Nutrition Basics for Welfare and Financial Sustainability in Ruminant Production Systems

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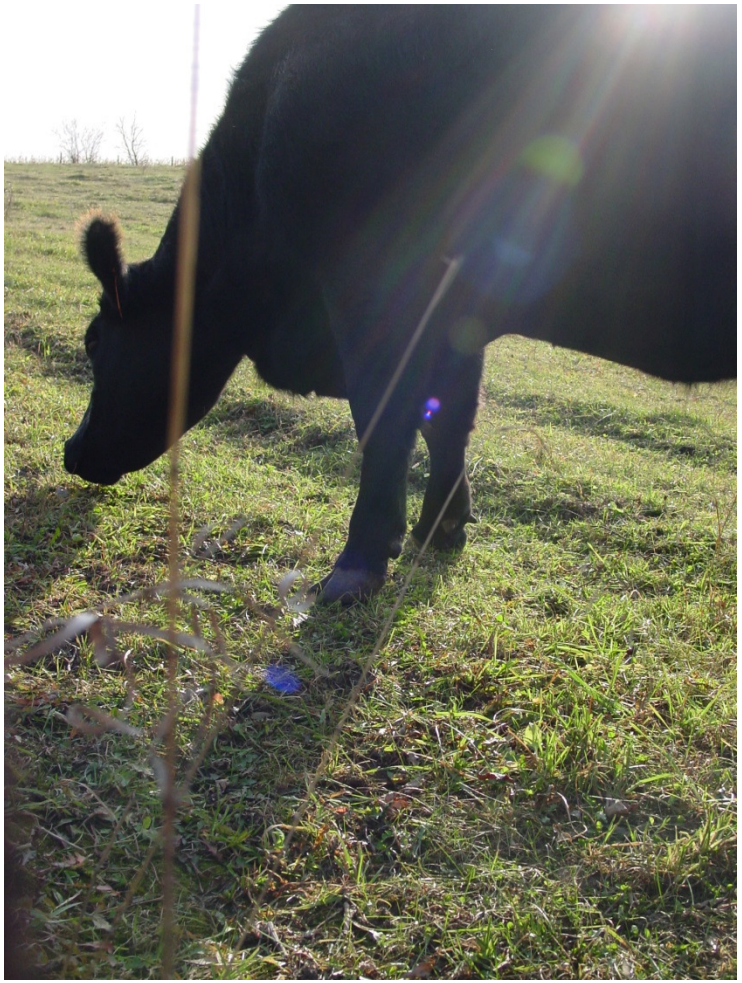
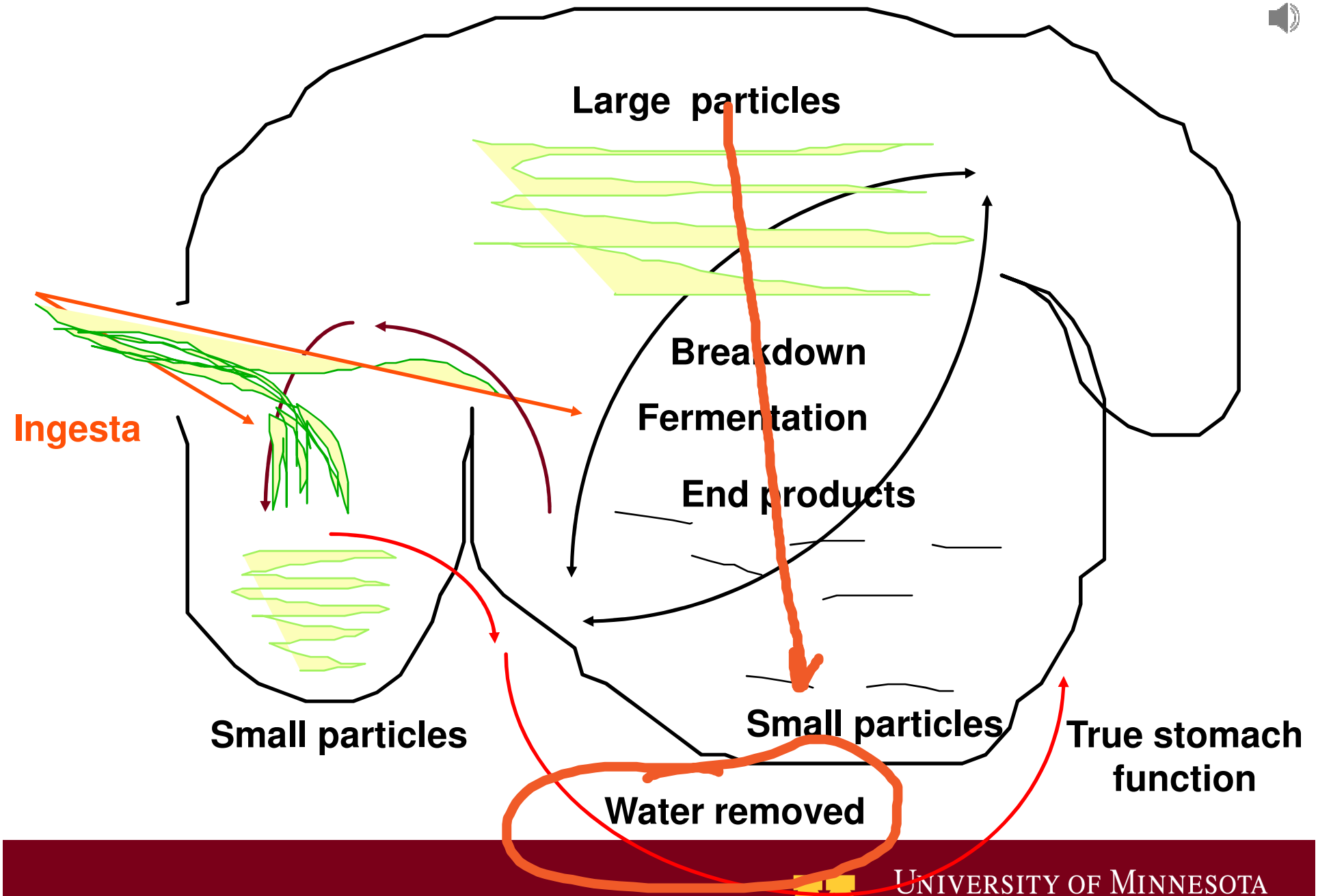
Ruminant Production Systems

