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Strategies to improve livestock system robustness: moving toward diversity

Fabienne Blanc, Emilie Ollion, Bertrand Dumont, Stéphane Ingrand

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Strategies to improve livestock system robustness: moving toward diversity

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

Why?

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Why?

⇒ Current systems raises concerns

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-
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Why?

⇒ Current systems raises concerns



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Why?

⇒ Current systems raises concerns



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⇒ Current systems raises concerns

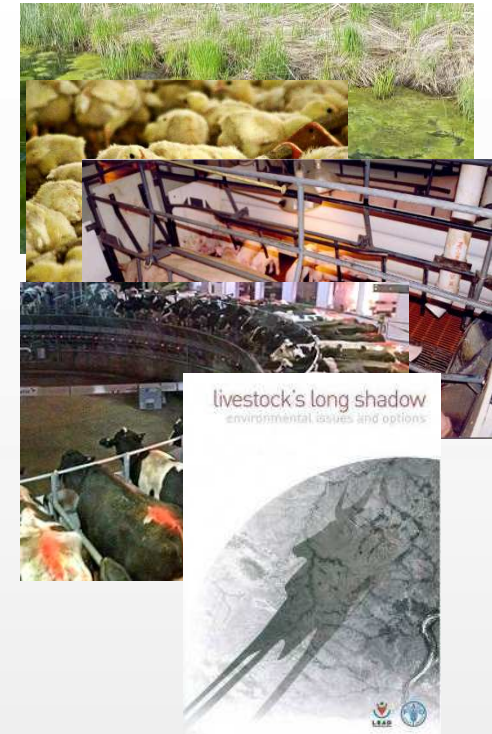
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Why?

⇒ Current systems raises concerns

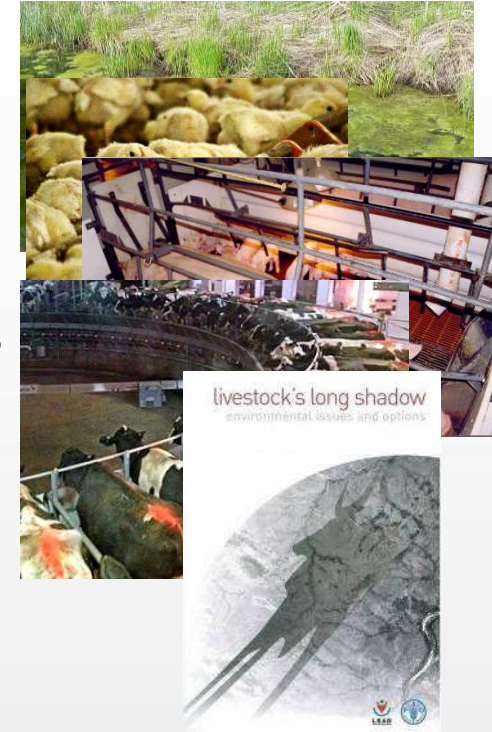
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Why?

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

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-



Why?

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- ⇒ Instability of productions contexts

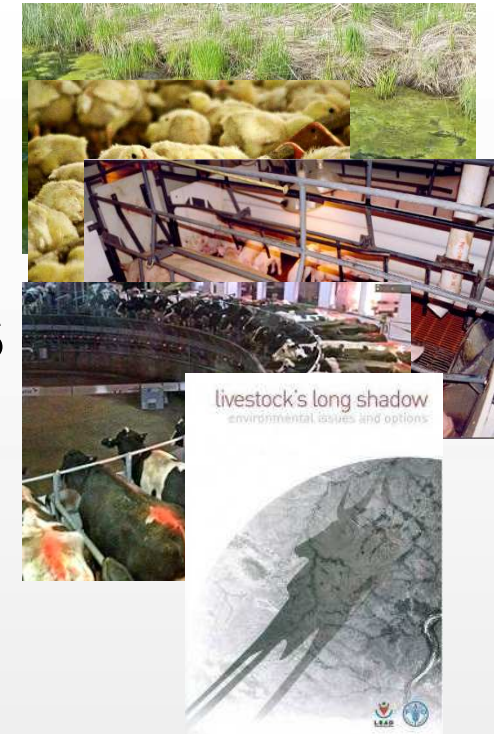
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- ⇒ Instability of productions contexts

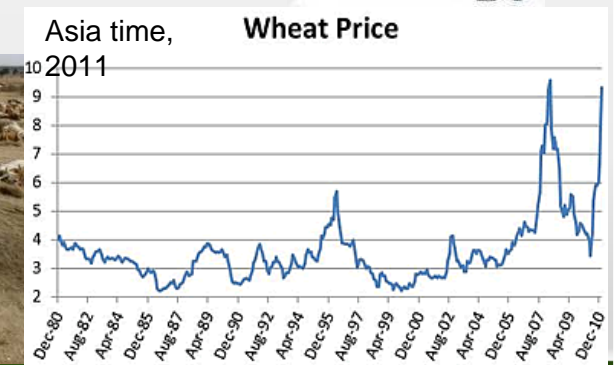
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- ⇒ Instability of productions contexts

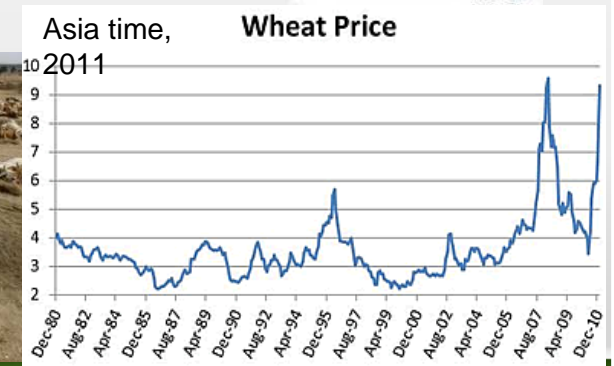
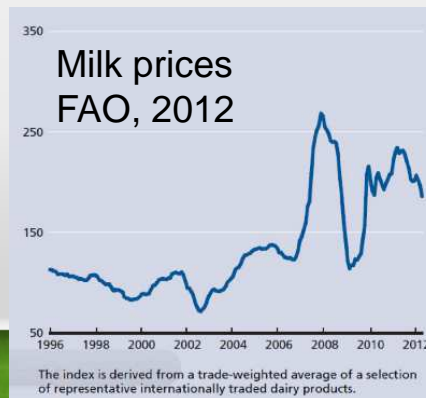
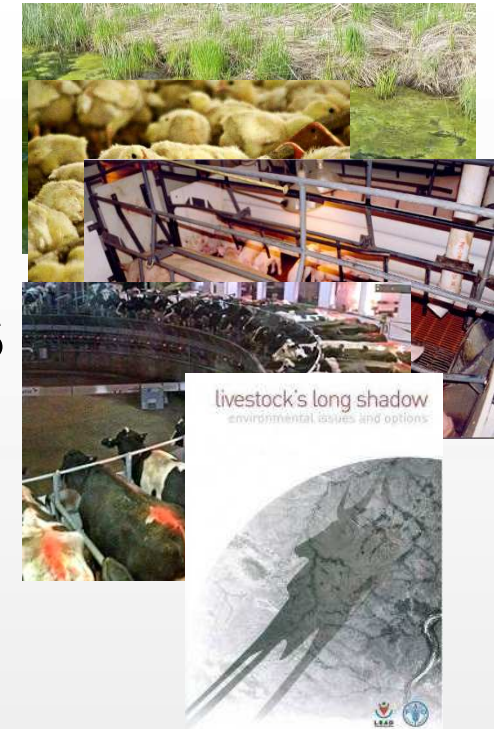
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Why?

