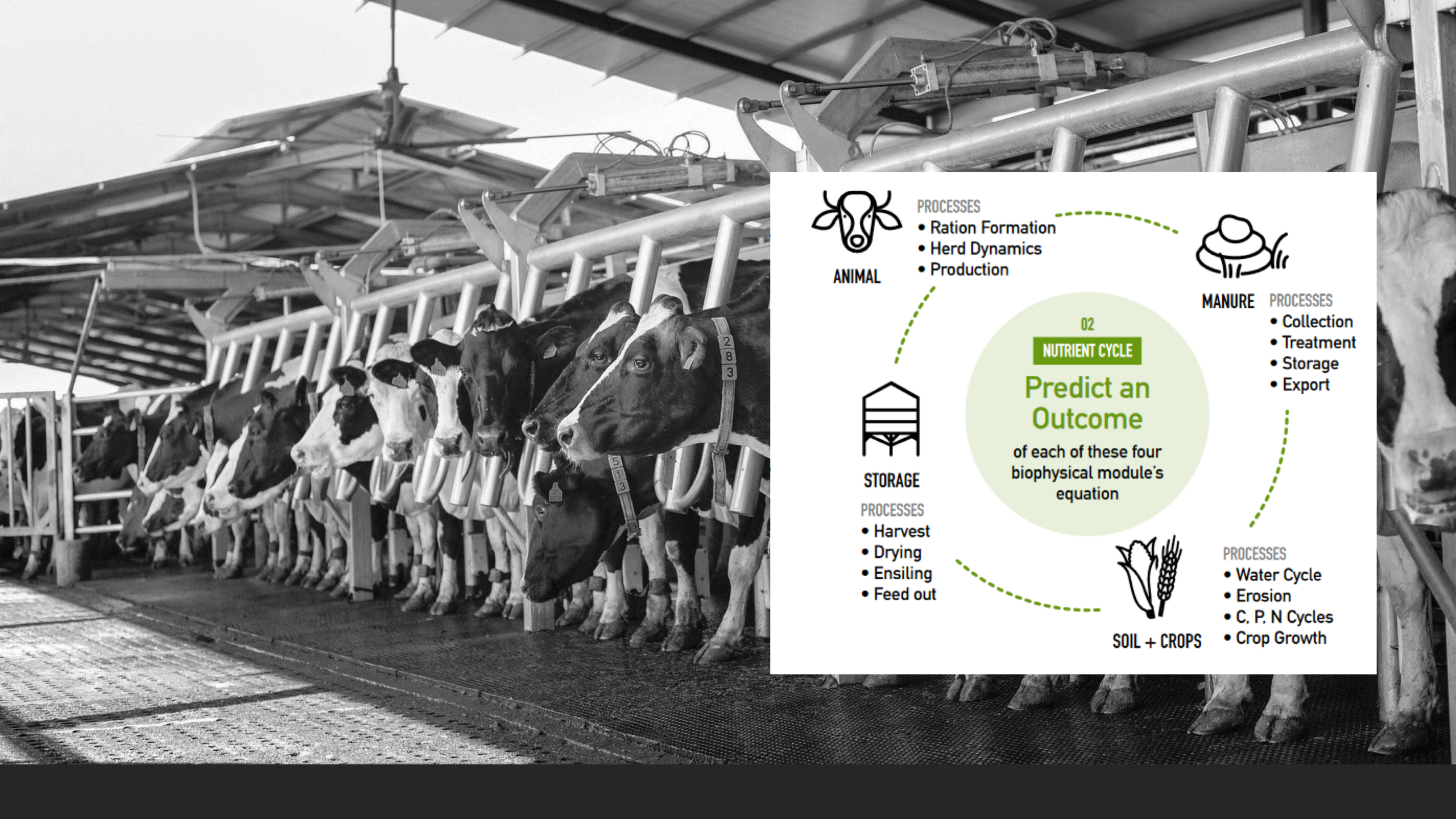
	Total Solids	Volatile Solids	N	P	K
<b>Calves</b>	1.4		0.063		
<b>Heifers</b>	3.7	3.2	<b>0.12</b>	<b>0.020</b>	
<b>Lactating Cows</b>	<b>8.9</b>	7.5	<b>0.45</b>	<b>0.078</b>	<b>0.103</b>
<b>Dry Cows</b>	<b>4.9</b>	4.2	<b>0.23</b>	0.03	0.148