- **Diverse**
  - **Grazing systems—meat or milk**
    - **Cattle**
    - **Sheep**
    - **Goats**
  - **Drylot systems—meat or milk**
    - **Cattle**
    - **Sheep**
    - **Goats***



Production Systems

- **Regardless of the species or purpose, we enter into an unwritten covenant to provide or maintain:**
  - **Safety**
  - **Comfort**
  - **Health**
  - **Feed and water**
    - **Feed—50% to 75% of cost of production**
      - **Feed consumption**
        - » **Welfare/financial sustainability**


Large particles
Breakdown
Fermentation
End products
Ingesta
Small particles
Small particles
True stomach function
Water removed

Ruminal fermentation

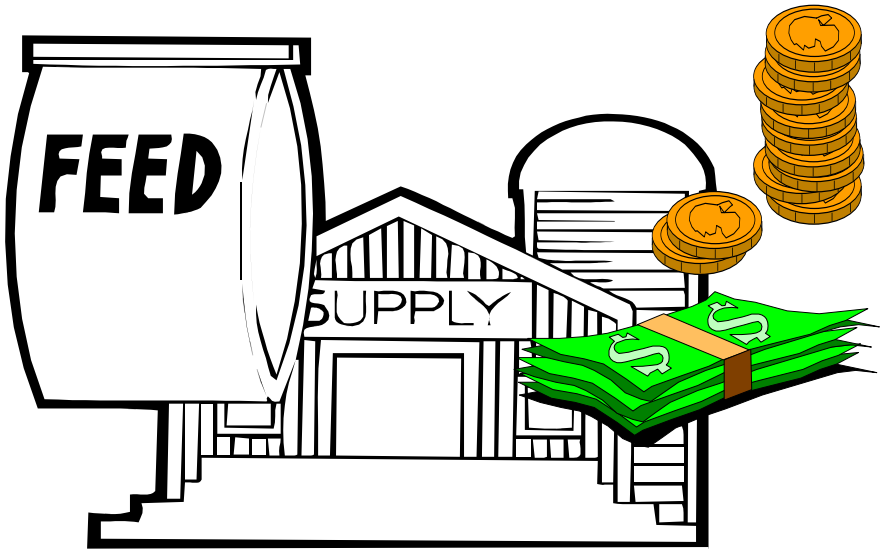
- Energy byproducts
  - Volatile fatty acids
  - Lipids
  - Protein and peptide fractions
- Protein
  - Nitrogen
  - Microbial protein
- B Vitamins
- Detoxified substances

What nutrients should we provide?

- Energy
  - carbohydrates, proteins and lipids
  - maintenance, growth and milk production
- Protein
  - non-protein nitrogen, rumen degradable and undegradable
- Vitamins A, D, E
- Minerals

What do we need to know?

- **Nutrient needs**
  - maintenance
  - growth
  - lactation
  - pregnancy
- **Nutrient supply**
  - forage
  - grains
  - supplements
- **Nutrient costs**
  - home-grown feeds
  - purchased feeds



Water Needs

- First limiting nutrient
  - Drives feed intake
    - Water used in many reactions in the body
  - Must be fresh and clean
  - Feed and other environmental contaminants (dust, bedding, bird droppings, etc.) readily reach most water tanks
  - Must ensure that water supply and access is ample during warm months

System	Need, gallons/day*
Lactating dairy cow	35
Lactating beef cow	10
Feedlot cattle	14
Growing cattle	10
Ewe with lamb(s)	3
Feedlot lamb	2
Goat	1

