

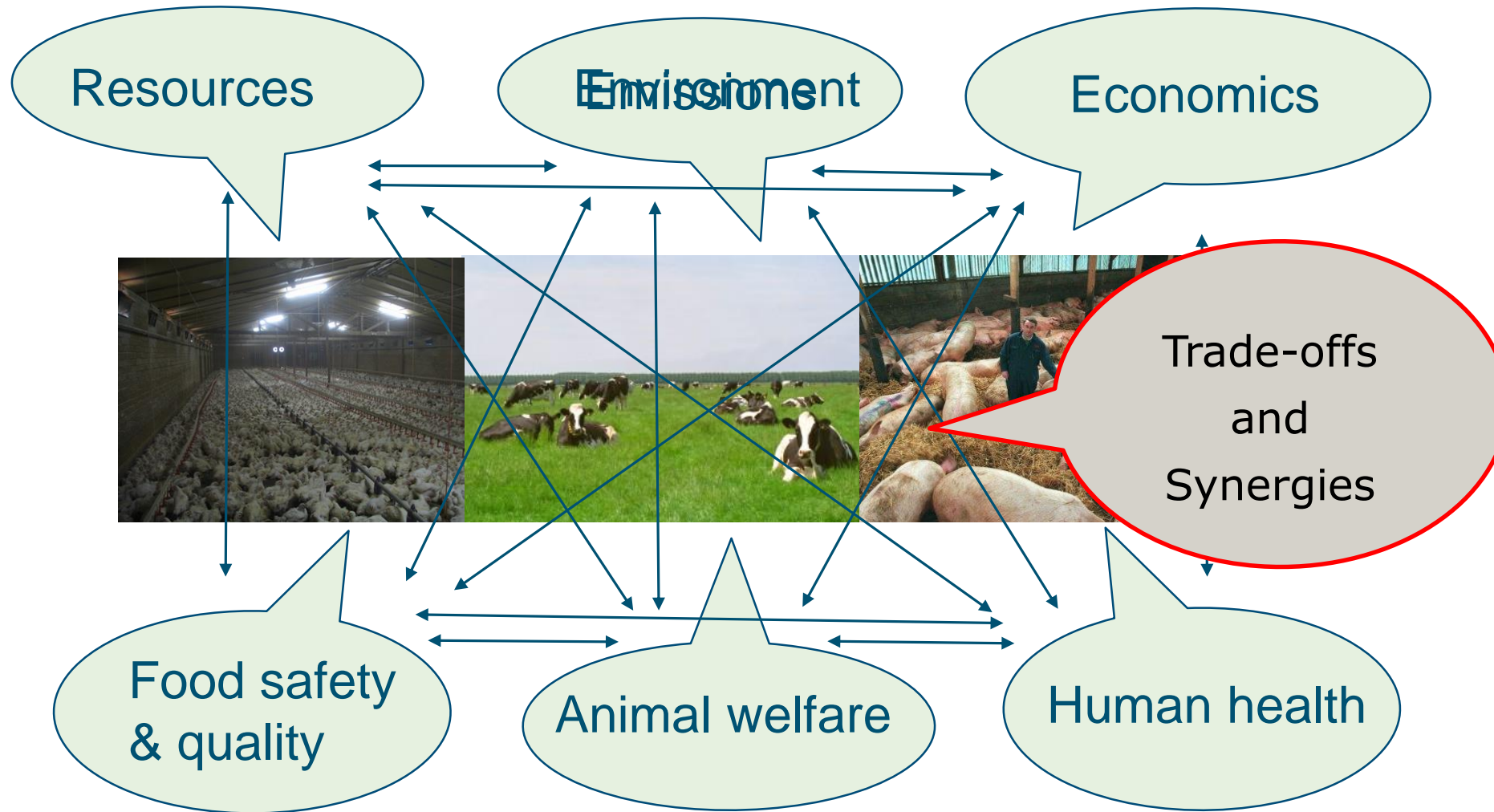
# Integrating animal welfare into sustainable development of animal production systems

Eddie Bokkers

Animal Production Systems group, Wageningen University & Research



# Challenges and concerns around animal production



# Assessing animal welfare

- Several protocols developed and available
- Preferable animal based measurements
- Technical data, farm and management characteristics