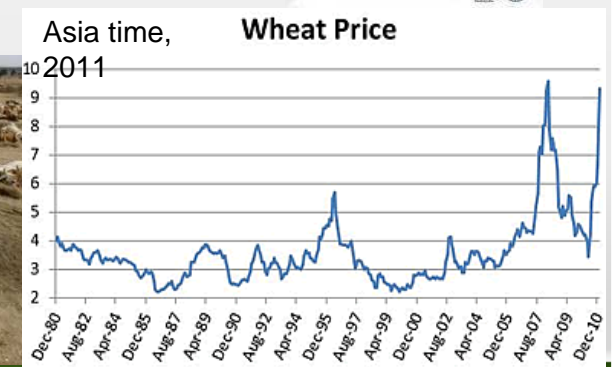
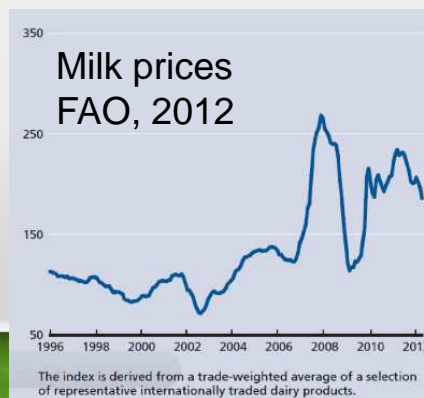
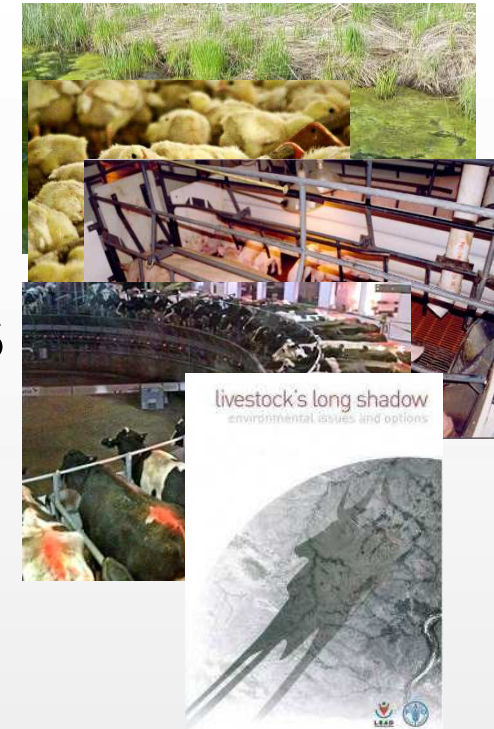
- ⇒ Current systems raises concerns
- ⇒ Instability of productions contexts

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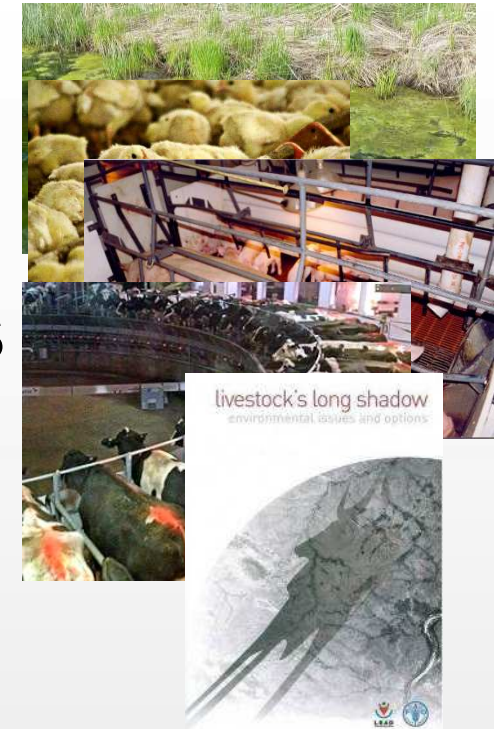
Why?

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

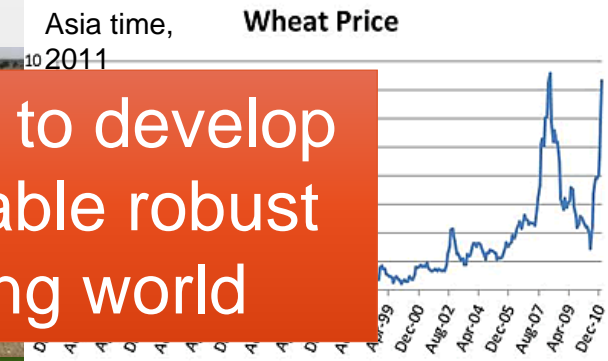


Why?

- ⇒ 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



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)



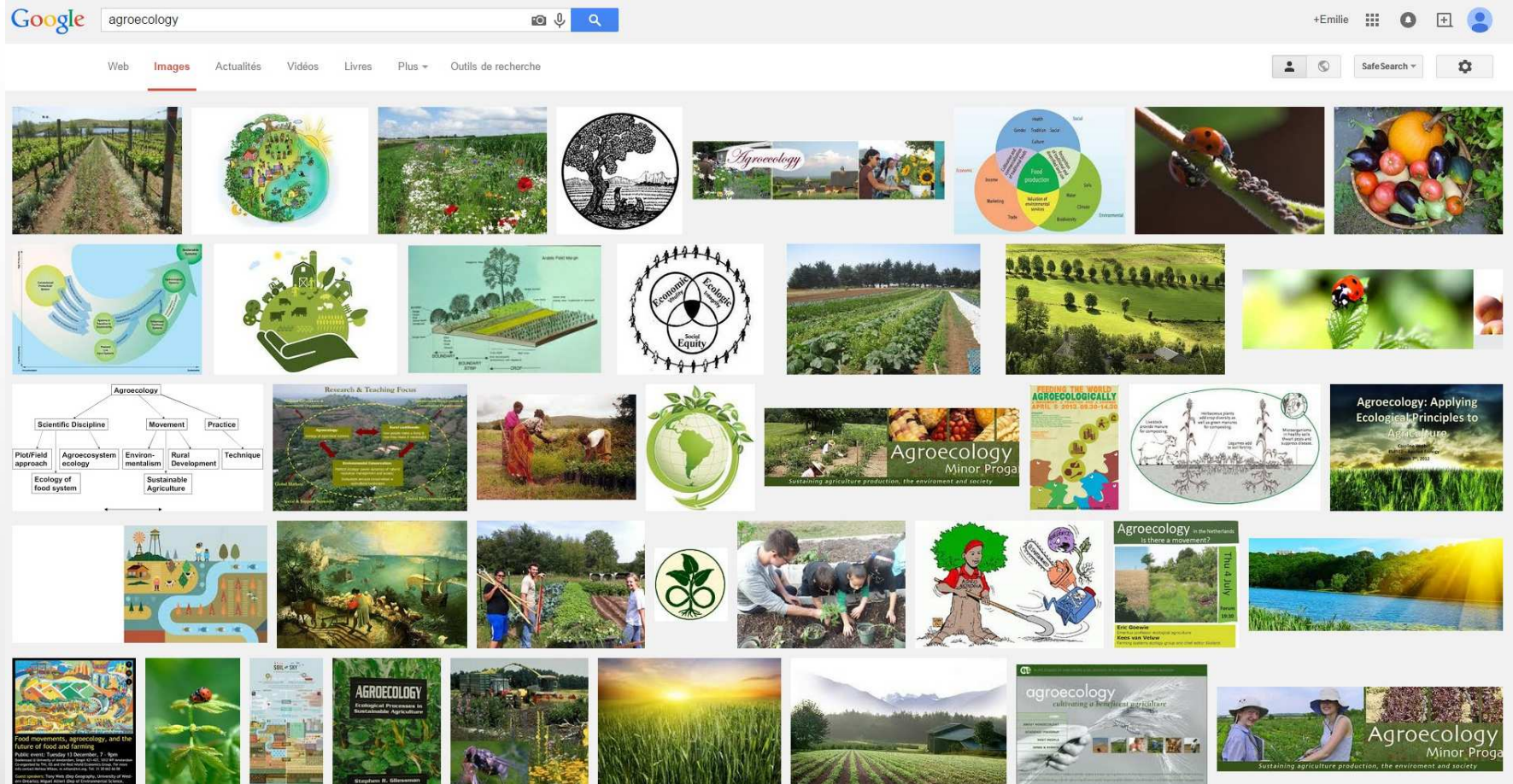
And How? (Dumont,2013)

