

# Minimizing the environmental footprint of livestock production: which measure to use?

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## Take home message

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The choice of your measure  
to assess environmental impact of food  
production systems  
affects your conclusion

Be aware of underlying choices and values



# Food production affects environment

climate change



water quality and depletion



40% ice-free land



Deforestation



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# Mitigation strategies

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Measures

relate **productivity of food systems** to  
**environmental impact**



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## To define a measure we need

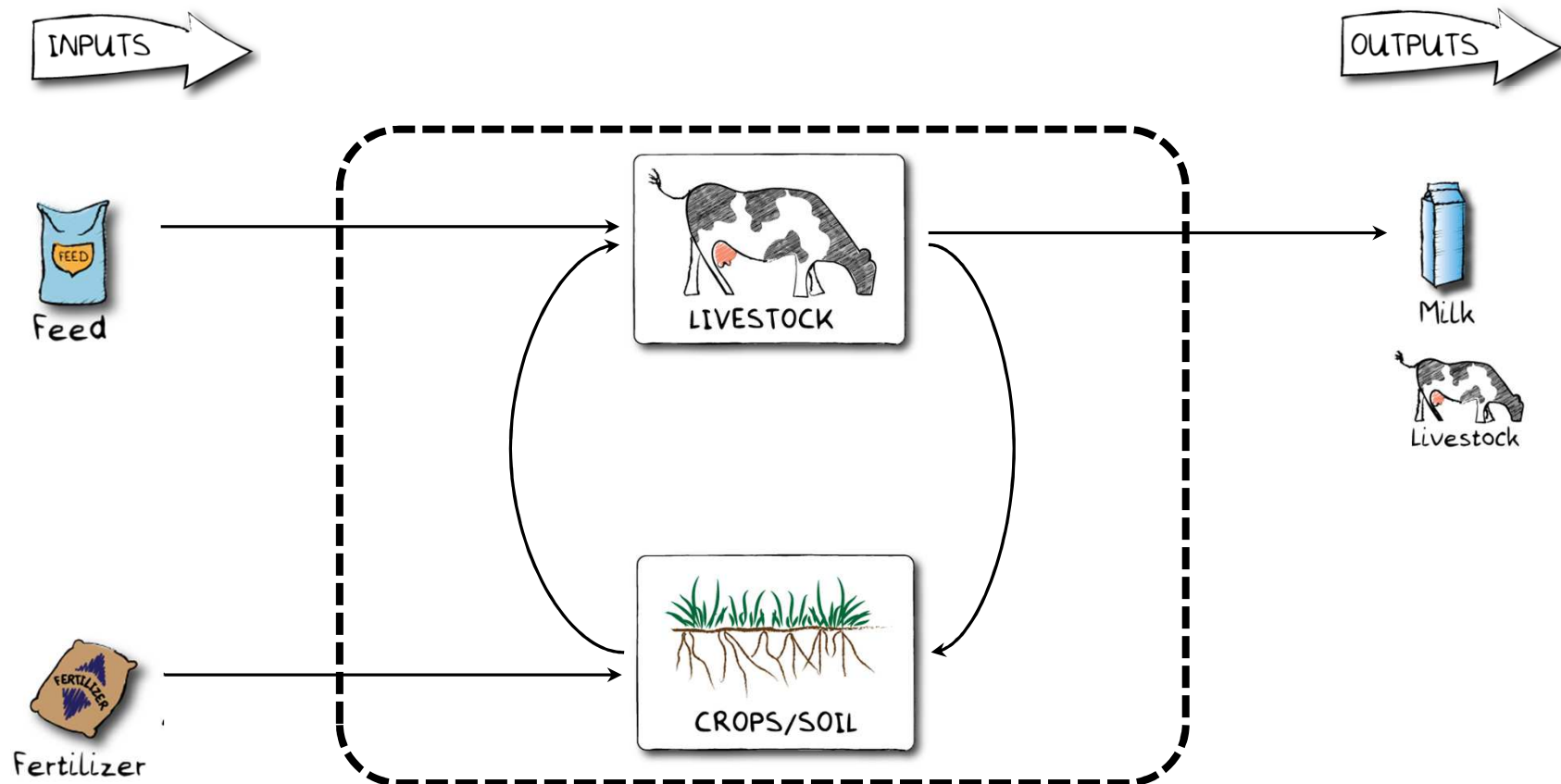
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- to define the **boundary** of food system
- assess its **environmental impact**  
use of natural resources - **land**  
emissions
- assess its **productivity**