Clinical observations



Behavioural observations



Post mortem observations

# Assessing environmental impact (e.g. LCA)

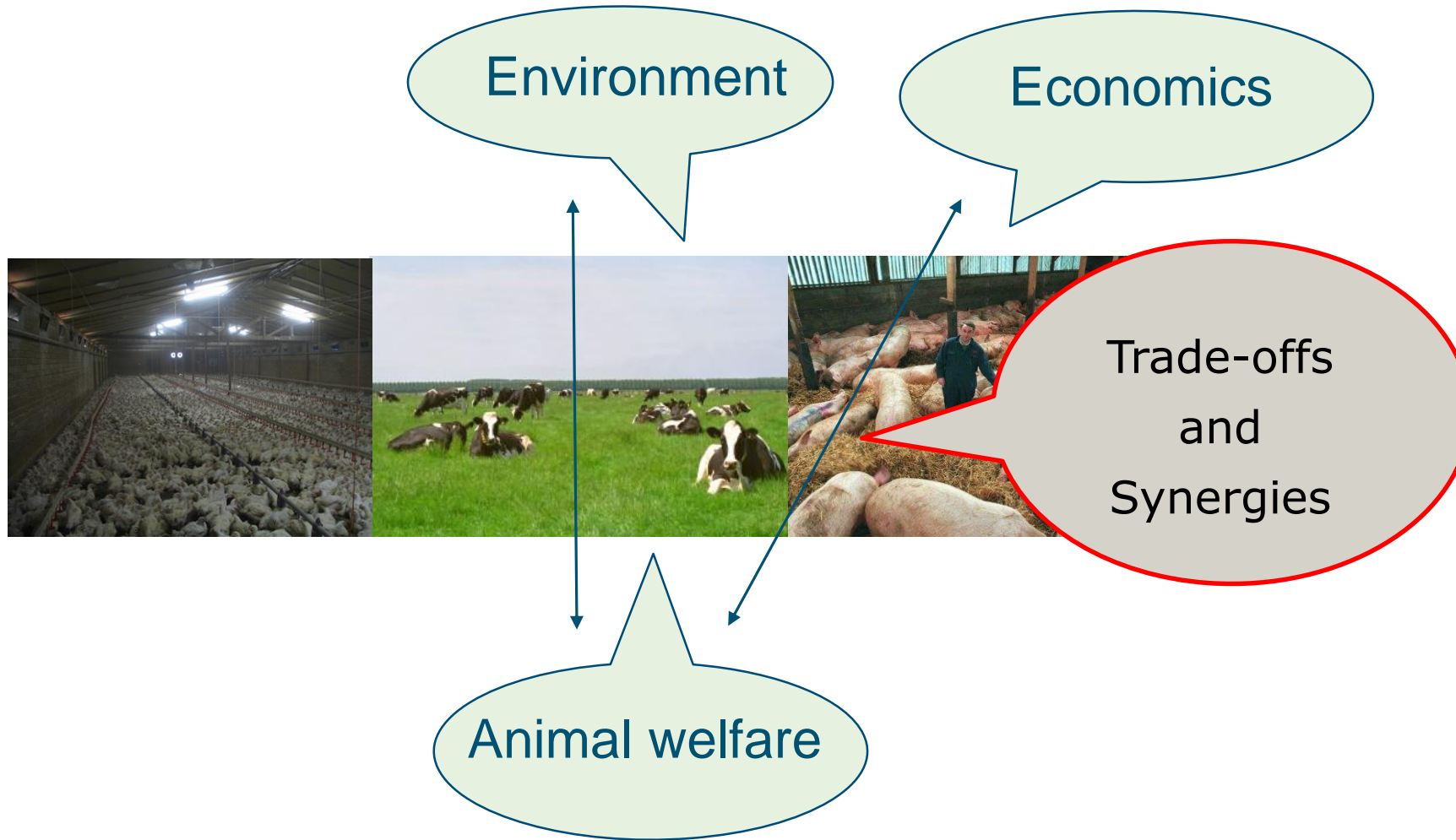


# Assessing economics

- Profitability (revenues – variable and fixed costs)