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



Holistic framework

And How? (Dumont, 2013)



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Crop productions

Agroecology

Holistic framework



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Crop productions

Agroecology

Livestock?

Holistic framework



And How? (Dumont,2013)

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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

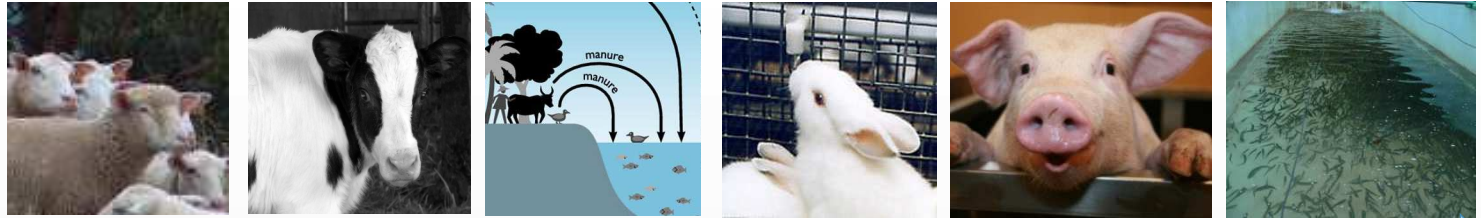
Diversity to ↑
resilience

Preserve
biodiversity



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

5 principles



Integrated
health
managmt

↓ inputs

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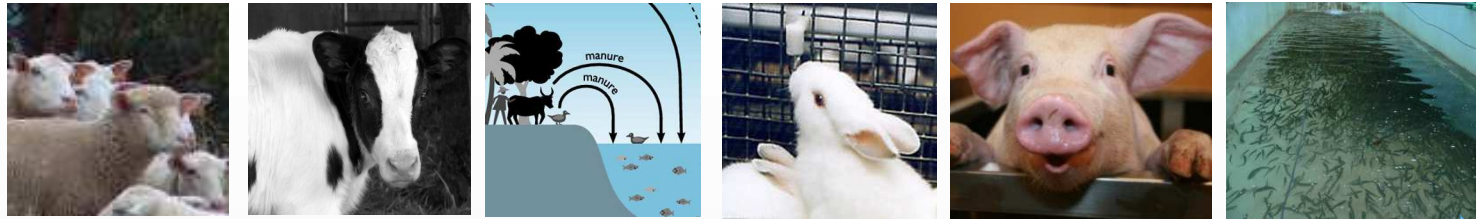
Diversity to ↑
resilience

Preserve
biodiversity

Intensification

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

5 principles

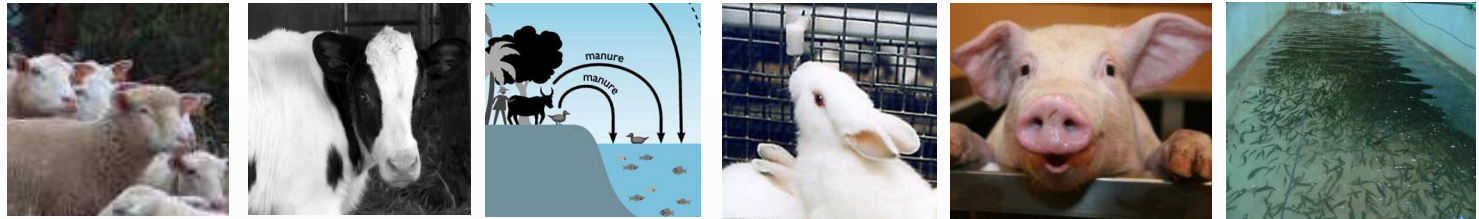


Intensification →

	Sheep	Cow	Manure Management	Rabbit	Pig	Fish Pond
Integrated health managment				**	*	**
↓ inputs	**	***	***	***	***	**
↓ pollution	*	***	**		***	***
Diversity to ↑ resilience	***	**	**	**	*	
Preserve biodiversity	**	*		*		

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

5 principles

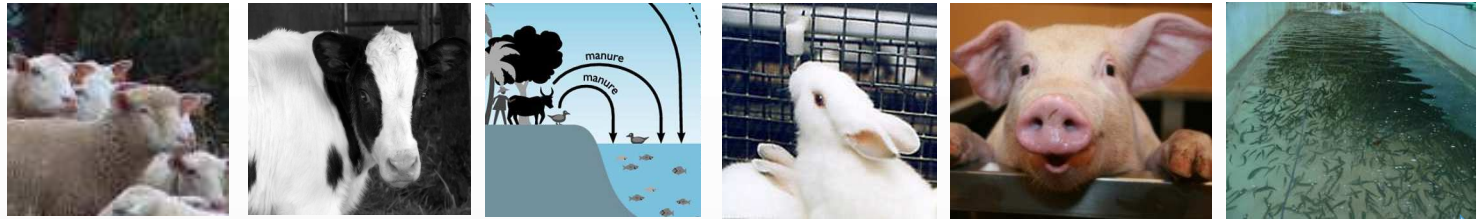


Intensification →

	Sheep	Cow	Manure Management	Rabbit	Pig	Fish
Integrated health managment				**	*	**
↓ inputs	**	***	***	***	***	**
↓ pollution	*	***	**		***	***
Diversity to ↑ resilience	***	**	**	**	*	
Preserve biodiversity	**	*		*		

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

5 principles

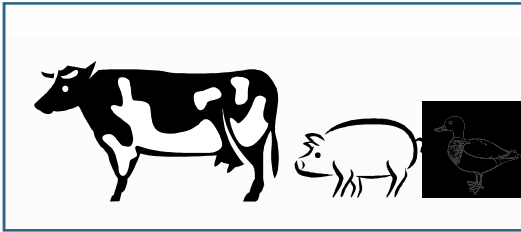


Intensification →

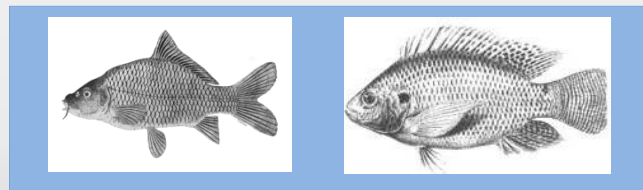
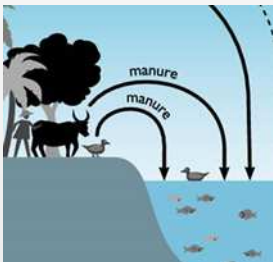
Integrated health managment				**	*	**
↓ inputs	**	***	***	***	***	**
↓ pollution	*	***	**		***	***
Diversity to ↑ resilience	***	**	**	**	*	
Preserv biodiversity	Which form and use of diversity ?					