# Measuring land use efficiency: past

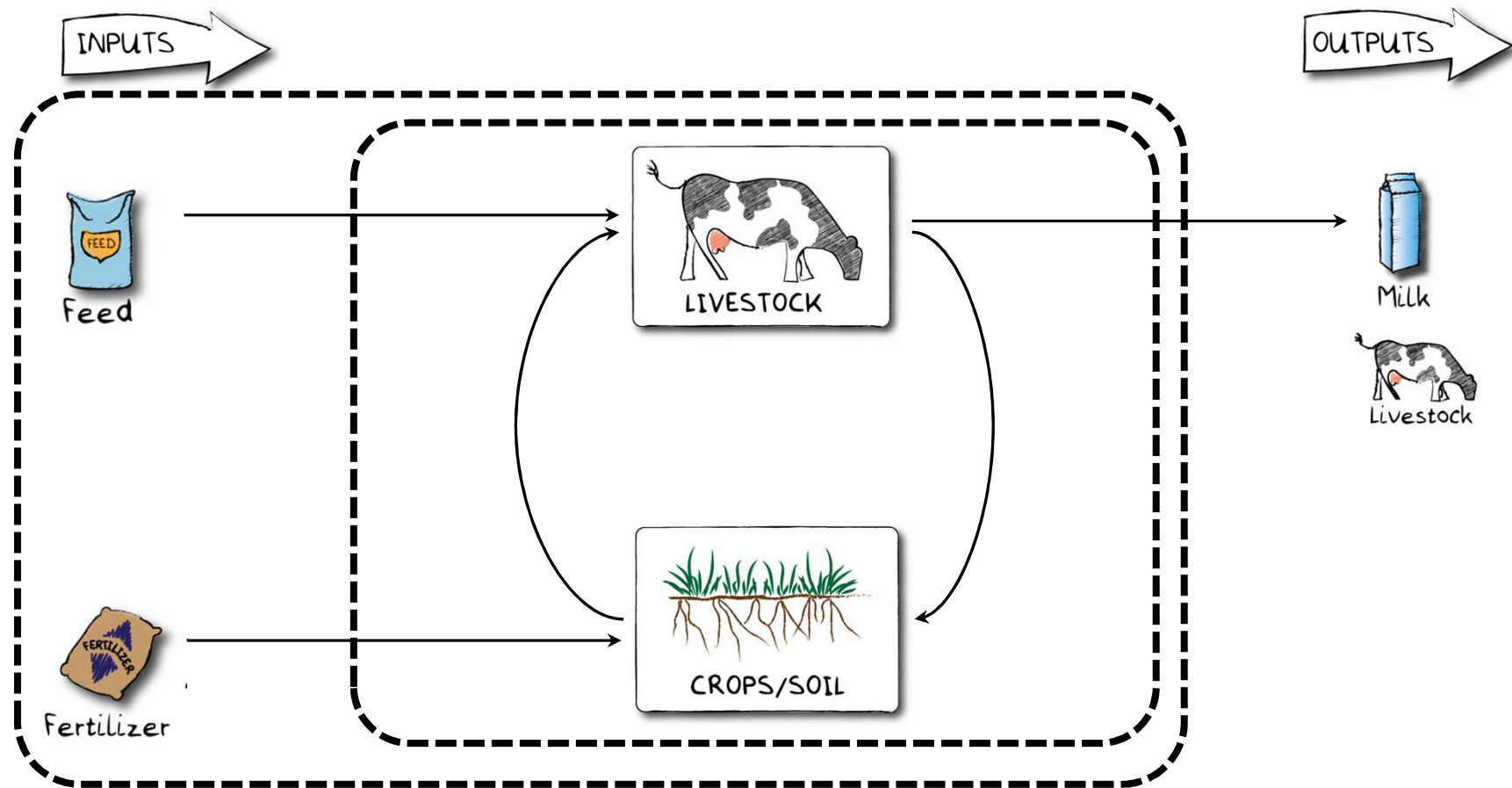
farm perspective: **milk production/ha**



Measures: feed efficiency animal/herd – crop yield/ha

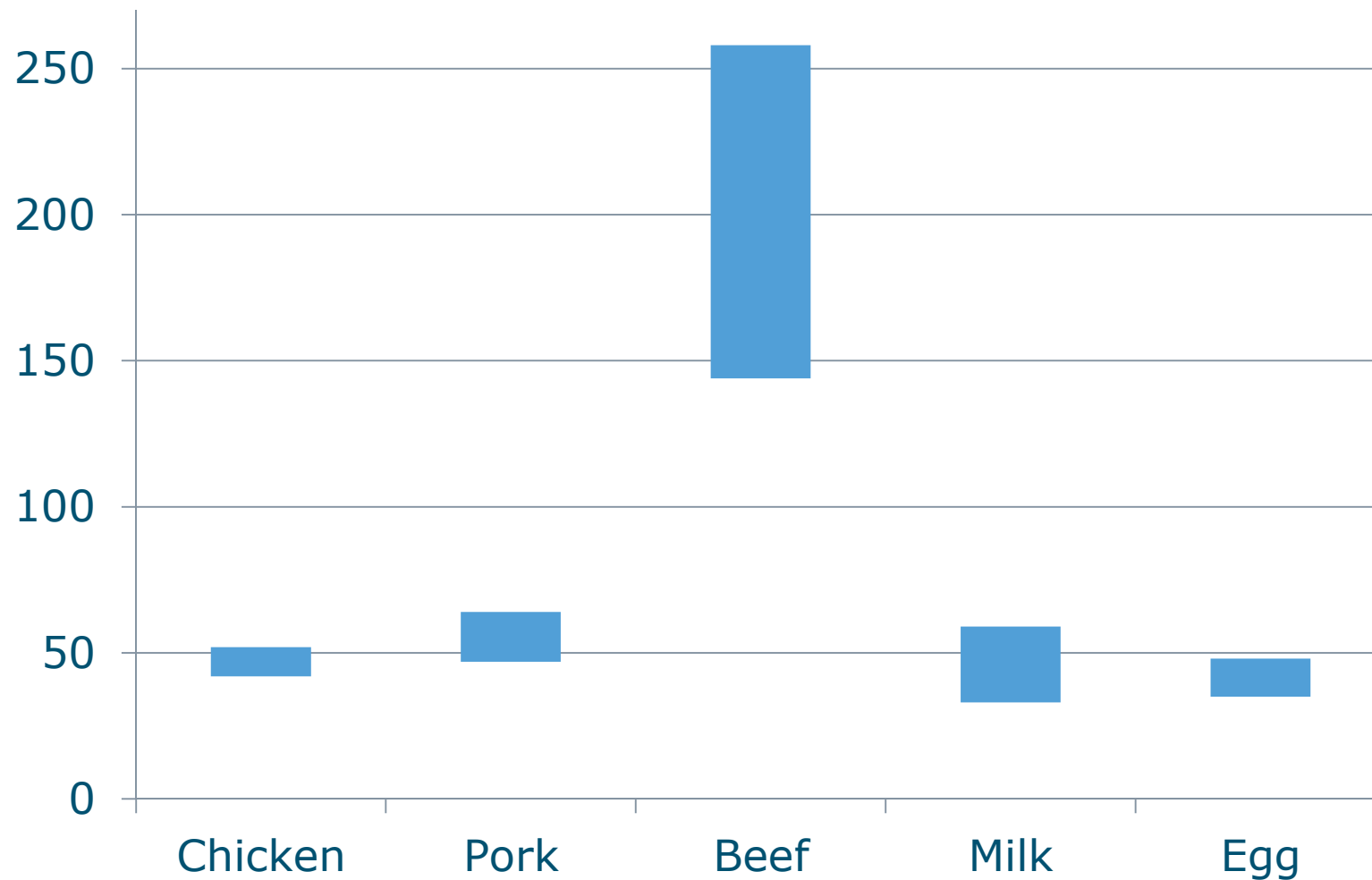
# Measuring land use efficiency: present