Diet based numbers are in **BOLD**

# Empirical Equations for Nutrient Excretion: Example Phosphorus<sup>1</sup>



<sup>1</sup>Weiss and Wyatt (2004)



ANIMAL

PROCESSES

- Ration Formation
- Herd Dynamics
- Production



MANURE

PROCESSES

- Collection
- Treatment
- Storage
- Export



STORAGE

PROCESSES

- Harvest
- Drying
- Ensiling
- Feed out

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NUTRIENT CYCLE

Predict an Outcome

of each of these four biophysical module's equation



SOIL + CROPS

PROCESSES

- Water Cycle
- Erosion
- C, P, N Cycles
- Crop Growth

# Combining Animal Excretion and Nutrient Mass Balance

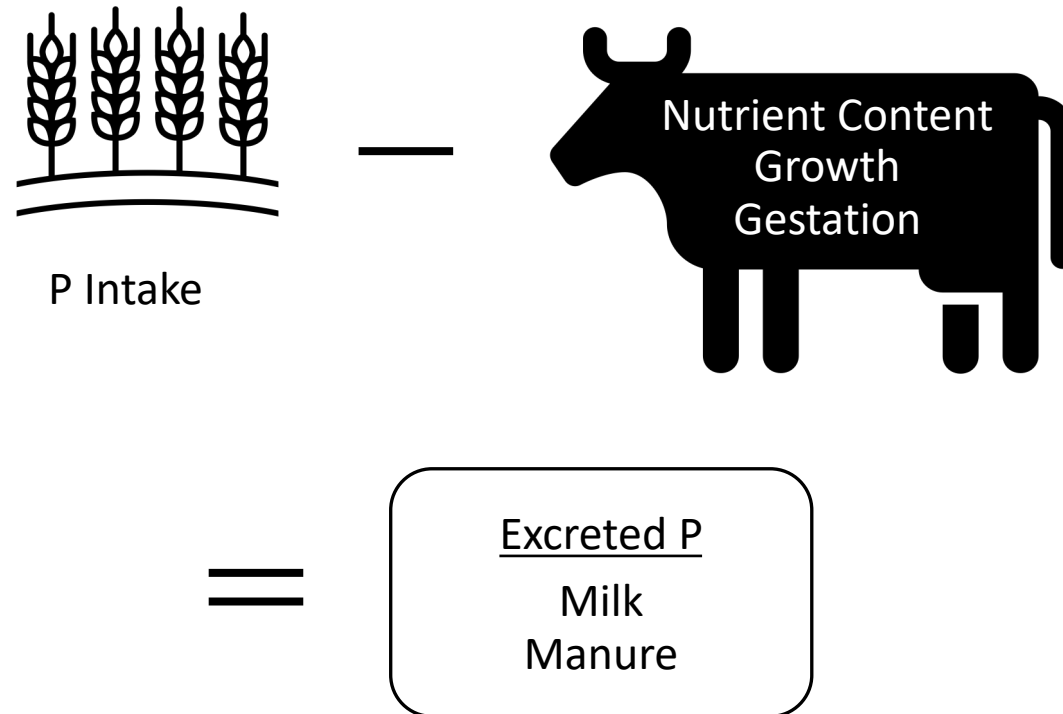
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P Balance