Productions diversity (Dumont et al., 2013)

Livestock



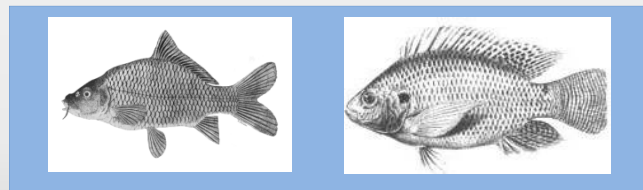
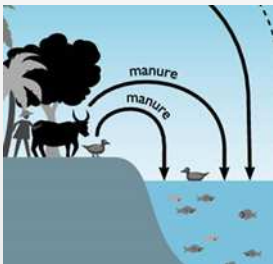
Rice, fruits, sugar cane



Fish (carp, tilapia)

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

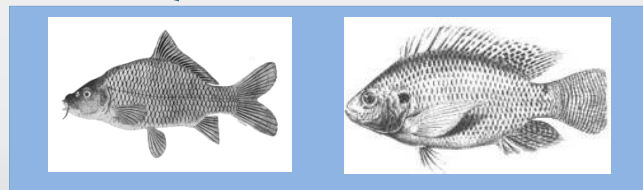
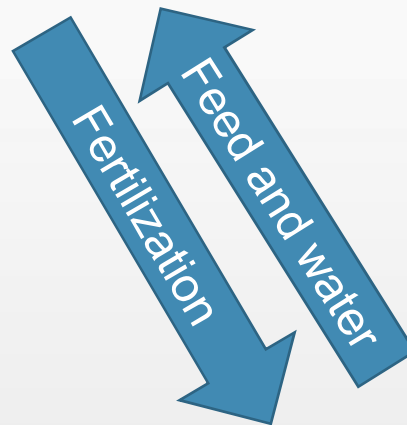
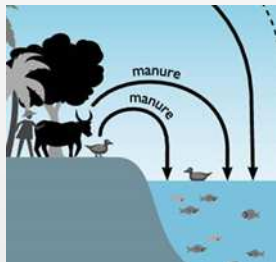
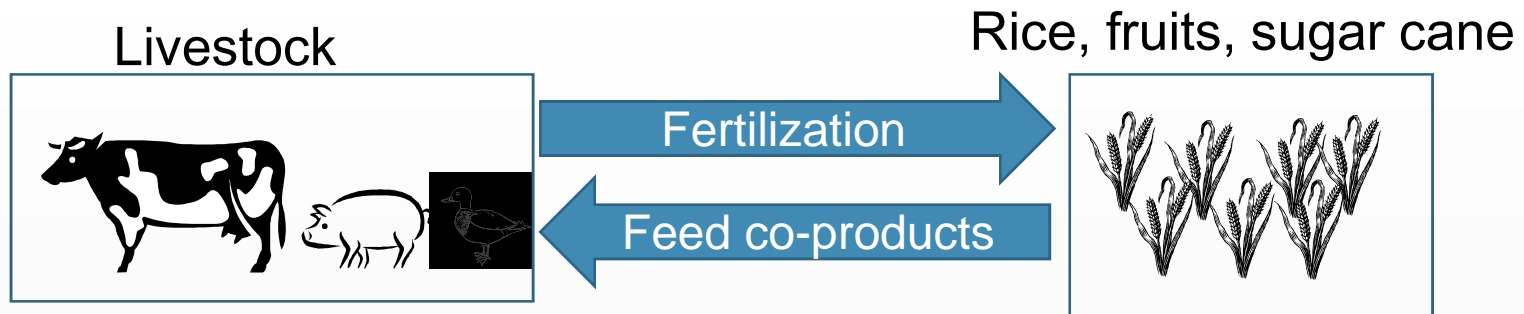
Productions diversity (Dumont et al., 2013)



Fish (carp, tilapia)

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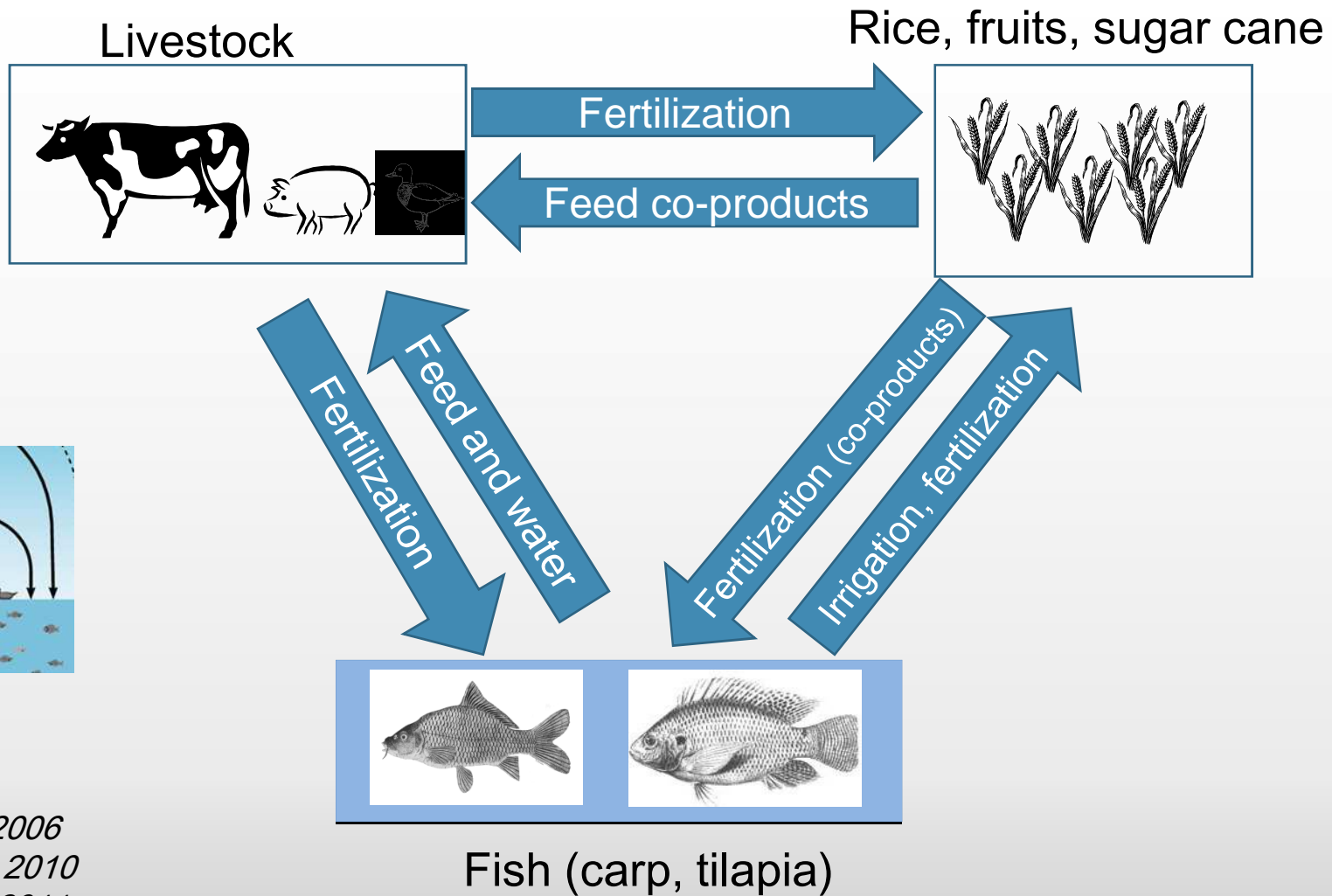
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Fish (carp, tilapia)

