Walloon Agricultural Research Centre

Resilience of contribution to food security of specialized Walloon dairy systems

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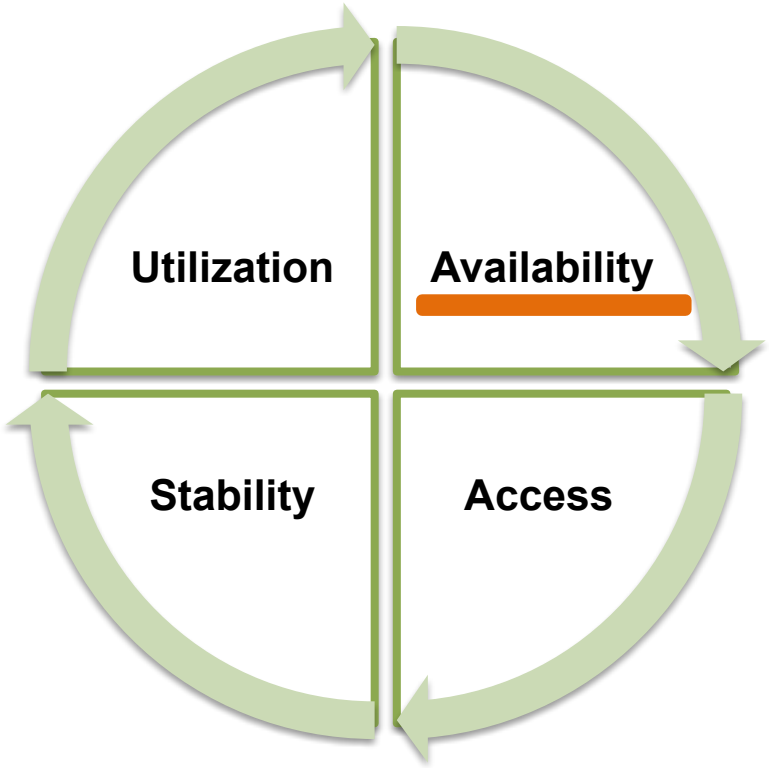
Introduction

Food security



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

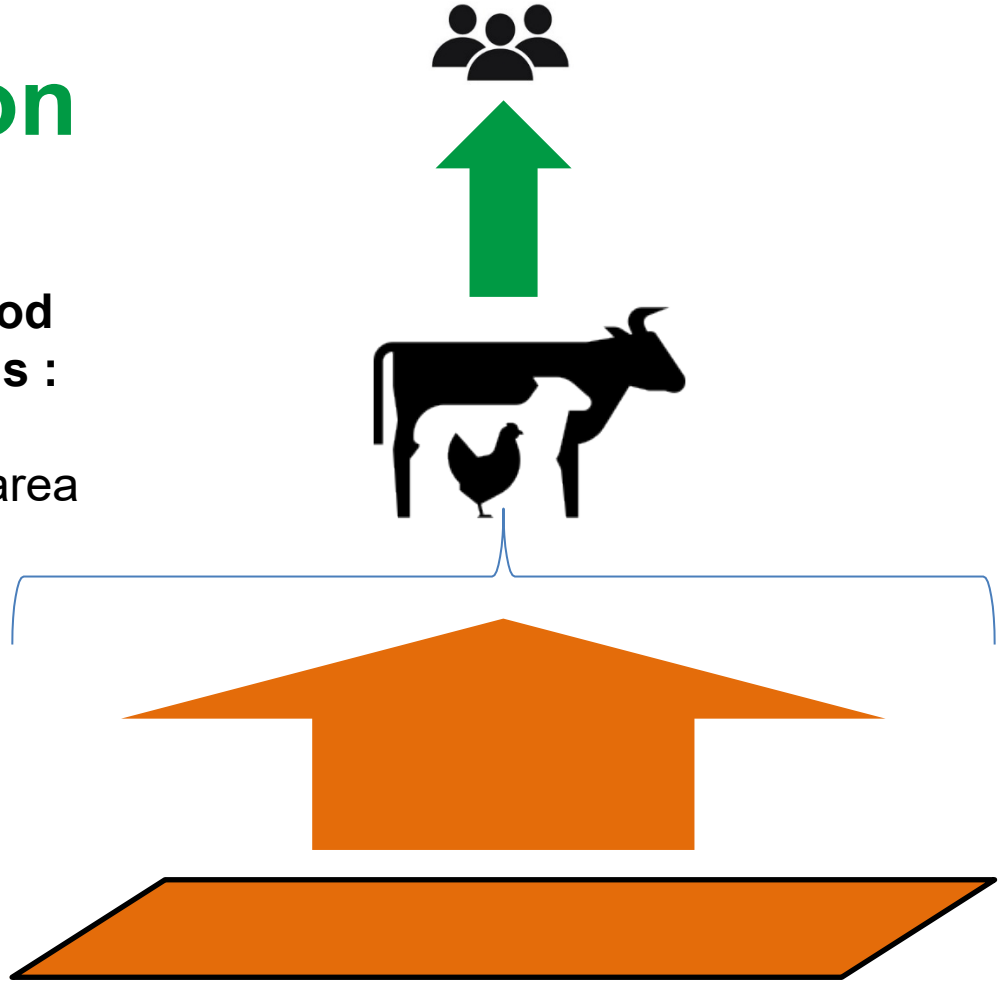
The four interconnected dimensions of food security