*Unadjusted for weather

Water Supply Situations

Anti Quality Factors

- Ideal salinity or TDS < 1,000 mg/L or 1,000 ppm
  - From 1,000 to 6,999 safe for adult ruminants
- Nitrate < 44 ppm
  - From 45 to 132 ppm safe if diet is N balanced
- Sulfate < 1,000 ppm
- Bacteria counts < 15 counts/100 mL
  - Coliforms < 10 counts/100 mL
- Algae

Animals (and humans) eat units of weight not units of concentration

- Nutrients represented as concentration in feeds (% ppm)
  - Hay sample (ABC) contains 1.12 Mcal NE_m/kg of DM or 55% TDN
- Nutrient needs of animals represented as mass
  - Beef cow (blue # 150) requires 16 lb TDN daily
  - Cow # 150 must consume 29 lb of hay as DM to meet her energy needs

Dry Matter Intake—concentration times mass

- Cow # 150 projected Dry Matter Intake (DMI)
  - Her BW times 2%
    - 1500 lb X 0.02 = 30 lb
- At 2% of BW, TDN content (55%) of hay ABC should be sufficient
  - If cow # 150 eats 29 lb DM = requirements met
  - If cow # 150 eats 1 lb DM = requirements not met
  - Adequate nutrient concentration and adequate DMI = satisfied requirements

DMI Estimates

System	DMI, % of BW
Lactating dairy cow	4.0
Lactating beef cow	2.0
Feedlot cattle	2.3
Growing cattle	2.8
Ewe with twins	4.0
Feedlot lamb	4.0
Goat, feeder	3.2

*Unadjusted for weather

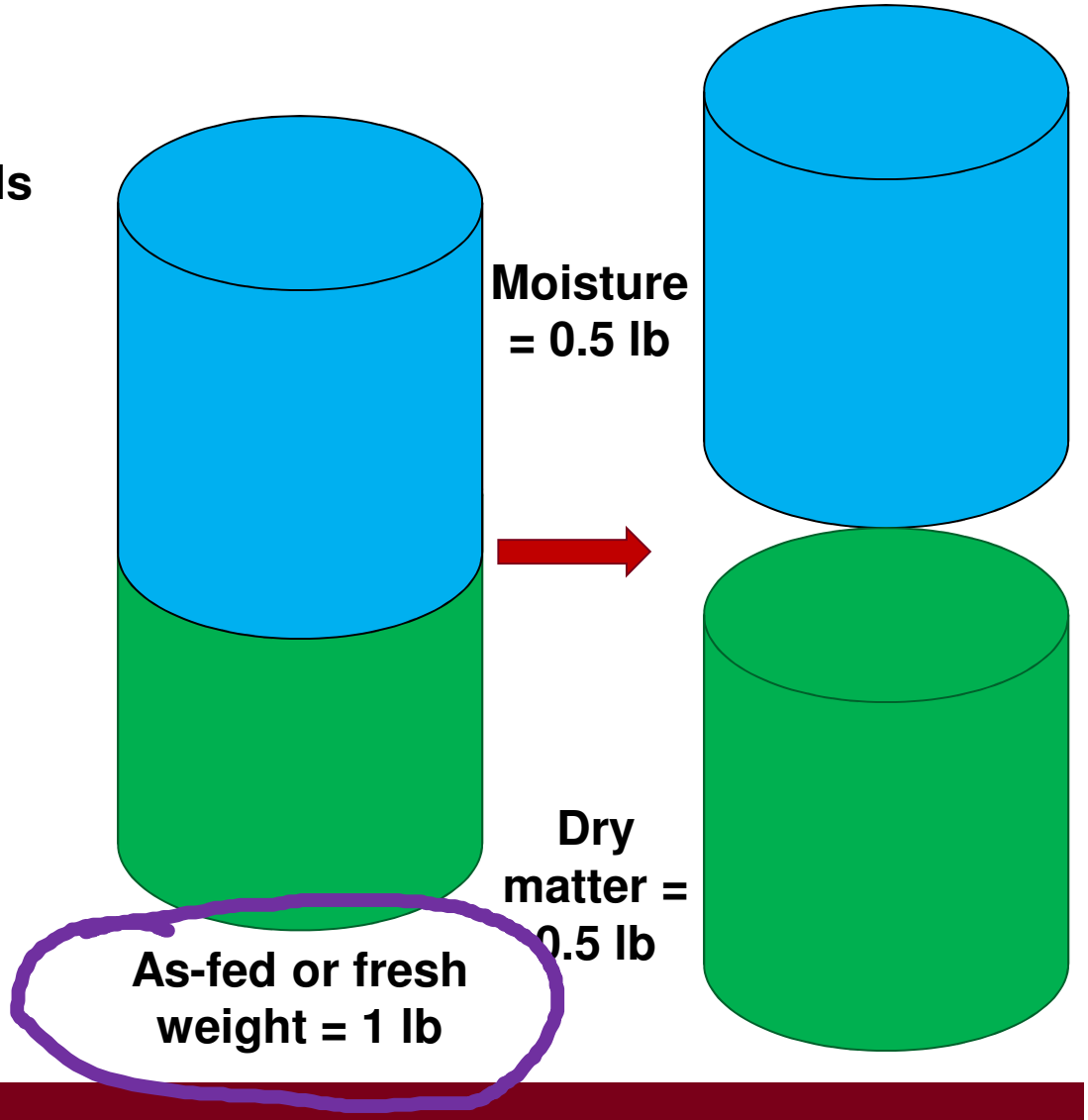
- DMI is calculated based on complex formulas
  - Energy of feed
  - Production
  - BW
- Approximate values for guidelines provided here

Managing DMI is Essential

Managing DMI is Essential

Why Dry Matter? Where the nutrients are!

