

EXPLORING THE RUMINANT DIGESTIVE SYSTEM

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Husker Mobile Beef Lab

Why does this beef animal have a hole in its stomach?

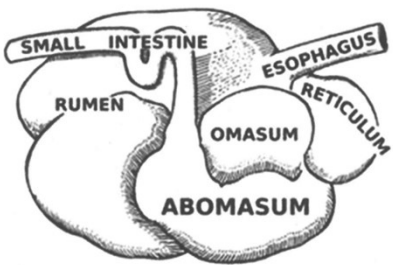
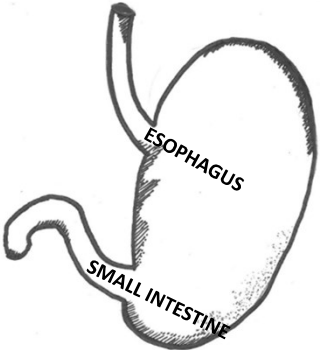
- The hole (fistula) is like a window we can use to learn more about cattle digestion.
- Through research, scientists and nutritionists are able to develop more efficient rations that produce less greenhouse gases.



N EXTENSION

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Ruminants have a complex four-compartment stomach.

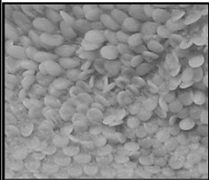
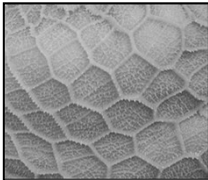


COW STOMACH HUMAN STOMACH

Ruminant animals are able to digest grass and other plants that humans can not digest.

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The four compartments work together to digest food.

The stomach includes the rumen or paunch, reticulum or "honeycomb," the omasum or "manyplies," and the abomasum or "true stomach."

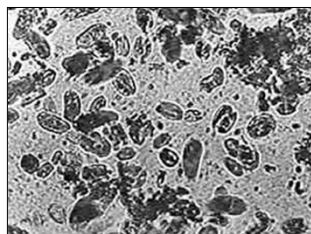
			
Papillae of interior rumen	Honeycomb tissues of reticulum	Omasum contains leaves of tissue	Abomasum breaks down food

- The rumen acts as a storage vat which ferments feed.
- Dense feed drops into the reticulum.
- The omasum absorbs water and other substances.
- Acids and enzymes are secreted into the abomasum (like our human stomach).

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Bugs in a cow's stomach help them digest their food.

- There are trillions of bacteria inside a cow's stomach.
- The cow provides the perfect environment for bacteria to breakdown cellulose in plants.
- Cows can digest rigid plant cells, converting it to sugars and nutrients for energy.

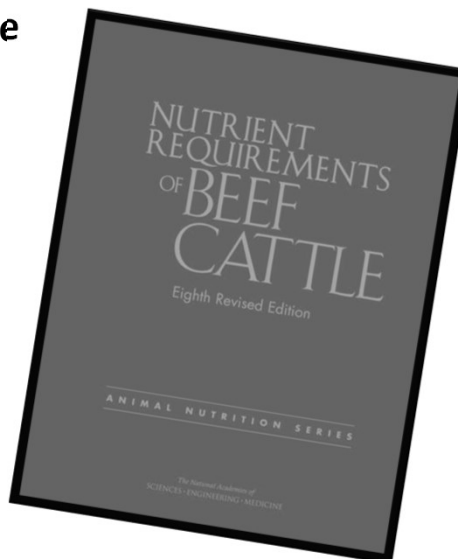


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Nutrient Requirements of Beef Cattle

National Research Council (NRC) Guidelines:

- Derived from a large volume of experimental feeding trials by a committee of nutritional scientists.
- In 1996, the NRC shifted from using a crude protein (CP) system to using a metabolizable protein (MP) system.



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Why the change from the crude protein (CP) system to the metabolizable protein (MP) system?

