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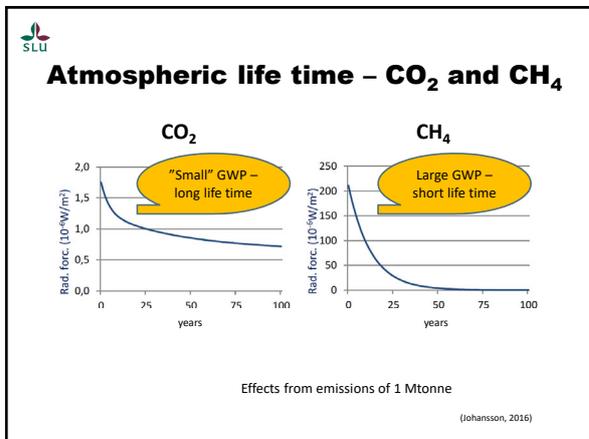
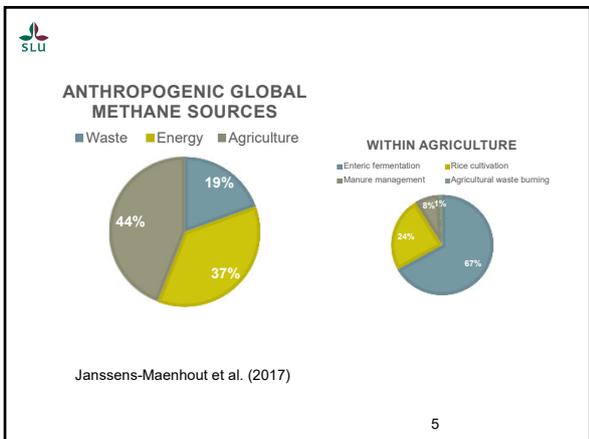
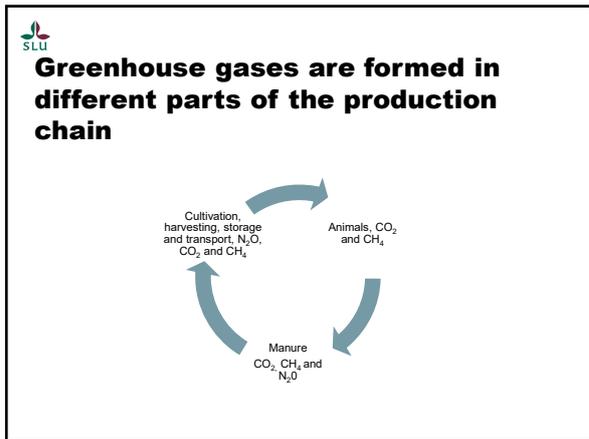
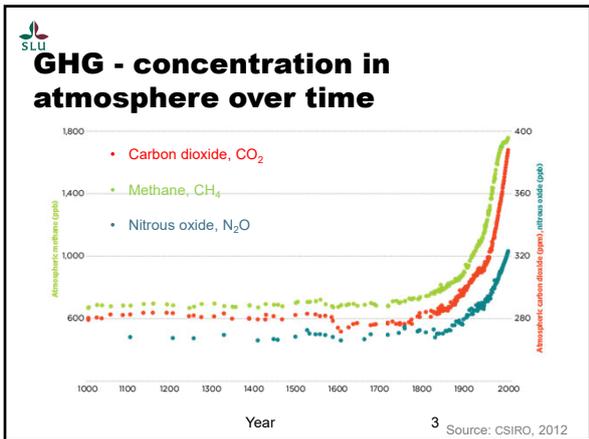
Sources of emissions - from cattle production

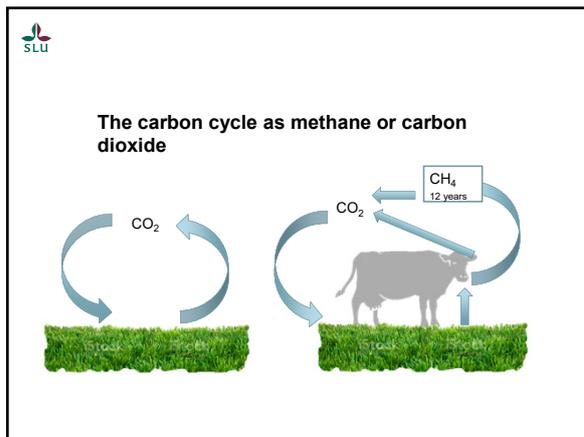
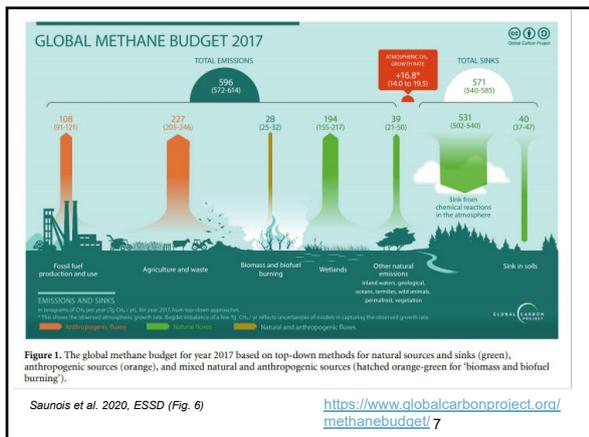
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Livestock production challenges