- **Why dry matter?**
  - **Because most ruminant feeds contain a fair amount of moisture within them**
  - **High-moisture content:**
    - **Pastures**
    - **Co-products**
      - **Corn**
      - **Potato**
      - **Beet**
    - **Fermented feeds**
      - **Haylage**
      - **Silage**
  - **Low-moisture content:**
    - **Dry storage feeds**
      - **Hay**
      - **Grains**



Energy Requirements for Maintenance

- Often represented as Mcal NE_m or lb of TDN/day
- Simplest method of calculating it is: $0.77 \times BW^{0.75}$, BW = kg

System	BW, lb	DMI, lb/day	NE_m, Mcal/day
Lactating cow	1500	60	10.2
Beef cow	1500	30	10.2
Feedlot cattle	1000	23	7.6
Growing cattle	800	22	6.4
Ewe	150	6	1.6
Goat, feeder	80	2.6	1.0

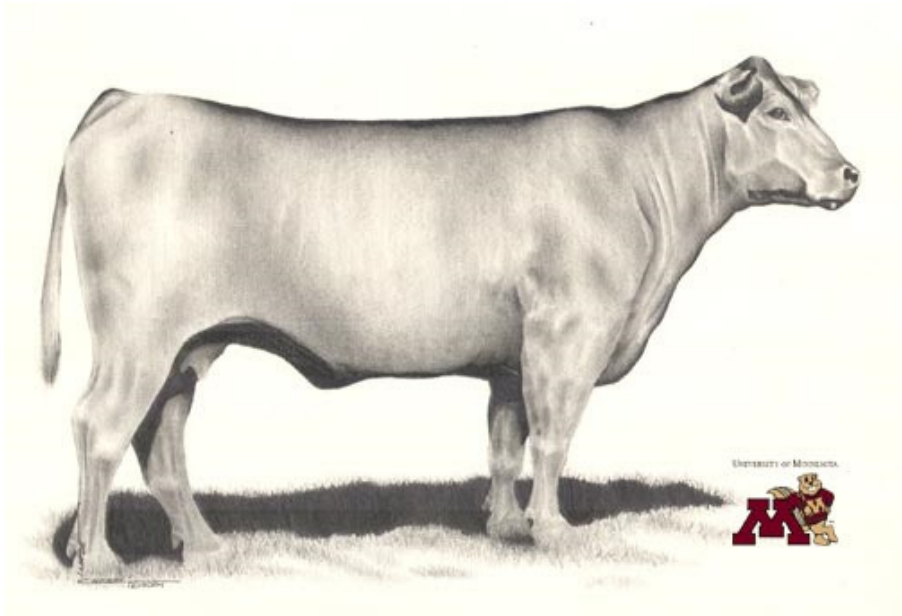
Gain, lactation, fetal growth requirements added onto maintenance

System	BW, lb	DMI, lb/d	NE_m, Mcal/day	NE_g or NE_l, Mcal/day	Dietary concentration
Lactating cow	1500	60	10.2	33.0	NE_l = 77/cwt
Beef cow	1500	30	10.2	9.6	NE_m = 66/cwt
Beef cow	1500	30	10.2	9.6	TDN = 64%
Feedlot cattle	1000	23	7.6	10.7	NE_g = 71/cwt
Growing cattle	800	22	6.4	6.3	NE_g = 48/cwt
Ewe	150	6	1.6	2.5	TDN = 69%
Goat, feeder	80	8	1.0	0.5	TDN = 67%