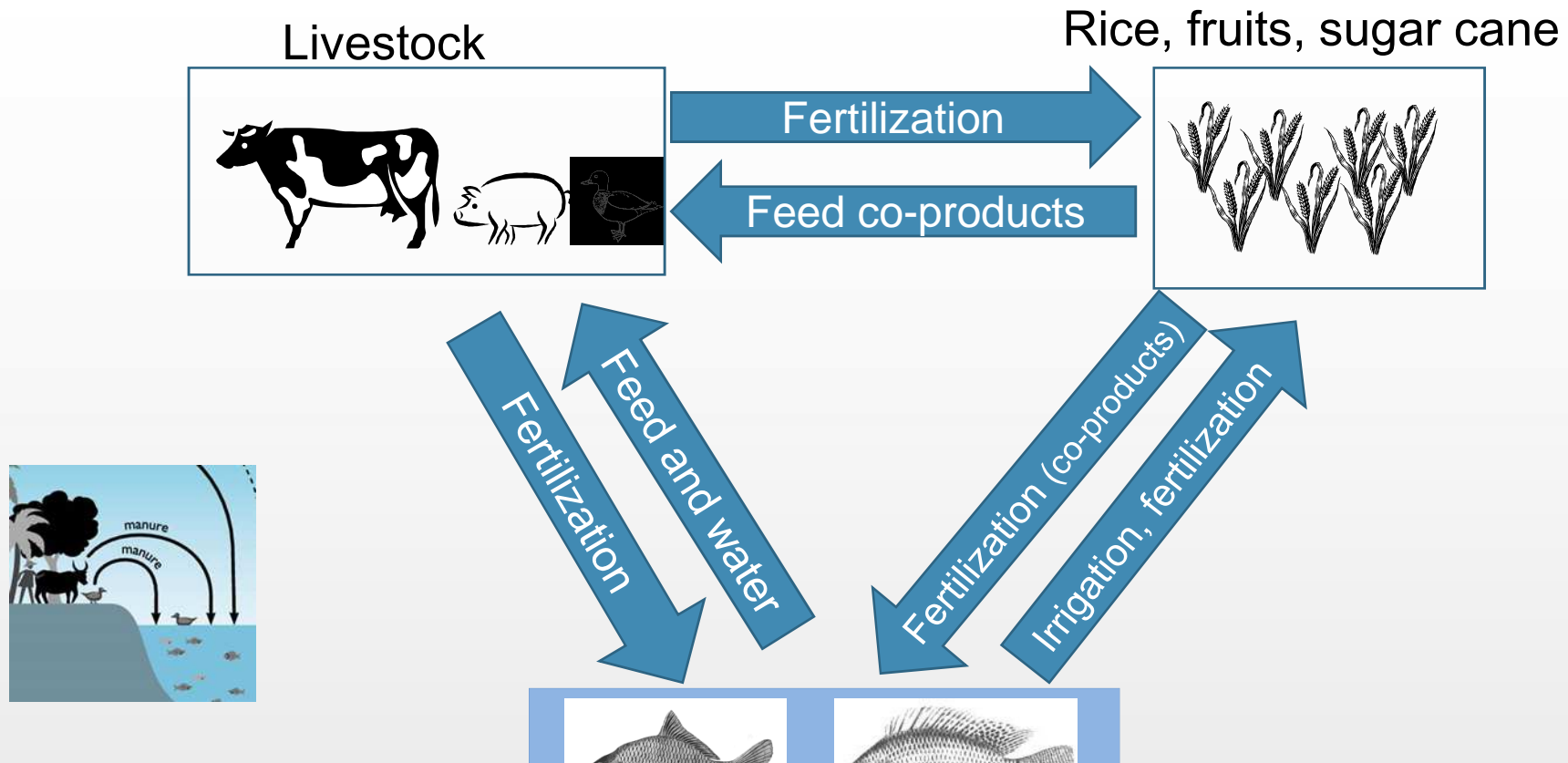
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Nhan et al. 2006
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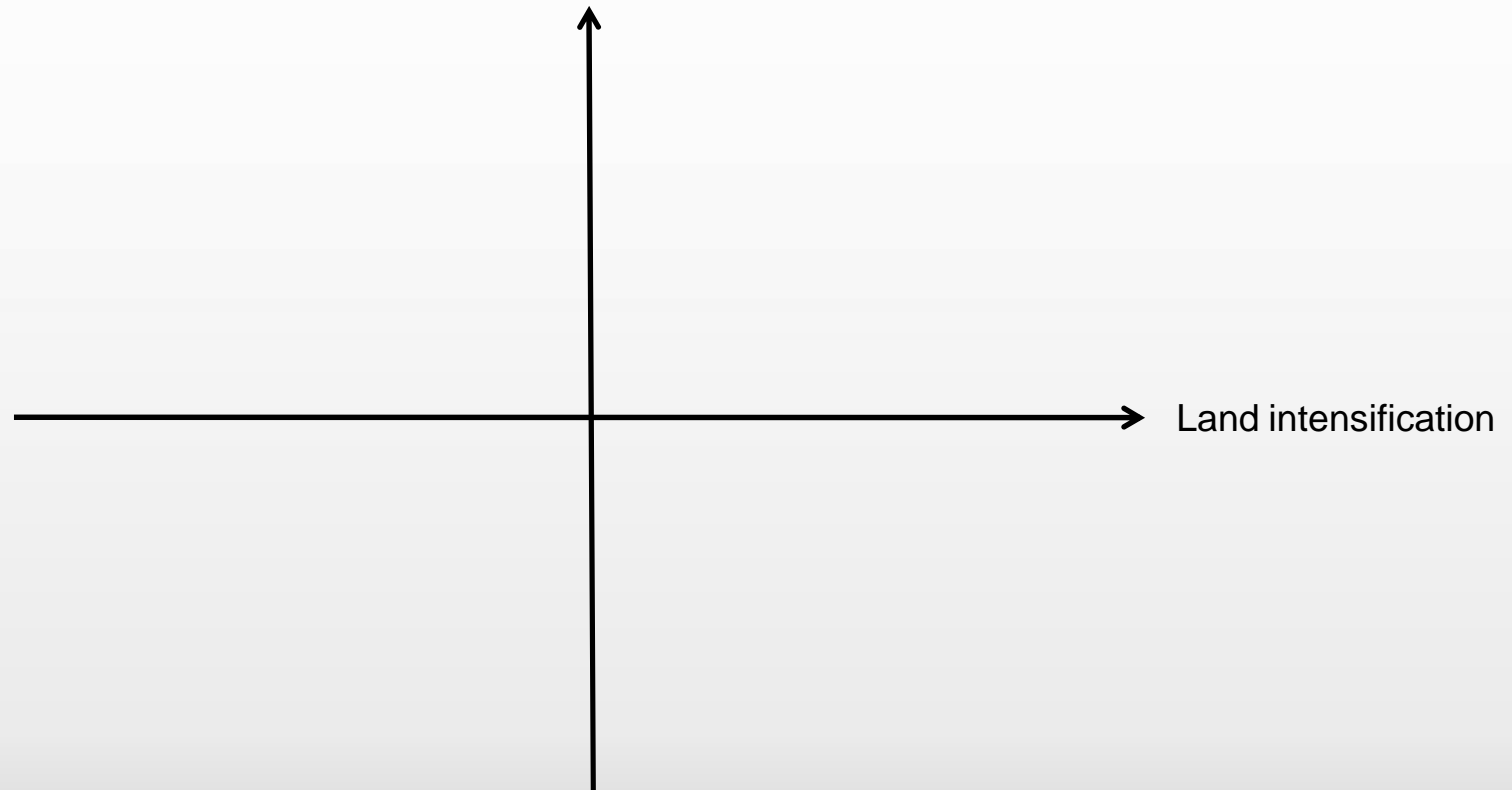
Productions diversity (Dumont et al., 2013)



