



Strategies to improve livestock system robustness: moving toward diversity

E. Ollion, B. Dumont, S. Ingrand and
F. Blanc

Why?

-

-

-

-



Why?

⇒ Current systems raises concerns

-

-

-



Why?

⇒ Current systems raises concerns



▪

▪

▪



Why?

⇒ Current systems raises concerns



▪

▪

▪

Why?

⇒ Current systems raises concerns

-

-

-



Why?

⇒ Current systems raises concerns

▪

▪

▪



Why?

⇒ Current systems raises concerns

-
-
-



Why?

- ⇒ Current systems raises concerns
- ⇒ Instability of productions contexts

-

-



Why?

- ⇒ Current systems raises concerns
- ⇒ Instability of productions contexts

-

-



Why?

- ⇒ Current systems raises concerns
- ⇒ Instability of productions contexts

-

-

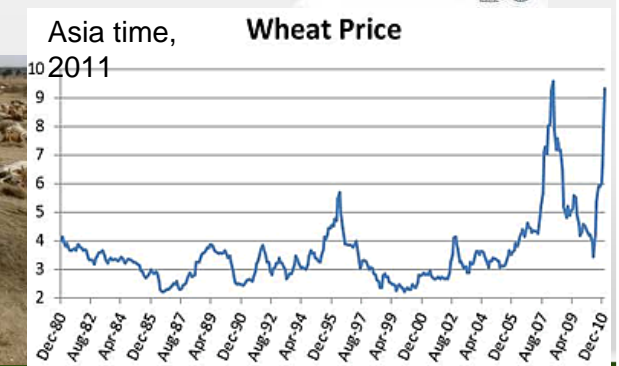


Why?

- ⇒ Current systems raises concerns
- ⇒ Instability of productions contexts

■

■

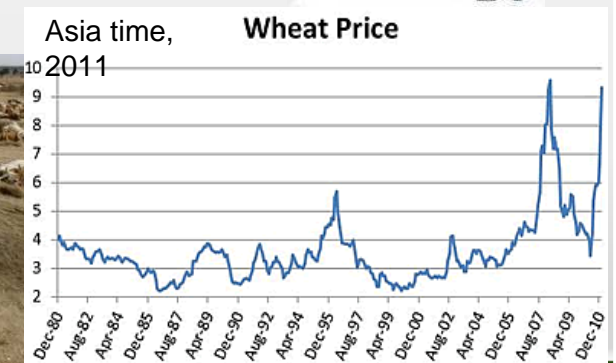
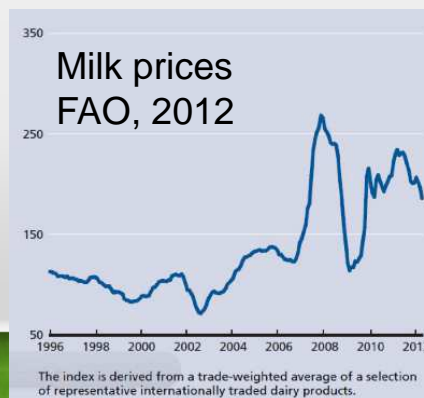


Why?

- ⇒ Current systems raises concerns
- ⇒ Instability of productions contexts

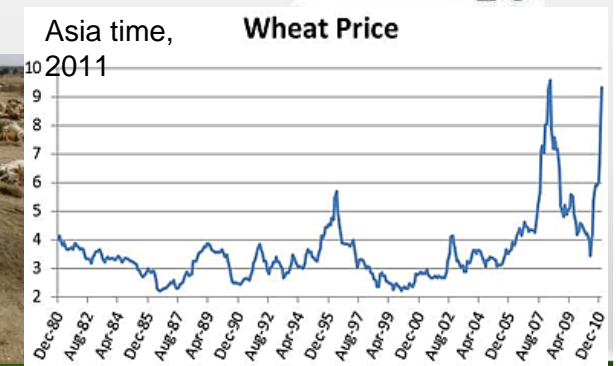
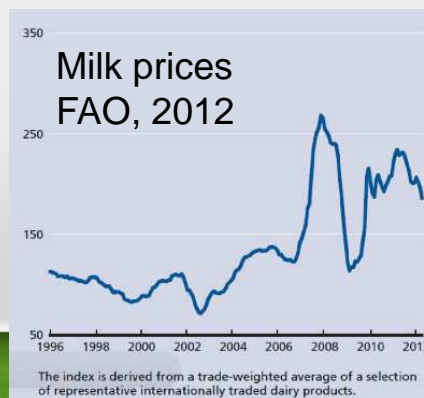
■

■



Why?

- ⇒ Current systems raises concerns
- ⇒ Instability of productions contexts
- ⇒ But essential roles: proteins, jobs income, draught power, social role



Why?

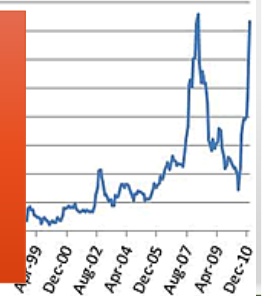
- ⇒ Current systems raises concerns
- ⇒ Instability of productions contexts
- ⇒ But essential roles: proteins, jobs income, draught power, social role



A change of paradigm is needed to develop sustainable and socially acceptable robust livestock systems in a changing world

Asia time,
10 2011

Wheat Price



And How? (Dumont,2013)



And How? (Dumont,2013)



And How? (Dumont, 2013)

Scientific discipline that applies ecological theory to the design and management of sustainable agroecosystems (Altieri, 1987)



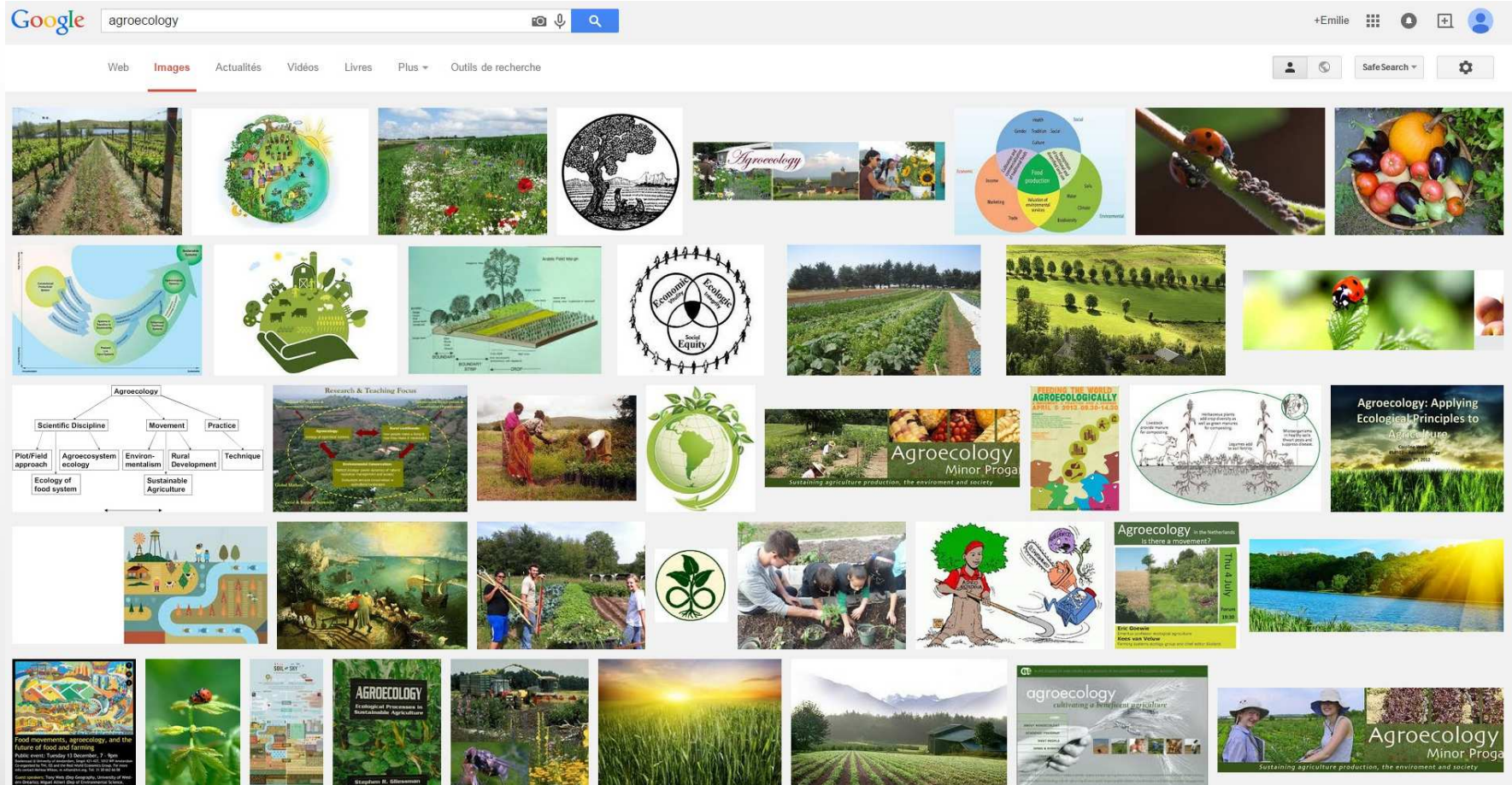
And How? (Dumont, 2013)

Scientific discipline that applies ecological theory to the design and management of sustainable agroecosystems (Altieri, 1987)



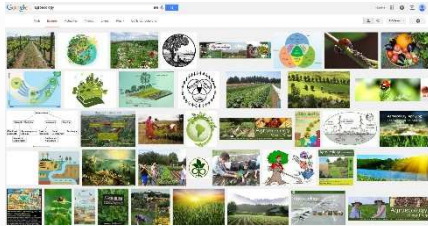
Holistic framework

And How? (Dumont, 2013)



Holistic framework

And How? (Dumont,2013)



Scientific discipline that applies ecological theory to the design and management of sustainable agroecosystems (Altieri, 1987)



Holistic framework

And How? (Dumont, 2013)



Scientific discipline that applies ecological theory to the design and management of sustainable agroecosystems (Altieri, 1987)

Crop productions

Agroecology

Holistic framework



And How? (Dumont,2013)



Scientific discipline that applies ecological theory to the design and management of sustainable agroecosystems (Altieri, 1987)

Crop productions



Holistic framework



And How? (Dumont,2013)



Scientific discipline that applies ecological theory to the design and management of sustainable agroecosystems (Altieri, 1987)

Crop productions



Agroecology

Holistic framework



ReColAd
Workshop 2018

11/02/2015

And How? (Dumont, 2013)



Scientific discipline that applies ecological theory to the design and management of sustainable agroecosystems (Altieri, 1987)

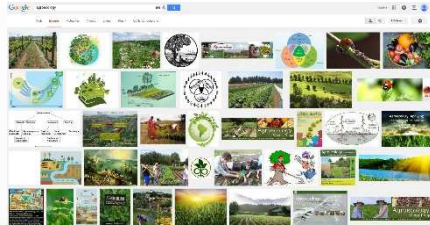
Crop productions



Agroecology

Holistic framework

And How? (Dumont, 2013)



Scientific discipline that applies ecological theory to the design and management of sustainable agroecosystems (Altieri, 1987)

Crop productions

Agroecology

Livestock?



Holistic framework

And How? (Dumont, 2013)



Scientific discipline that applies ecological theory to the design and management of sustainable agroecosystems (Altieri, 1987)

Crop productions

Agroecology

Livestock?



Agroecological transition of livestock farming system is an option

Agroecology in livestock farming systems: 6 case studies (Dumont et al. 2013)

5 principles

Integrated
health
managmt

↓ inputs

↓ pollution

Diversity to ↑
resilience

Preserve
biodiversity

Agroecology in livestock farming systems: 6 case studies (Dumont et al. 2013)

5 principles

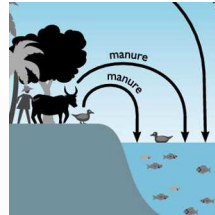
Integrated
health
managmt

↓ inputs

↓ pollution

Diversity to ↑
resilience

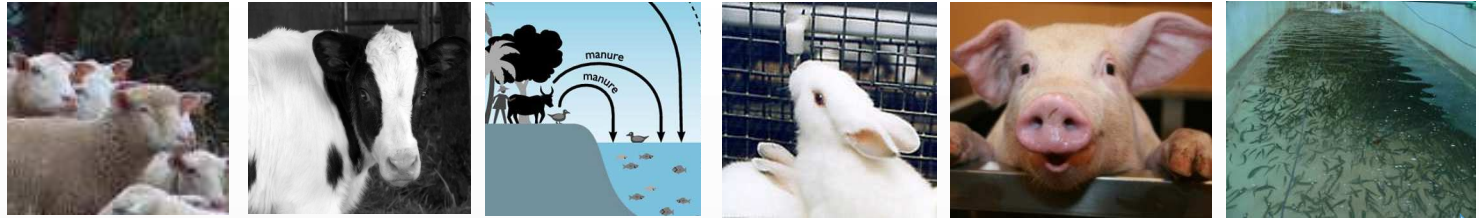
Preserve
biodiversity



Intensification

Agroecology in livestock farming systems: 6 case studies (Dumont et al. 2013)

5 principles



Intensification →

Integrated
health
managmt

↓ inputs

↓ pollution

Diversity to ↑
resilience

Preserve
biodiversity

**

*

**

**

**

*

**

**

**

**

*

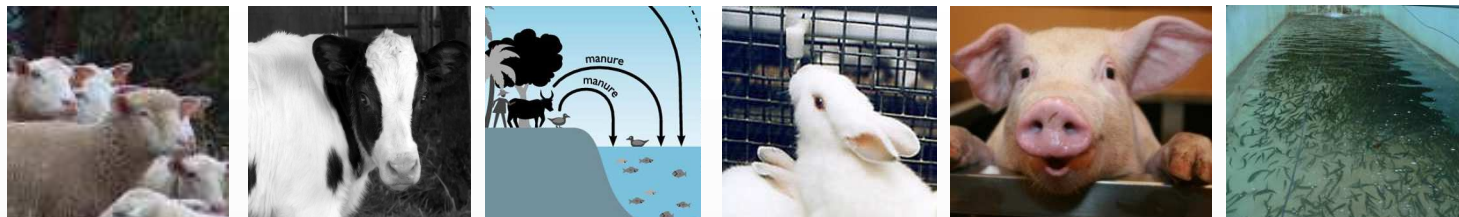
**

*

*

Agroecology in livestock farming systems: 6 case studies (Dumont et al. 2013)

5 principles

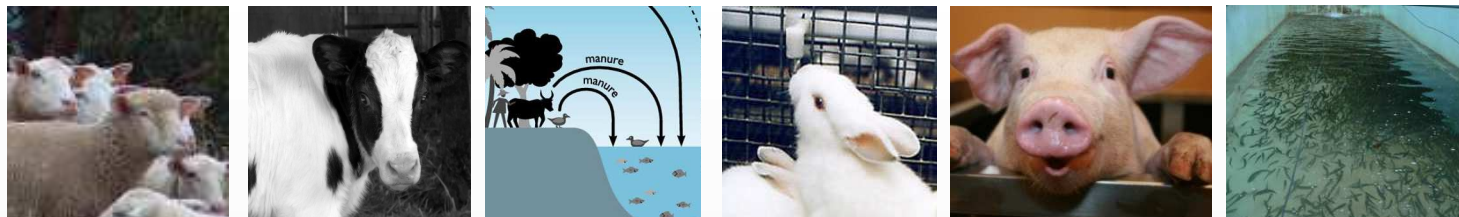


Intensification →

Integrated health managmt				**	*	**
↓ inputs	**	***	***	***	***	**
↓ pollution	*	***	**		***	***
Diversity to ↑ resilience	***	**	**	**	*	
Preserve biodiversity	**	*		*		

Agroecology in livestock farming systems: 6 case studies (Dumont et al. 2013)

5 principles



Intensification →

Integrated
health
managmt

**

*

**

↓ inputs

**

**

↓ pollution

*

**

Diversity to ↑
resilience

**

**

**

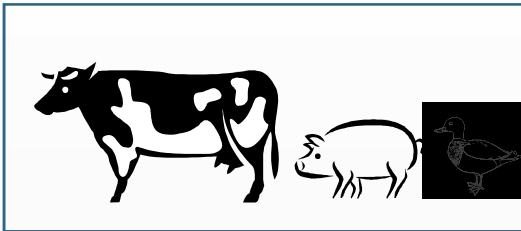
*

Preserv
biodiversity

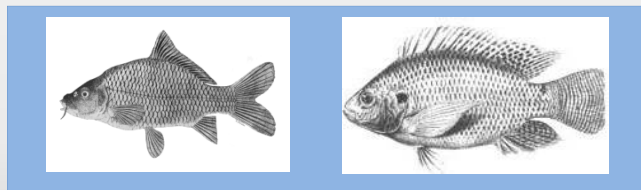
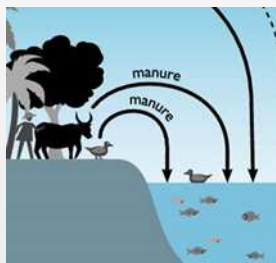
Which form and use of diversity ?

Productions diversity (Dumont et al., 2013)

Livestock



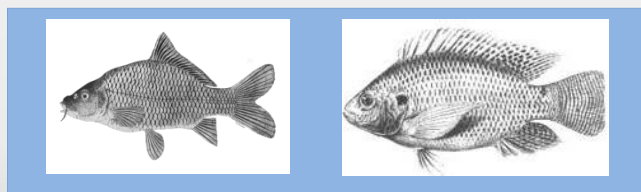
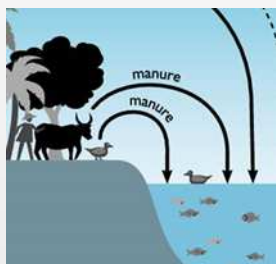
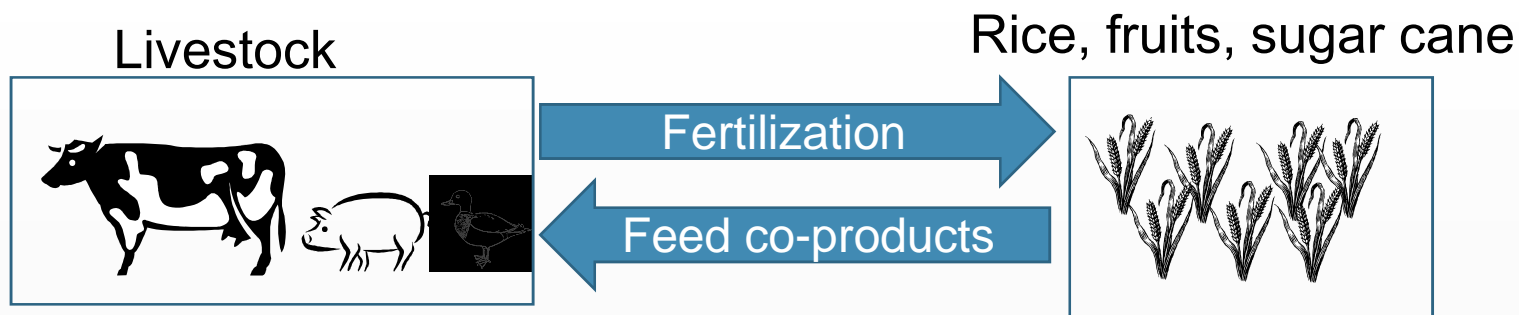
Rice, fruits, sugar cane



Fish (carp, tilapia)