- CP assumes that all protein is equal
- $CP = RDP + RUP$
 - Rumen Degradable Protein (RDP) - used by rumen microorganisms
 - Rumen Undegradable Protein (RUP) - bypass protein
- MP system expresses protein requirements on a RDP and a metabolizable protein (MP) basis



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Metabolizable Protein (MP)

- $MP = BCP + RUP$
- Bacterial Crude Protein (BCP)
 - Made by microbes using RDP
- Rumen Undegradable Protein (RUP)
 - Escape or bypass protein which is absorbed in the intestine



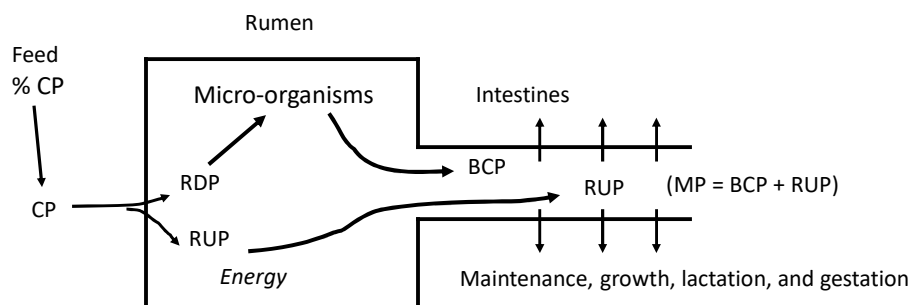
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Protein Requirements

- Why are RDP and RUP important?
- Cattle have two distinct protein requirements:
 1. Microbial requirements in the rumen (RDP)
 2. Physiological demand (growth & maintenance of animal)
 - a) Bacterial crude protein (BCP) - made by microbes using RDP
 - b) Protein that has escaped rumen degradation – RUP