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

Species diversity (Cournut et al. 2014)

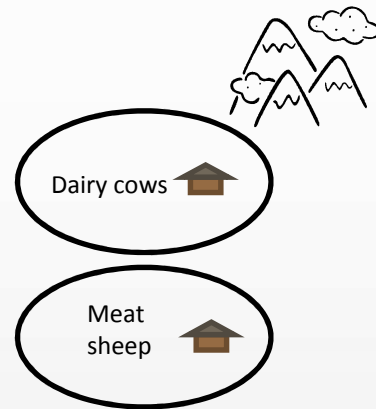
Animals' productivity



Species diversity (Cournut et al. 2014)

**Separated
management**

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

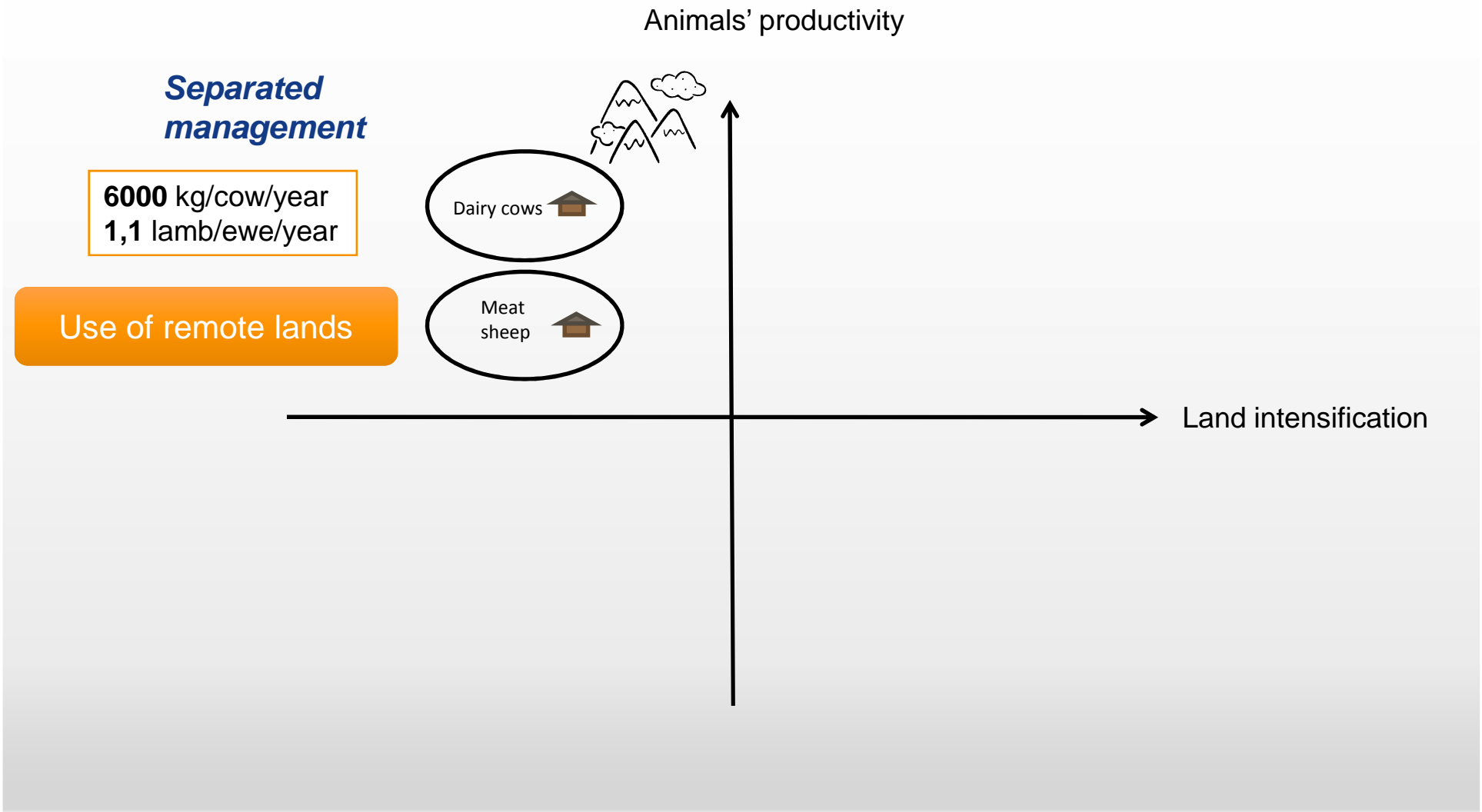


Animals' productivity

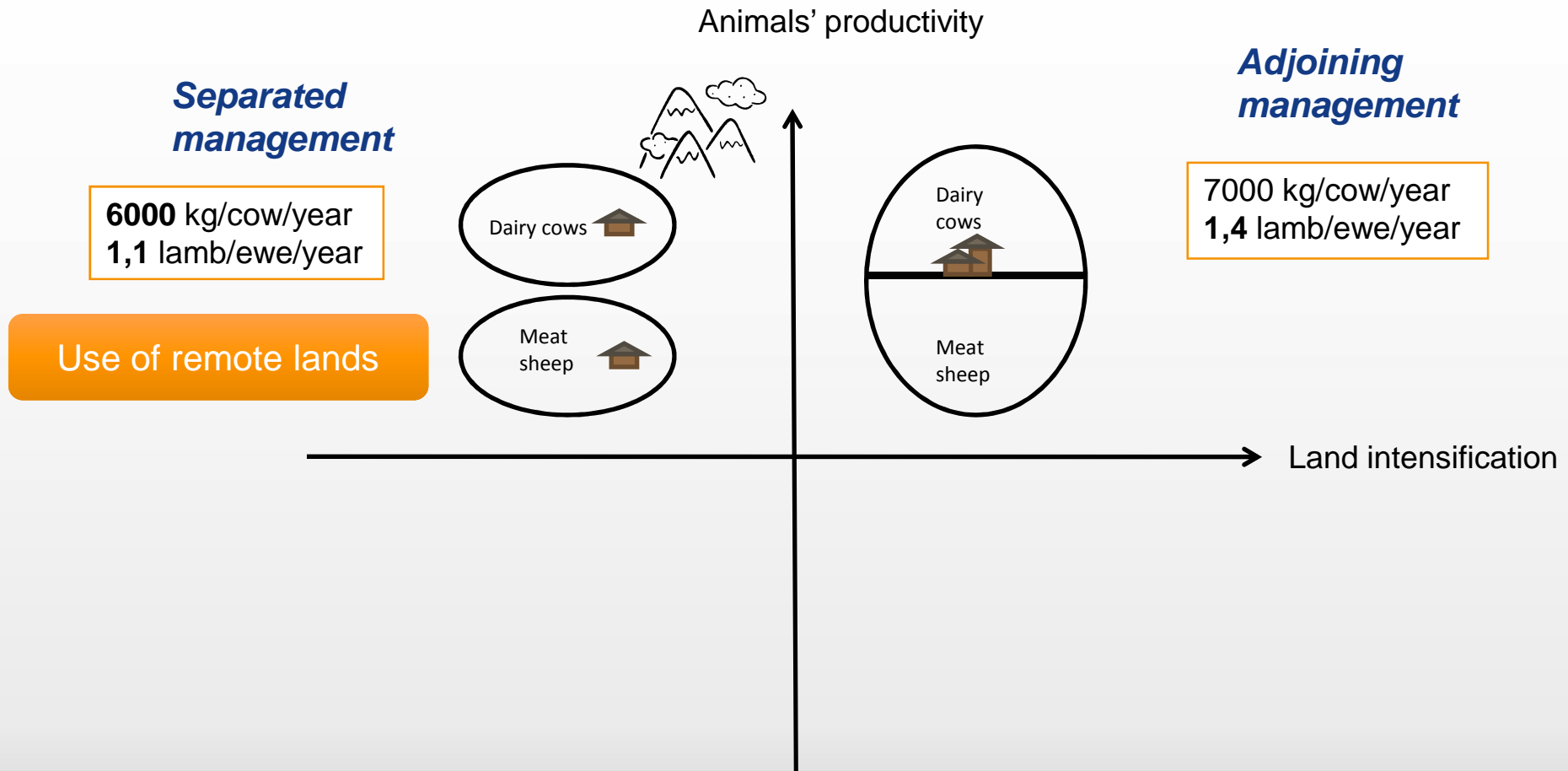
Land intensification



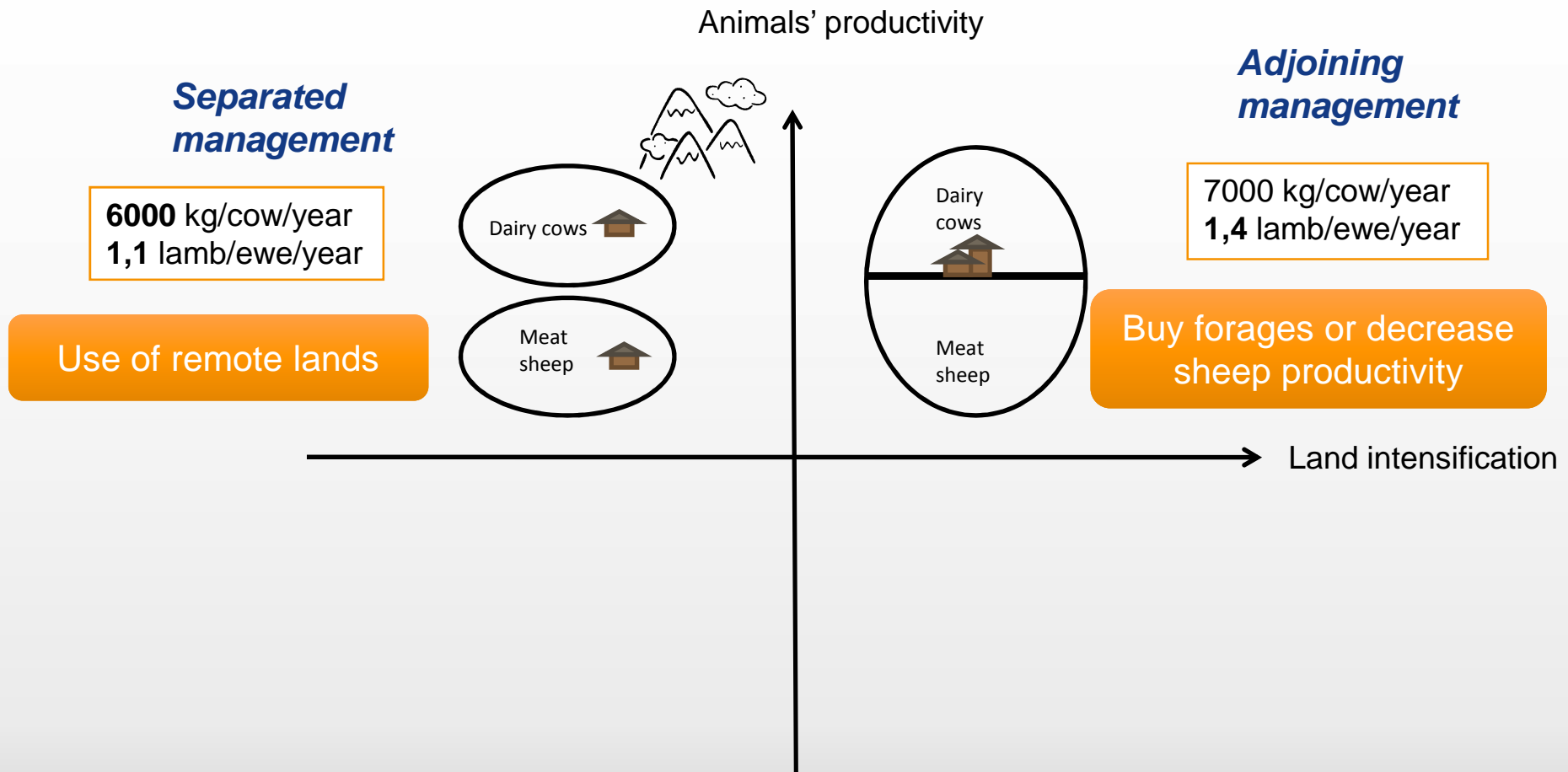
Species diversity (Cournut et al. 2014)