- Increased demand from animal products – competition for resources
- Environmental impact must be reduced

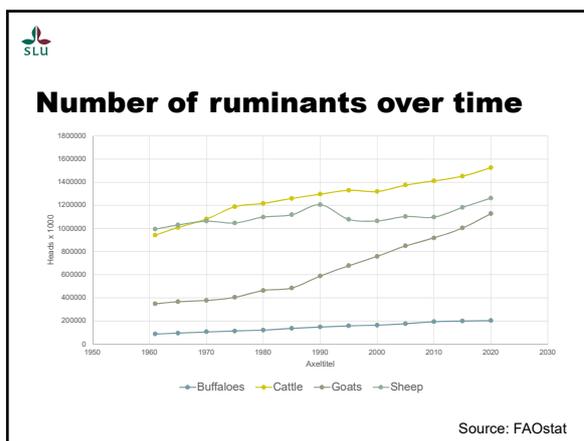


Methane is an energy loss for the cow

- Energy loss in gross energy (2-12%)
- Research has been going on in more than 100 years (Kellner, 1900)
- Methane production per cow and year in Sweden 2015, 141 KG, energy loss 6.5 % of gross energy

CH₄

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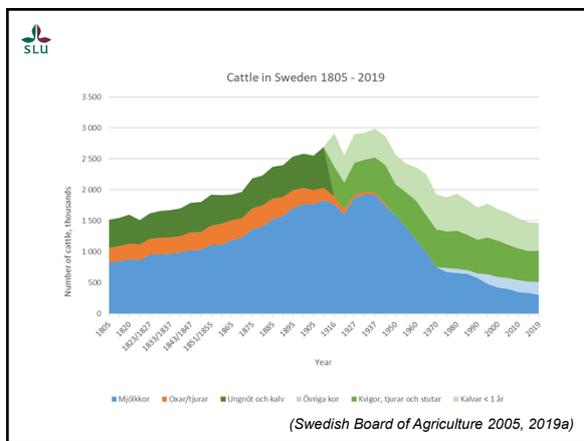


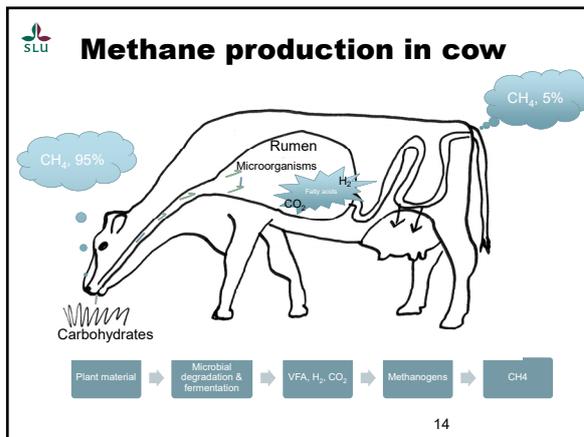
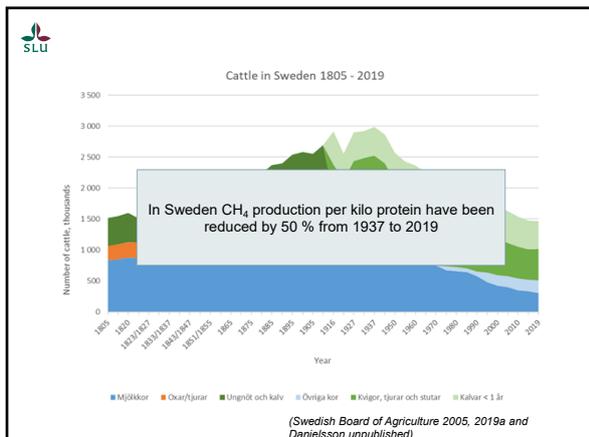
Number of ruminants over time

To meet 1.5 C target by 2030 CH₄ from ruminants must be reduced by 11-30% the 2010 level and 24-47 % by 2050.

How do we reach that goal with a steady increase of mainly Cattle?