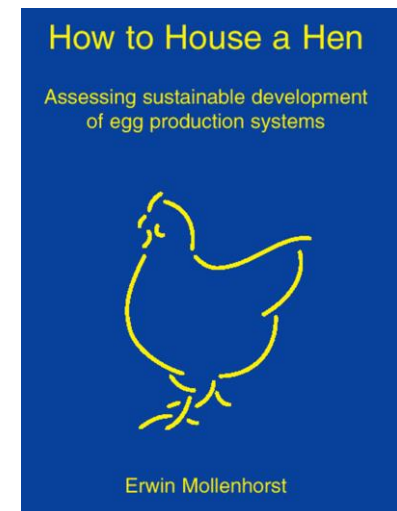


# Intgrated analyses

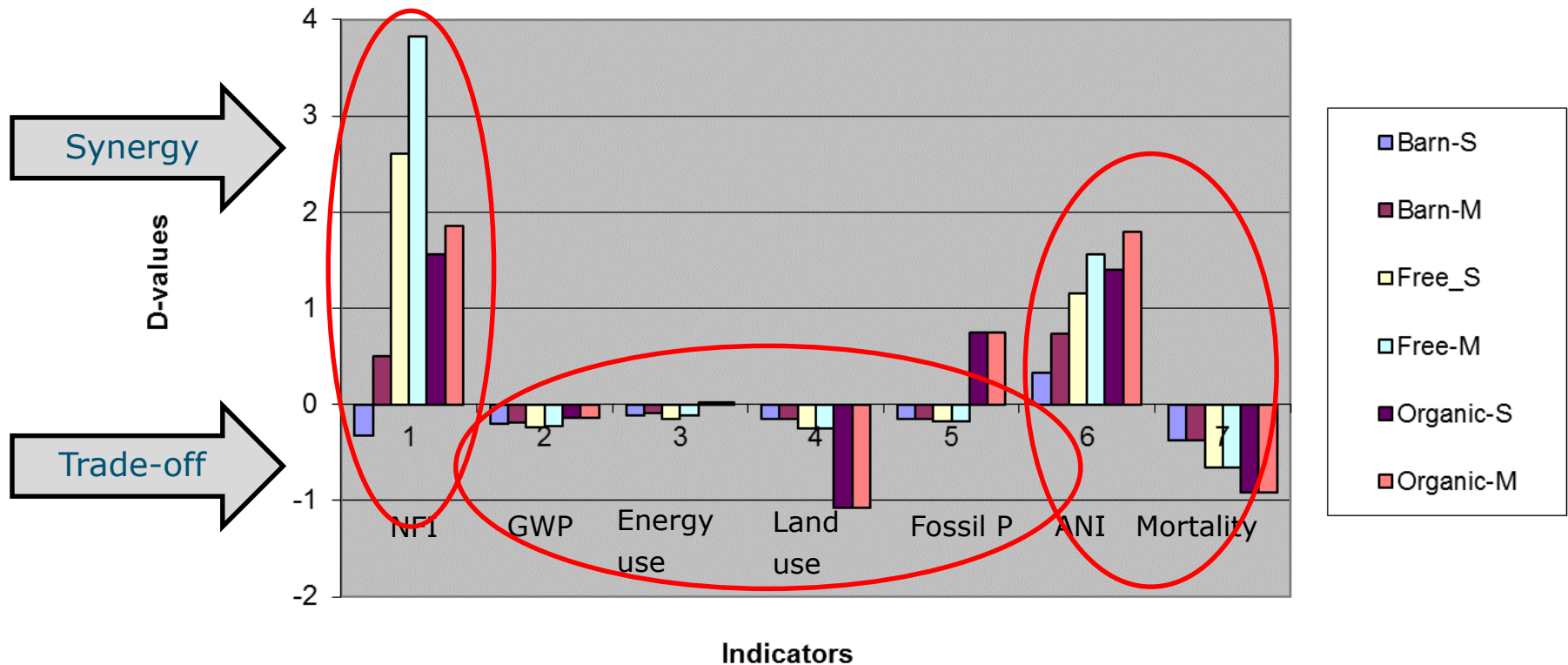


# Assessing sustainable development of egg production systems (Mollenhorst et al, 2005)

- Animal welfare: Animal Needs Index, mortality
- Environment: global warming, energy use, land use, etc.
- Economy: profitability