life cycle perspective:  $\text{m}^2$  per kg milk



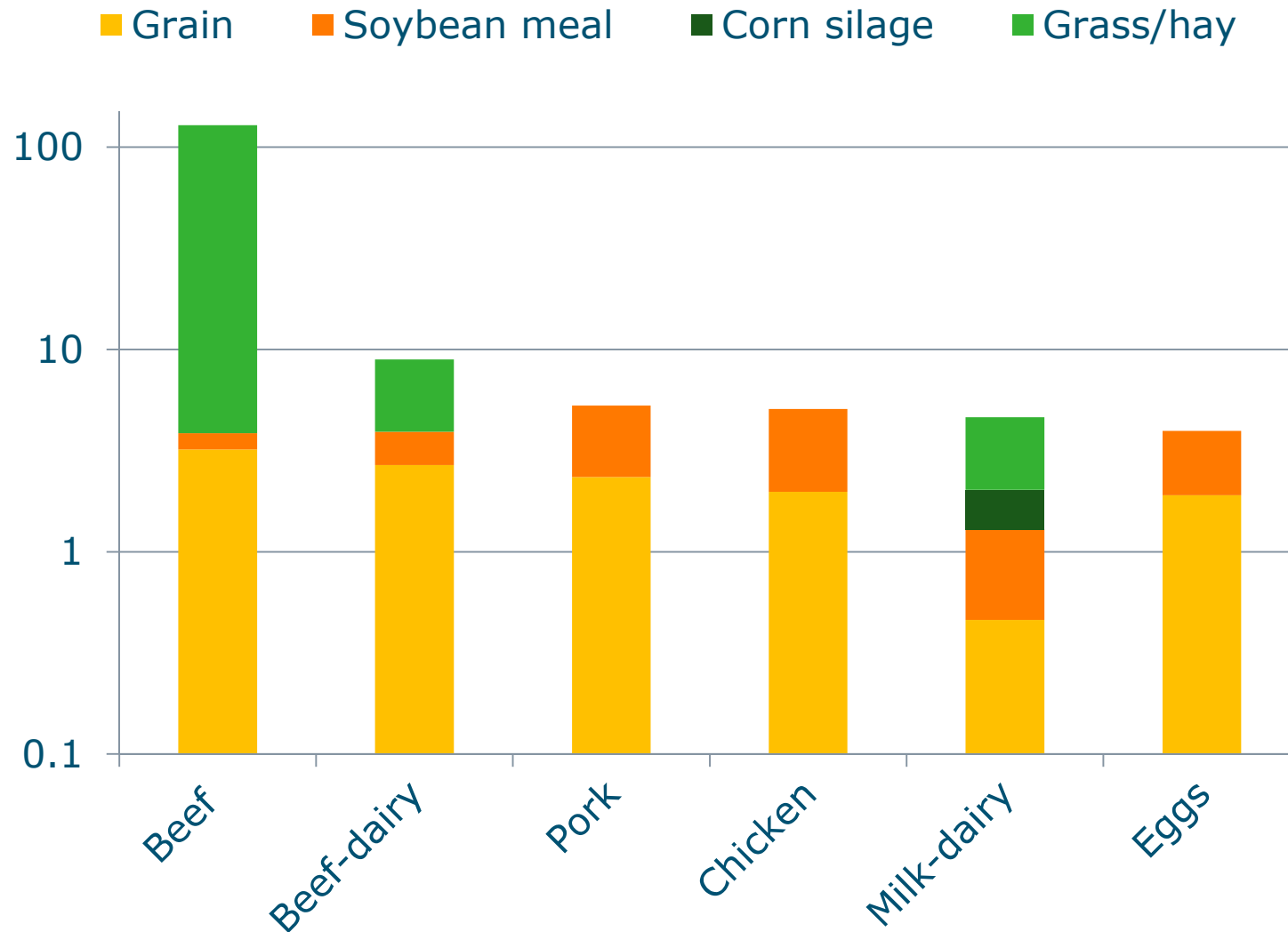
# Measuring land-use-efficiency: present