Nhan et al. 2006
Phong et al. 2010
Karim et al. 2011

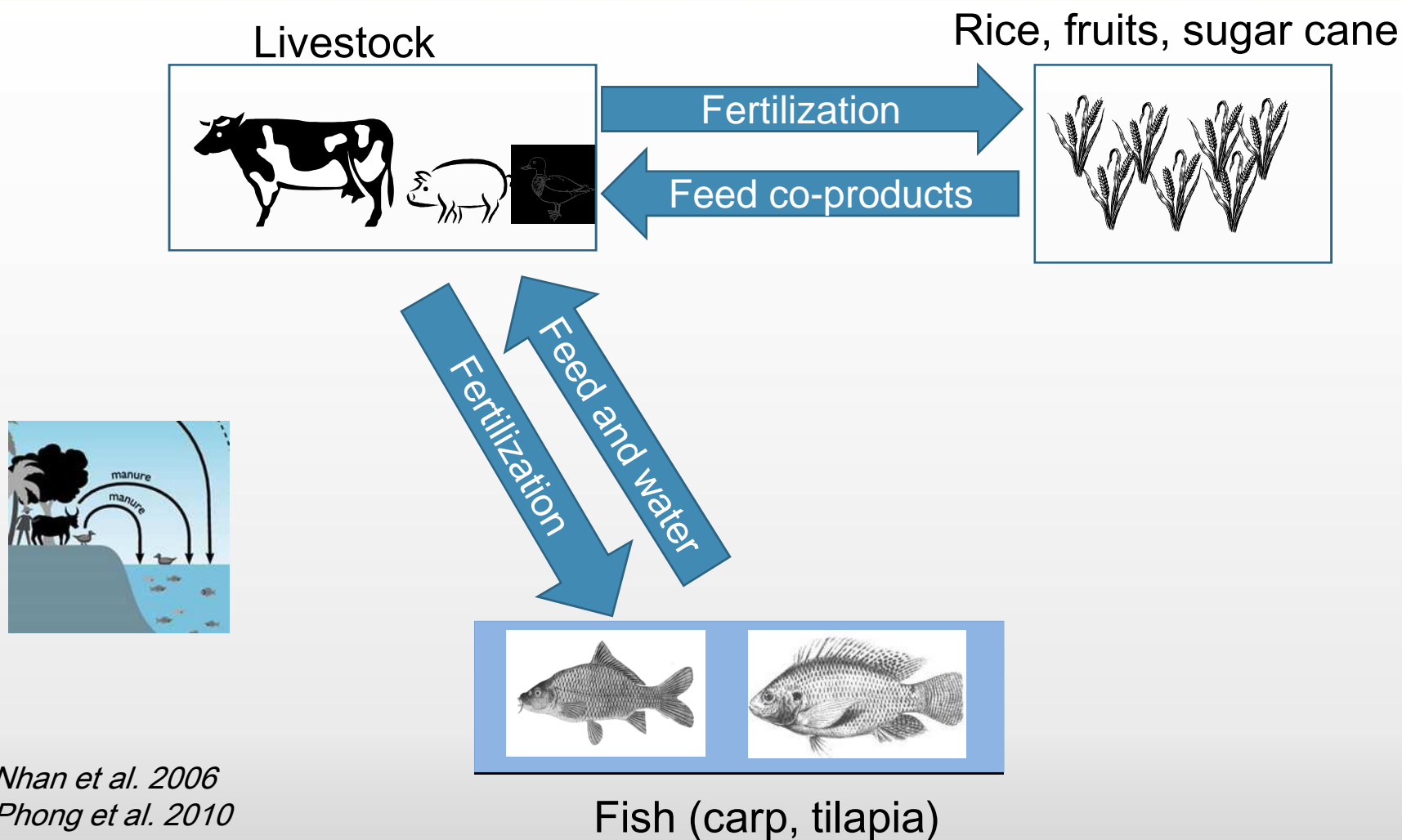
Productions diversity (Dumont et al., 2013)



Fish (carp, tilapia)

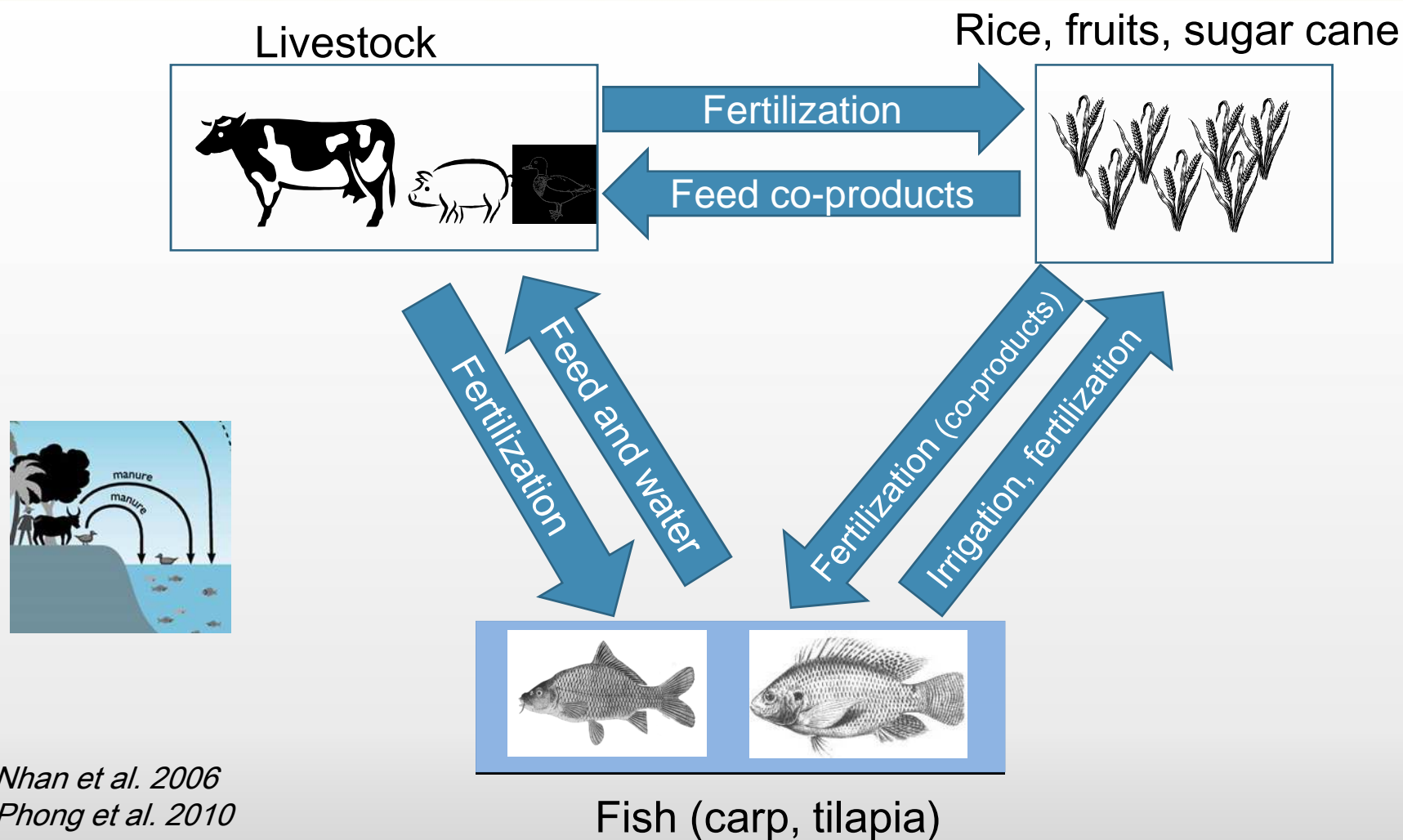
Nhan et al. 2006
Phong et al. 2010
Karim et al. 2011

Productions diversity (Dumont et al., 2013)



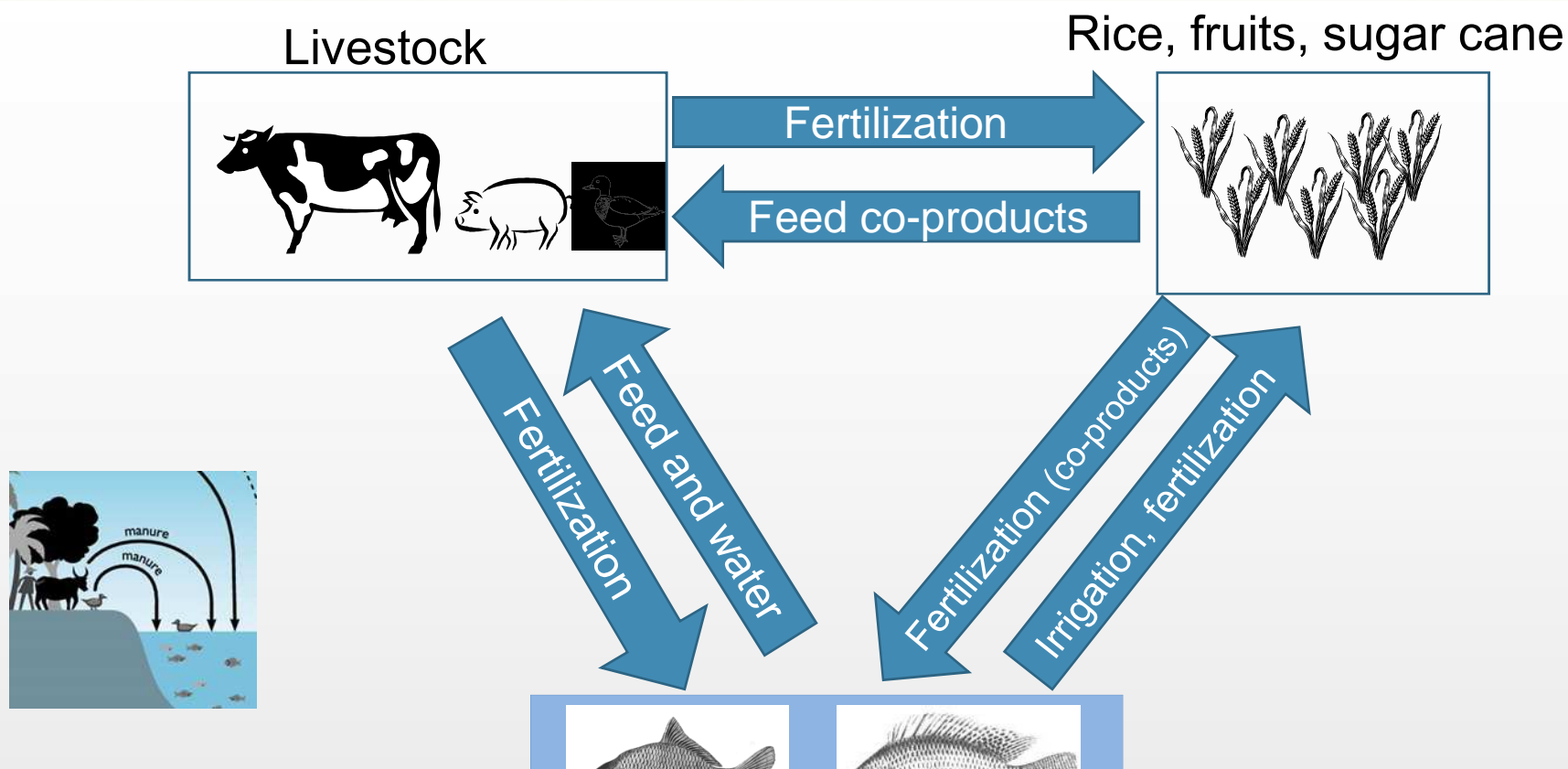
Nhan et al. 2006
Phong et al. 2010
Karim et al. 2011

Productions diversity (Dumont et al., 2013)



Nhan et al. 2006
Phong et al. 2010
Karim et al. 2011

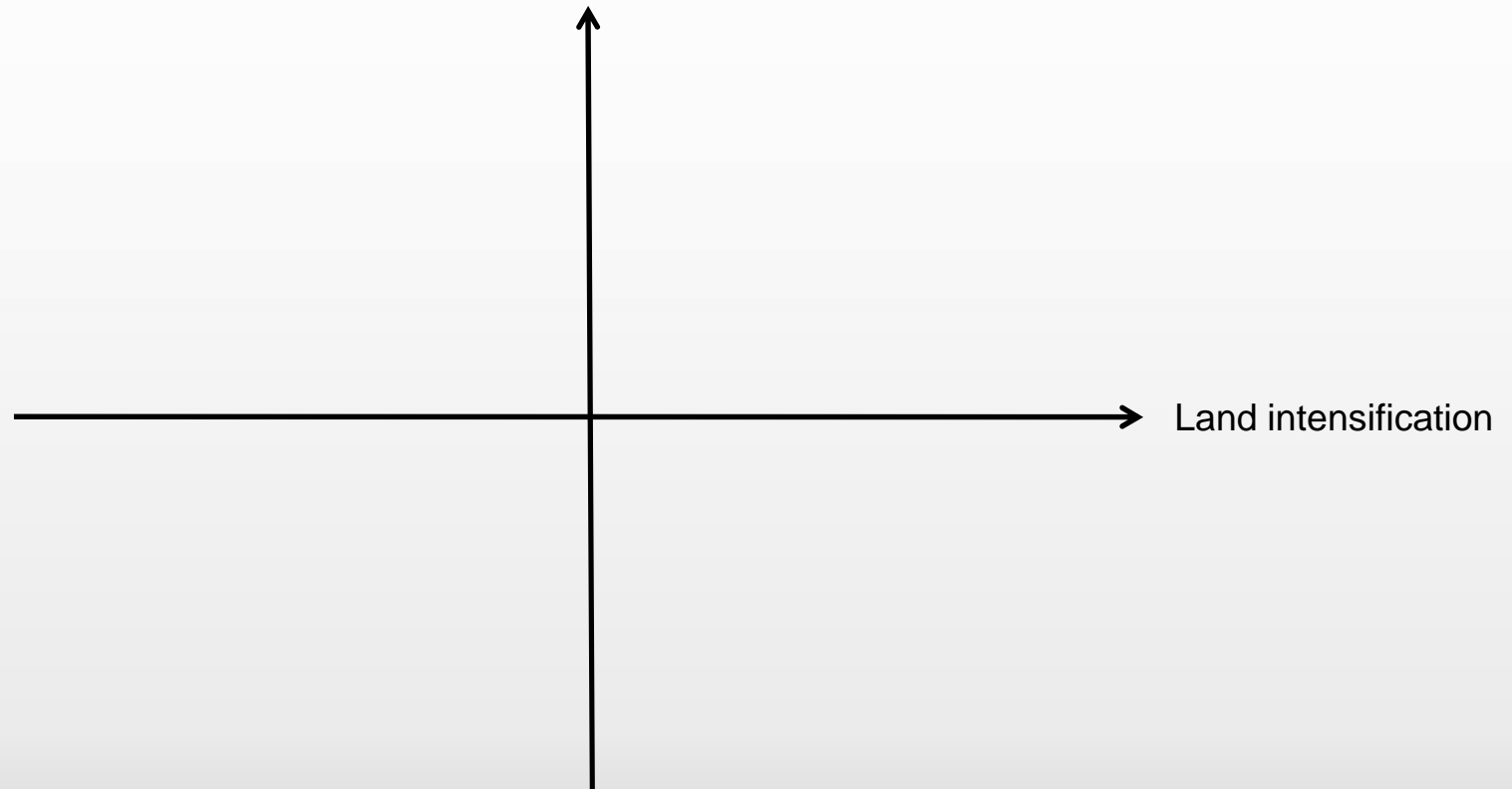
Productions diversity (Dumont et al., 2013)



Diversity secures income and autonomy reduces vulnerability and environmental burden, increases productivity

Species diversity (Cournut et al. 2014)

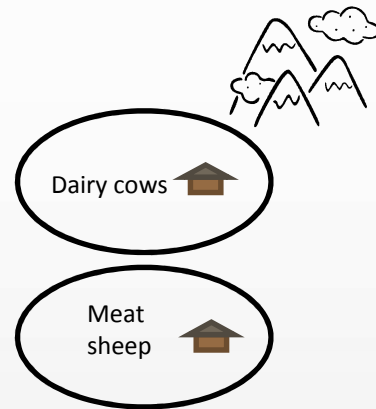
Animals' productivity



Species diversity (Cournut et al. 2014)