# Alternative systems compared to battery cage system





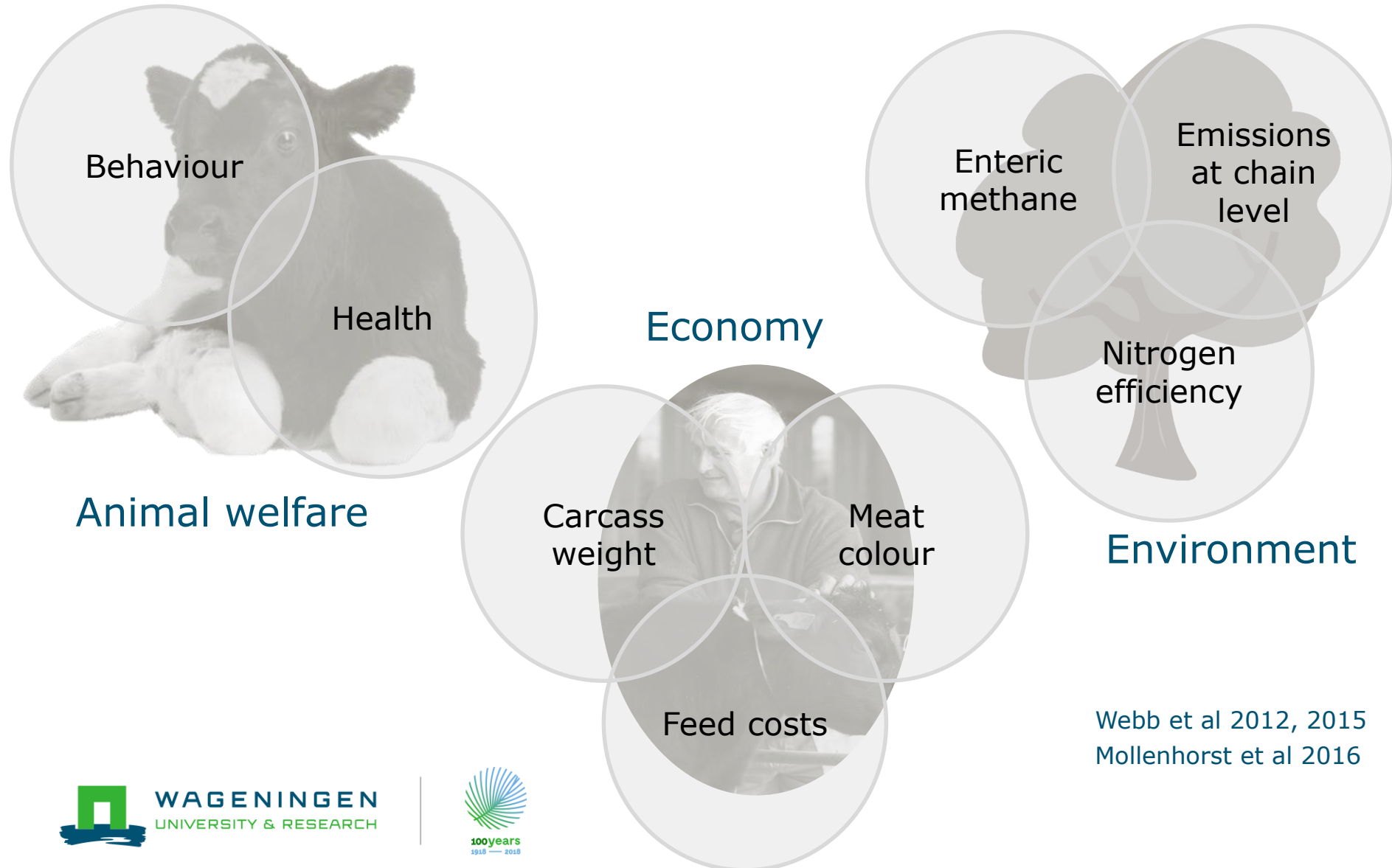
# Sustainable feeding strategies for veal calves:

improve welfare, economically viable, environmentally sound



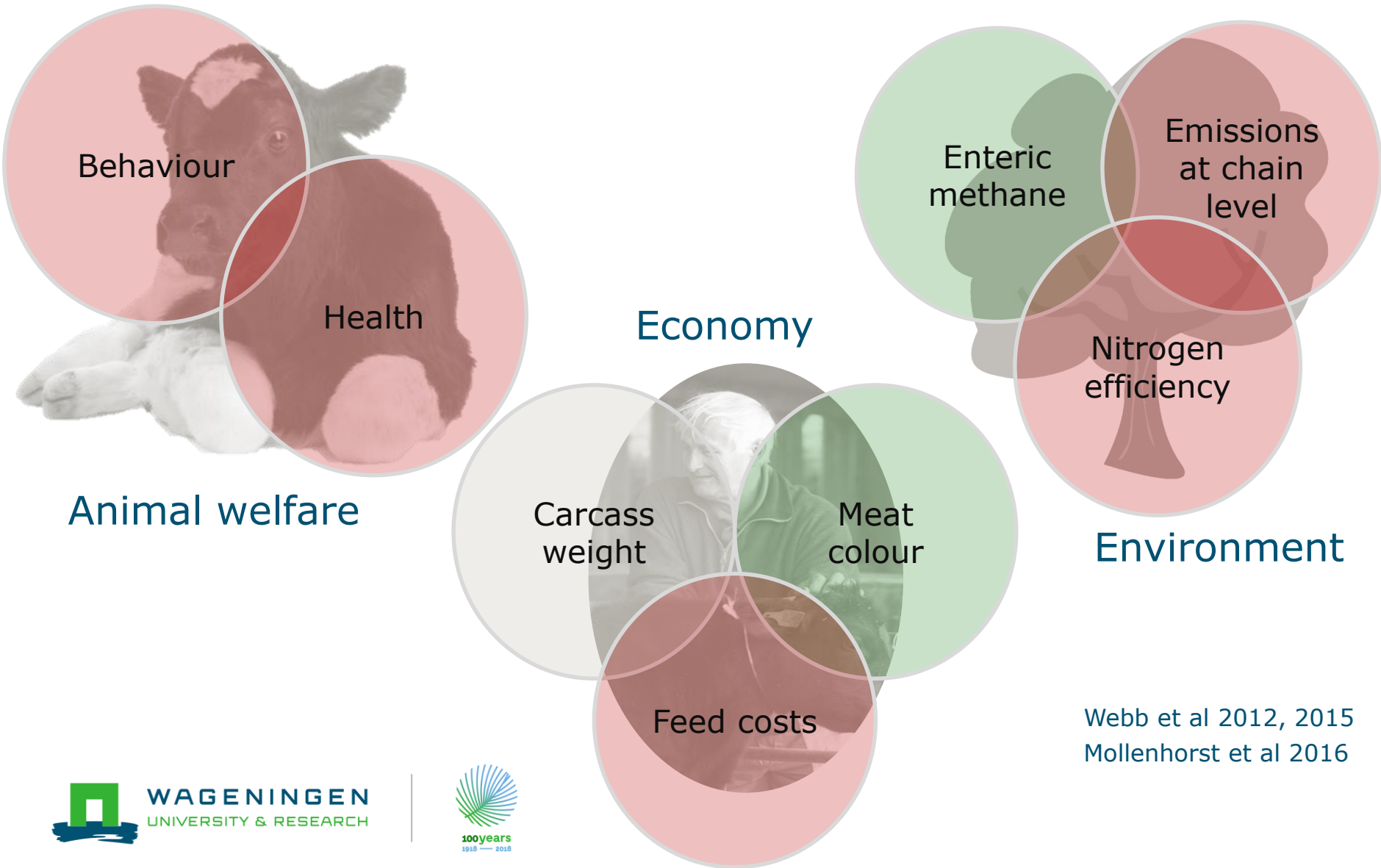