- life cycle perspective: m<sup>2</sup> per kg edible protein -

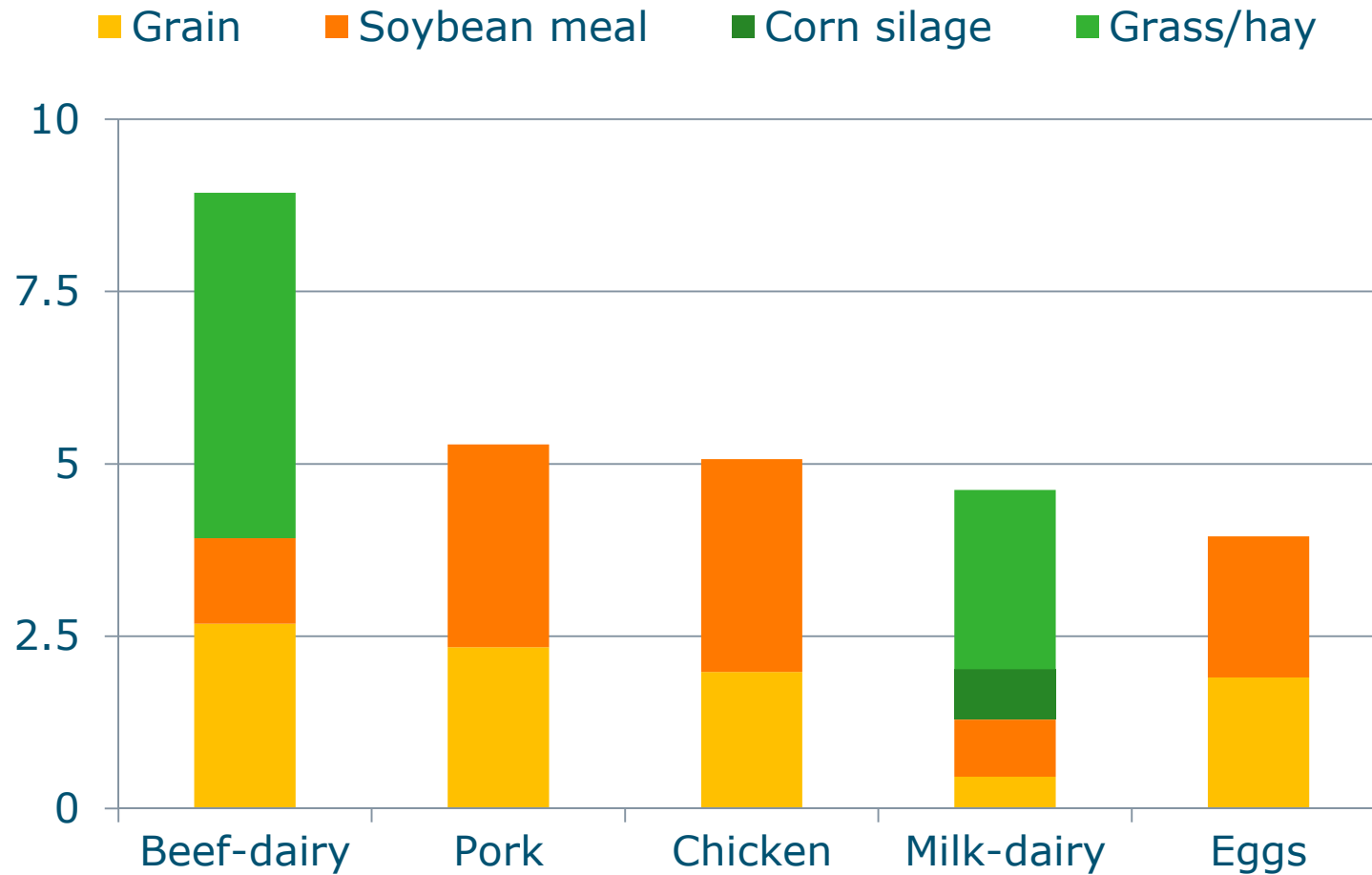




# m<sup>2</sup> per 100 g edible protein - USA



# m<sup>2</sup> per 100 g edible protein - USA



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# Land use efficiency

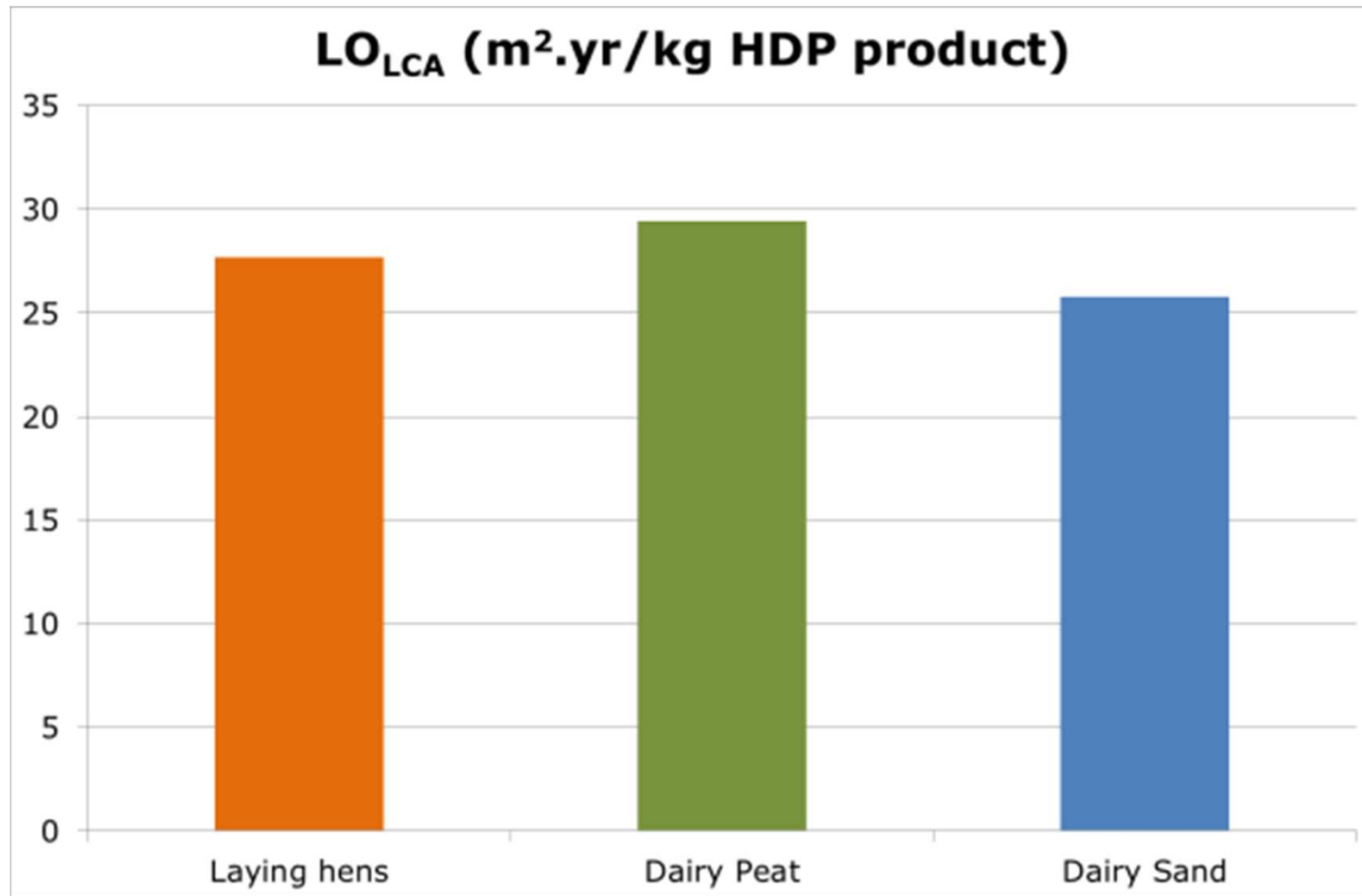
## Dairy vs laying hen systems in NL

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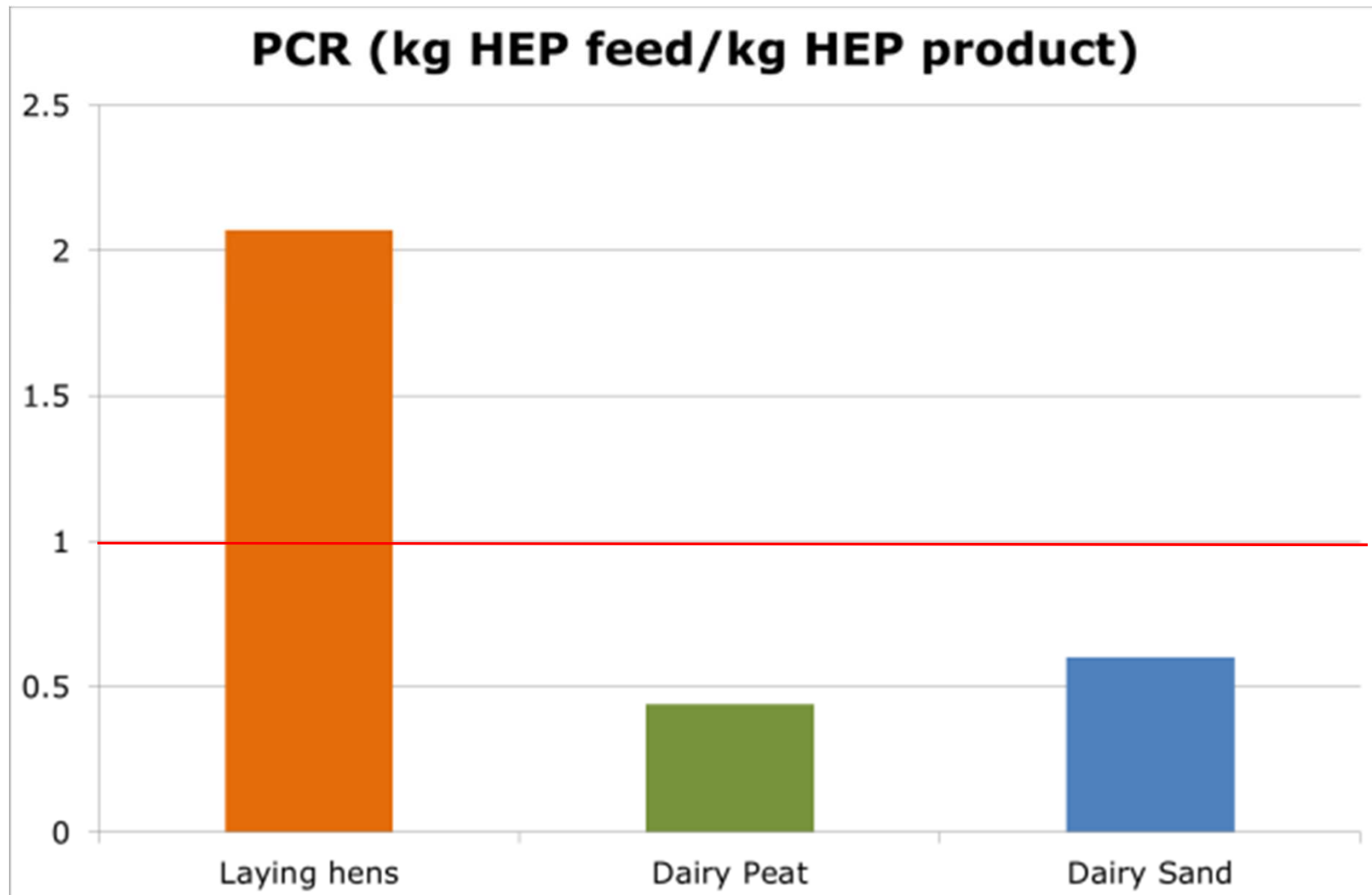
- NL Dairy farms > 90% peat soils