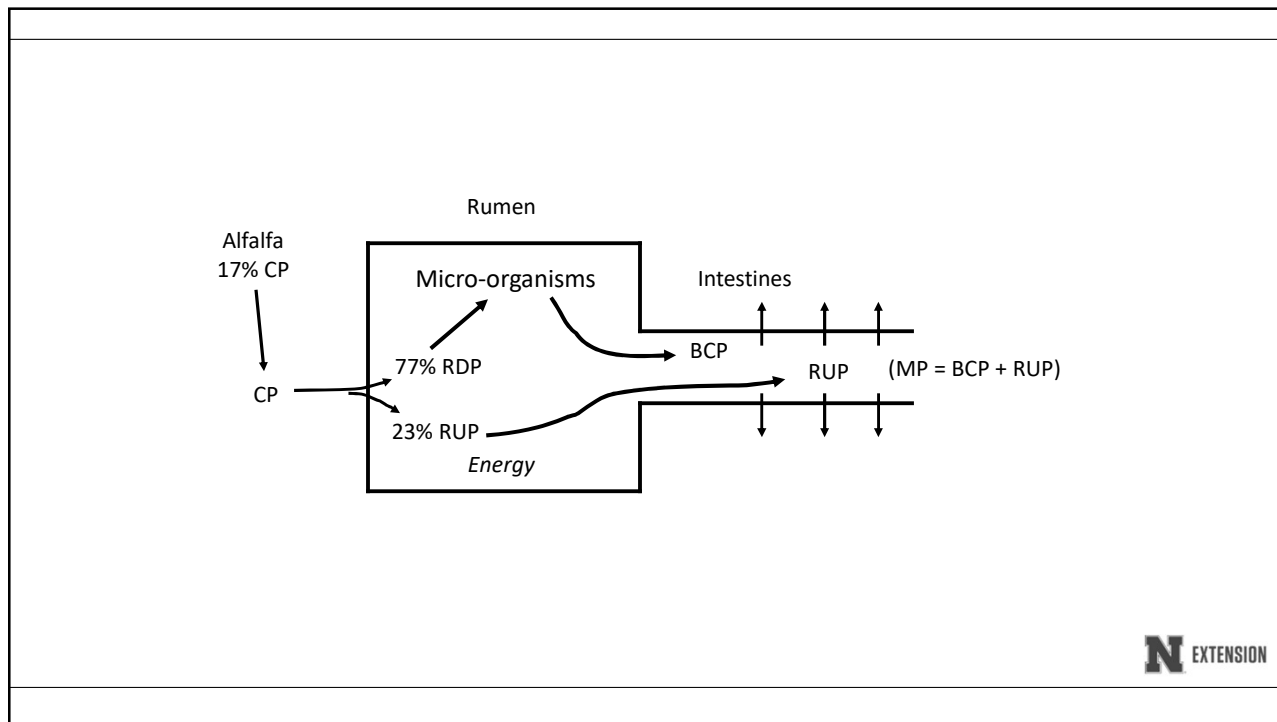
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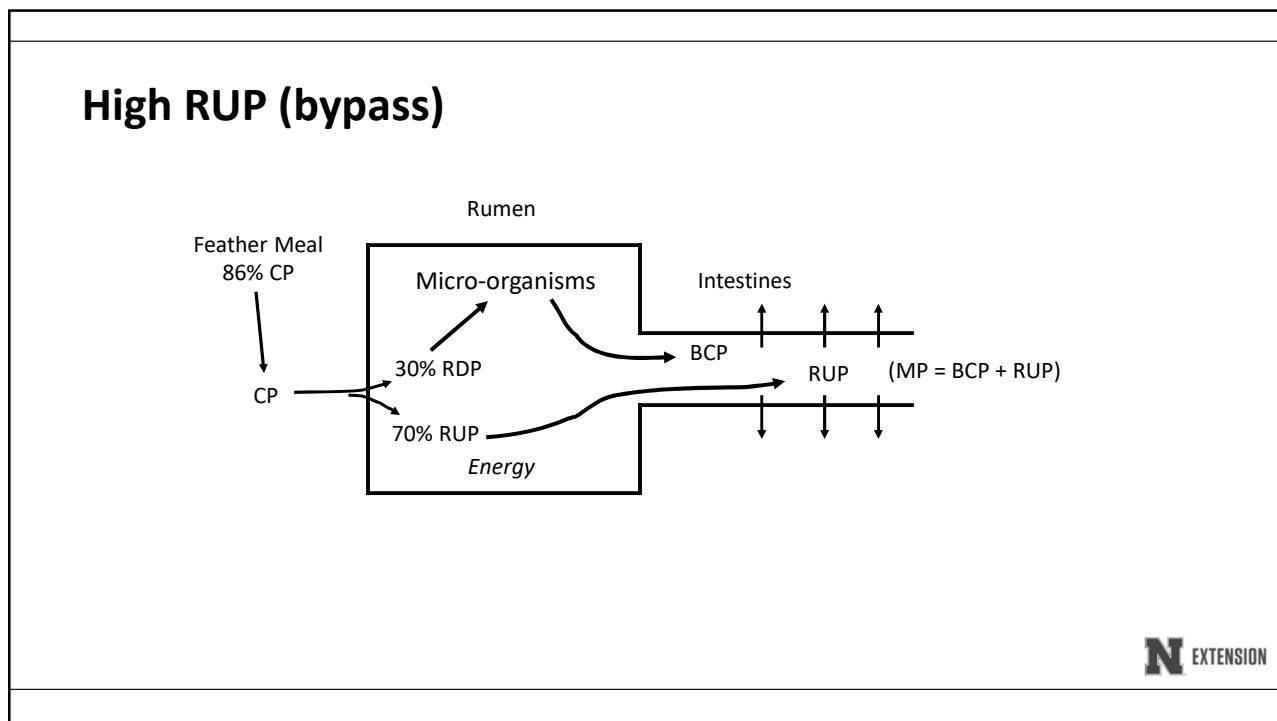