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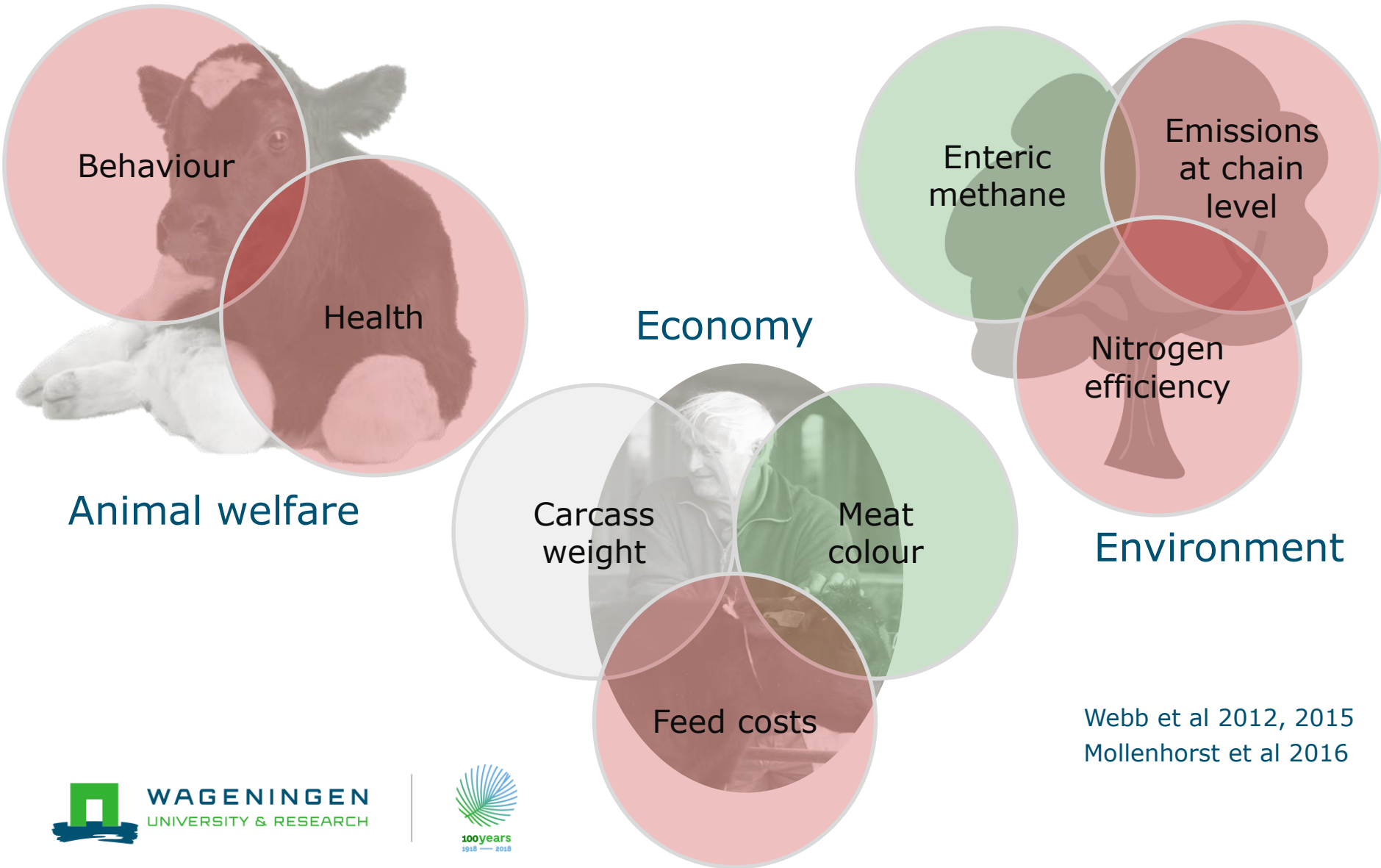
Webb et al 2012, 2015  
Mollenhorst et al 2016