- NL Dairy farms > 90% sandy soils
- NL Egg production – barn system



# Milk versus egg production in NL – LCA



# Milk versus egg production in NL



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# Measuring land use efficiency: future

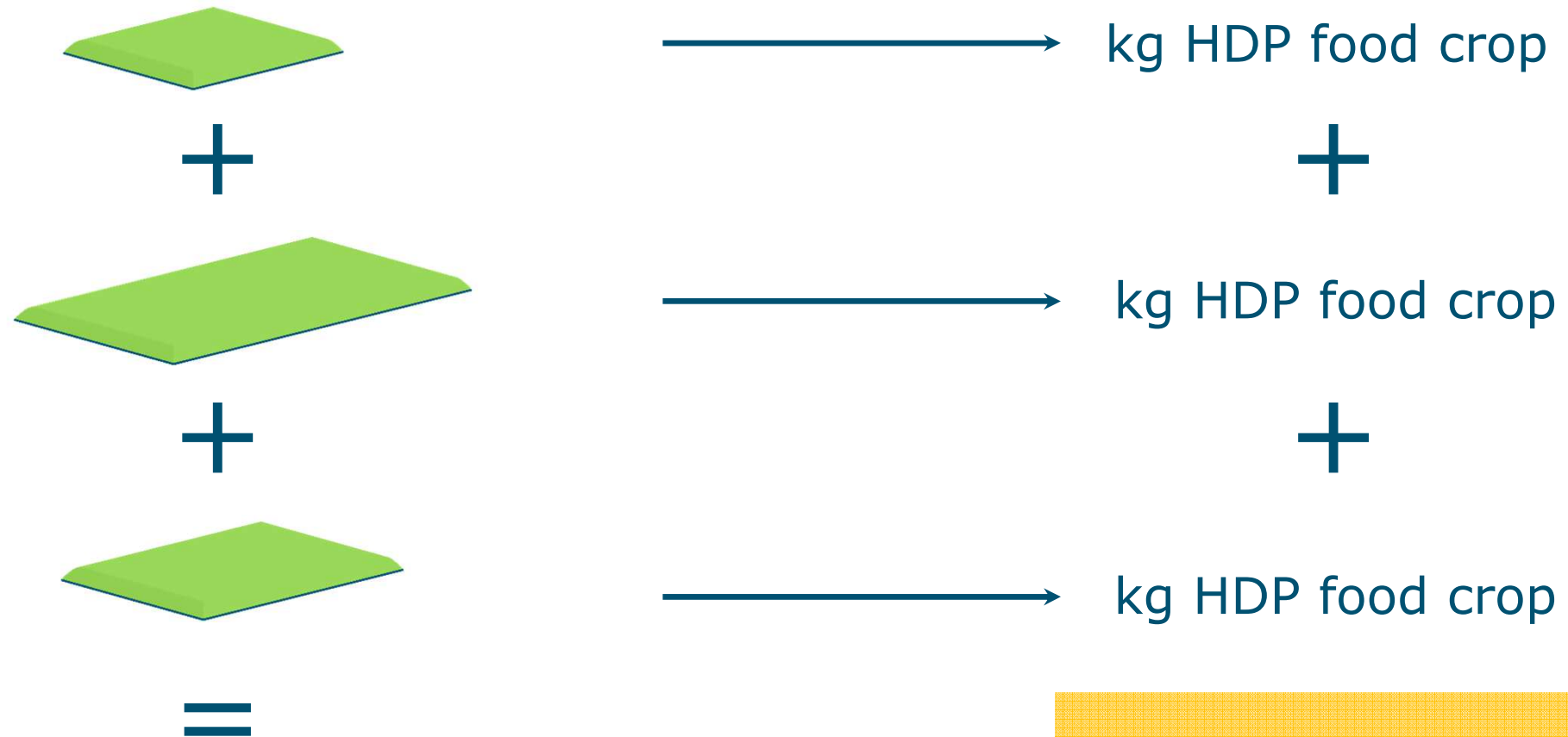
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- Include crop productivity
- Include animal productivity
- Account for competition between feed and food
- Account for suitability of land to cultivate food crop