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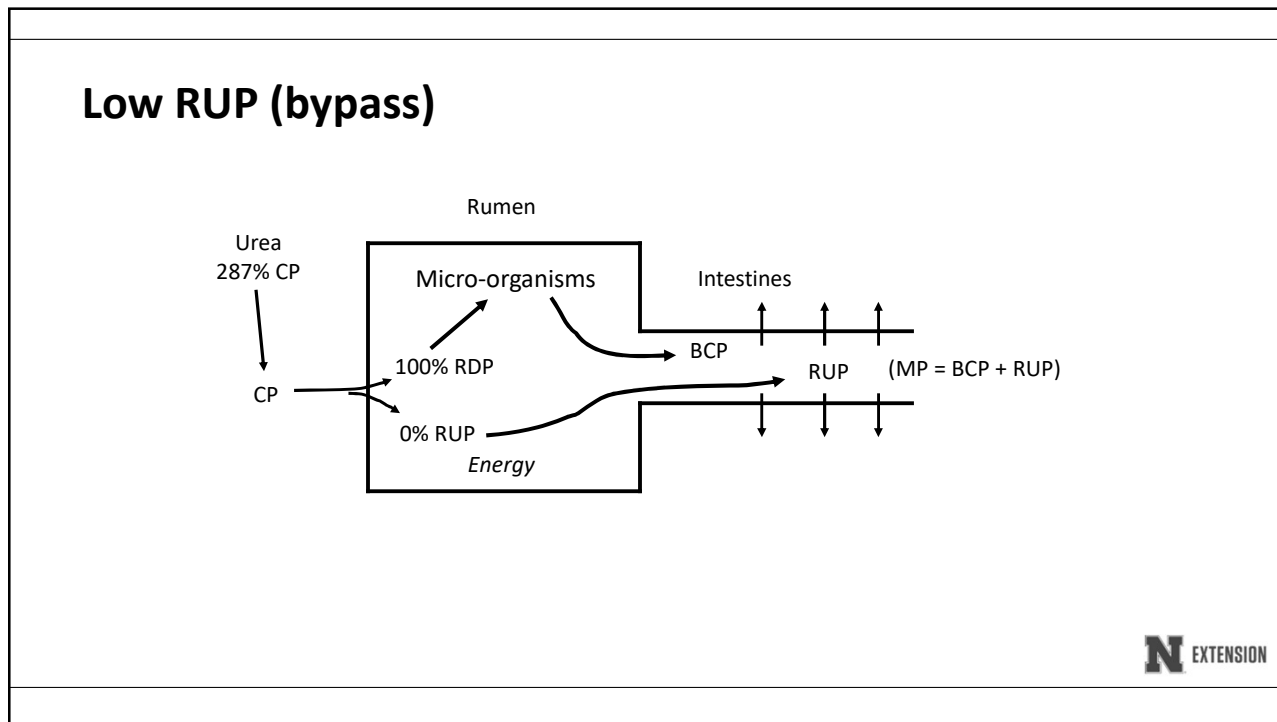
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RUP (Bypass) Values

Very low bypass	Urea	0 – 20% bypass
	Casein	
	Corn steep liquor	
Low bypass	Soybean meal	20 – 40% bypass
	Peanut meal	
	Sunflower meal	
Medium bypass	Alfalfa hay	40 – 60% bypass
	Cottonseed meal	
	Dehydrated alfalfa	
High bypass	Linseed meal	60% or higher
	Corn grain	
	Brewers dried grains	
	Distillers dried grains	
	Corn gluten meal	
	Feather meal	

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Why meet the protein requirements?

- If not met, the animal will use its own body proteins to meet its demands. Thus, the animal will lose condition!
- If not met, the cow/heifer may not rebreed.



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When are nutrient needs the highest?

- Growing calves/replacement heifers
- Late gestation
- Lactation



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Plant Structure and Plant Growth/Development

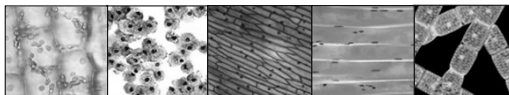
What gives a plant its structure and ability to stand up or grow tall?



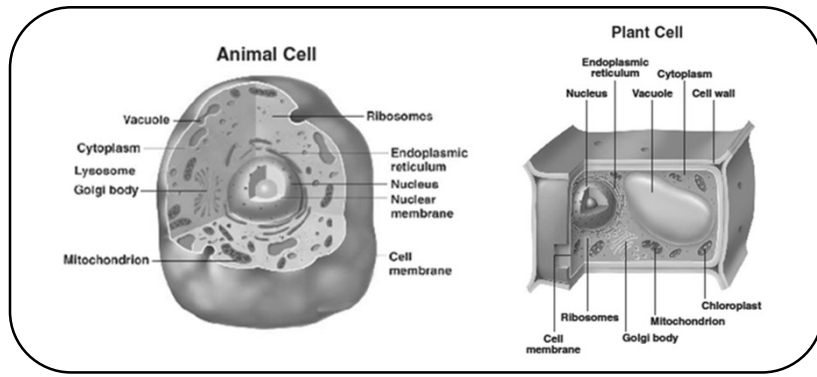
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Cells are the basic building blocks of life.