# Mainly milk replacer



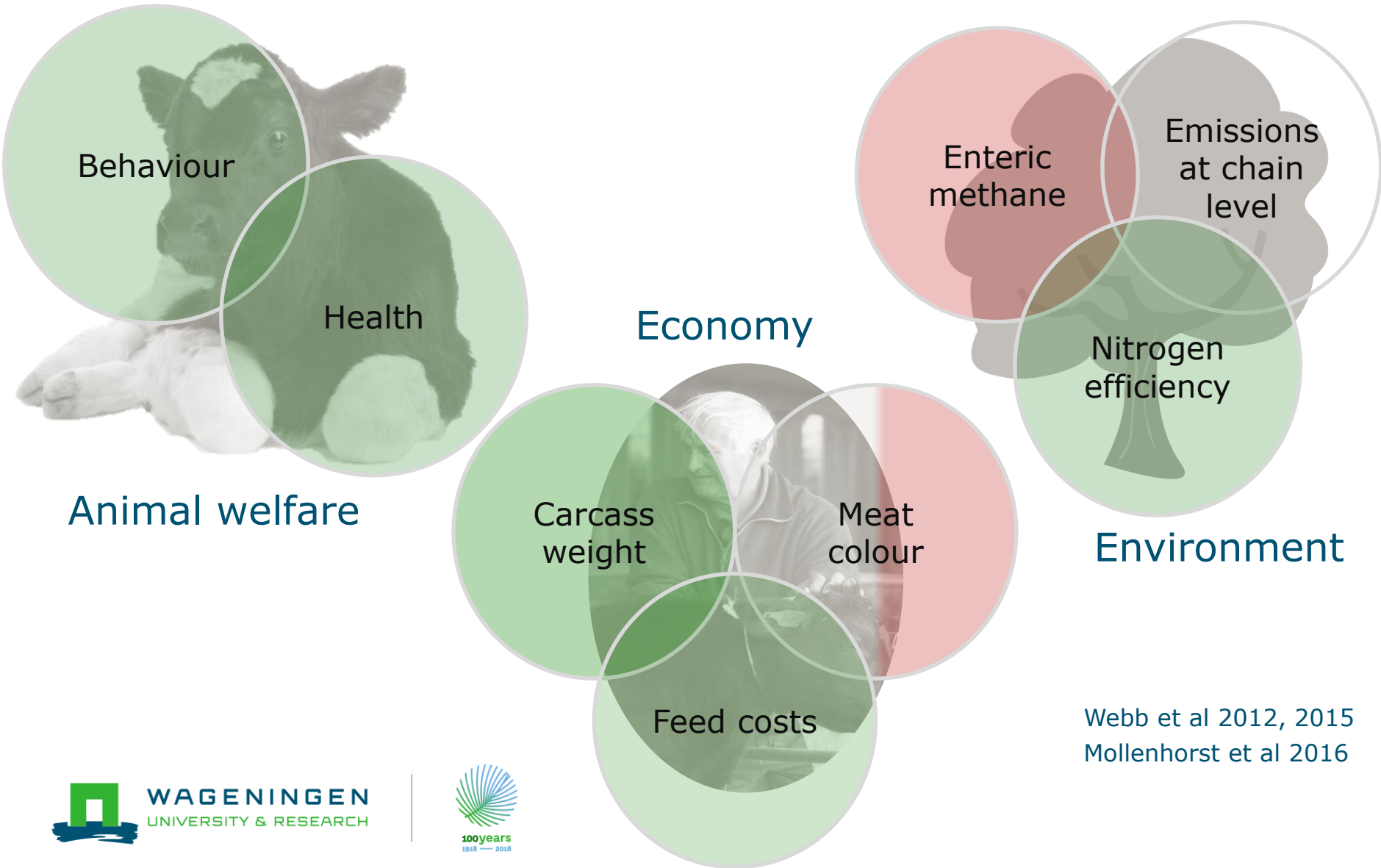
Webb et al 2012, 2015  
Mollenhorst et al 2016