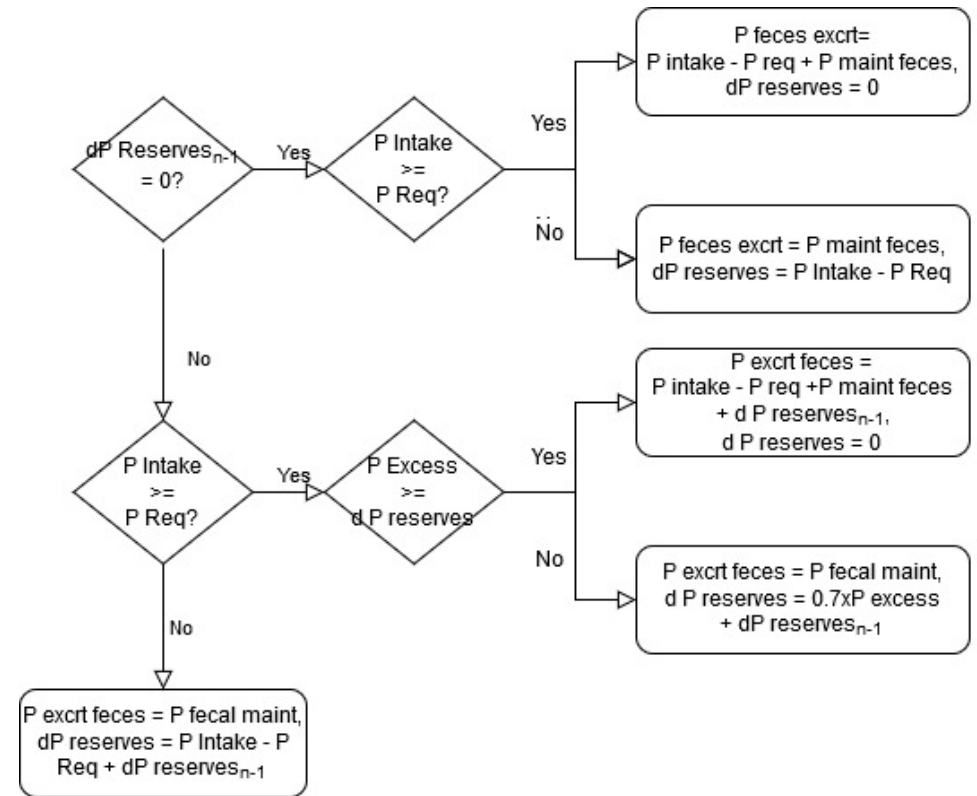
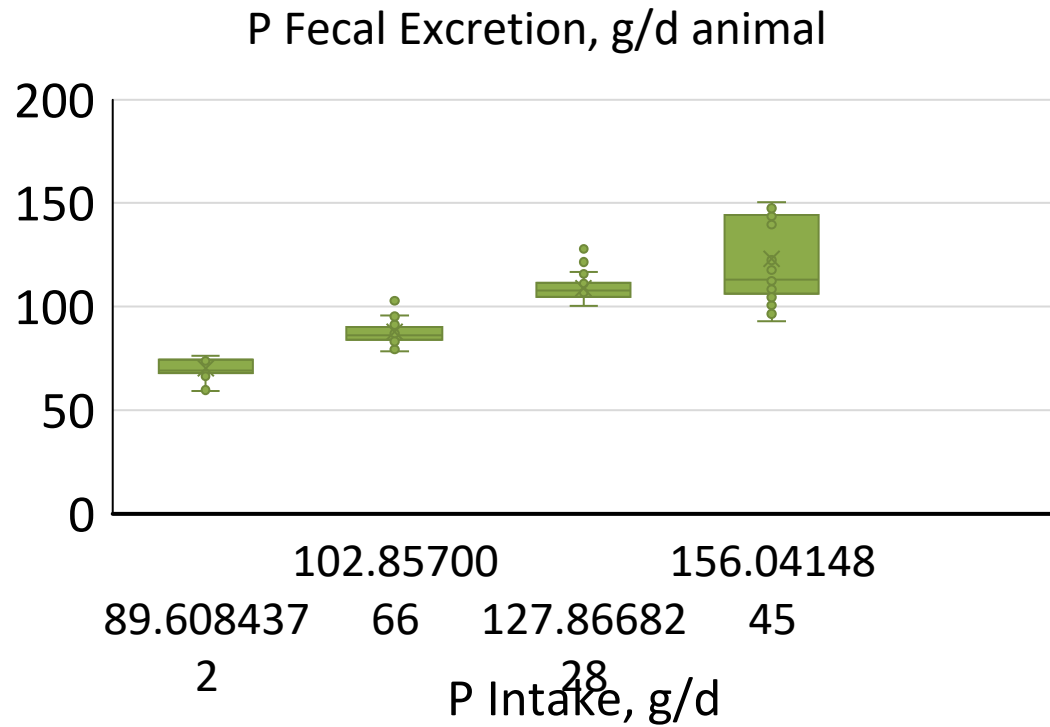
K Balance

*N Balance*

*C Balance*



# Phosphorus Balance





# Next Steps

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**Completing Nitrogen Balance**

**Carbon Balance – large check off for environmental emissions**

**Barnyard Management: Heat Stress, Water Use**



# Questions?

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# Break

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