**Separated
management**

6000 kg/cow/year
1,1 lamb/ewe/year

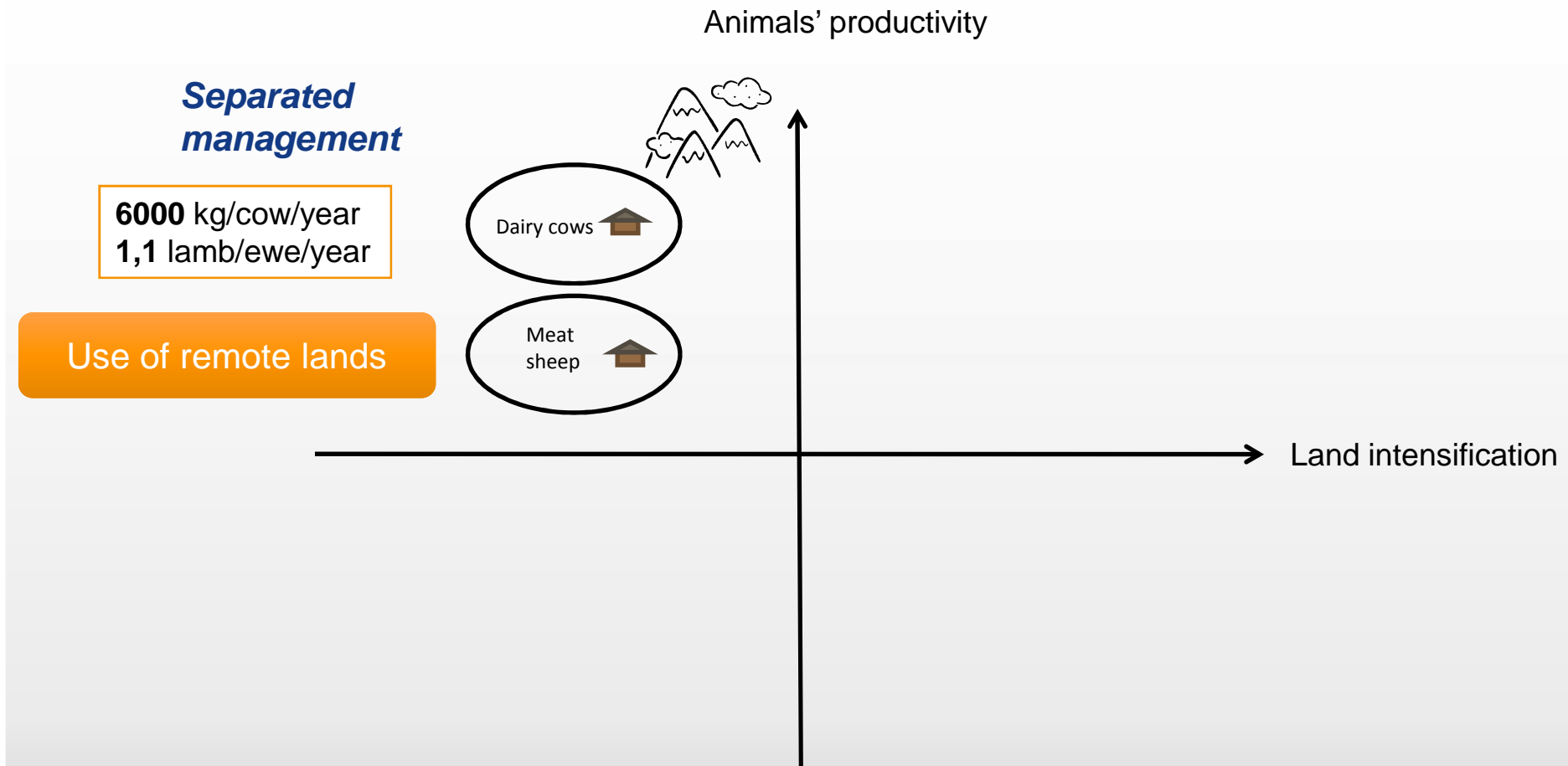


Animals' productivity

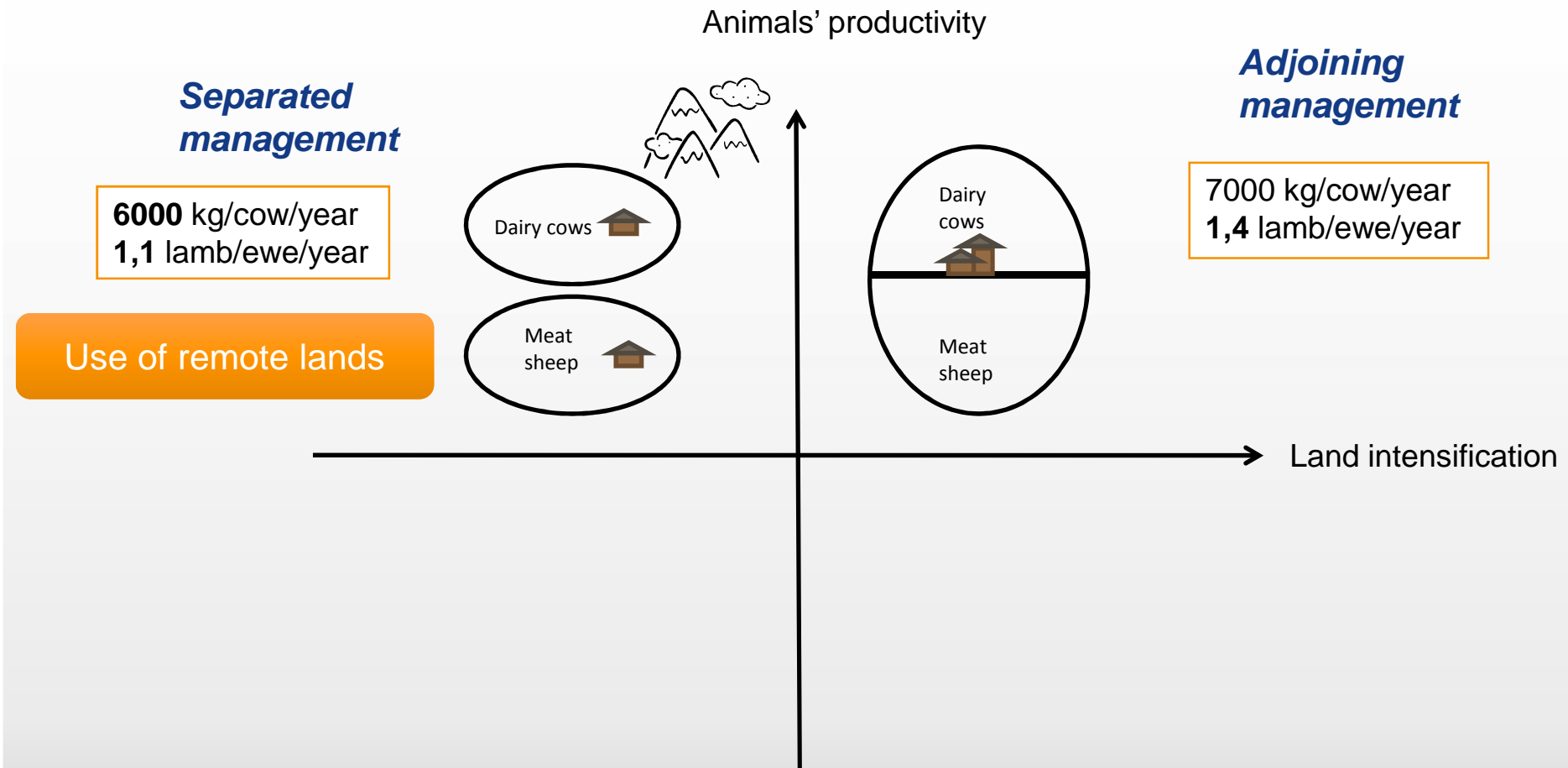
Land intensification



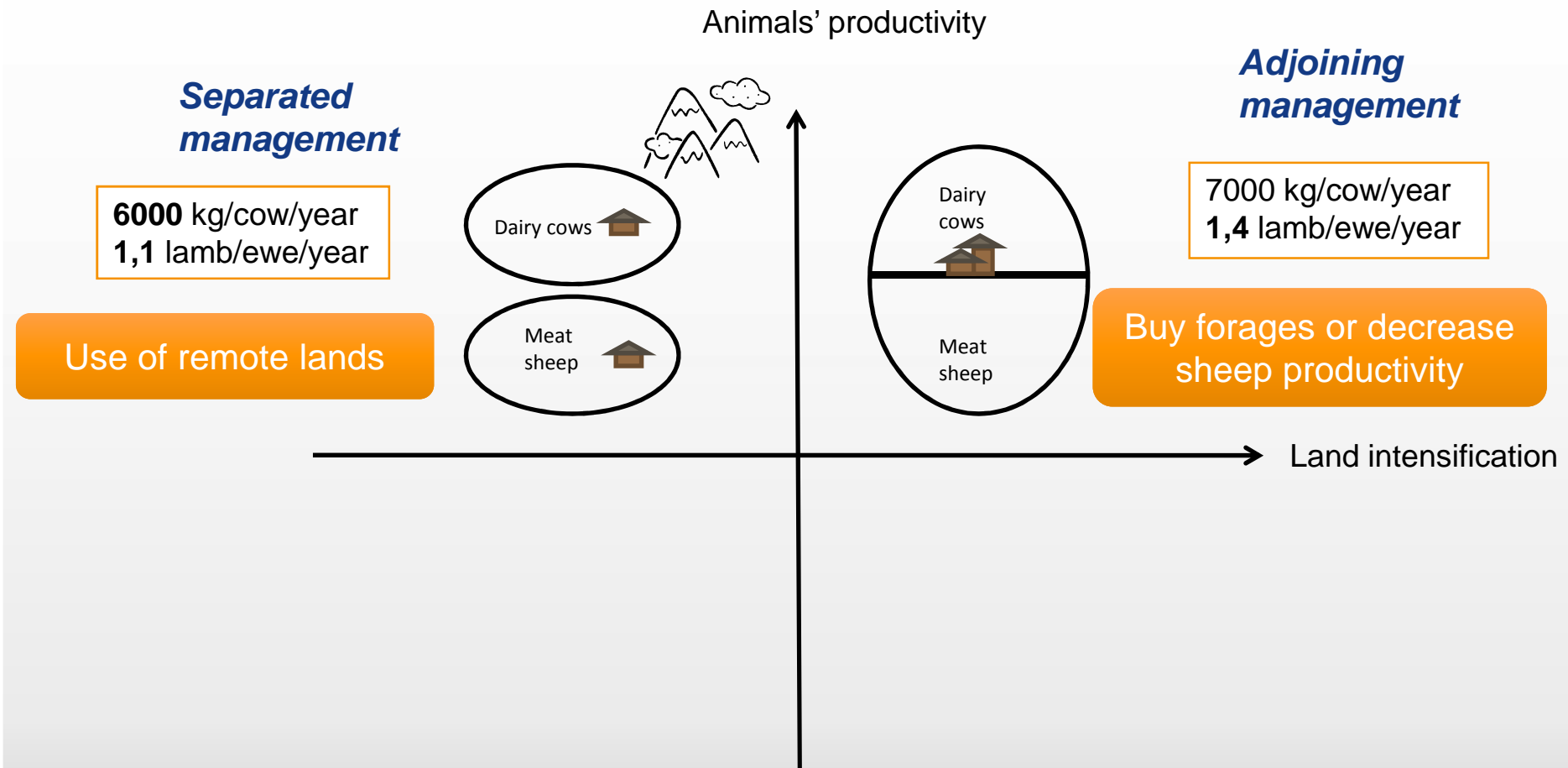
Species diversity (Cournut et al. 2014)



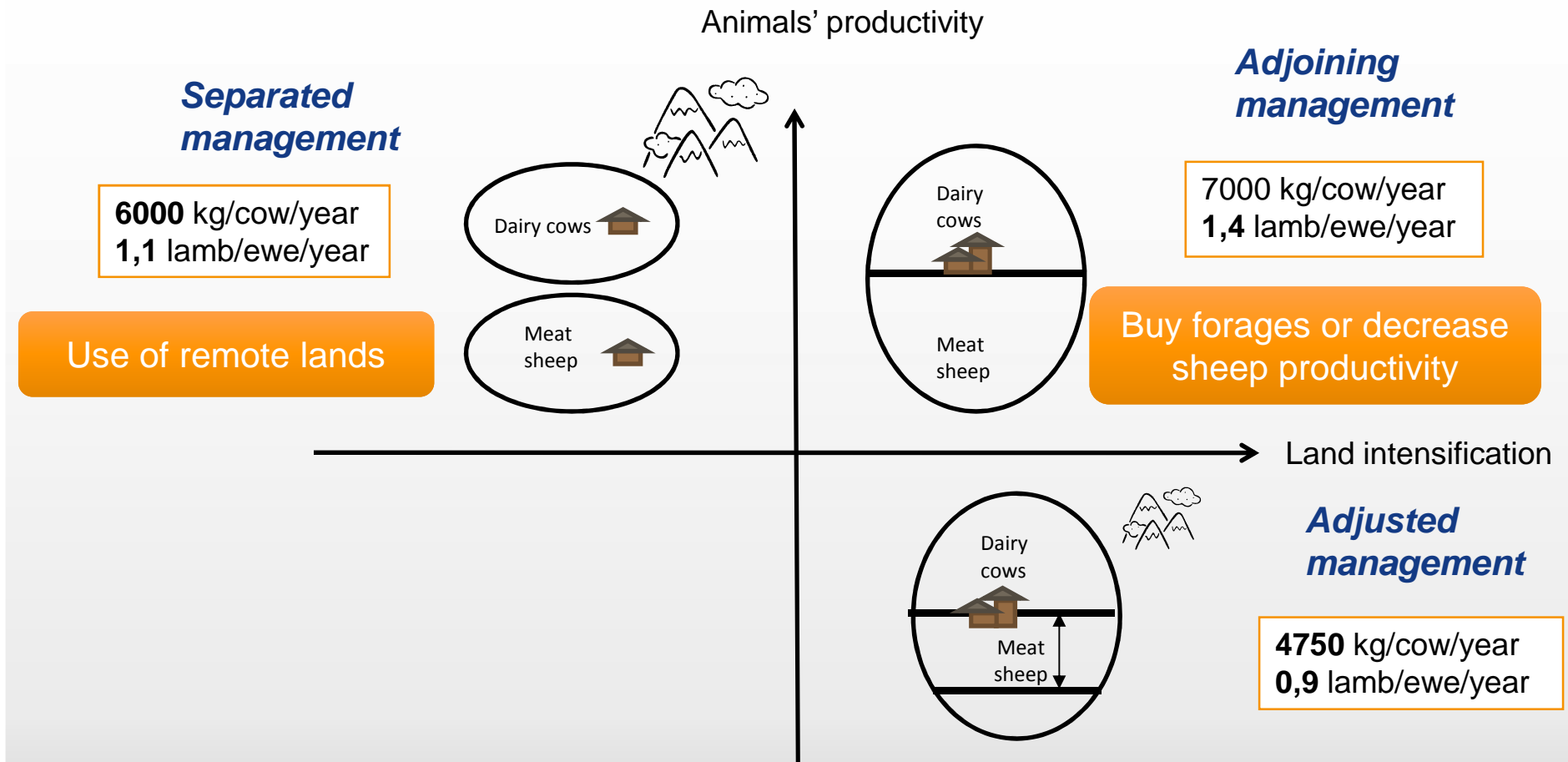
Species diversity (Cournut et al. 2014)



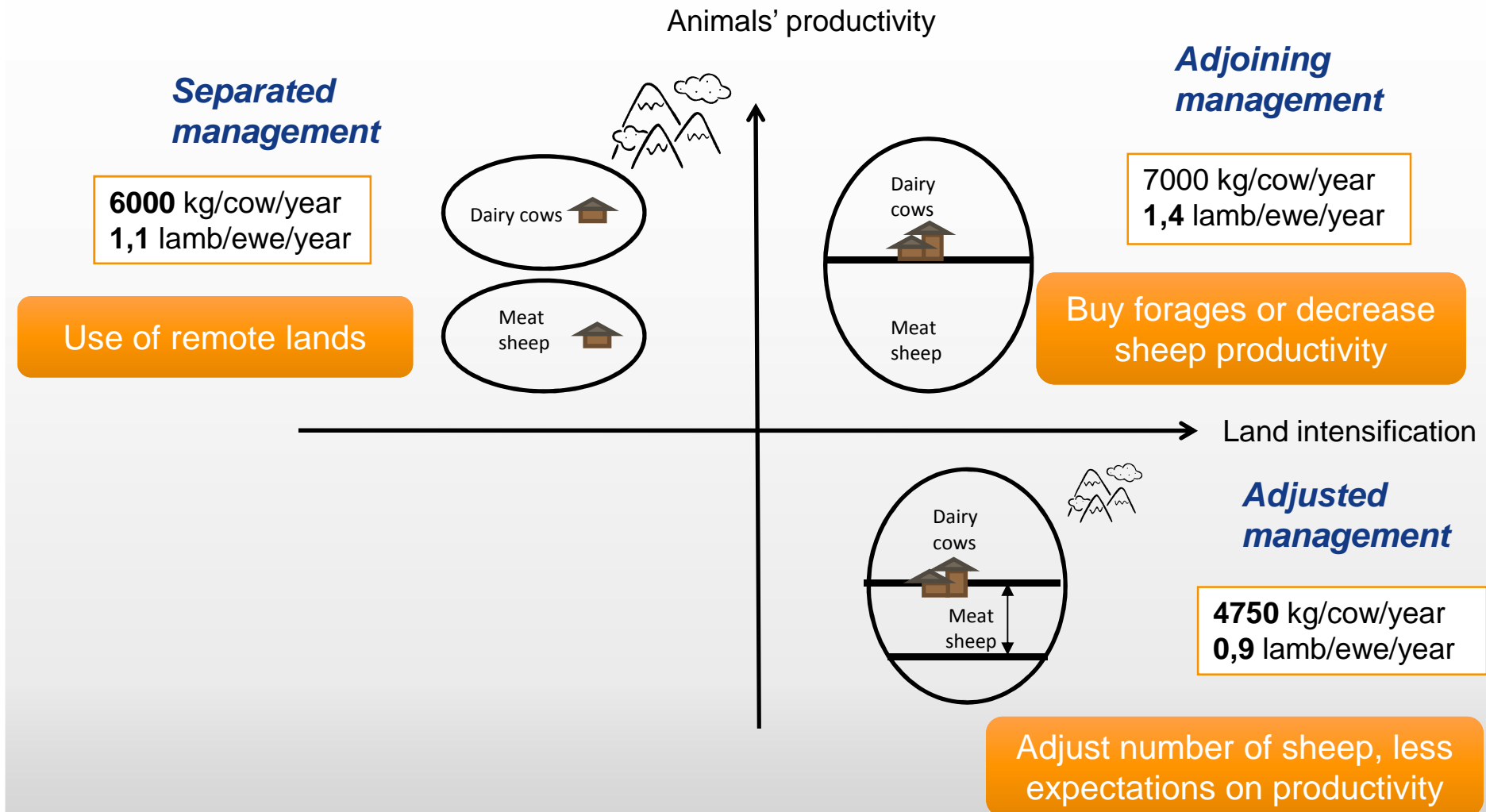
Species diversity (Cournut et al. 2014)



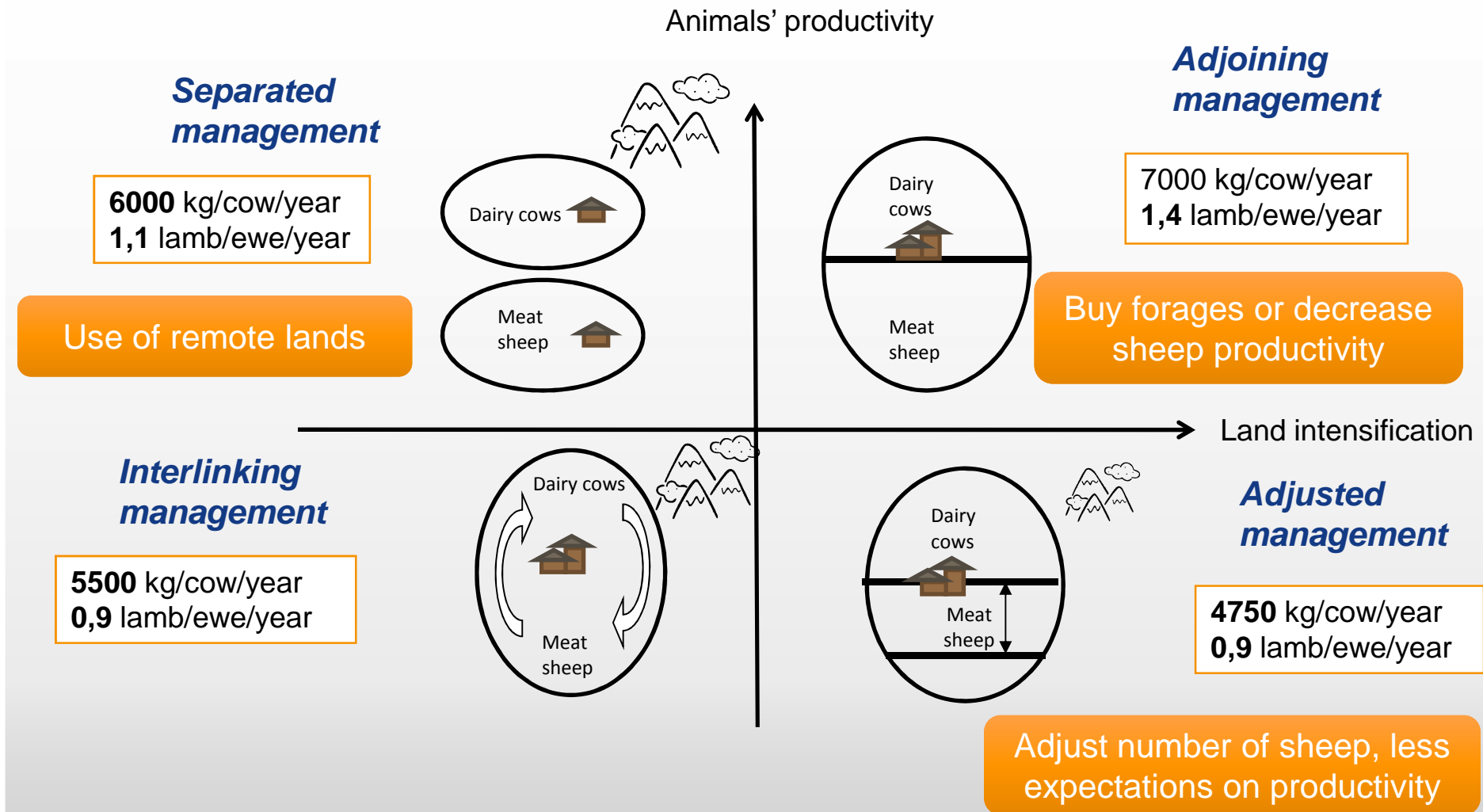
Species diversity (Cournut et al. 2014)



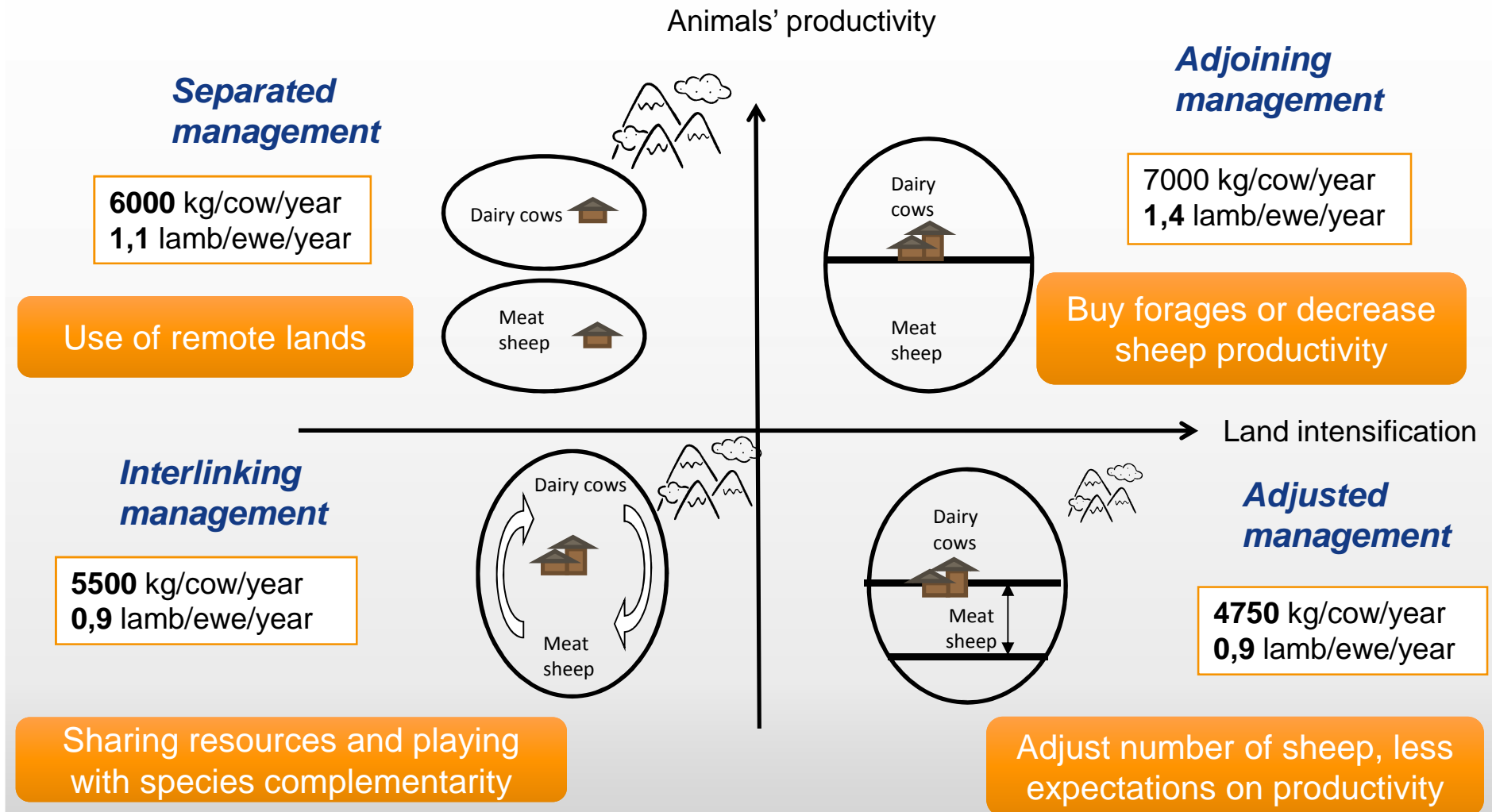
Species diversity (Cournut et al. 2014)