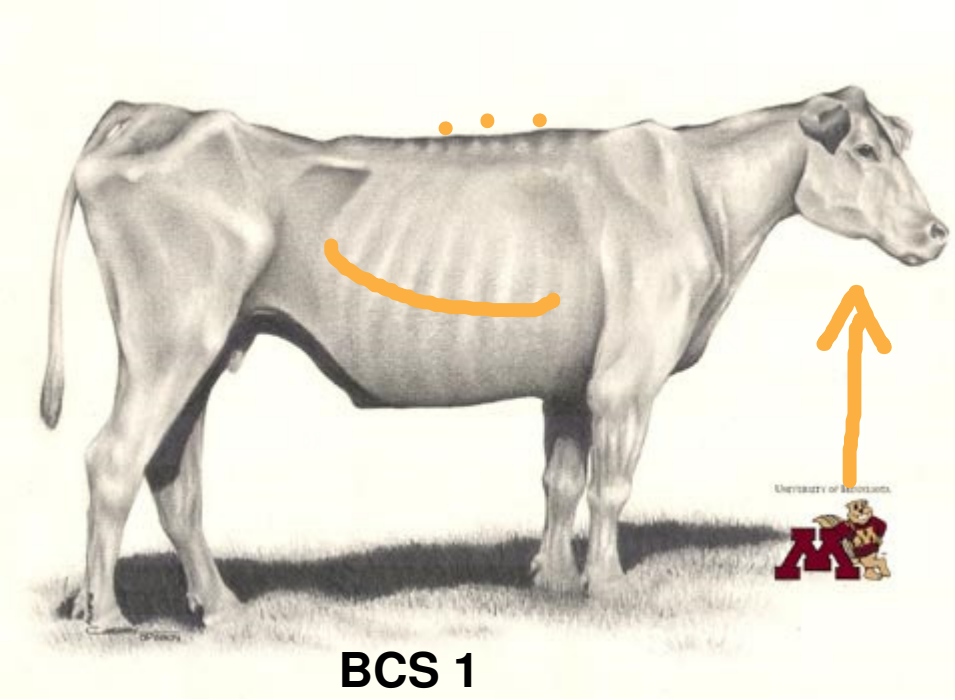
Body Condition Scoring

- On animals fed at or near maintenance
  - Dry dairy cow
  - Beef cow
  - Gestating small ruminants
- Assigning a body condition score (BCS) helps us manage nutrition

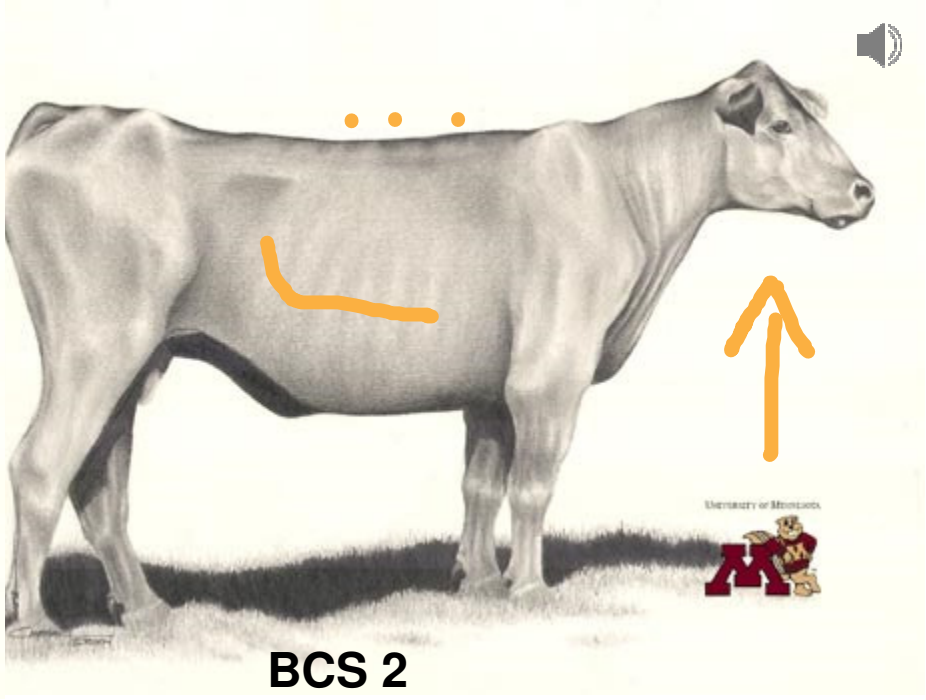
BCS Defined



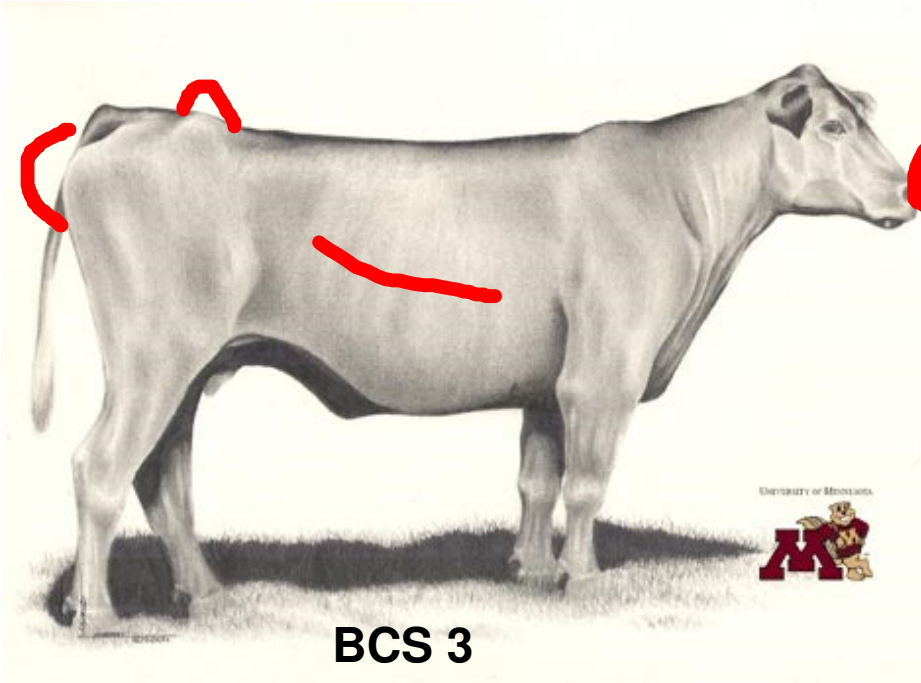
1. Bone structures visible and sharp No fat deposits or muscling.
2. No fat deposition, muscle loss
3. Very little fat cover over the loin, back and fore-ribs
4. Fore-ribs noticeable
5. Ribs still visible but beginning to round
6. Ribs are covered and not noticeable. Hindquarters plump and full.
7. Abundant fat cover on tailhead with. Fat in the brisket.
8. Fat cover thick and patch. Full brisket.
9. Tailhead is buried in fat. Mobility impaired.