# Land use ratio

Van Zanten et al. (2015)

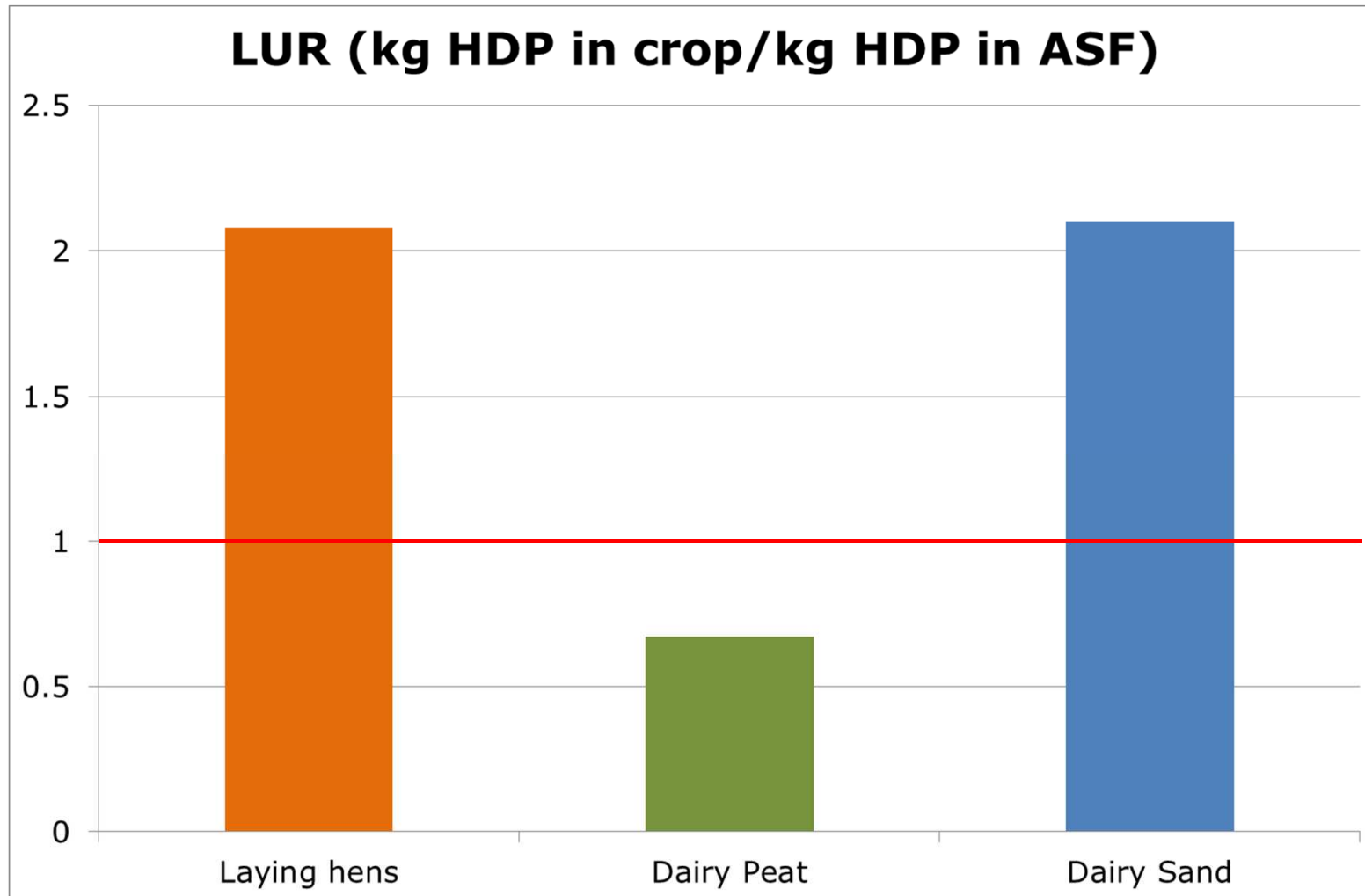
Area feed cultivation



1 kg animal-source food

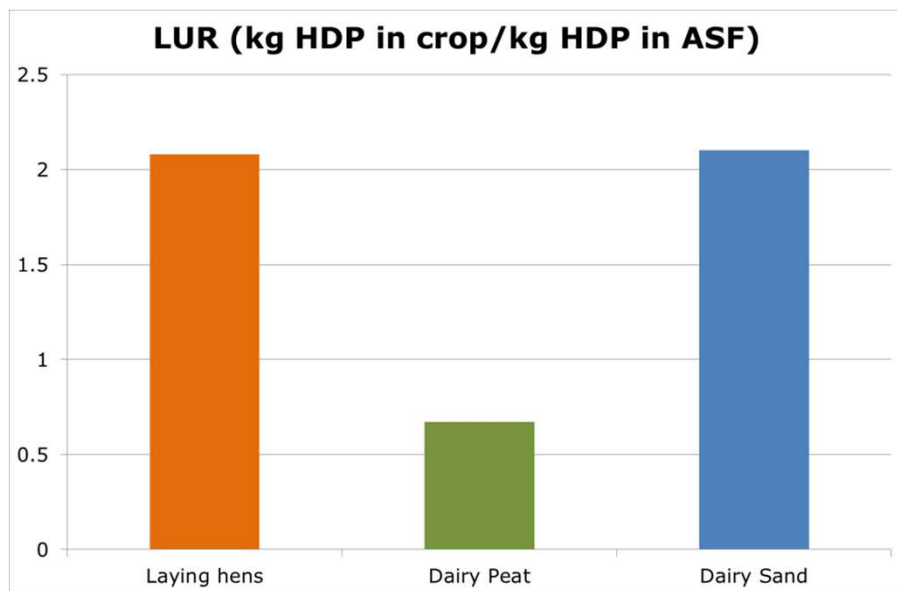
$$\frac{\sum \text{HDP food crops}}{\text{HDP in one kg ASF}}$$