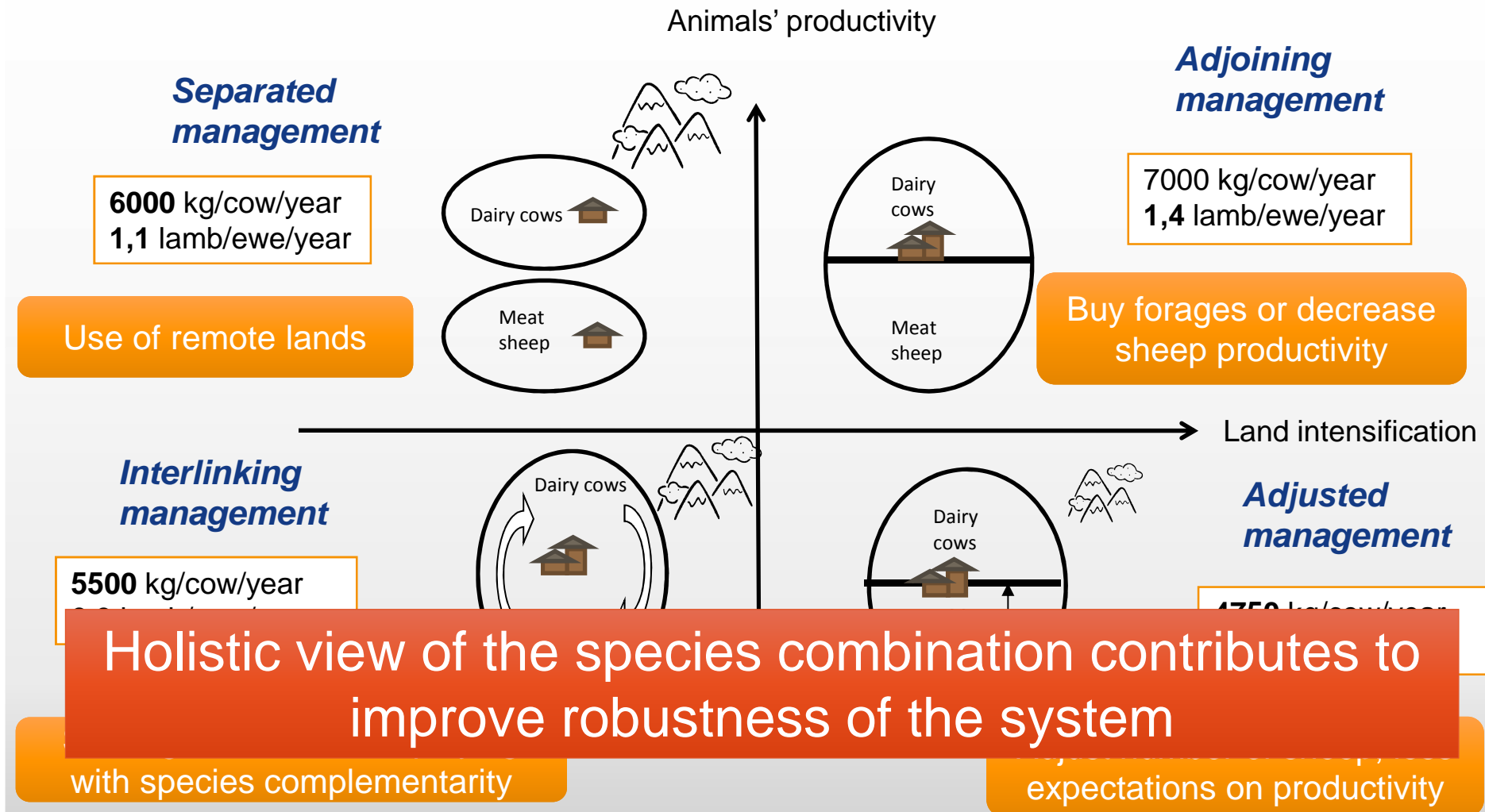
Species diversity (Cournut et al. 2014)



Species diversity (Cournut et al. 2014)



Species diversity (Cournut et al. 2014)



Within-herd diversity

-

-

-



Within-herd diversity

⇒ Physiologic status

-

-

Within-herd diversity

⇒ Physiologic status

⇒ Diversity of individual capacities to face disturbances → robustness

▪

Within-herd diversity

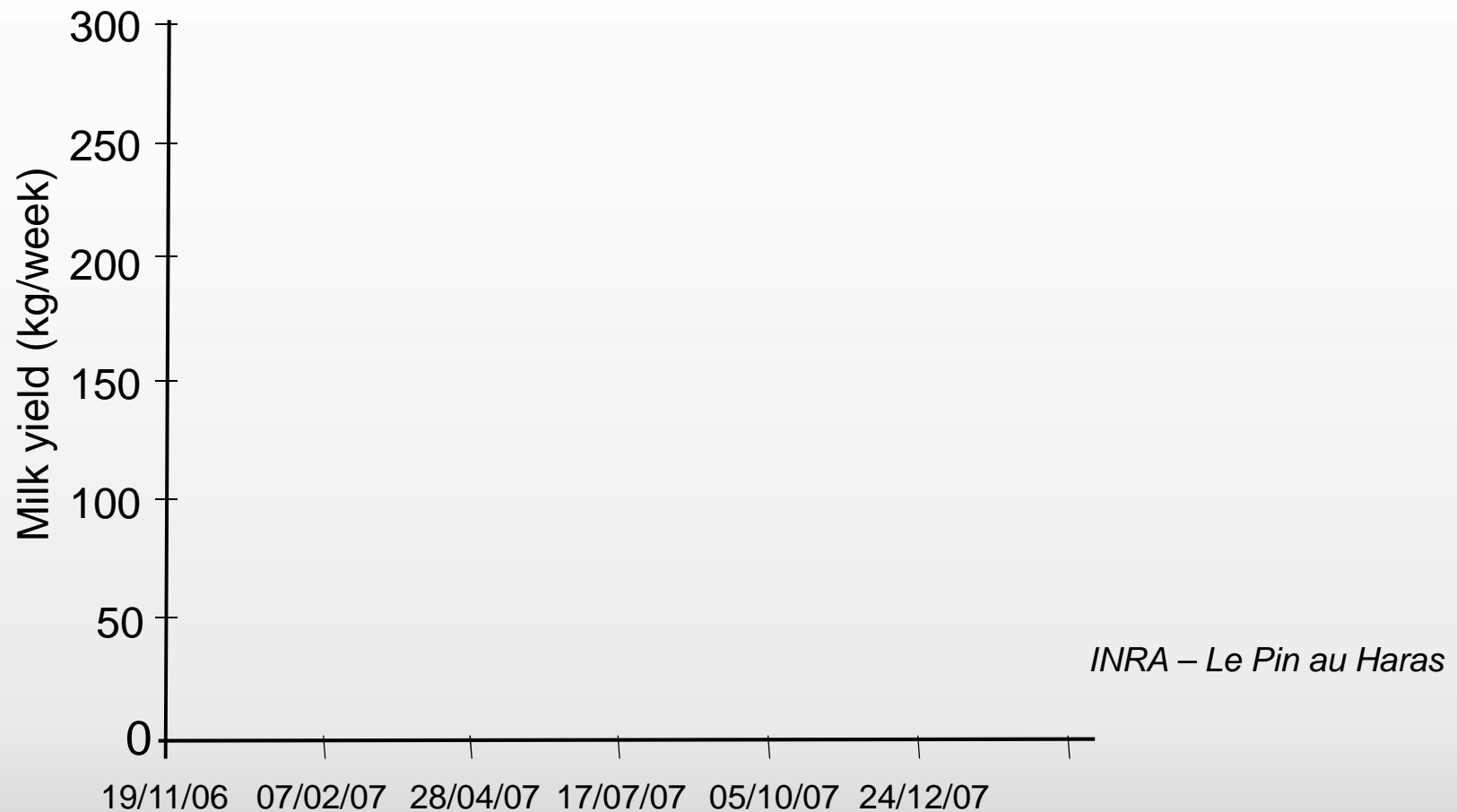
- ⇒ Physiologic status
- ⇒ Diversity of individual capacities to face disturbances → robustness
- ⇒ Case study: dairy cows



