Walloon Agricultural Research Centre

# Resilience of contribution to food security of specialized Walloon dairy systems

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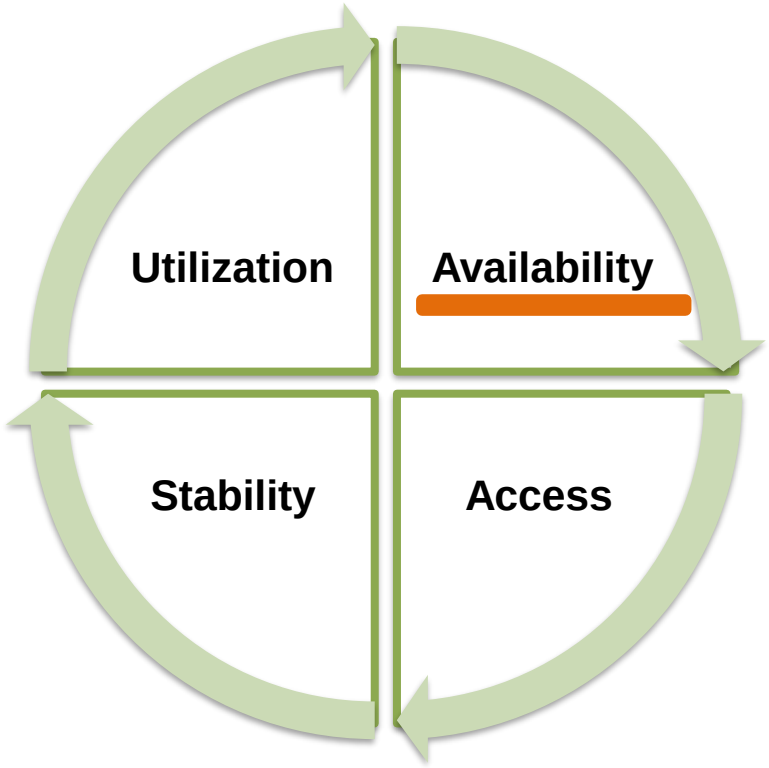
# Introduction

## Food security




The four interconnected dimensions of food security

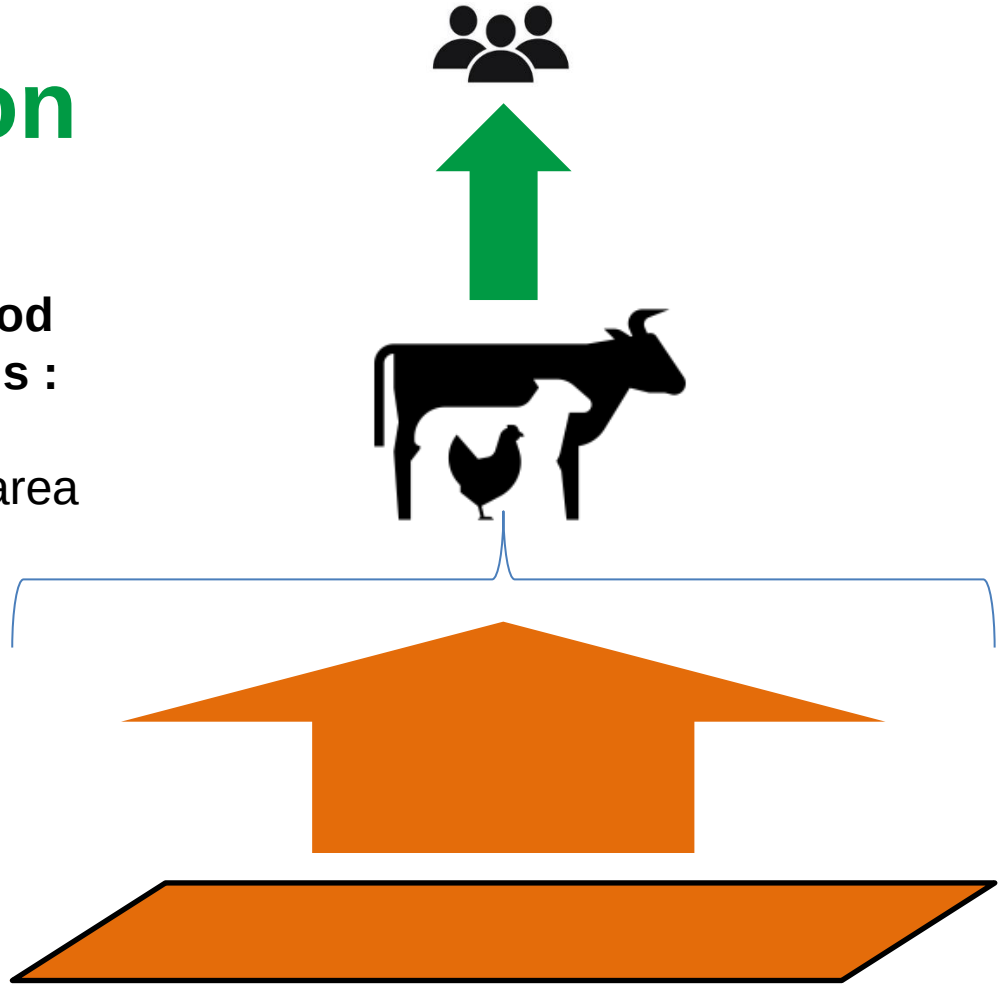
Reaction to **food insecurity** crisis around the globe → **increase productivity** of agricultural systems