# Increasing amount of concentrates



Webb et al 2012, 2015  
Mollenhorst et al 2016

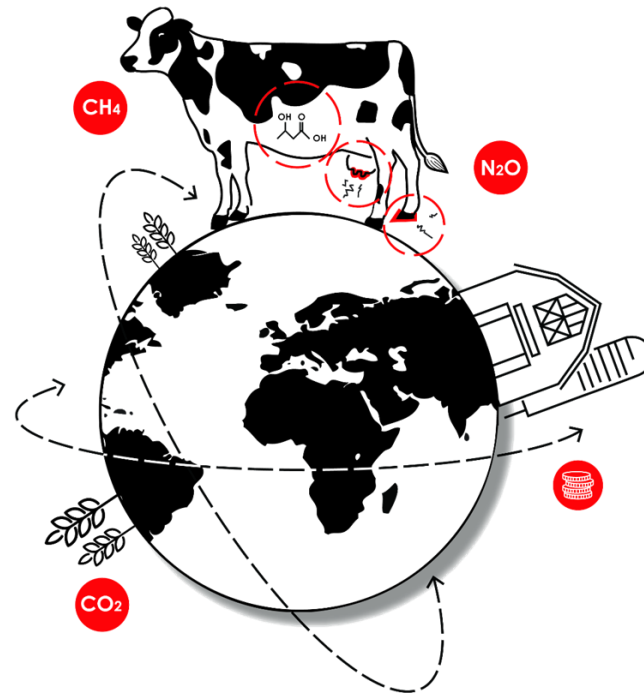
# Increasing amount of roughage



Webb et al 2012, 2015  
Mollenhorst et al 2016

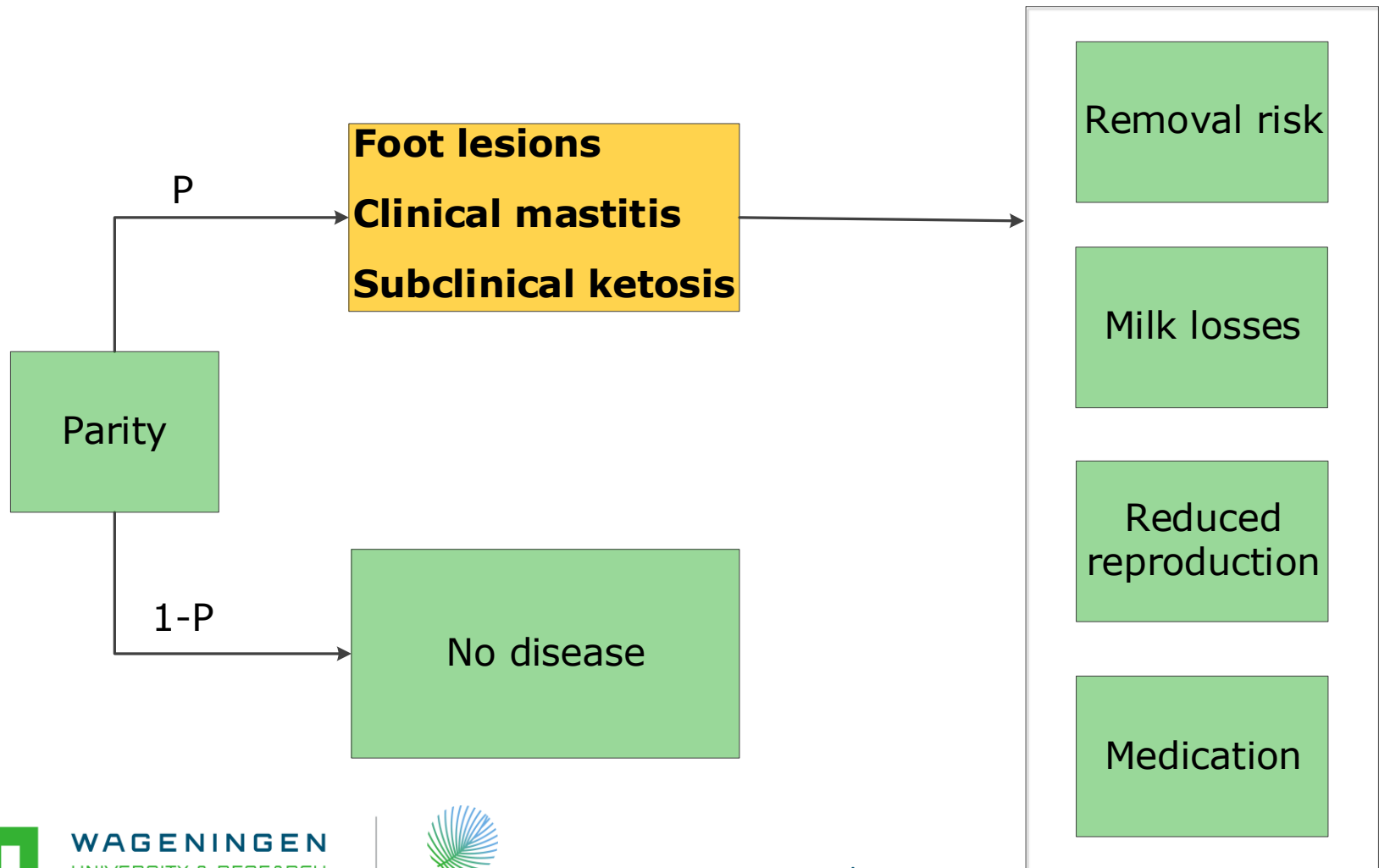
# Consequences of diseases in dairy production

- A major animal welfare issue
- Economic and environmental impact



# Simulating diseases in dairy cattle

Dynamic, stochastic, simulation model



# Impact of clinical mastitis, ketosis and foot lesions in dairy cattle

	GHG emissions (kg CO <sub>2</sub> e/t milk)	Costs (€/cow/year)
Clinical mastitis (case/cow)	58 <sup>c</sup>	€ 182 <sup>a</sup> -257 <sup>b</sup>
Subclinical ketosis (case/cow)	21 <sup>c</sup>	€ 130 <sup>c</sup>
Foot lesions (case/cow)	14 <sup>c</sup>	€ 192 <sup>d</sup>

- a. Huijps et al. 2008;
- b. Van Soest et al. (2016);
- c. Mostert et al. (2018a,b,c; 2019)
- d. Ettema and Ostergaard (2006)



# In general ...

- Reducing animal diseases contributes to sustainable development because it
  - Reduces the carbon footprint and use of resources
  - Reduces costs
  - Improves animal welfare

# Conclusions and future challenges

- Animal welfare is an essential part of sustainable development of livestock systems
- Animal welfare and other sustainability issues can have trade-offs and synergies
- Insights in trade-offs and synergies are essential for improving livestock systems sustainably
- Accessibility/Availability of data



# Animal welfare must be an integrative part of sustainable development of livestock systems

Eddie Bokkers

*Animal Production Systems group  
Wageningen University & Research  
the Netherlands*