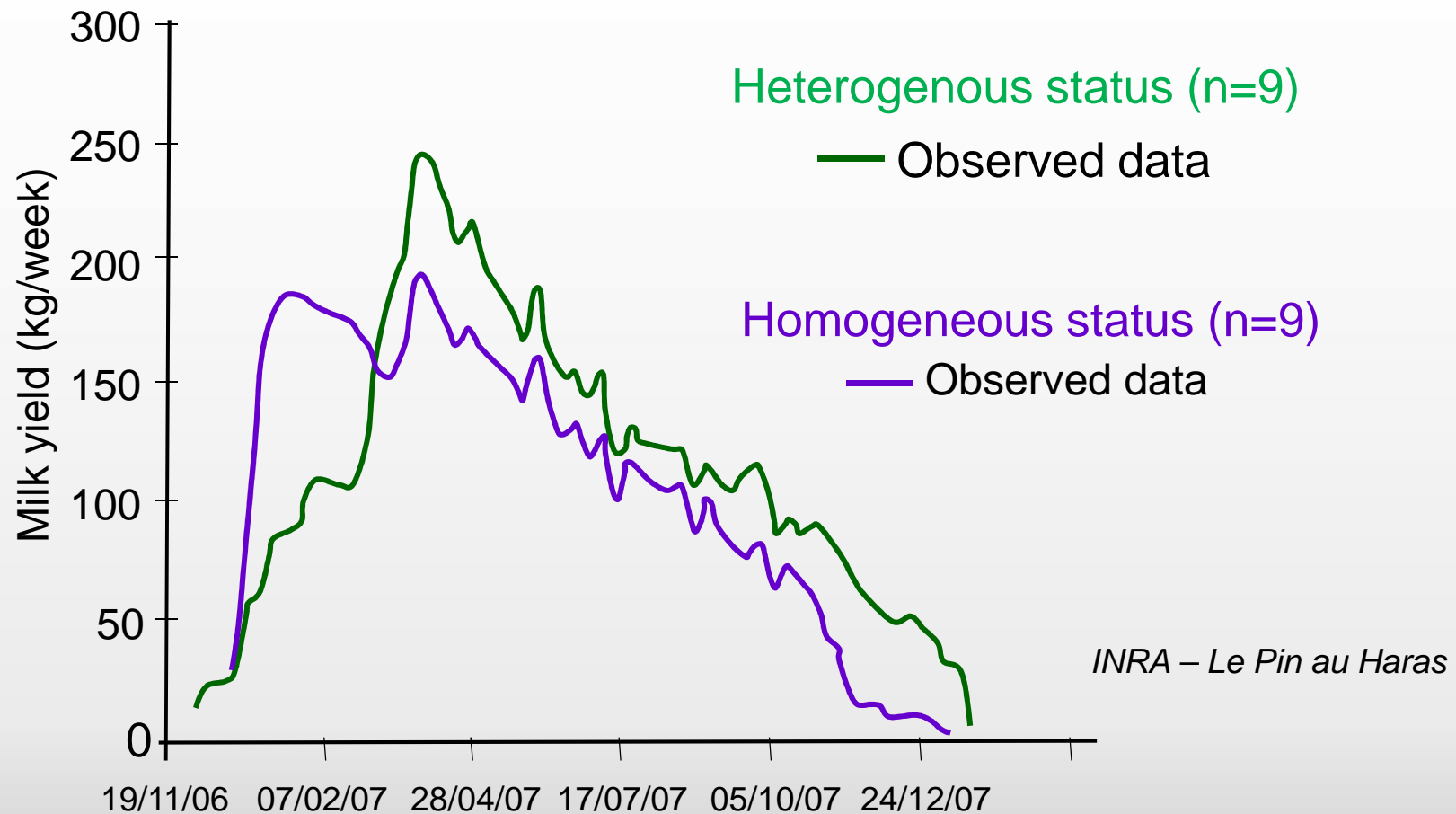
Diversity of physiological status



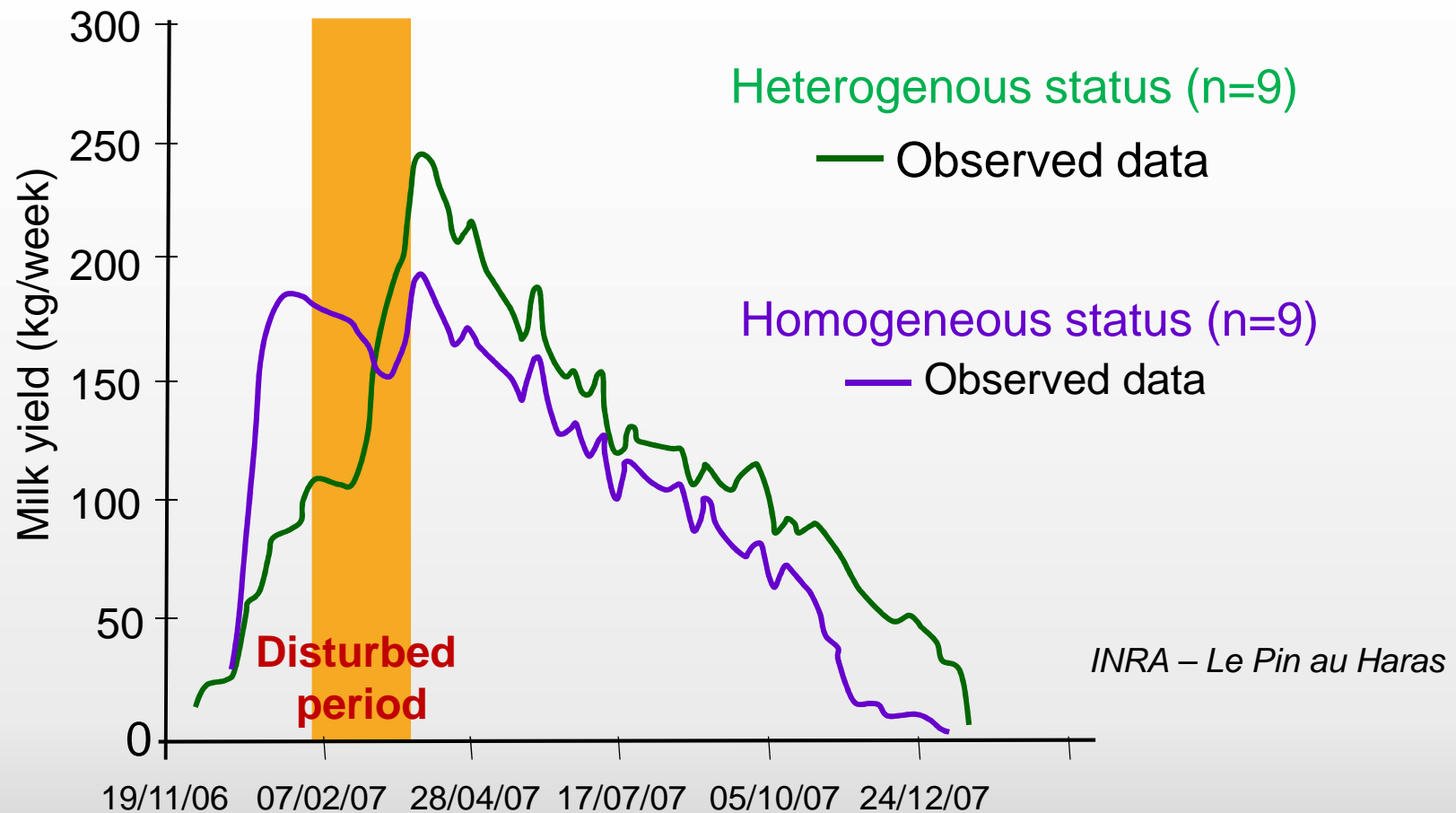
Diversity of physiological status



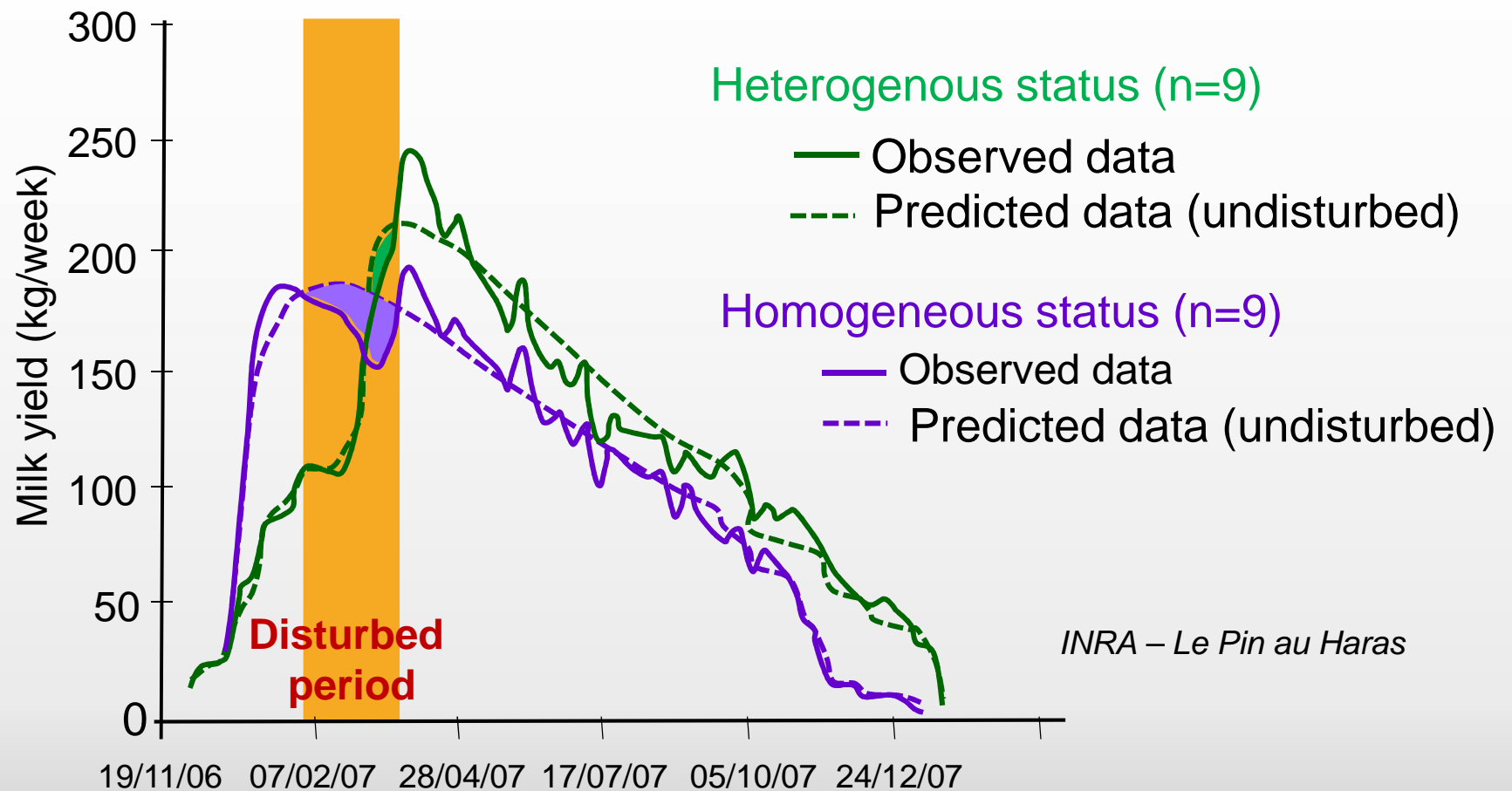
Diversity of physiological status



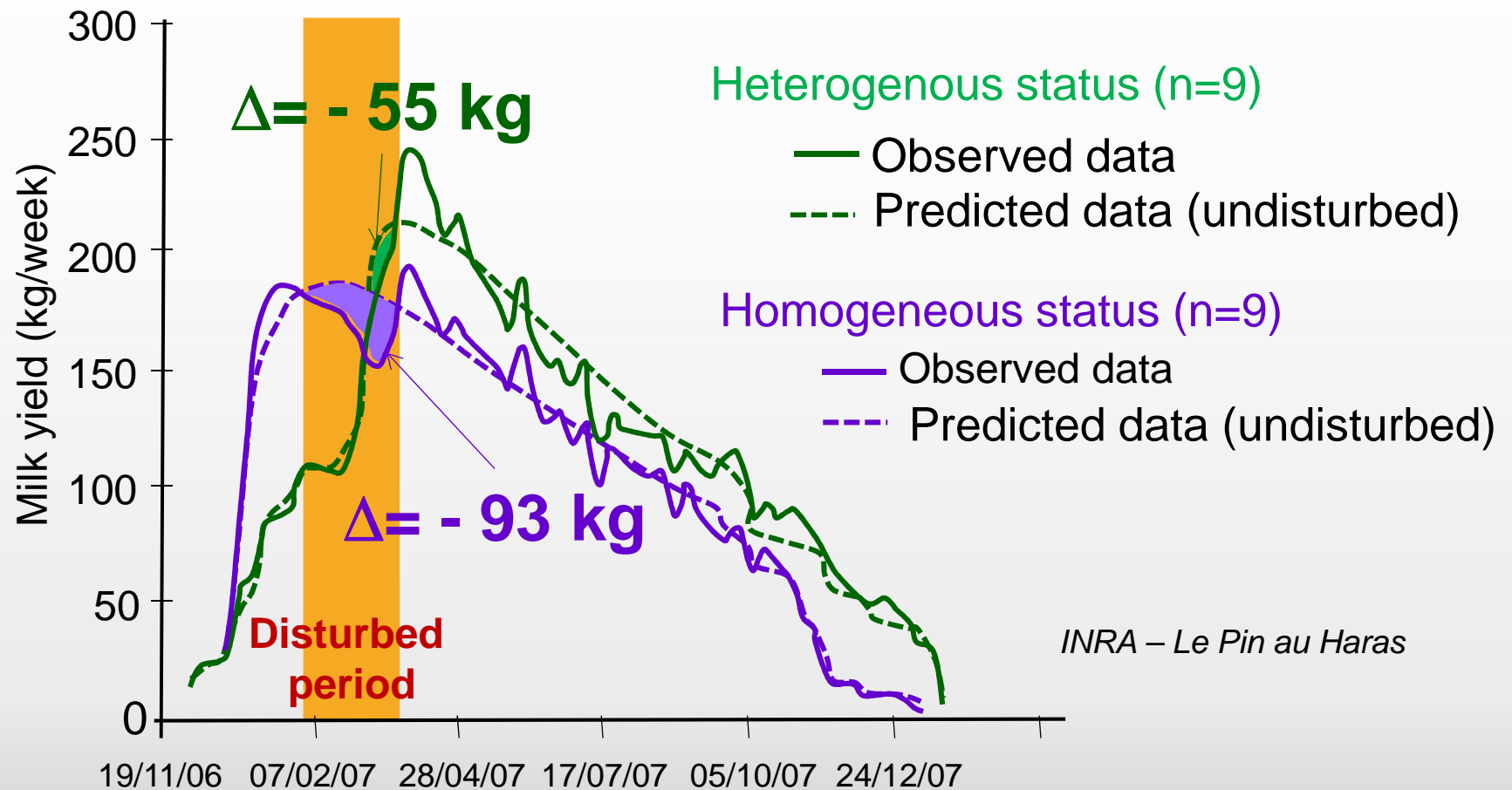
Diversity of physiological status



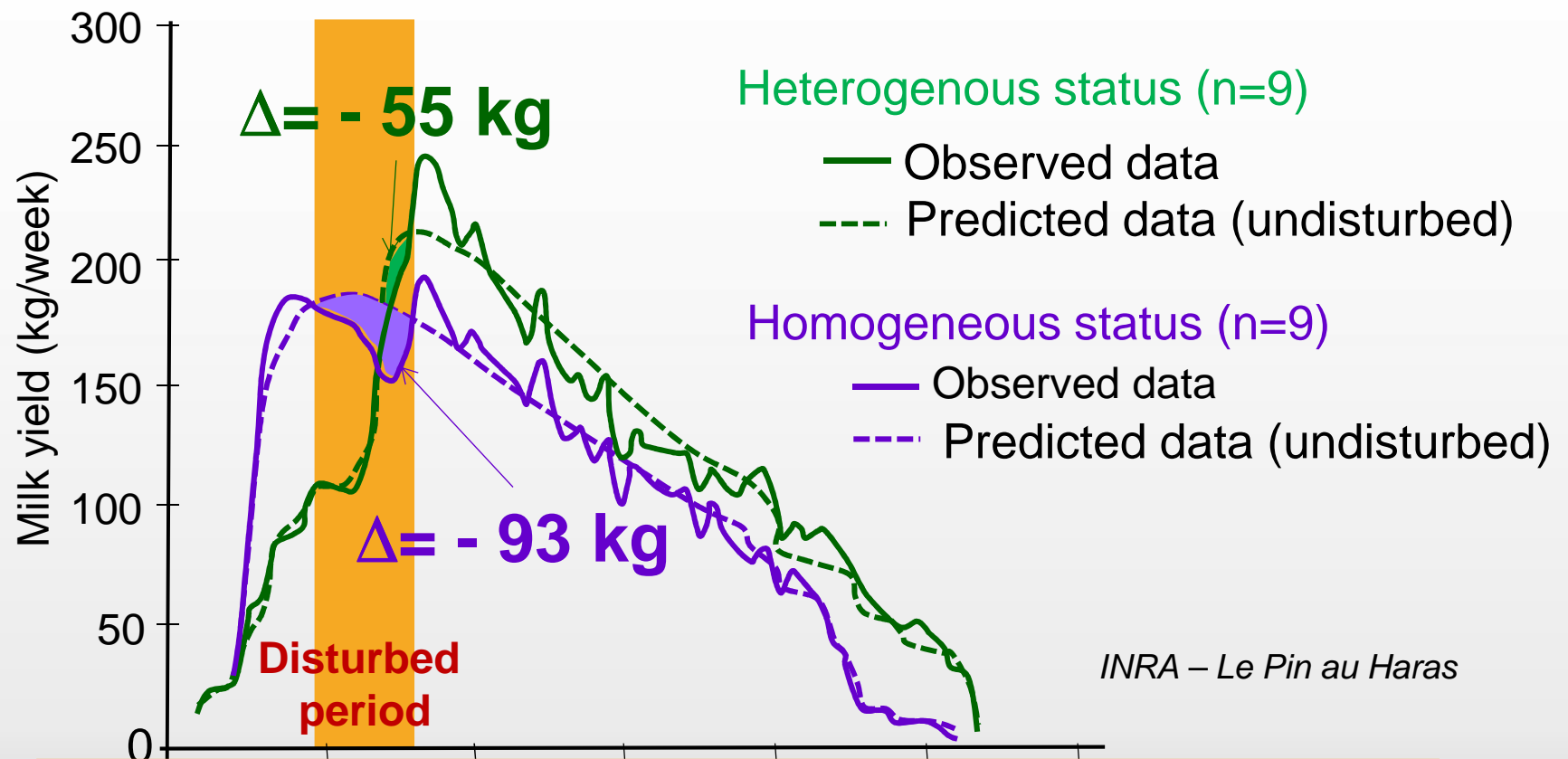
Diversity of physiological status



Diversity of physiological status



Diversity of physiological status



Diversity of physiological status can buffer the effect of disturbances at the herd level

Diversity of individual robustness

■

Diversity of individual robustness

⇒ Robust cows:

- Able to produce and reproduce in a wide range of environments (Knap, 2005)

Diversity of individual robustness

⇒ Robust cows:

- Able to produce and reproduce in a wide range of environments (Knap, 2005)
- “A cow that you do not hear in the herd, a cow lasting in the herd” (Ollion et al. unpublished)

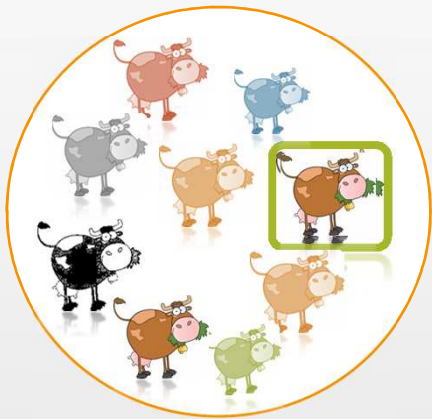
Diversity of individual robustness

⇒ Robust cows:

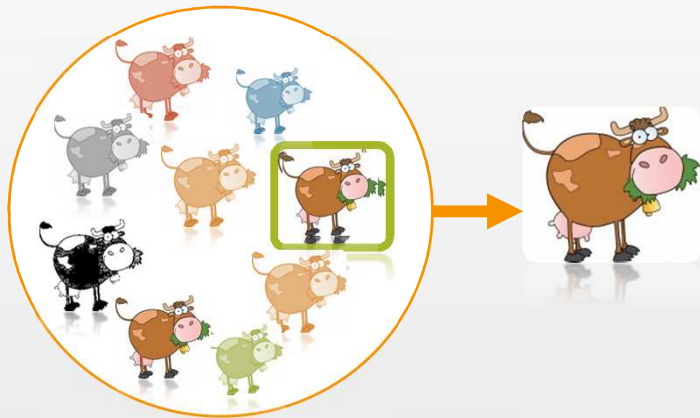
- Able to produce and reproduce in a wide range of environments (Knap, 2005)
- “A cow that you do not hear in the herd, a cow lasting in the herd” (Ollion et al. unpublished)

A robust cow gives **adaptive answers** to disturbances maintaining her in the range of farmer's expectations and so contributing to her longevity

Diversity of individual robustness

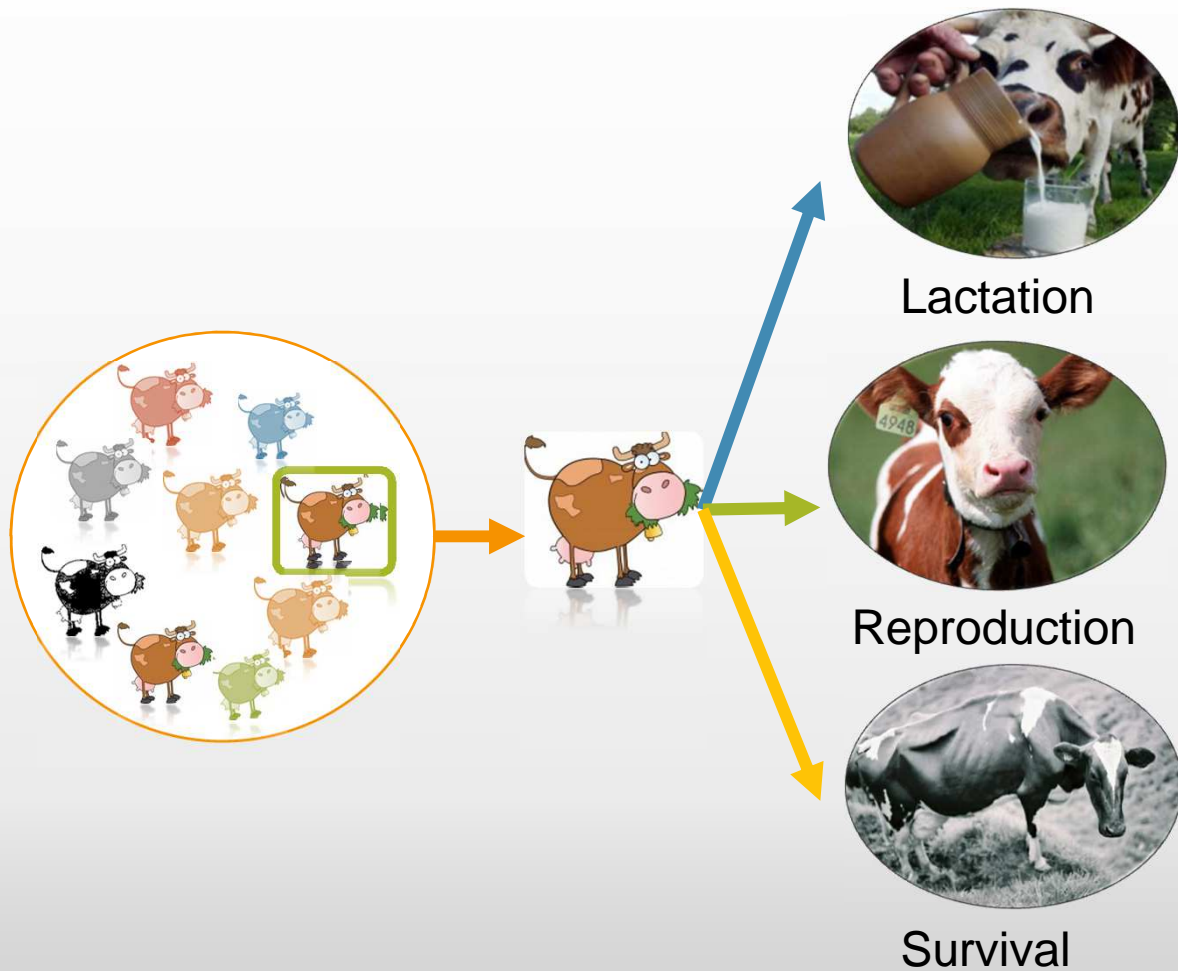


Diversity of individual robustness



Diversity of individual robustness

Essential functions



Diversity of individual robustness

Limited resources
Low energy



Essential functions



Lactation

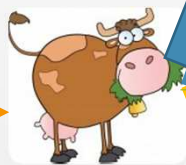
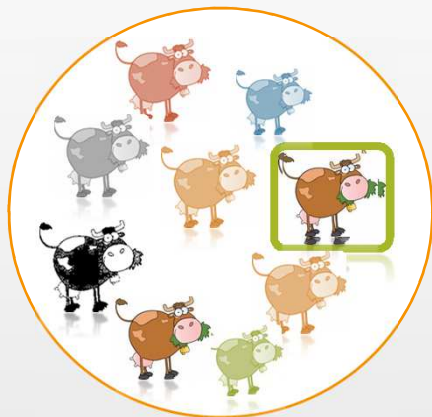


Reproduction



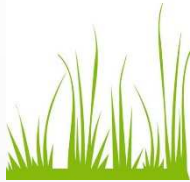
Survival

Selection

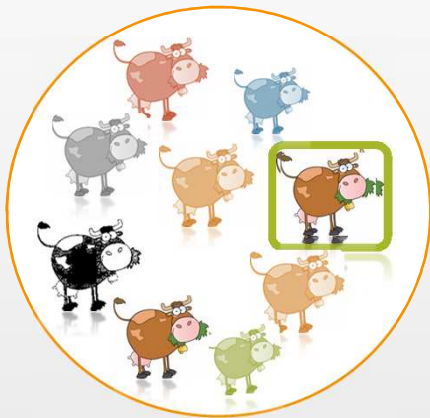


Diversity of individual robustness

Limited resources
Low energy



Selection



Essential functions



Lactation



Reproduction



Survival

Trade-off profiles

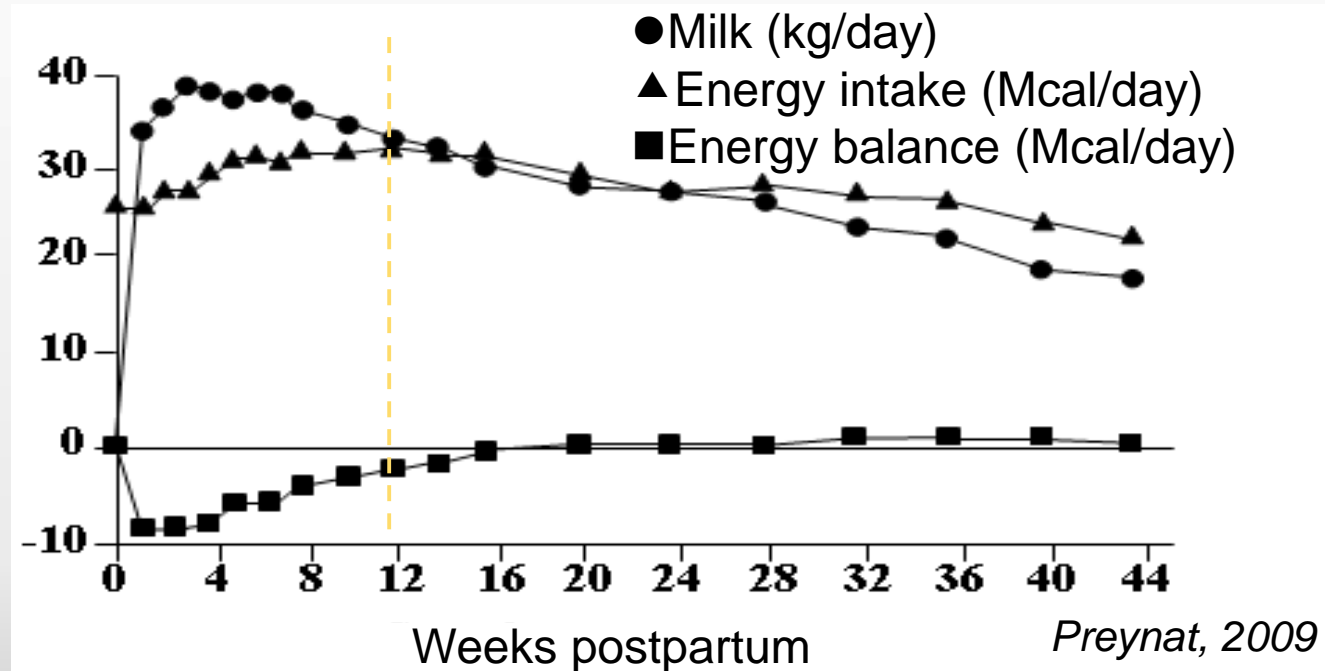


Diversity of individual robustness

- Used the period 0-90d postpartum: suboptimal nutritional period (negative energy balance)

Diversity of individual robustness

- Used the period 0-90d postpartum: suboptimal nutritional period (negative energy balance)



Diversity of individual robustness

- Used the period 0-90d postpartum: suboptimal nutritional period (negative energy balance)

Diversity of individual robustness

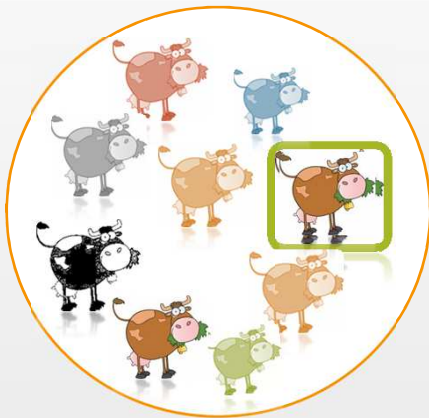
- Used the period 0-90d postpartum: suboptimal nutritional period (negative energy balance)
- Data from Inra experimental units of Mirecourt (2002-2012) et du Pin-au-Haras (2006-2011)
 - Data on milk yield, BCS, reproduction, individual characteristics (number lactation, âge at 1st calving...)
 - ➔ 334 validated lactations