Introduction

Gross productivity

Limiting factors of food production by animals :

- Human-edible feed
- Non human-edible area



Food

Human-edible Feed

Area

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

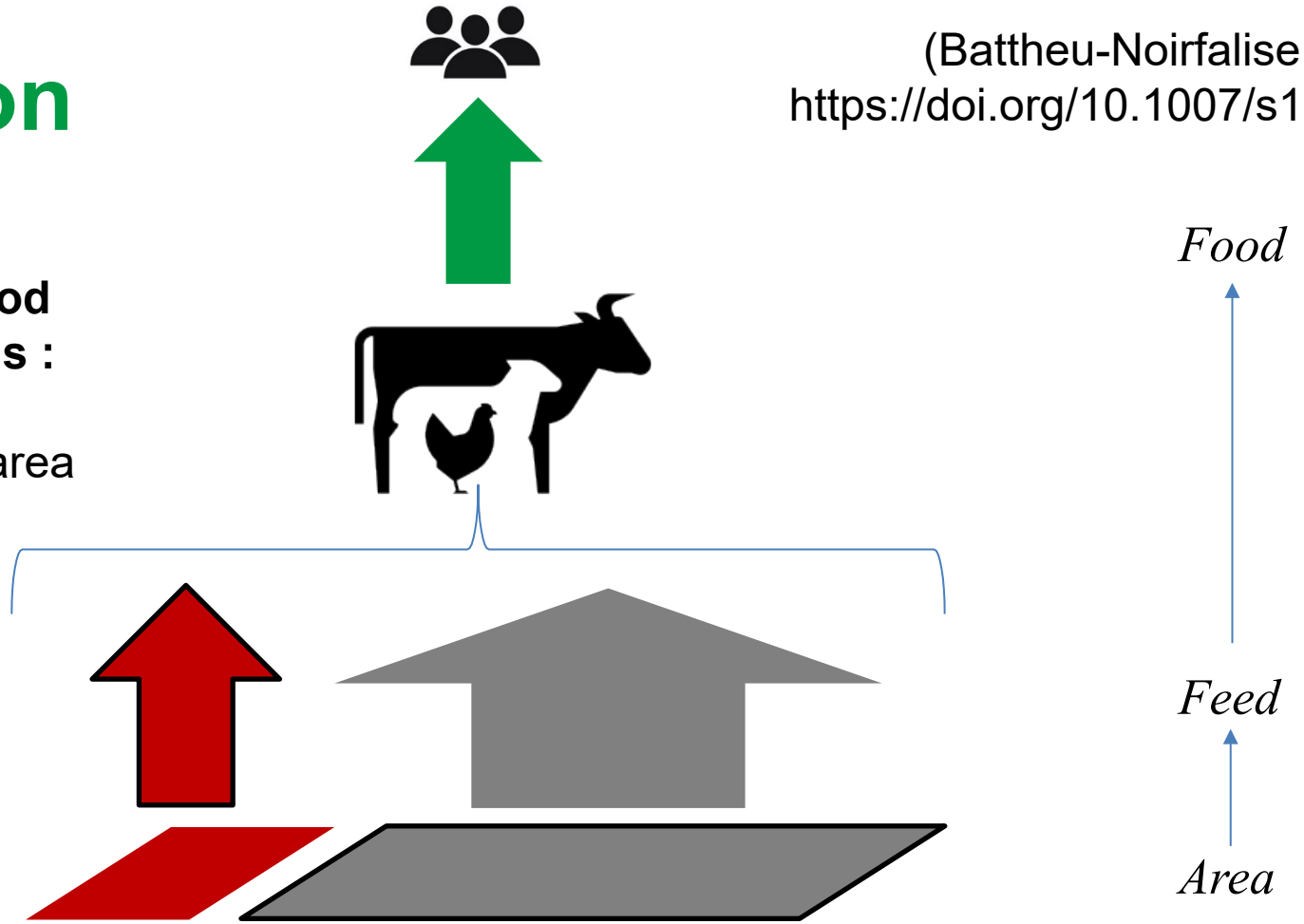
Introduction

Net productivity

Limiting factors of food production by animals :

- Human-edible feed
- Non human-edible area

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