# Land use ratio

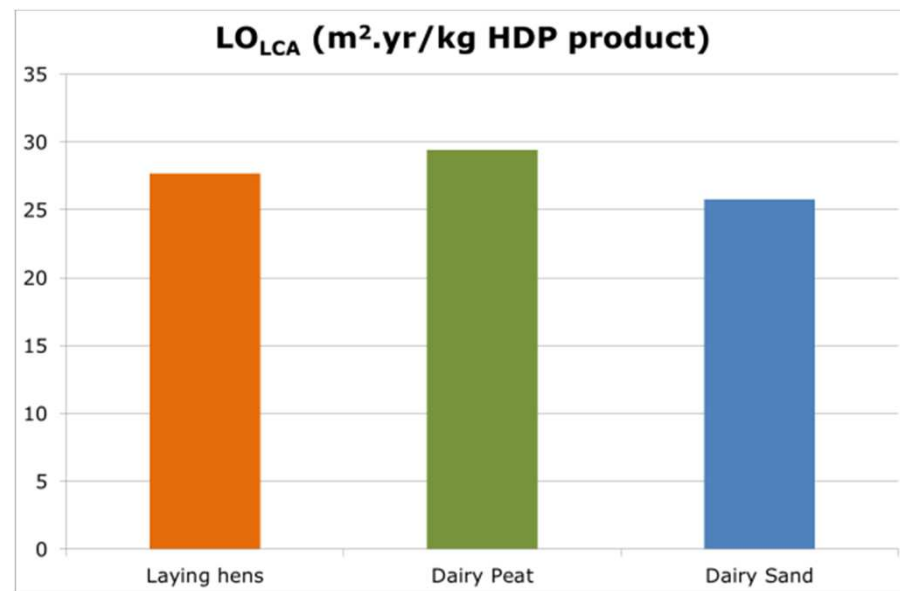




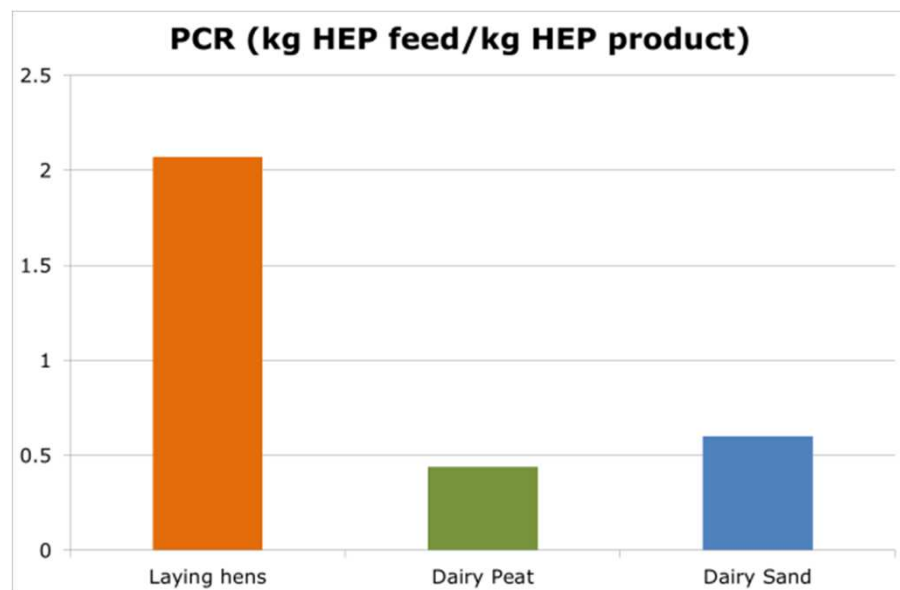
## Land use ratio



## LCA results

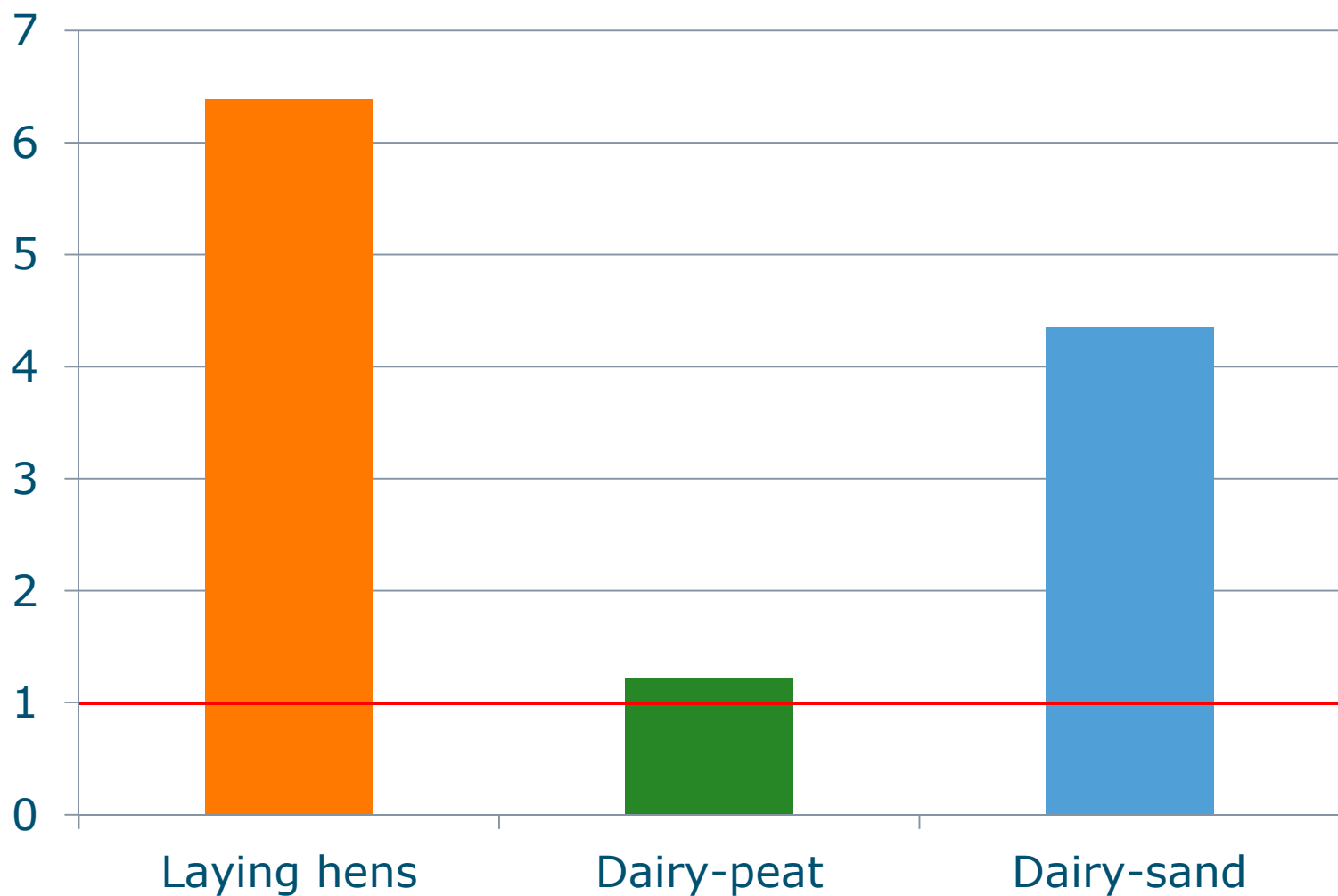


## Protein conversion ratio



# LUR – energy

(kg HDE crop/kg HDE ASF)



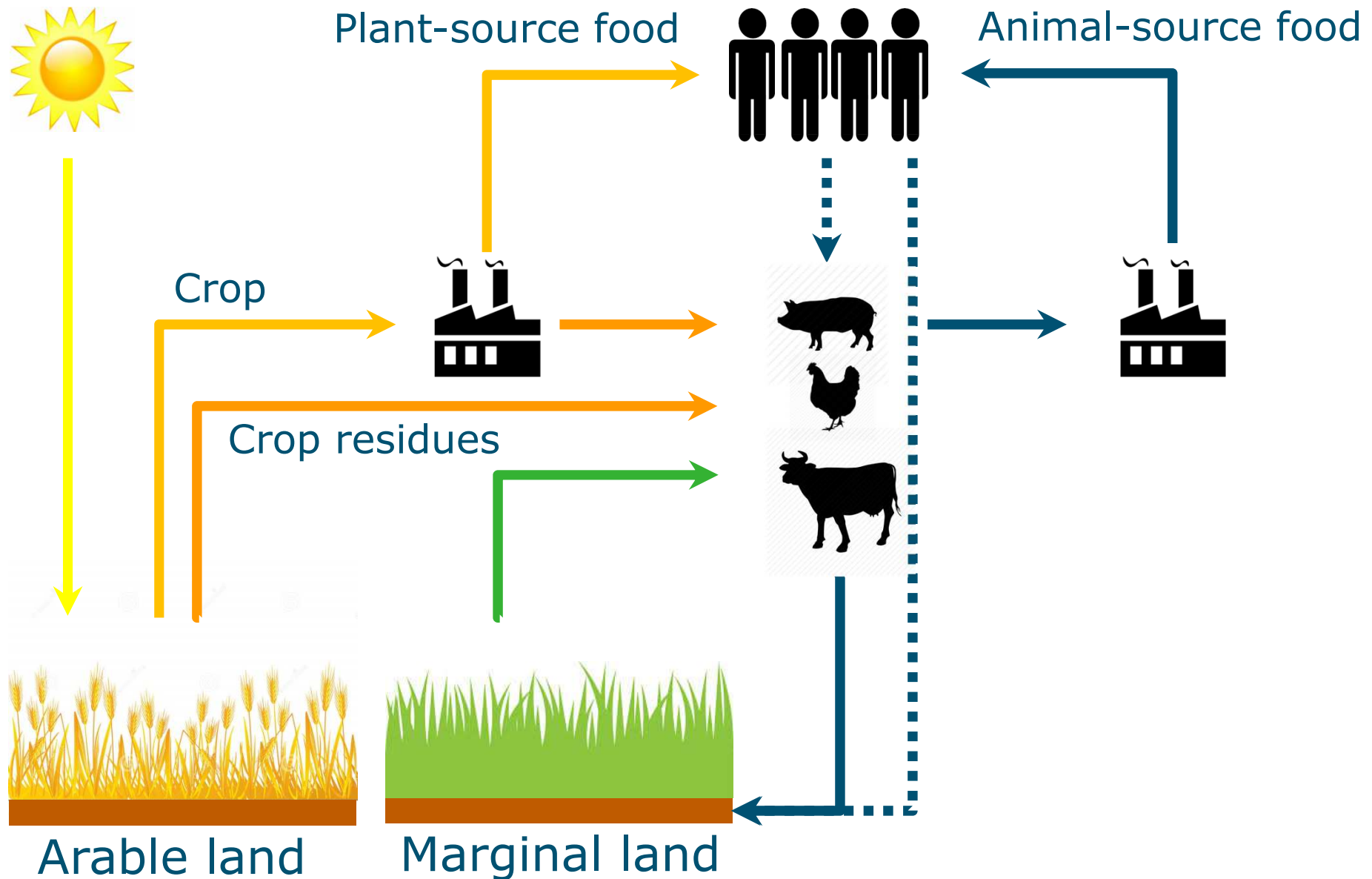
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# Measuring land use efficiency

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| Measures     | System     | Productivity      | What do you improve?                              |
|--------------|------------|-------------------|---|
| FCR – animal | animal     | kg animal product | feed efficiency animal                            |
| FCR - herd   | herd       | kg product herd   | feed efficiency herd                              |
| LCA          | life cycle | kg milk           | crop – herd efficiency                            |
| PCR - herd   | herd       | Kg milk           | conversion non-edible protein into edible protein |
| LUR          | life cycle | kg food protein   | land use efficiency food production               |

# Optimal use of biomass



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## Take home message

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The choice of your measure  
to assess environmental impact of food  
production systems  
affects your conclusion

Shift our focus from improving efficiency at animal  
level to improving the number of people to be  
nourished per ha (unit of resource)

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Thank you for  
your attention

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