Diversity of individual robustness

Limited resources



Essential functions



Lactation



Reproduction

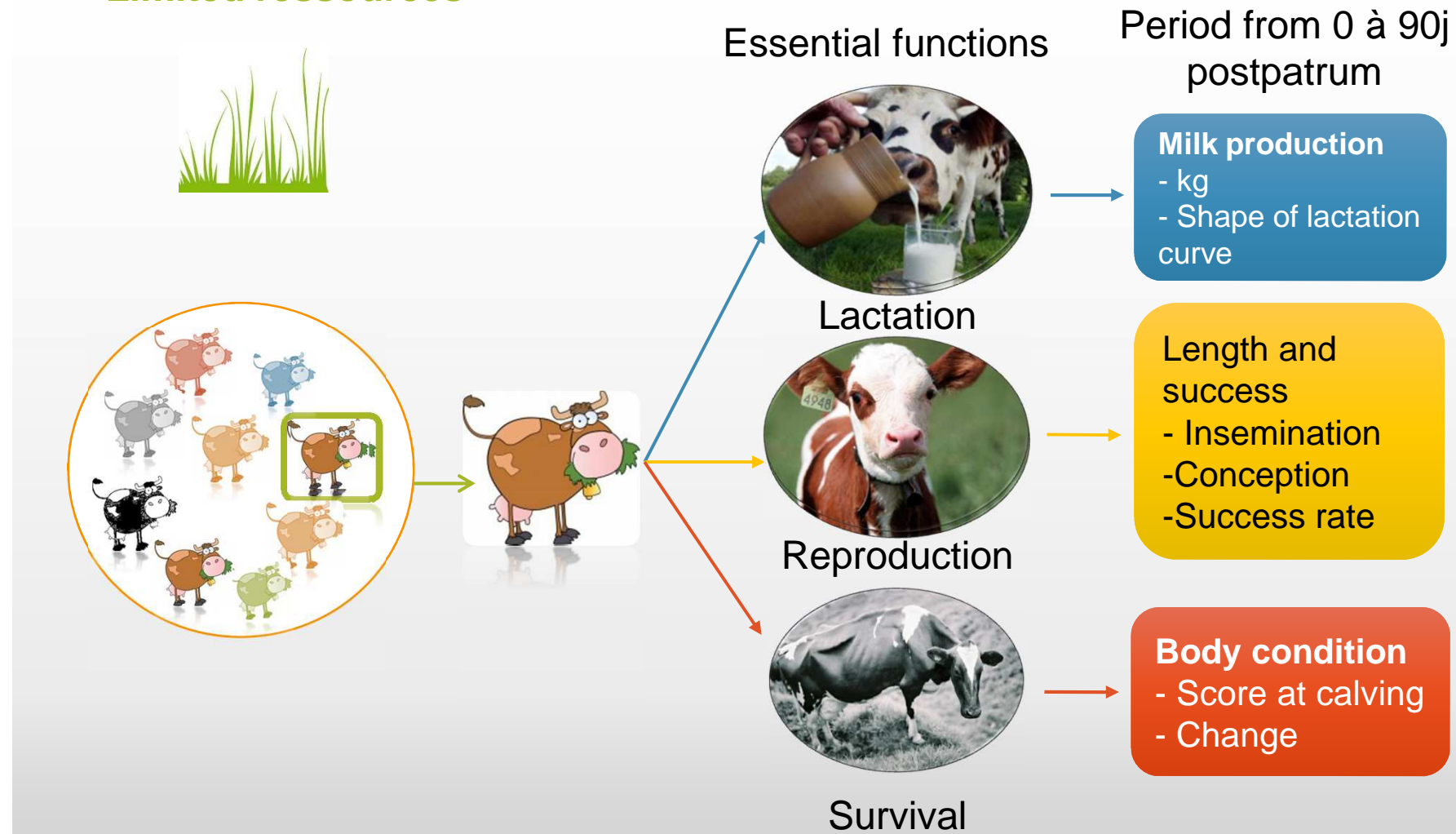


Survival



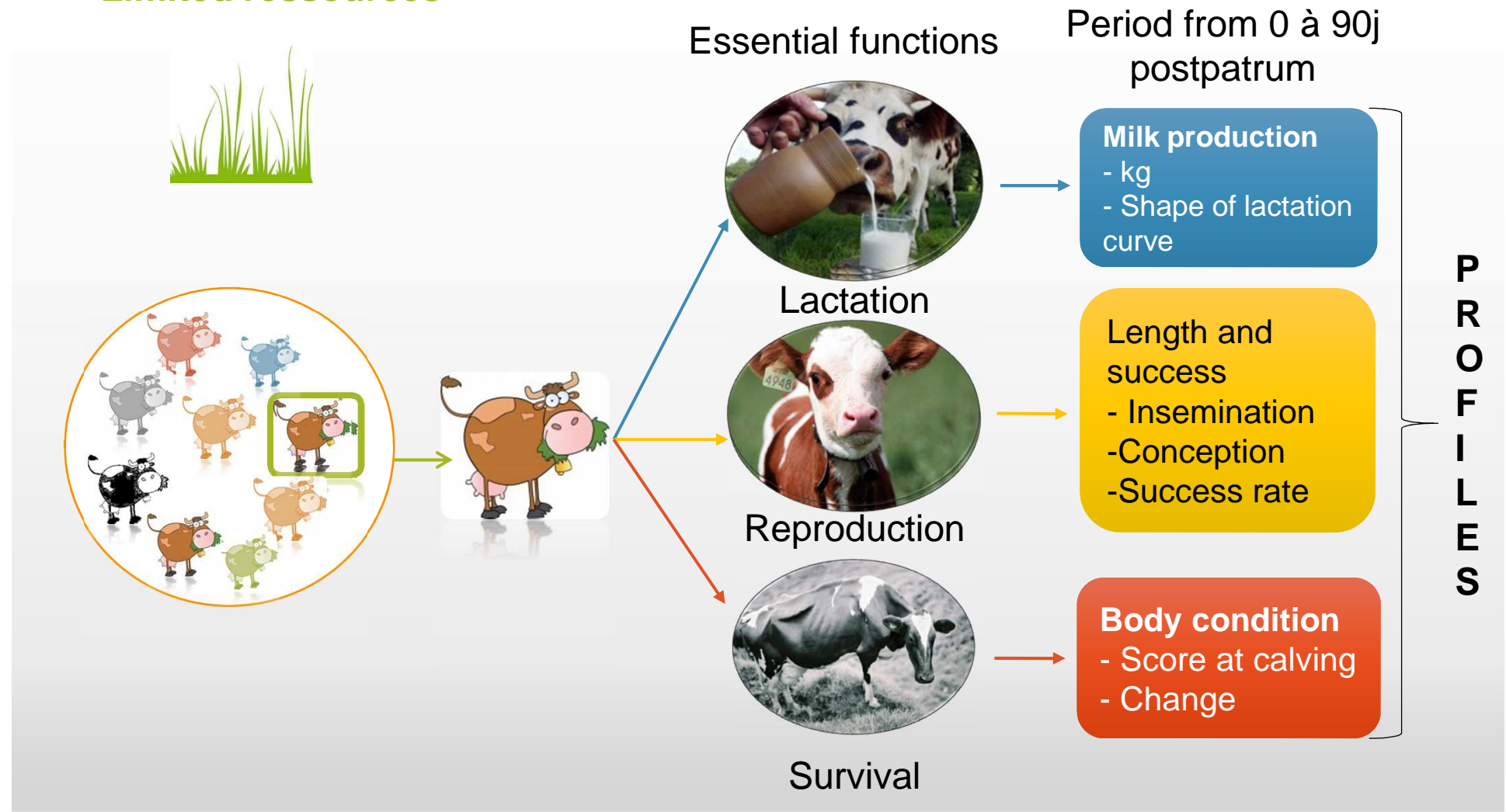
Diversity of individual robustness

Limited resources



Diversity of individual robustness

Limited resources

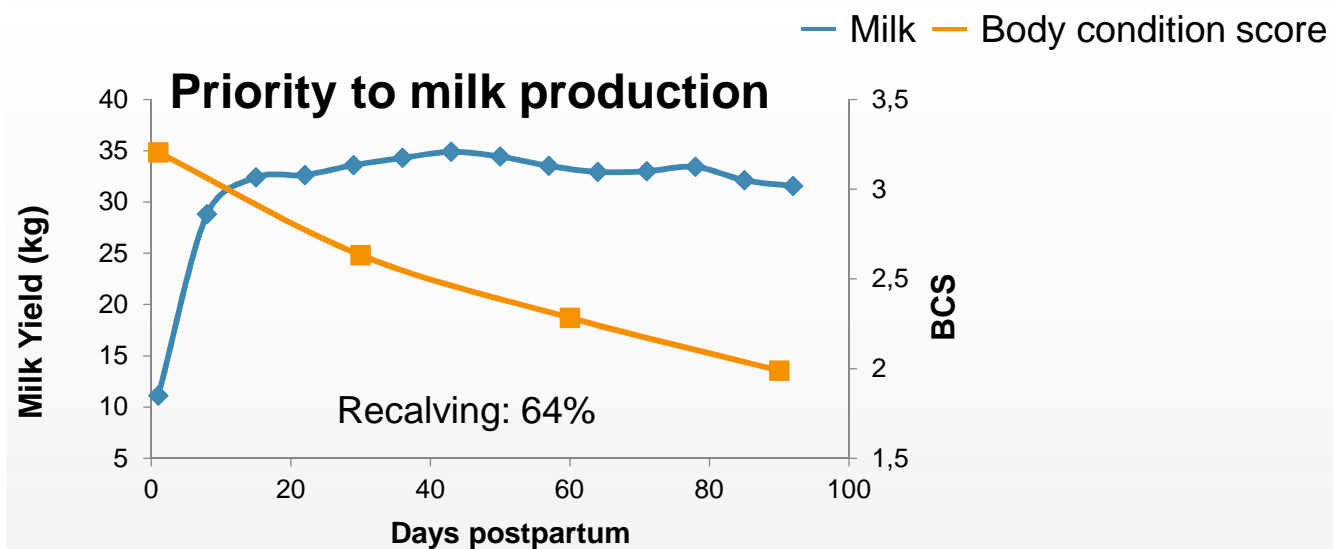


Diversity of individual robustness

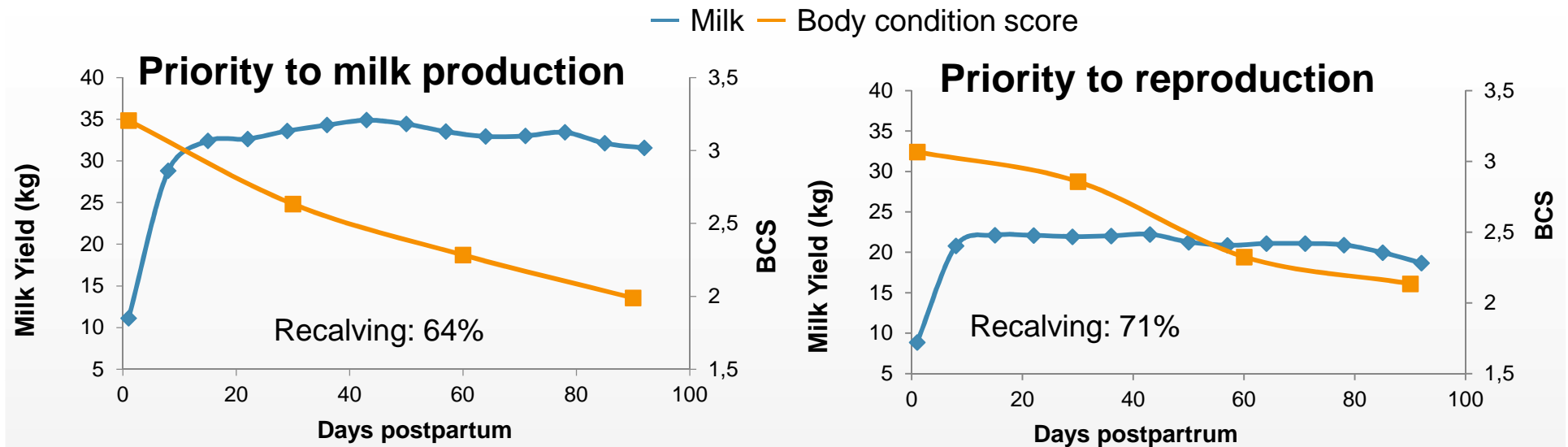
— Milk — Body condition score



Diversity of individual robustness

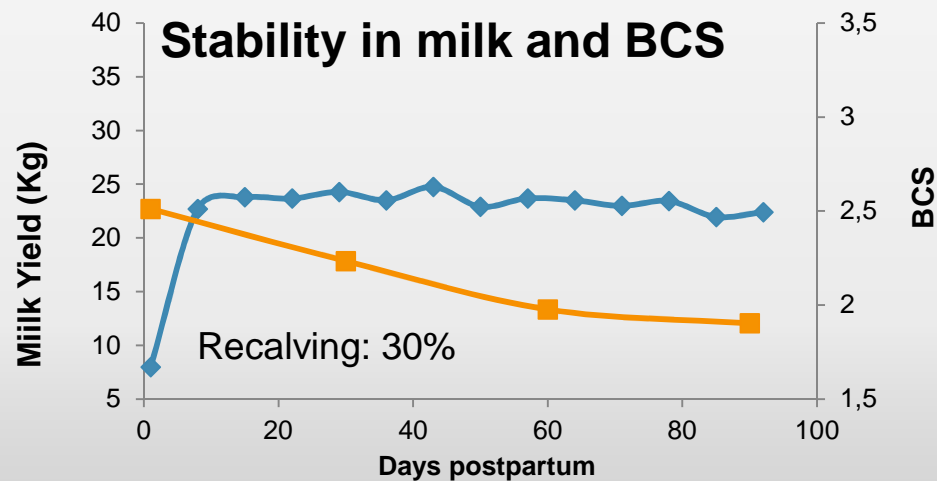
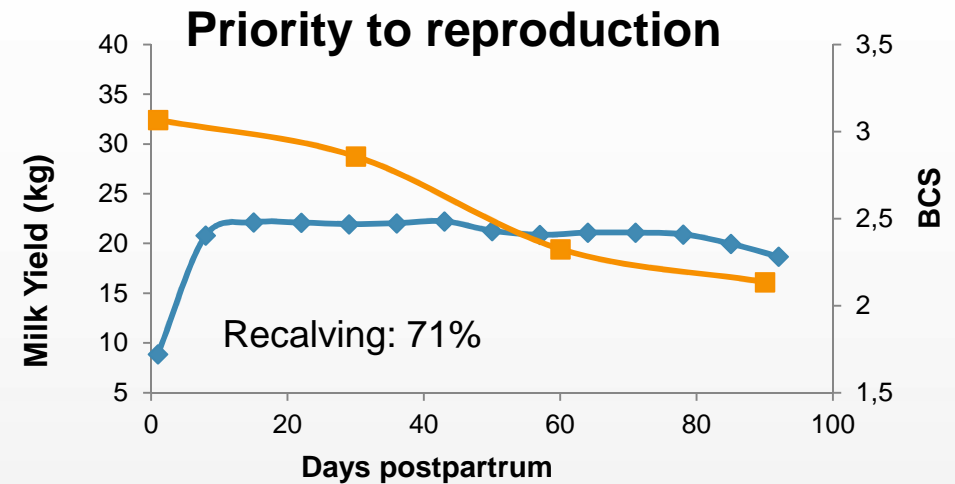
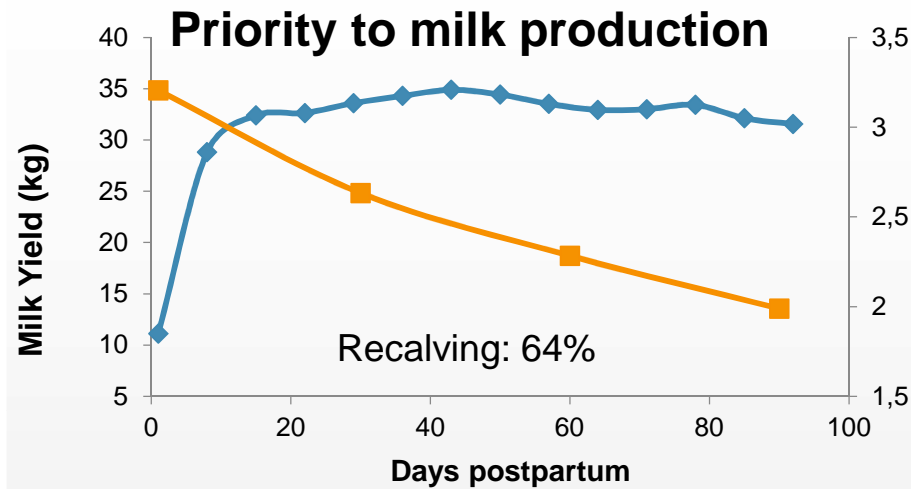


Diversity of individual robustness



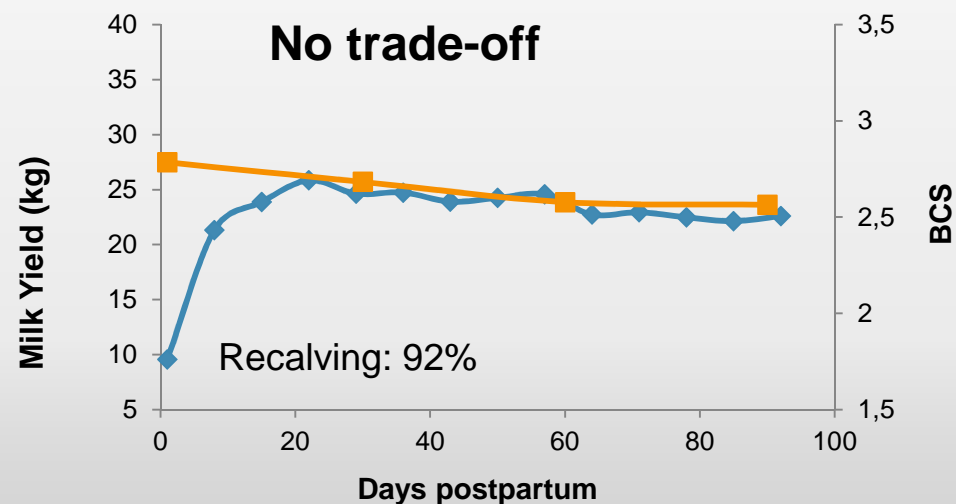
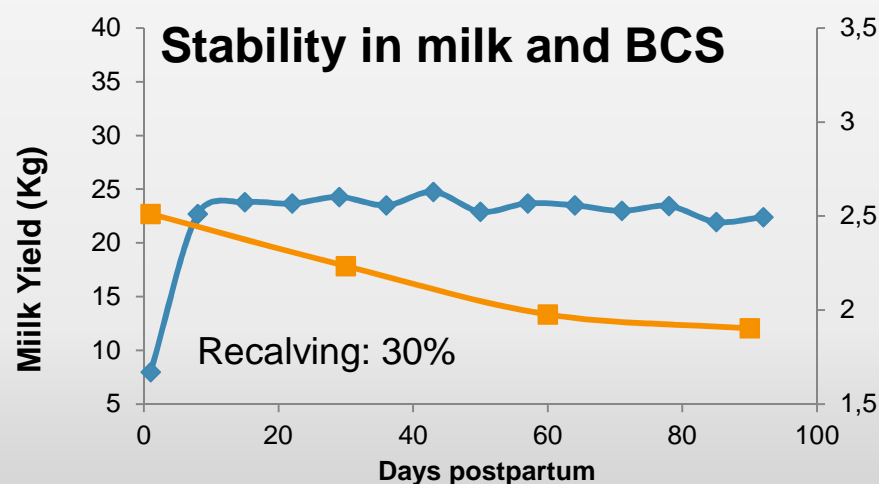
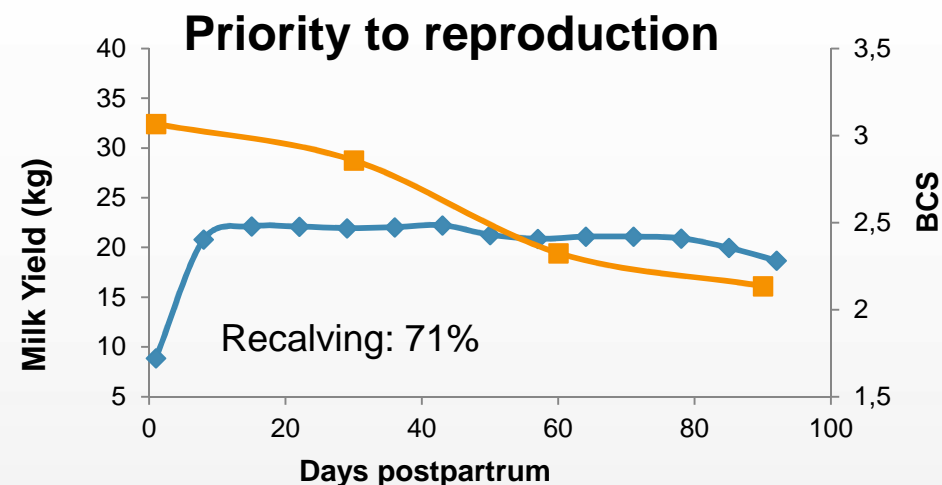
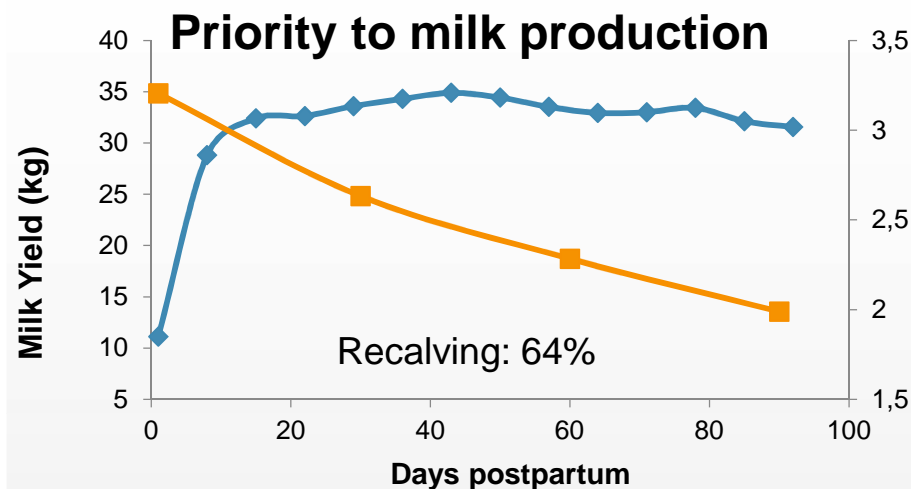
Diversity of individual robustness