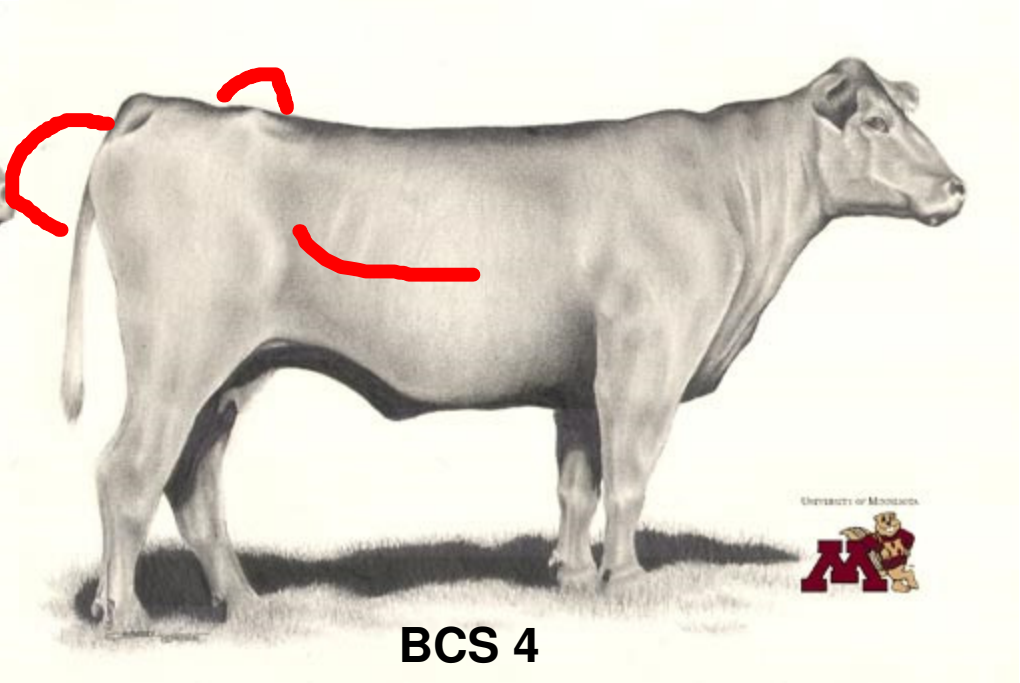
BCS 1



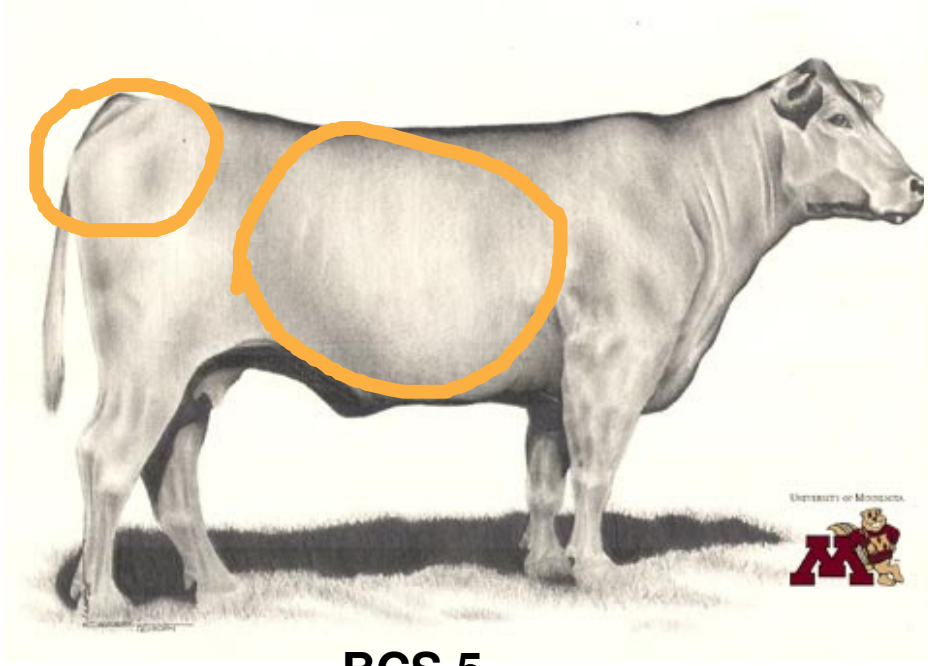
BCS 2



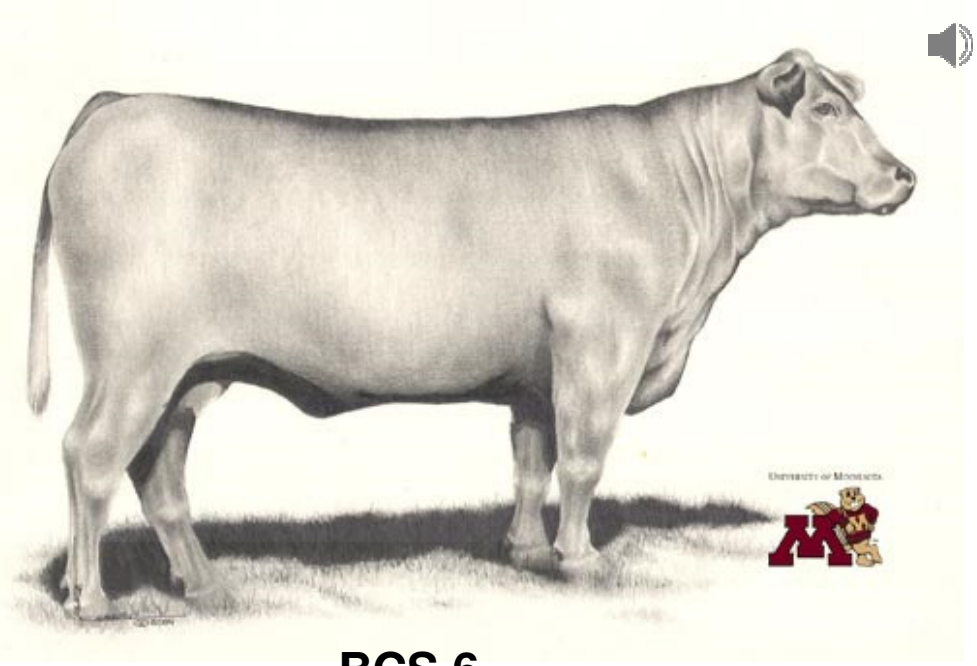
BCS 3



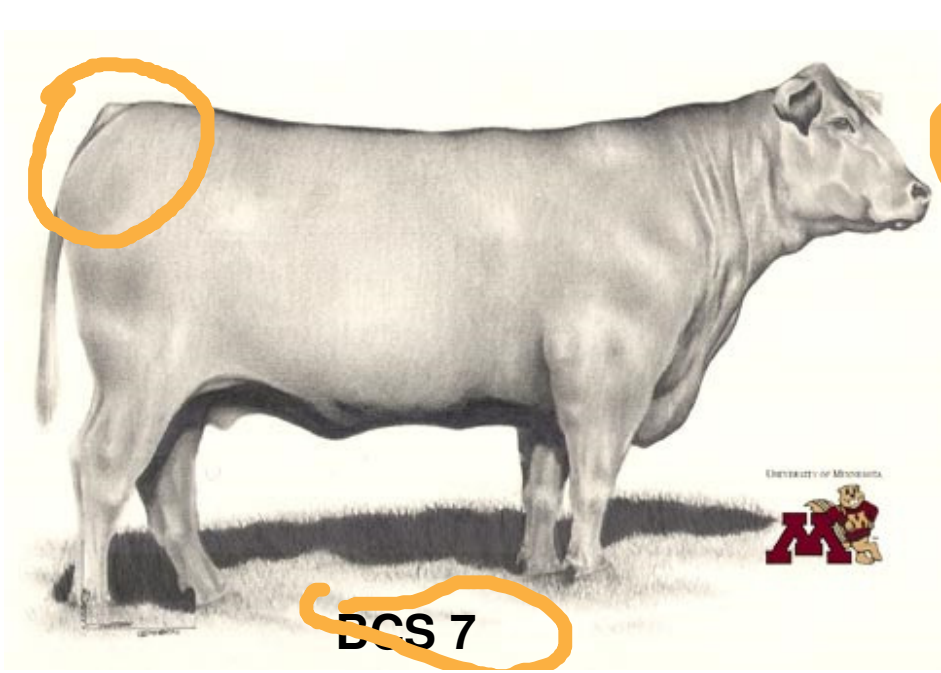
BCS 4



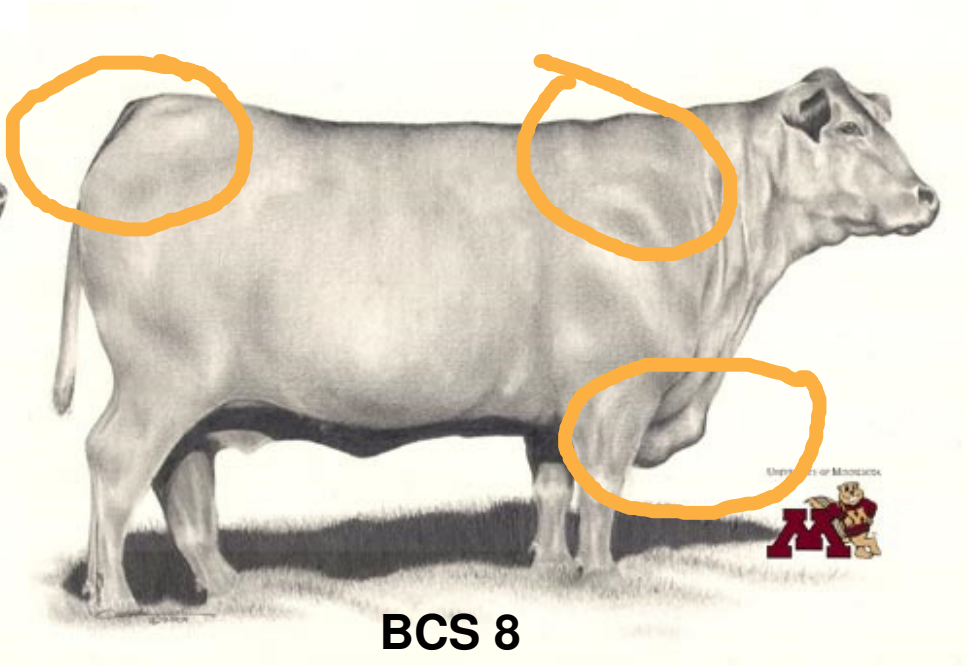
BCS 5



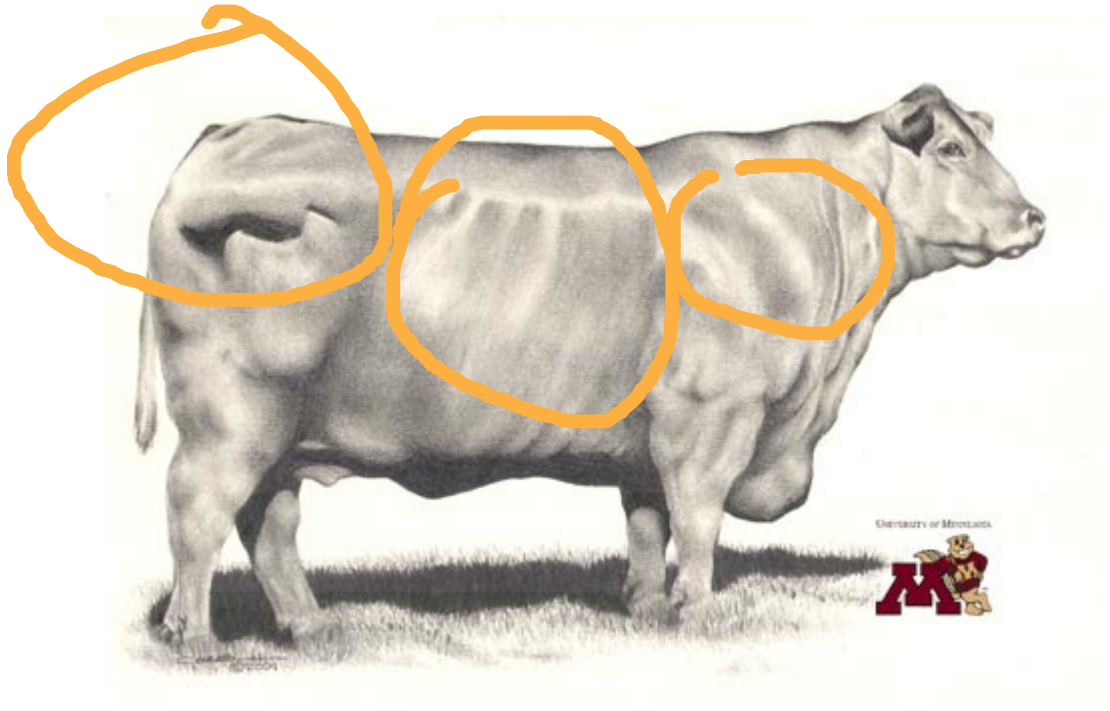
BCS 6



BCS 7



BCS 8



Conclusions

- Rumen microbes aid in supplying nutrients to cattle, sheep and goats—feed to maximize microbial yield
- Water is the most important nutrient—yet we could improve supply, particularly in summer
  - Keep water quality in mind (clean and free of excessive solids)
- Nutrients in feed expressed as concentrations
- Nutrient needs expressed as amounts
  - Intake is the driver by which nutrients reach animals not concentration
  - Dry matter intake—because ruminant feeds contain variable amounts of water
    - Feeding below required intake at the correct nutrient concentration does not work
    - Neither does feeding above intake at low nutrient concentrations
- Energy need = maintenance + production requirements
  - Energy measurements = NE_m , NE_l , NE_g ,TDN
- Assigning a body condition score is a way to manage nutrition in ruminants fed at maintenance
  - Measure of fat cover