# Introduction

## Gross productivity

**Limiting factors of food production by animals :**

- Human-edible feed
- Non human-edible area



*Food*

*Human-edible Feed*

*Area*

$$Gross\ productivity : \frac{Human\ Edible\ Protein}{Total\ Area}$$

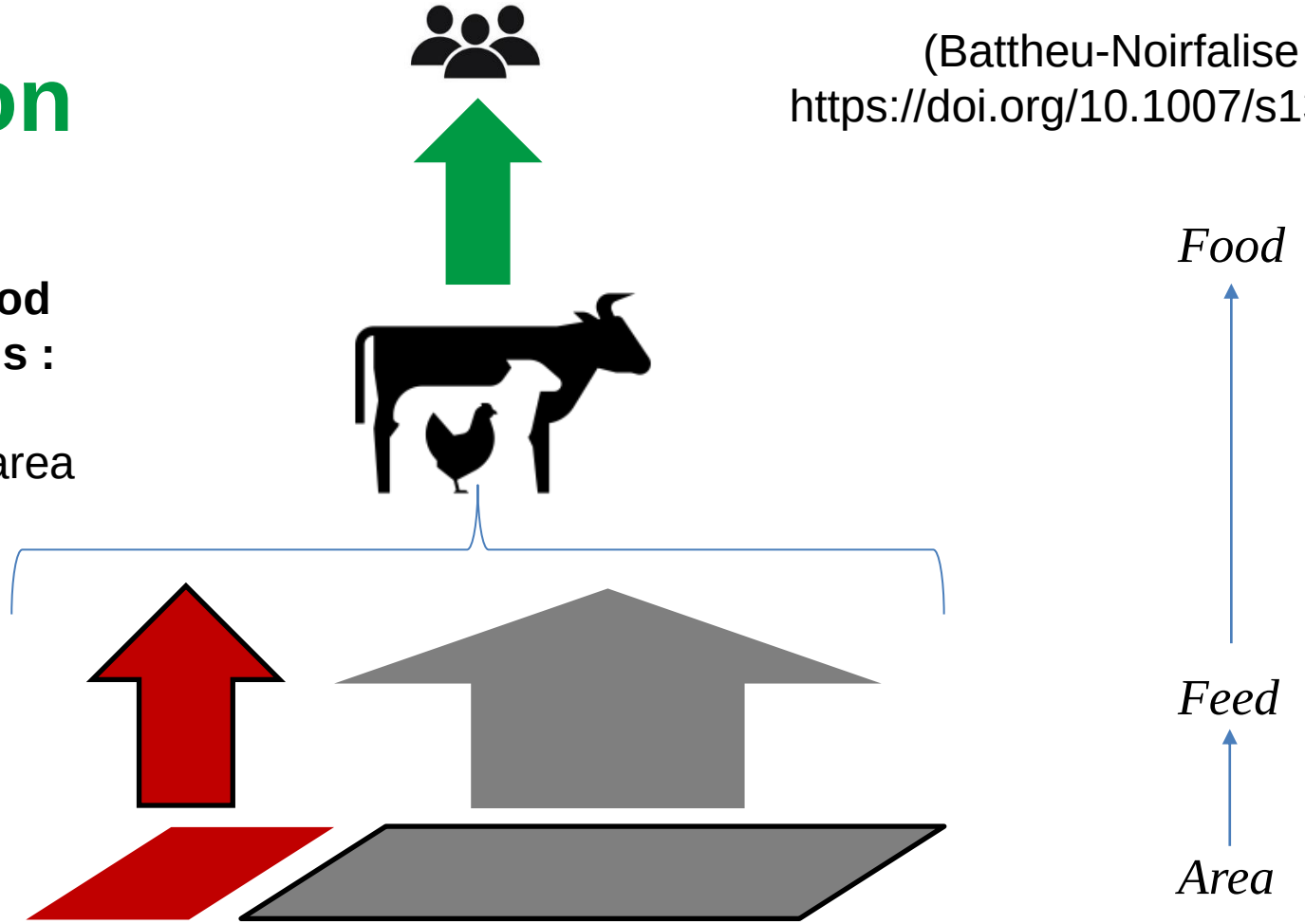
# Introduction

(Battheu-Noirfalise et al. 2023)
https://doi.org/10.1007/s13593-023-00901-z

## Net productivity

**Limiting factors of food production by animals :**

- Human-edible feed
- Non human-edible area




$$Net\ productivity : \frac{Human\ Edible\ Protein\ - Human\ Edible\ Feed}{Non - Human\ Edible\ Area}$$

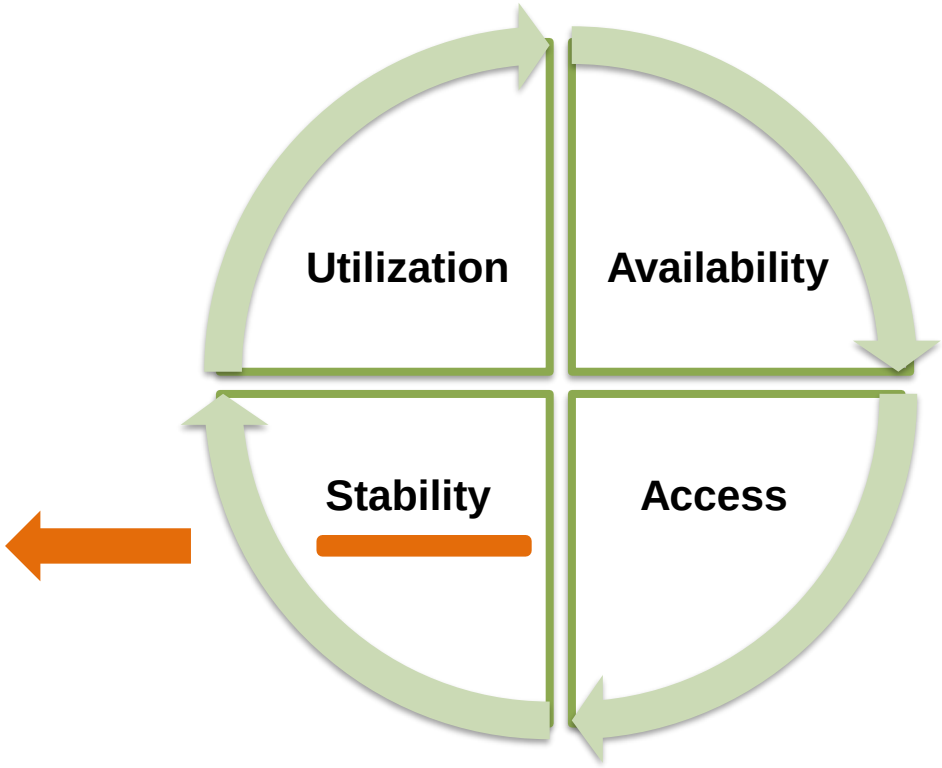
# Introduction

## Resilience of production

(Zampieri et al. 2020)
https://doi.org/10.1016/j.scitotenv.2020.139378

**Resilience of production**

$$R_p = \frac{mean(P)^2}{Var(P)}$$




The four interconnected dimensions of food security

# Objectives

- **Analyse the resilience of contribution to food security of dairy systems**
  - *H : intensive systems have lower resilience of net productivity ~ fixed requirement in rich feeds of high productive cows*

- **Compare the results of gross and net productivity**
  - *H : net productivity has lower resilience than gross productivity ~ lower mean value*

- **Study the influence of the end of milk quotas**
  - *H : resilience of both metrics will decrease after the end of milk quotas ~ destabilization of the market + farms will increase intensification to cope with open market prices*

# Results

## Farm types

| | IG | IM | EG |
|---|---|---|---|
| Number of farms | 29 | 16 | 34 |
| Milk production per cow (kg FPCM cow$^{-1}$ year$^{-1}$) | 7580 a | 7670 a | 5480 b |
| Grassland yield (t DM ha$^{-1}$) | 9.3 a | 7.8 b | 7.3 b |
| Percentage of maize silage (%) | 6 b | 38 a | 9 b |
| Concentrates per cow (kg DM cow$^{-1}$ day$^{-1}$) | 4.8 a | 4.2 a | 2.3 b |
| CP-content of concentrates (%) | 19.8 b | 26.3 a | 19.8 b |
| Stocking rate (LU ha$^{-1}$) | 2.33 a | 2.62 a | 1.69 b |
| Age at first calving (months) | 29.2 b | 30.3 b | 33.6 a |
| Female followers per cow (cow$^{-1}$) | 0.75 b | 0.88 a | 0.63 c |