There are different types of cells, each having their own function.

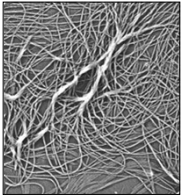


Plant cells are different than animal cells.

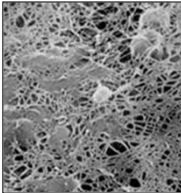


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**Plant cell walls are made up of three things:
Cellulose, Hemicelluloses, and Lignin**



Cellulose fibers




Microfibrils

- Cellulose fibers are made up of chains called microfibrils.
- Microfibrils form a bigger chain called a macrofibril.
- Macrofibrils make up fibers.


Microfibrils ⇒ Macrofibrils ⇒ Cellulose fibers ⇒ Plant materials

Did you know that cotton is made up of 100% cellulose?




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Photosynthesis is one of the most crucial processes in plant life.



Energy



Through the process of photosynthesis, plants grow and provide a source of food for animals and humans.

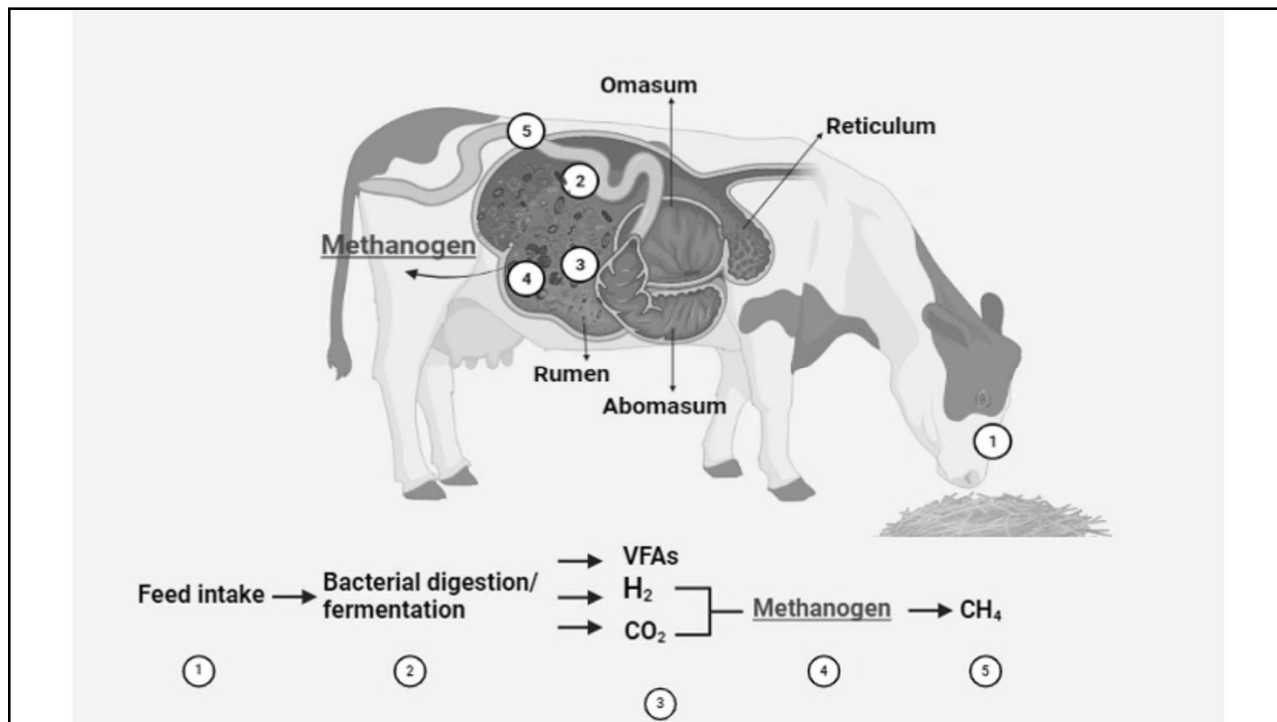
Carbon Dioxide

Nutrients

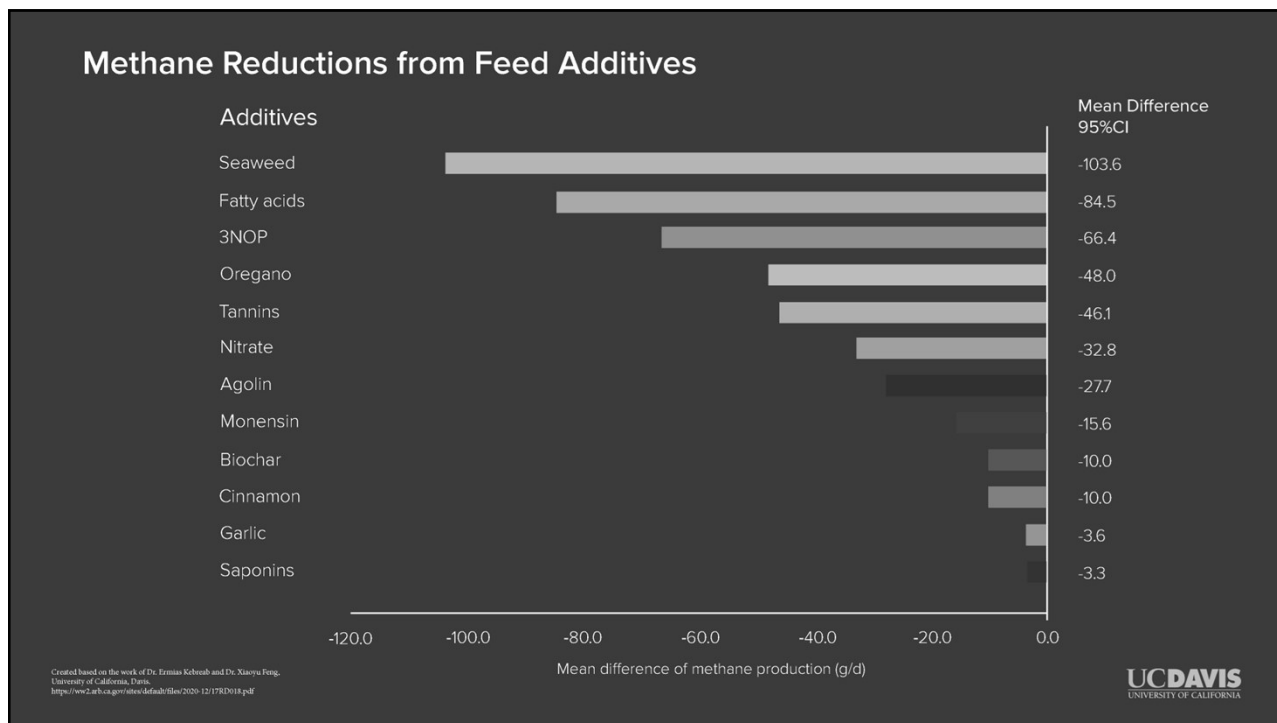
Oxygen

Food

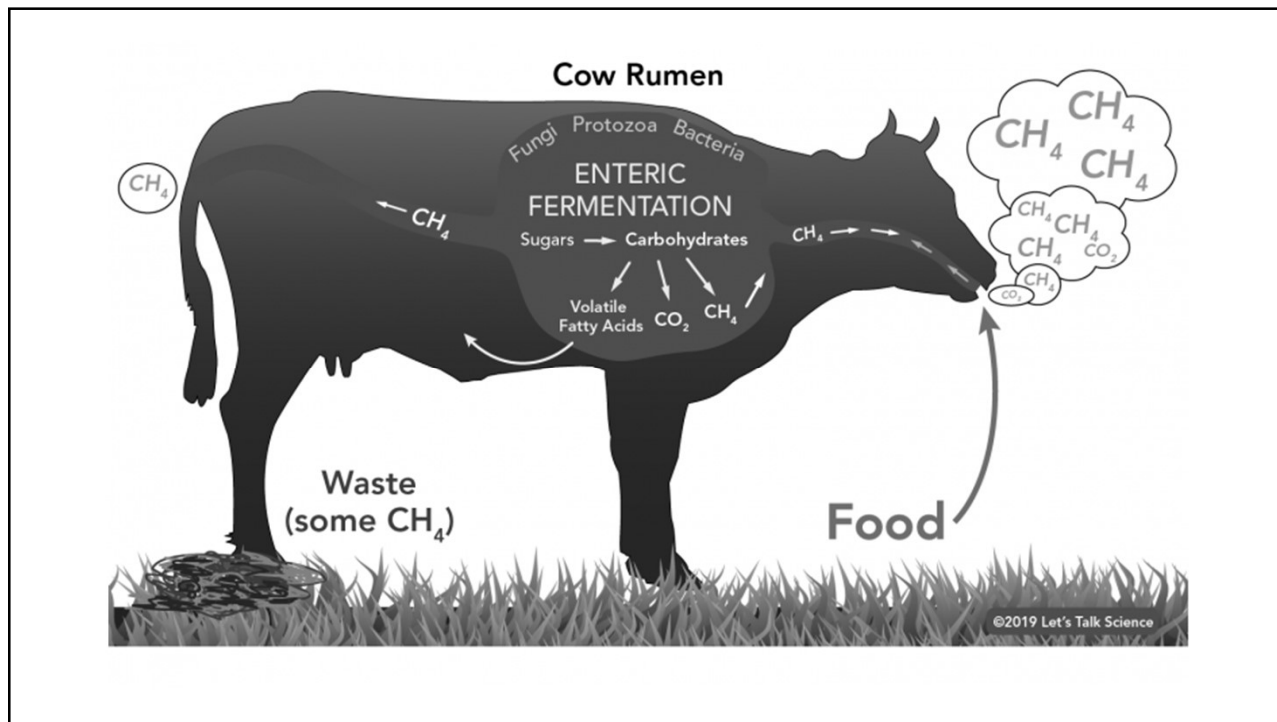
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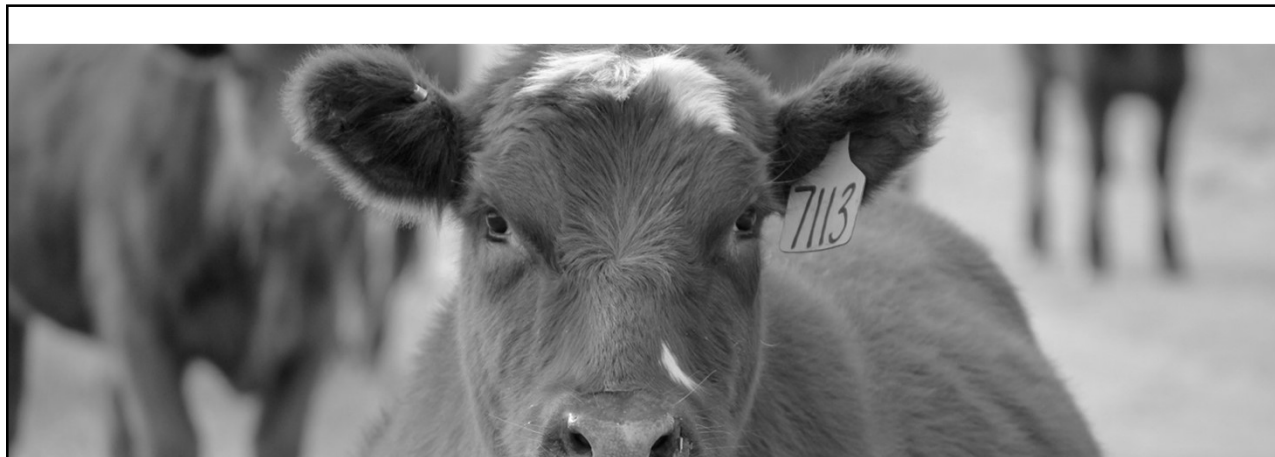
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Nebraska's land is its most valuable resource.

Cattle occupy two-thirds of Nebraska's grazing land, nearly 23 million acres — half is in the Sandhills.

The Nebraska Sandhills provide good grazing land, in an area where crops are not able to be produced.

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TOP 3 BEEF COW COUNTIES IN THE U.S.

1. Cherry County – 184,716 cows
2. Custer County – 100,000 cows
3. Holt County – 93,000 cows

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