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

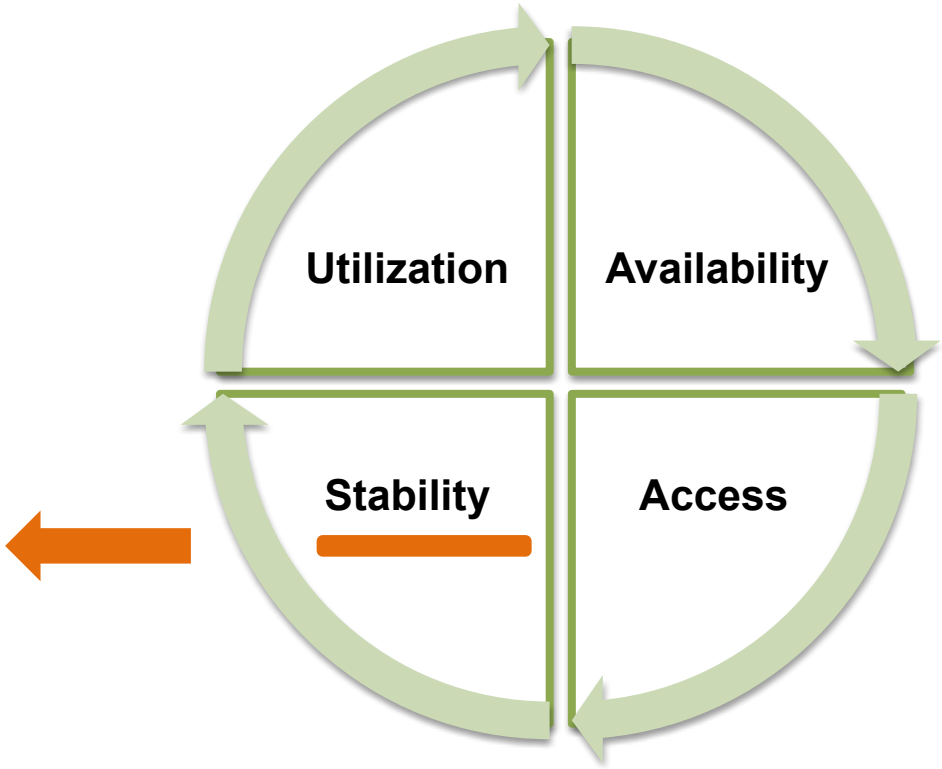
Introduction

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

<u>Dataset :</u>
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

<u>Definition of farm types :</u>
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 !

Wallonie recherche CRA-W

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