— Milk — Body condition score



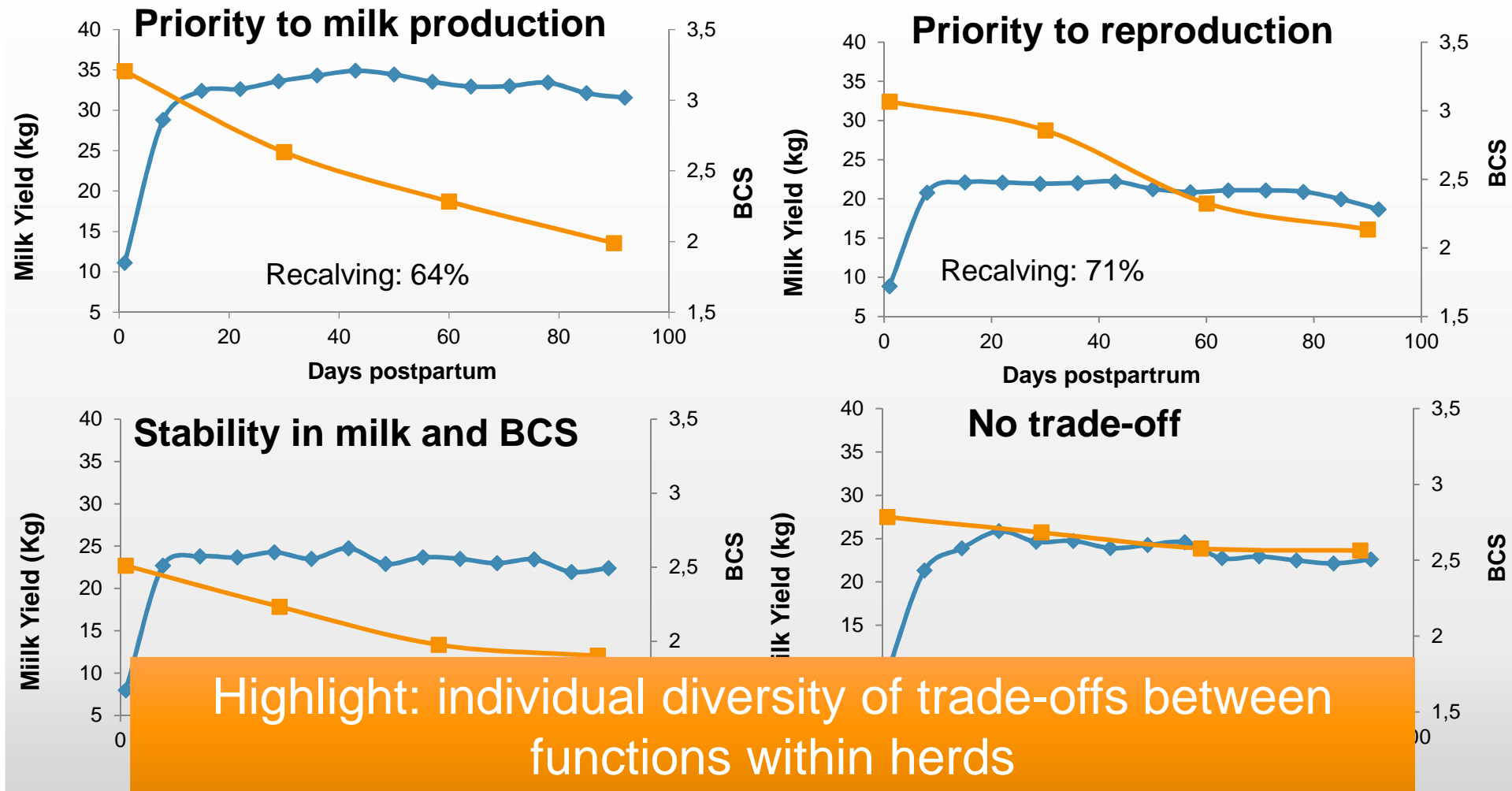
Diversity of individual robustness

— Milk — Body condition score



Diversity of individual robustness

— Milk — Body condition score



Diversity of individual robustness



Profile 1



Profile 2



Profile 3

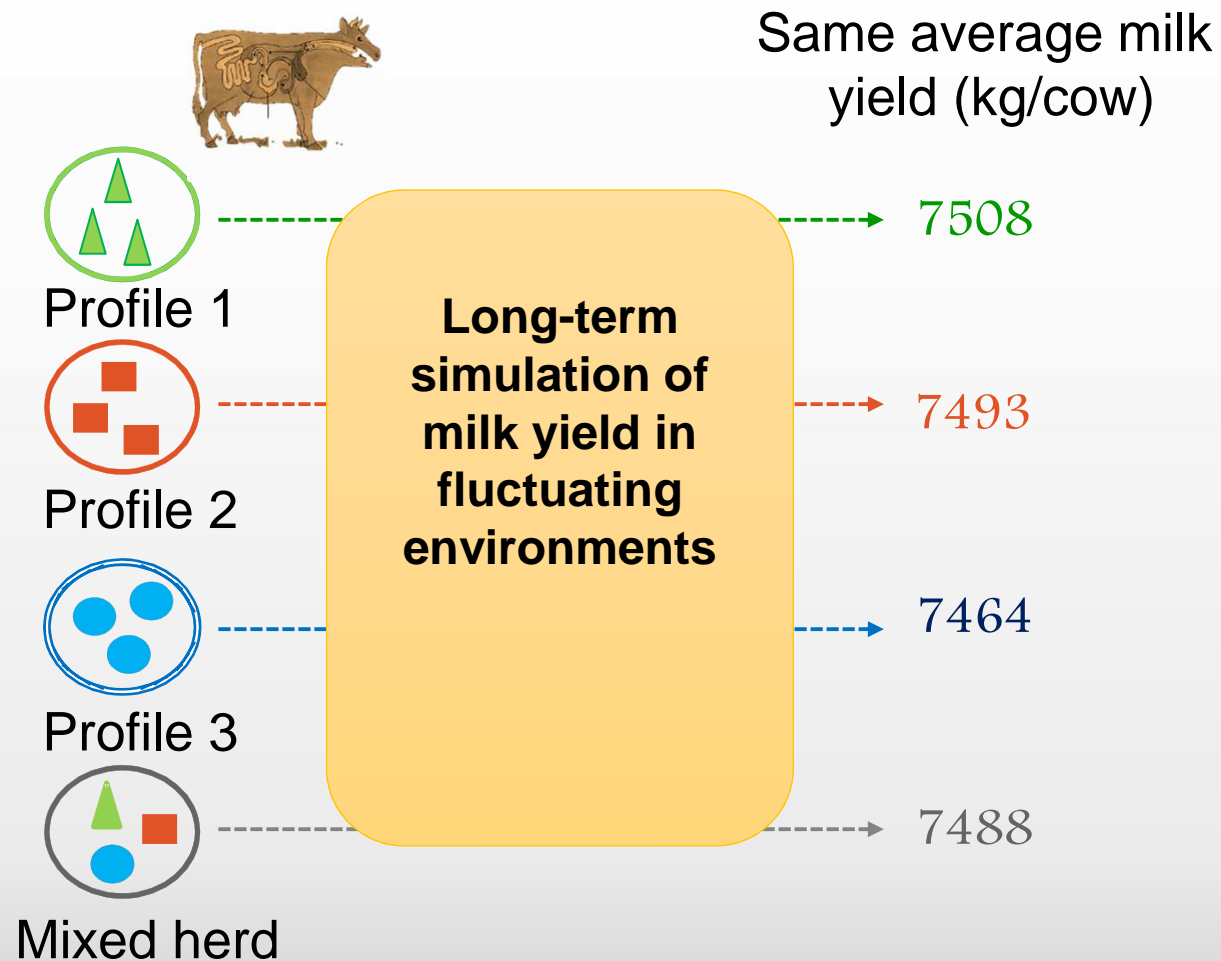


Mixed herd

**Long-term
simulation of
milk yield in
fluctuating
environments**

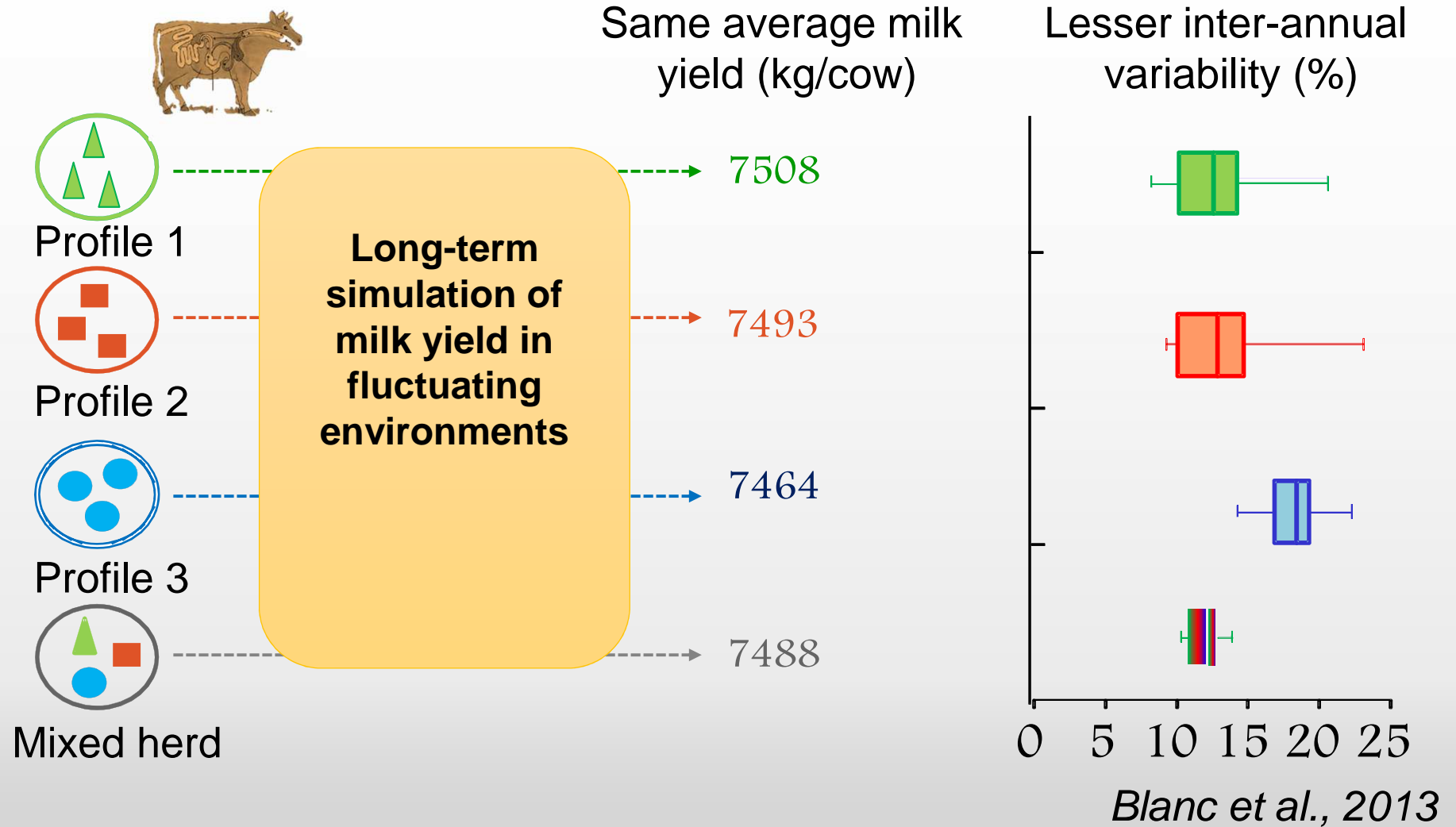
Blanc et al., 2013

Diversity of individual robustness

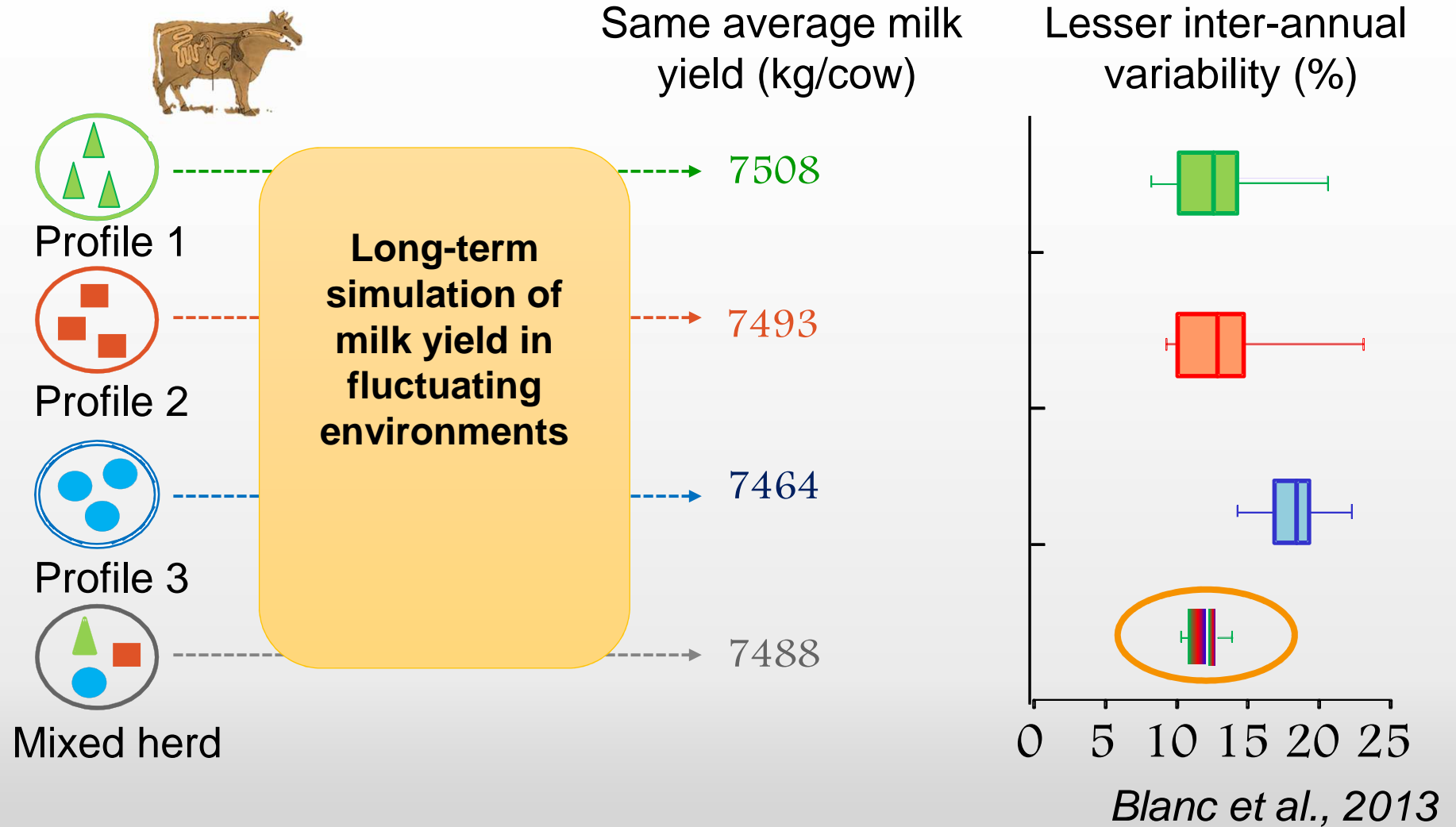


Blanc et al., 2013

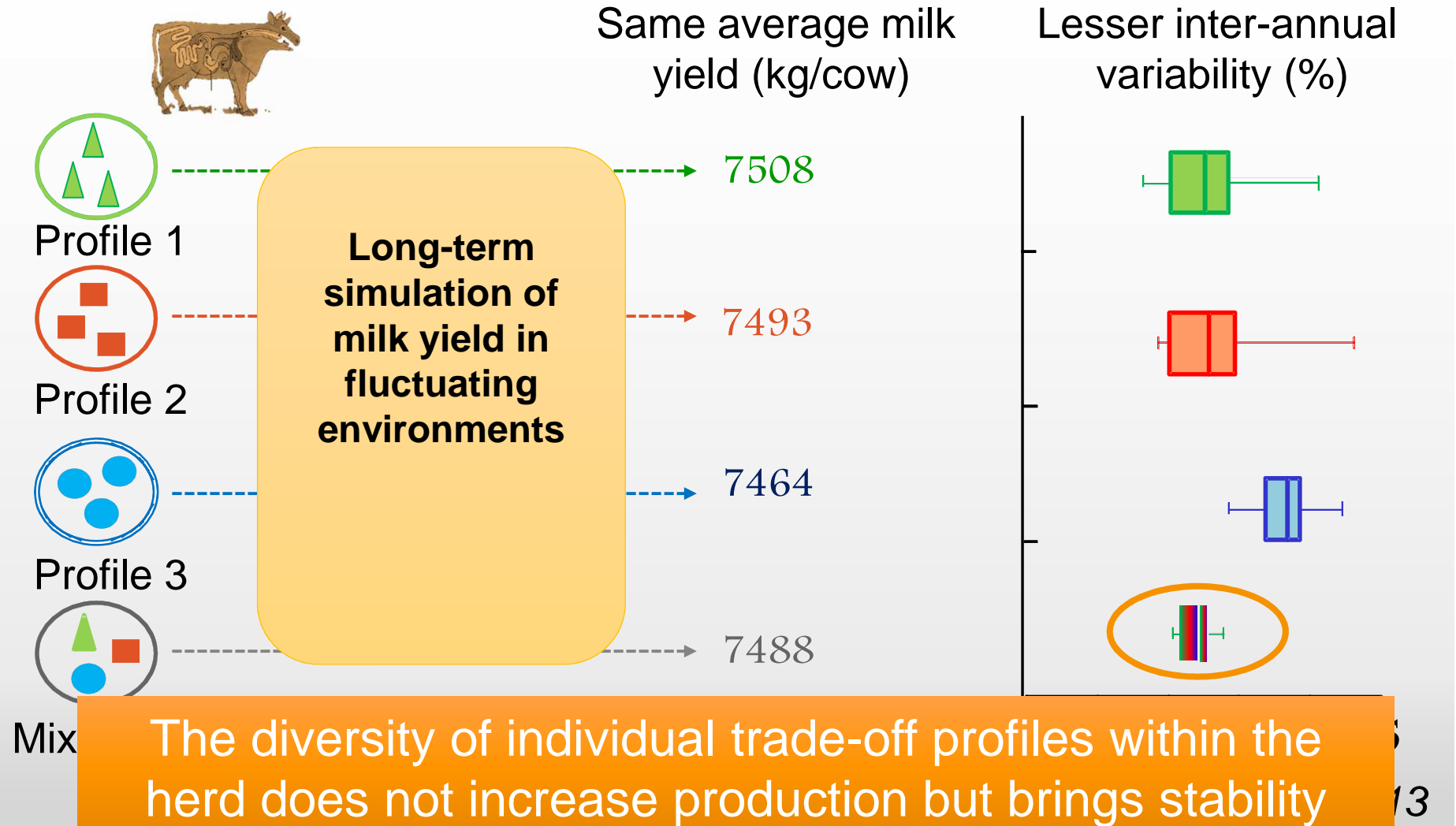
Diversity of individual robustness



Diversity of individual robustness



Diversity of individual robustness



And on the field?

-

-

-

-

-

-



And on the field?

L'homogénéité du troupeau chez les ruminants

our vérifier que son lot (gestation, mise bas...). Le nécessaire que le troupeau soit

“Herd homogeneity is an essential step to optimize animal feeding”

La Maison des Paysans vous propose de former. L'objectif est de redécouvrir la physiologie de la digestion des ruminants et la méthylation de l'Obsalim[®]. La présentation de quelques situations permet à l'éleveur de changer ses animaux et de s'interroger sur l'effet alimentaire. Les prochaines formations Ont le 13 janvier dans le secteur de Giat et le secteur de Thiers. **Plus d'infos : 04 73**

présentent des symptômes.
Il serait contreproductif
de se débarrasser des



And on the field?

-

-

-

-

-

-



And on the field?

➡ 39 surveyed dairy farms in three distinct dairy areas

▪

▪

▪

▪

▪



And on the field?

➔ 39 surveyed dairy farms in three distinct dairy areas



And on the field?

➔ 39 surveyed dairy farms in three distinct dairy areas

▪

▪

▪

▪

▪



And on the field?

➡ 39 surveyed dairy farms in three distinct dairy areas

➡ Already existing diversity:

- Herd size: from 25 to 200
- 72% one breed, 18% two breeds, 18% crossbred
- 26% in organic agriculture

▪

▪

▪

▪

And on the field?

⇒ 39 surveyed dairy farms in three distinct dairy areas

⇒ Already existing diversity:

- Herd size: from 25 to 200
- 72% one breed, 18% two breeds, 18% crossbred
- 26% in organic agriculture

⇒ 72% see diversity in their herd

▪

▪

▪

And on the field?