*Mean of the 10 years*

Dataset :
FADN data
79 dairy farms
10 years (2011-2020)

| | IG | IM | EG |
|---|---|---|---|
| Gross productivity (kg HDP ha$^{-1}$) | 302 +/- 52 a | 301 +/- 68 a | 199 +/- 51 b |

Definition of farm types :
Kmeans clustering on the PCs
On the mean of the years

IG : Intensive Grass
IM : Intensive Maize
EG : Extensive Grass

# Results

## Influence of milk quota regime

| | IG | | | IM | | | EG | | |
|---|---|---|---|---|---|---|---|---|---|
| Milk quota | Yes | No | P-val | Yes | No | P-val | Yes | No | P-val |
| Gross productivity (kg HDP $ha^{-1}$) | 306 +/- 44 | 298 +/- 50 | | 297 +/- 51 | 305 +/- 71 | | 212 +/- 45 | 185 +/- 48 | *** |
| Net productivity (kg HDP $ha^{-1}$) | 272 +/- 46 | 266 +/- 53 | | 236 +/- 41 | 227 +/- 55 | | 195 +/- 43 | 170 +/- 47 | *** |
| Resilience of gross productivity () | 92.6 | 90.8 | *** | 63.9 | 56.4 | *** | 56.1 | 49.5 | *** |
| Resilience of net productivity () | 62.7 | 53.1 | *** | 23.5 | 18.0 | *** | 49.1 | 42.7 | *** |

*All farm types show a lower resilience of both gross and net productivity after the end of milk quotas :*
*- IG and IM ~ Variability*
*- EG ~ Mean value*

# Results

## Influence of milk quota regime

| | IG | | | | IM | | | | EG | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Milk quota | Yes | | No | P-val | Yes | | No | P-val | Yes | No | P-val |
| Milk production per cow (kg FPCM cow$^{-1}$ year$^{-1}$) | 7490 | < | 7660 | * | 7470 | < | 7870 | *** | 5530 | 5440 | |
| Fodder yield correction (%) | 117 | | 115 | | 92 | | 102 | *** | 92 | 91 | |
| Percentage of maize silage (%) | 7 | | 5 | | 39 | | 38 | | 10 | 9 | |
| Concentrates per cow (kg DM cow$^{-1}$ day$^{-1}$) | 4.6 | < | 5.0 | ** | 4.0 | < | 4.4 | * | 2.4 | 2.2 | |
| CP of concentrates (%) | 20.4 | > | 19.3 | * | 26.0 | | 26.5 | | 20.1 | 19.4 | |
| Stocking rate (LU ha$^{-1}$ farm$^{-1}$) | 2.39 | > | 2.26 | *** | 2.56 | | 2.67 | | 1.75 | 1.62 | *** |
| Age at first calving (months) | 29.2 | | 29.2 | | 30.8 | | 29.7 | * | 33.0 | 34.3 | *** |
| Female followers per cow (cow$^{-1}$) | 0.75 | | 0.75 | | 0.94 | > | 0.83 | *** | 0.58 | 0.69 | *** |

*Farm types show specific evolution pathways :*
*- IG and IM show an intensification*
*- EG shows an extensification*

# Discussion

- **Analyse the resilience of contribution to food security of dairy systems**
  - *H : intensive systems have lower resilience of net productivity ~ fixed requirement in rich feeds of high productive cows*
  - The intensive and grass-based type (IG) shows the highest mean levels of net productivity and resilience of net productivity → IG can couple the dimensions availability and stability of food security
  - Although the intensive maize based type has a higher mean level of net productivity, its resilience of net productivity is lower than the extensive grass-based type

- **Compare the results of gross and net productivity**
  - *H : net productivity has lower resilience than gross productivity ~ lower mean value*
  - Net productivity show lower resilience ~ lower mean value than gross productivity

- **Study the influence of the end of milk quotas**
  - *H : resilience of both metrics will decrease after the end of milk quotas ~ destabilization of the market + farms will increase intensification to cope with open market prices*
  - The period after the end of milk quotas (> 2015) is associated with lower resilience. However, five years is a short period, that can also be influenced by other factors such as extreme weather events


*Easily said, …*
*Hardly done.*

# Valorize grass !

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