Source: FAO-stat, IPCC 2021 and Arndt et al., 2022





Methanogenesis

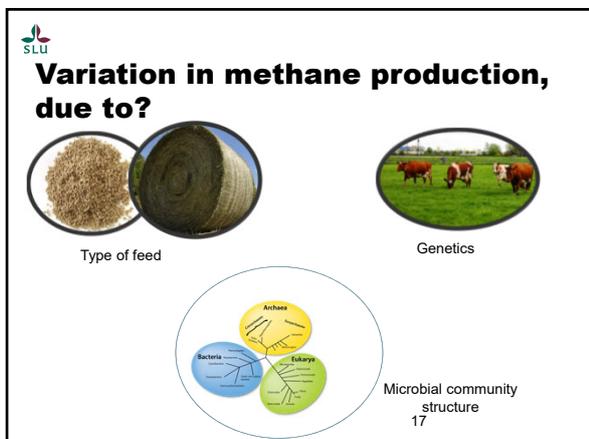
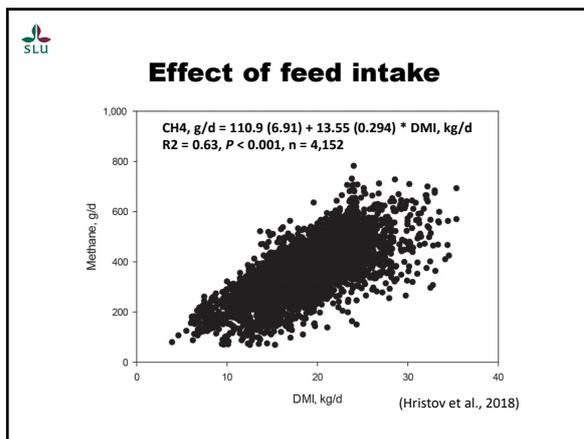
From fermentation:

Acetate + Propionate + Butyrate + CO₂ + H₂

Methanogenesis, major pathway:

CO₂ + 4 H₂ → CH₄ + 2 H₂O

Volatile fatty acids (VFA) ratios different amounts of CH₄ is produced



EU approves methane-reducing feed additive for dairy

Feeding cows seaweed could slash global greenhouse gas emissions, researchers say

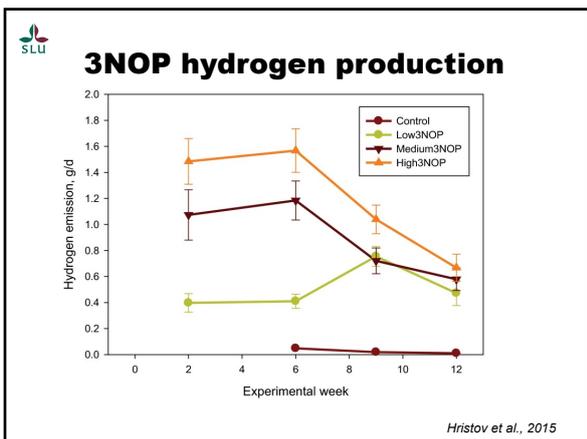
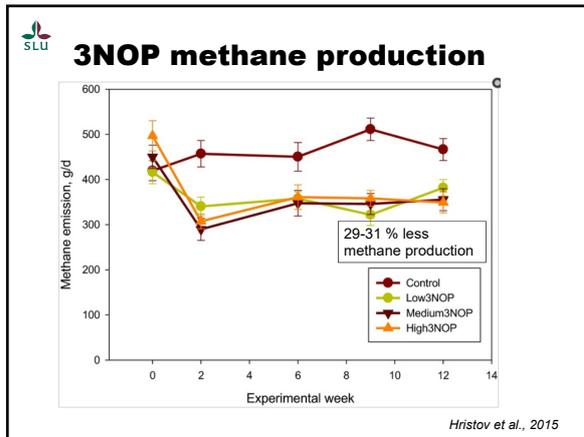
Feeding cows oregano can reduce methane and 'help fight climate change'

Seaweed could hold the key to cutting greenhouse gas emissions, one cow herd at a time.

Garlic and citrus reduce cattle methane

Rumen manipulation substrates

- 3NOP (Nitrooxypropanol) or Bovaer - Small molecule inhibitors that block the final step in methanogenesis.
 - Approved in EU for dairy cows spring 2022
- Red algae, inhibits methanogens in similar way as 3NOP.
 - What happens with the hydrogen?
- Cost



Diet and feed additives

Intervention	Effect	Comment
Concentrate:Roughage	Low - medium	Some effect with > 70%. Negative for the rumen environment.
Fat	Medium	<5 % otherwise risk for inhibiting fermentation in the rumen
Nitrate	Medium	Toxicity, needs to be carefully added
Tanniferous forages	Low	To high inclusion in diet reduce digestibility
3-nitrooxypropanol	Medium-high,	Approved by EU 2022 for dairy cows. Cost? In which systems?
Seaweed	Medium-high?	Cost? Iodine and bromine levels, need long term study on dairy cows.

Management factors

Intervention	Effect
Shorter rearing period/decrease age at first calving	Fewer days with maintenance methane production, earlier start of production
Precision feeding: right nutrient at the right time	Resource efficiency gains
Increased feed efficiency	More milk/meat per kg feed
Healthy and fertile animals	More productive days
Increase longevity	Increased life time production decrease emissions per unit product
Increased digestibility of feed	Increase production: increase methane/kg feed – but reduce methane per kg product
Reduce feed waste from field to mouth	Less input / output = increased efficiency

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What do we know today?

How methane is formed - which organisms that are responsible for the formation of methane, but not the connection between different groups and how different substrates affect the entire microorganism community.

The focus is on trying to reduce methane production by:

- Various substrate that inhibit methane-producing microorganisms (inhibit H₂ formation or block methane formation, or stimulate other electron sinks)
- Choice of feed - effect throughout the chain
- Breeding for more efficient feed utilization and less methane
- Increased productivity



Thank you for listening!

Questions?



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