➡ 39 surveyed dairy farms in three distinct dairy areas

➡ Already existing diversity:

- Herd size: from 25 to 200
- 72% one breed, 18% two breeds, 18% crossbred
- 26% in organic agriculture

➡ 72% see diversity in their herd

➡ 44% see interest in diversity of physiological status

▪

▪

And on the field?

- 39 surveyed dairy farms in three distinct dairy areas
- Already existing diversity:
 - Herd size: from 25 to 200
 - 72% one breed, 18% two breeds, 18% crossbred
 - 26% in organic agriculture
- 72% see diversity in their herd
- 44% see interest in diversity of physiological status
- 51% see interest in individual diversity

▪

And on the field?

- 39 surveyed dairy farms in three distinct dairy areas
- Already existing diversity:
 - Herd size: from 25 to 200
 - 72% one breed, 18% two breeds, 18% crossbred
 - 26% in organic agriculture
- 72% see diversity in their herd
- 44% see interest in diversity of physiological status
- 51% see interest in individual diversity
- 13% see the link between diversity and robustness

And on the field?

⇒ 39 surveyed dairy farms in three distinct dairy areas

⇒ Already existing diversity:

- Herd size: from 25 to 200
- 72% one breed, 18% two breeds, 18% crossbred
- 26% in organic agriculture

⇒ 72% see diversity in their herd

⇒ 44% see interest in diversity of physiological status

⇒ 51% see interest in individual diversity

⇒ There is still a gap between farmers seeing diversity and farmers managing diversity

Take home messages

■

■

■

■



Take home messages

➔ Agroecology is a transition pathway to move toward more sustainable livestock systems

-

-

-

Take home messages

- ➔ Agroecology is a transition pathway to move toward more sustainable livestock systems
- ➔ Diversity is a resource contributing to systems capacities to face disturbances e.g. climate change

-

-

Take home messages

- ➔ Agroecology is a transition pathway to move toward more sustainable livestock systems
- ➔ Diversity is a resource contributing to systems capacities to face disturbances e.g. climate change
- ➔ A gradient of diversity can be found in livestock production systems: resources, species, physiological status, individual robustness

■

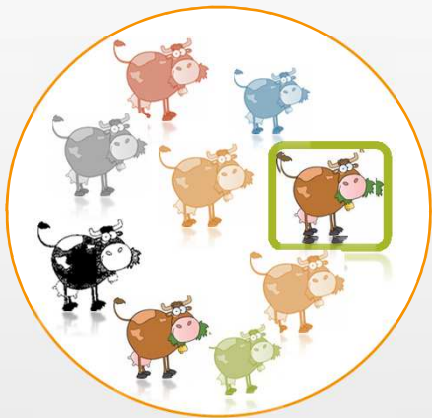
Take home messages

- ➡ Agroecology is a transition pathway to move toward more sustainable livestock systems
- ➡ Diversity is a resource contributing to systems capacities to face disturbances e.g. climate change
- ➡ A gradient of diversity can be found in livestock production systems: resources, species, physiological status, individual robustness
- ➡ These diversities are already experimented on the field. More knowledge is needed to give tools for farmers to manage diversity

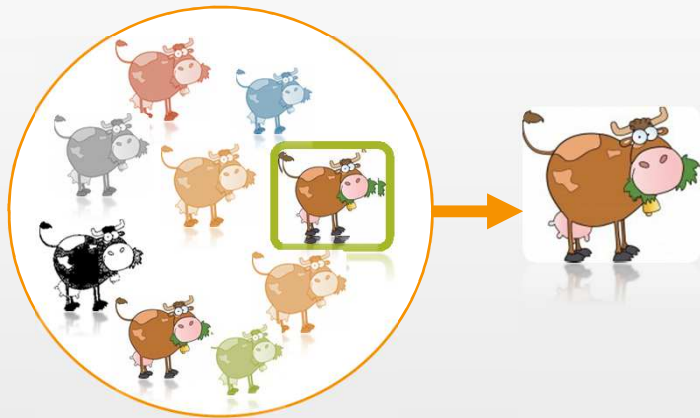
Thank you for your attention



Diversity of individual robustness

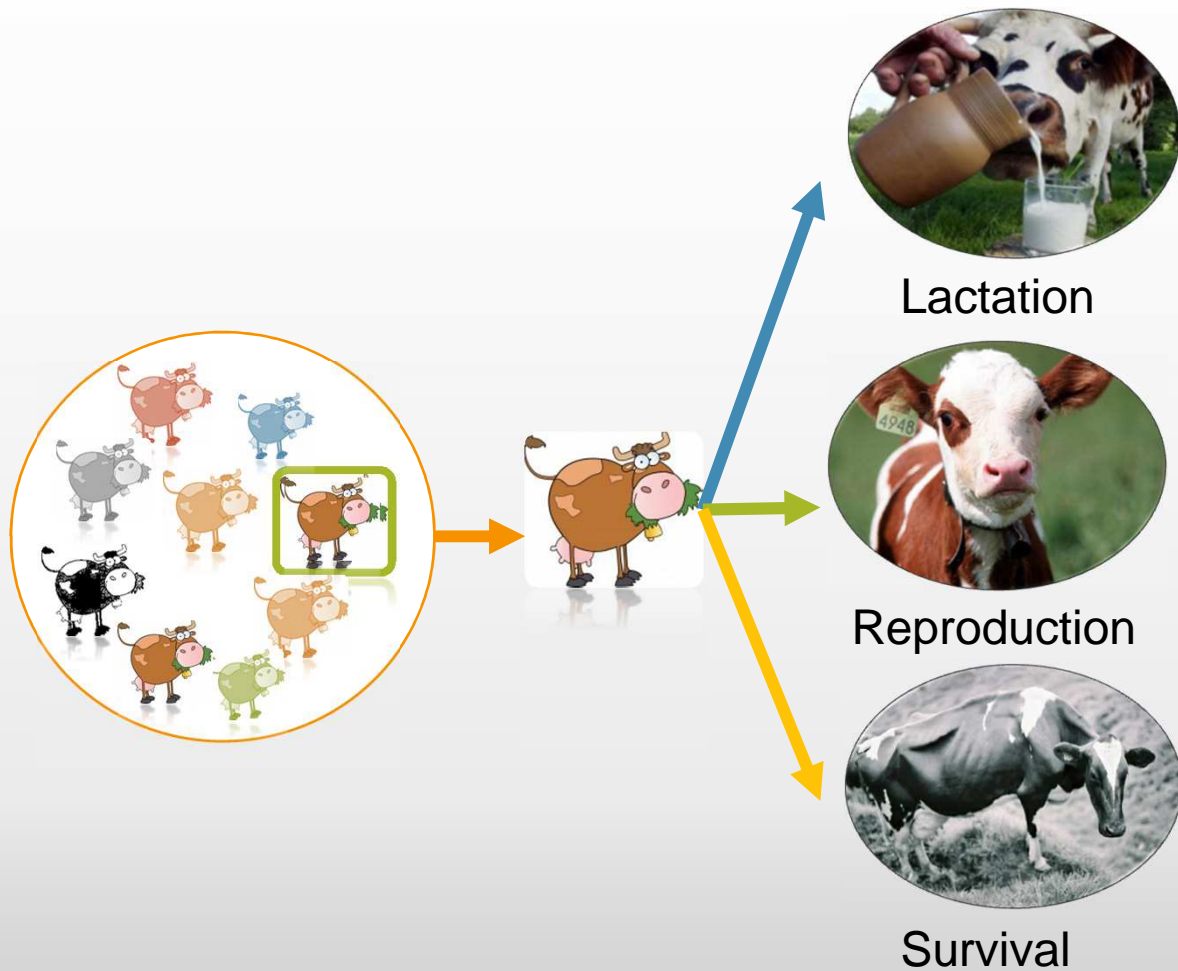


Diversity of individual robustness



Diversity of individual robustness

Essential functions



Diversity of individual robustness

Limited resources
Low energy



Essential functions



Lactation

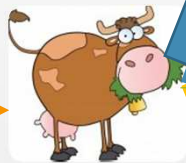
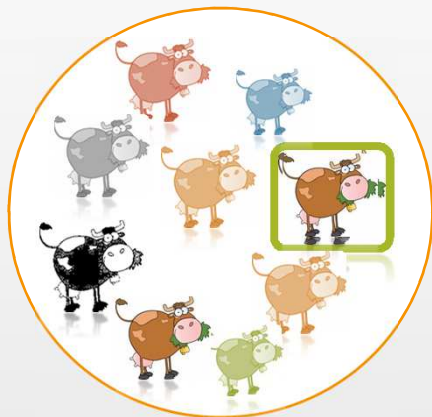


Reproduction



Survival

Selection

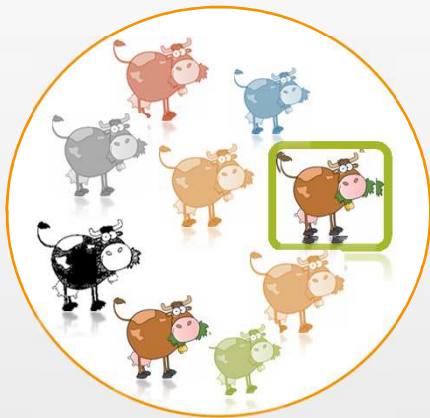


Diversity of individual robustness

Limited resources
Low energy



Selection



Essential functions



Lactation



Reproduction

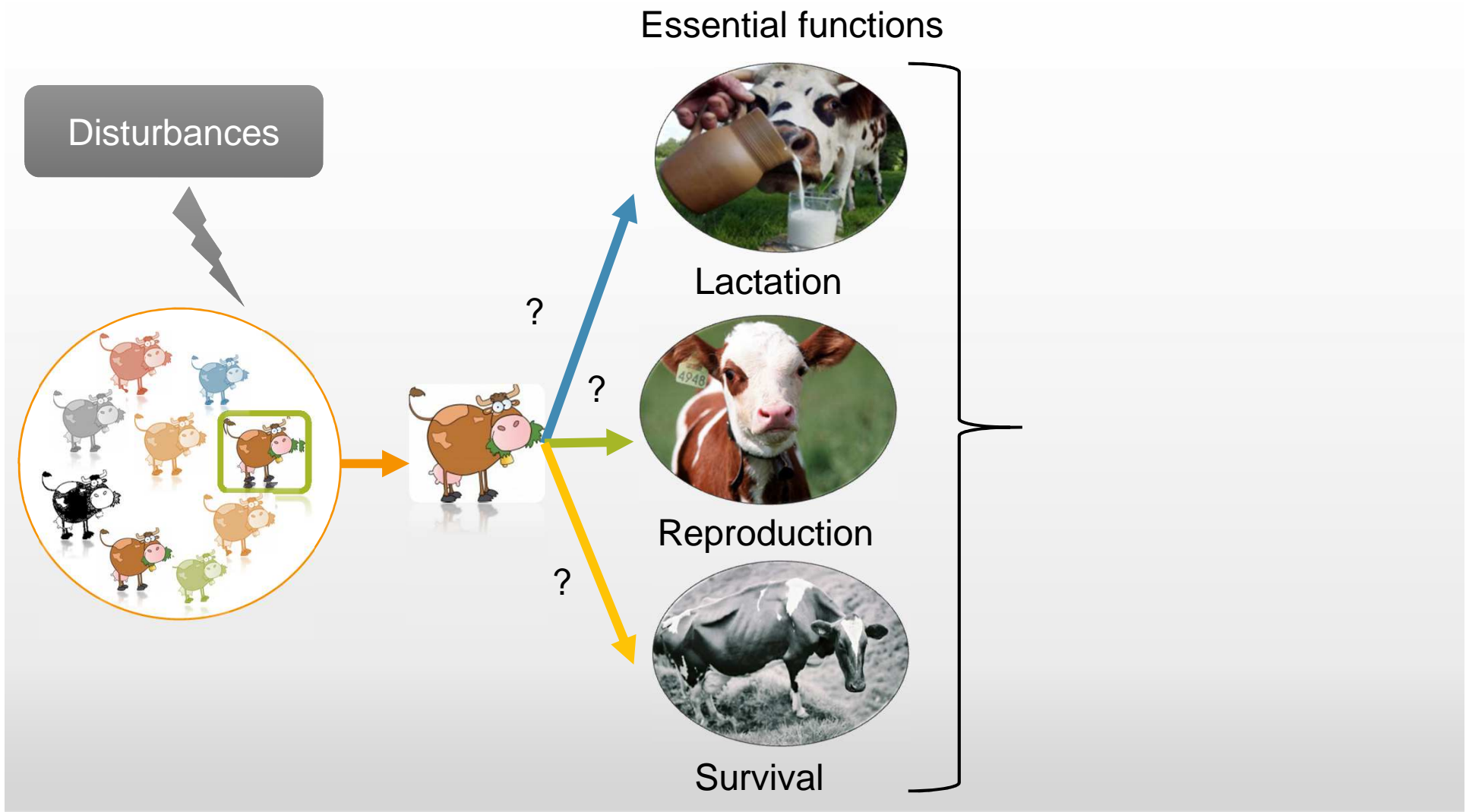


Survival

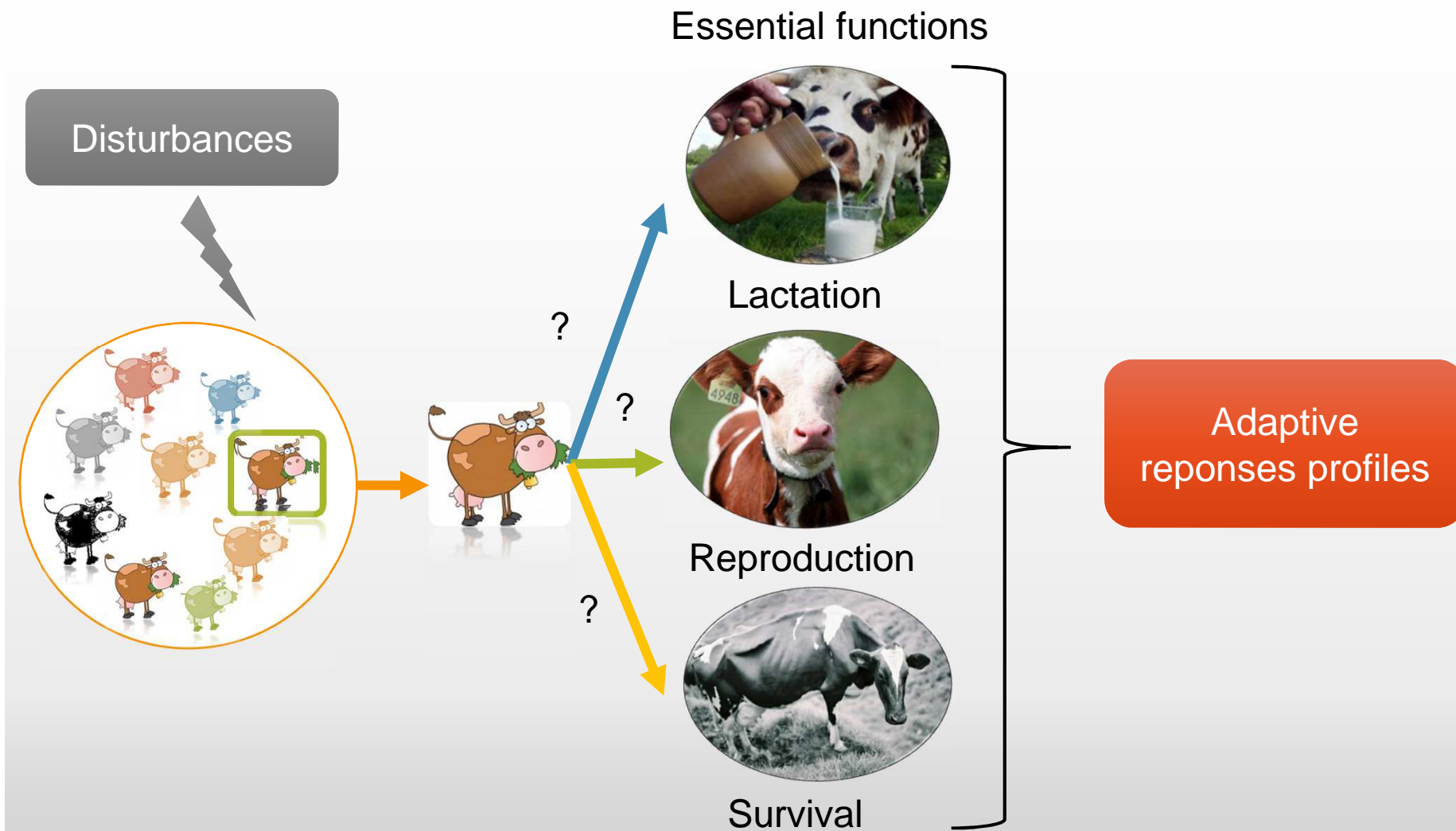
Trade-off profiles



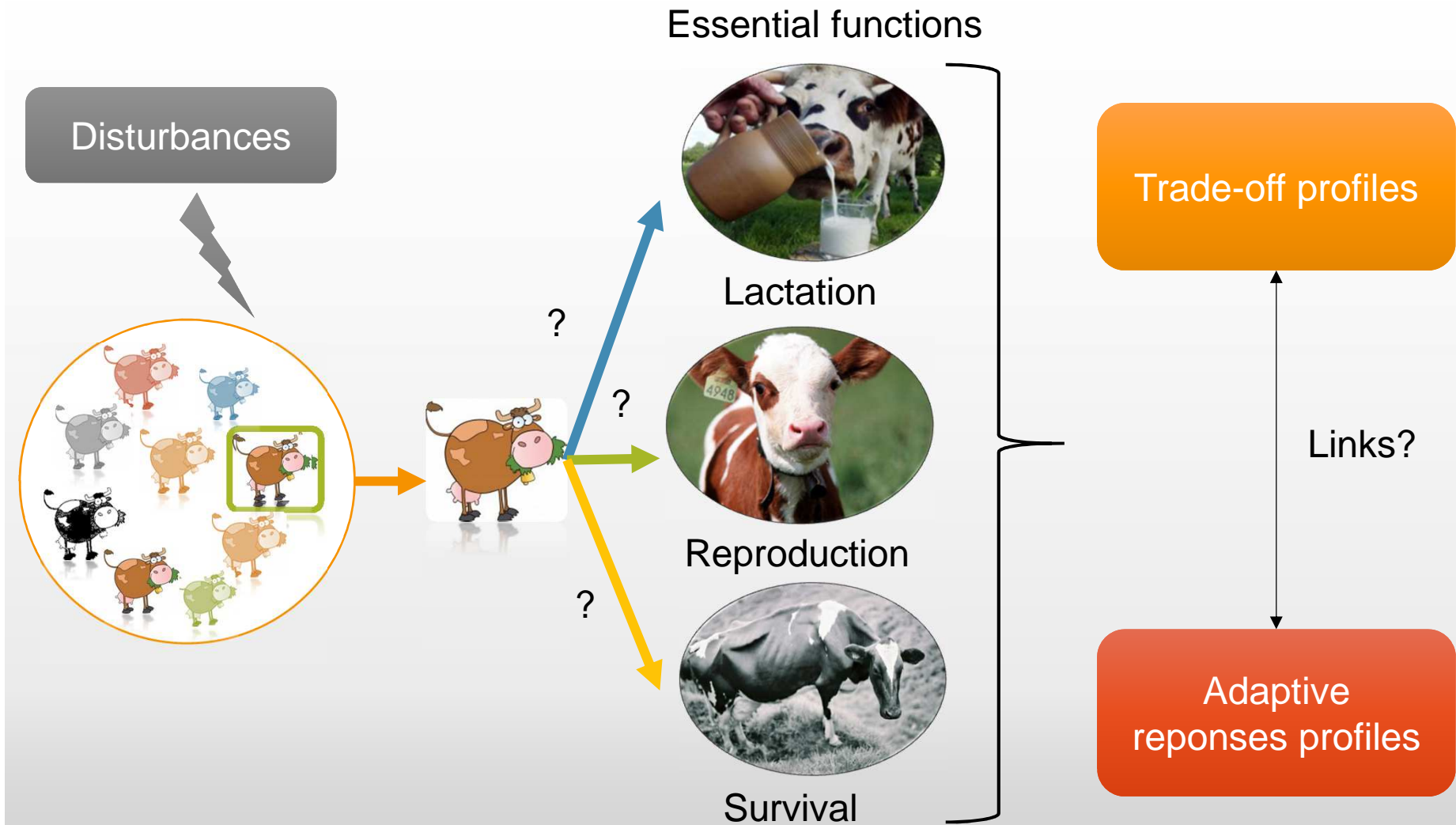
Diversity of individual robustness



Diversity of individual robustness



Diversity of individual robustness



Diversity of individual robustness