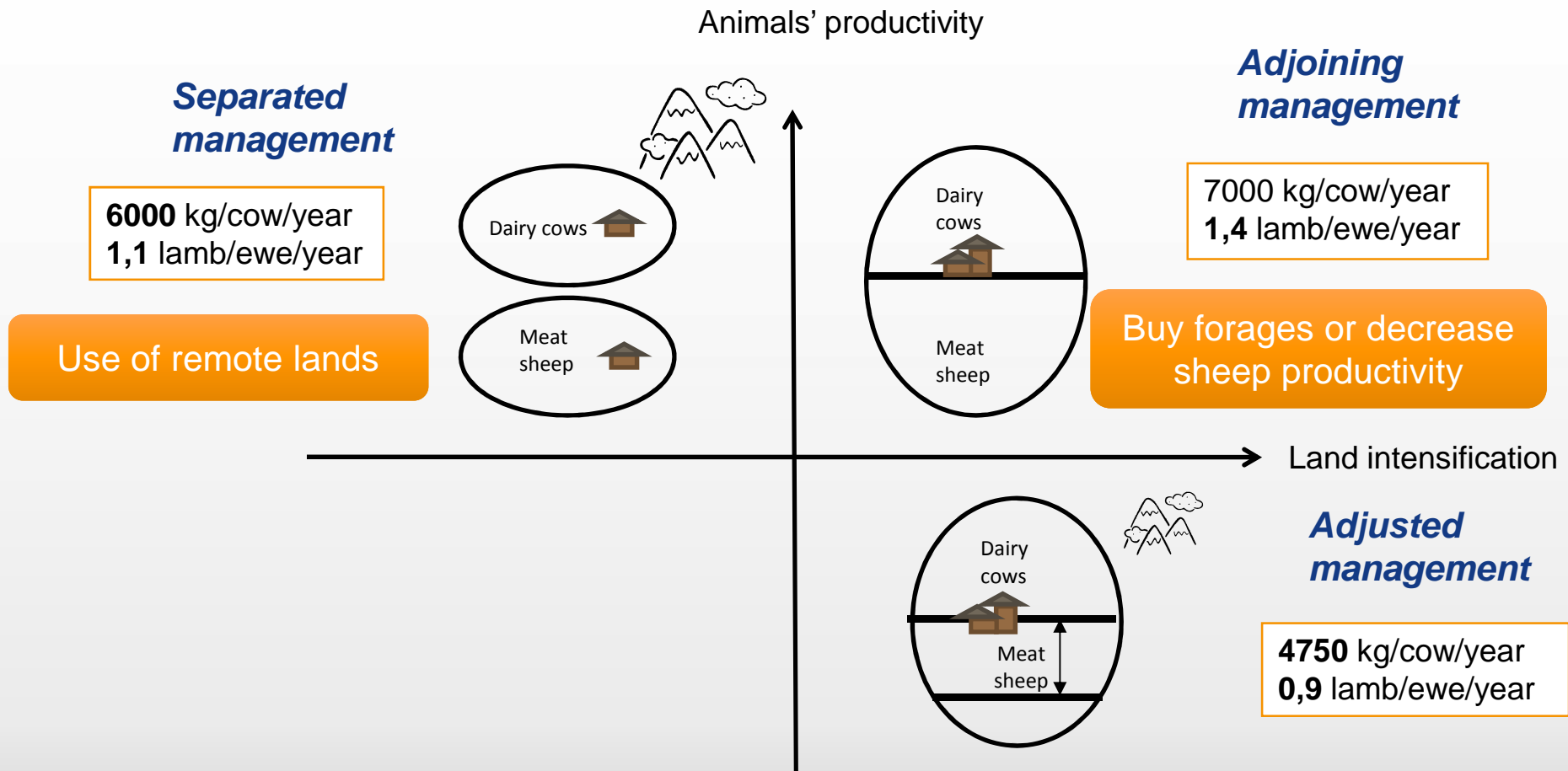
Species diversity (Cournut et al. 2014)



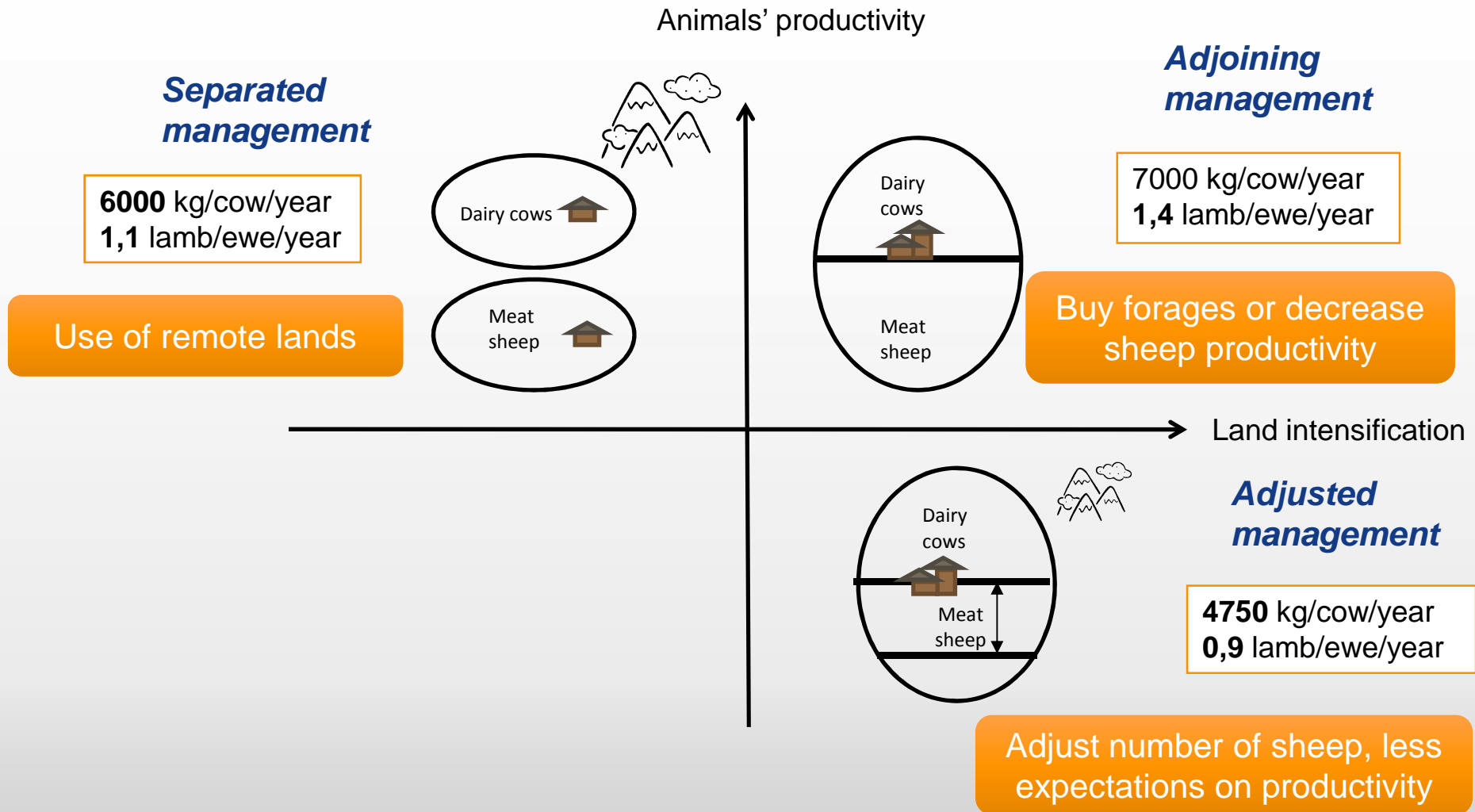
Species diversity (Cournut et al. 2014)



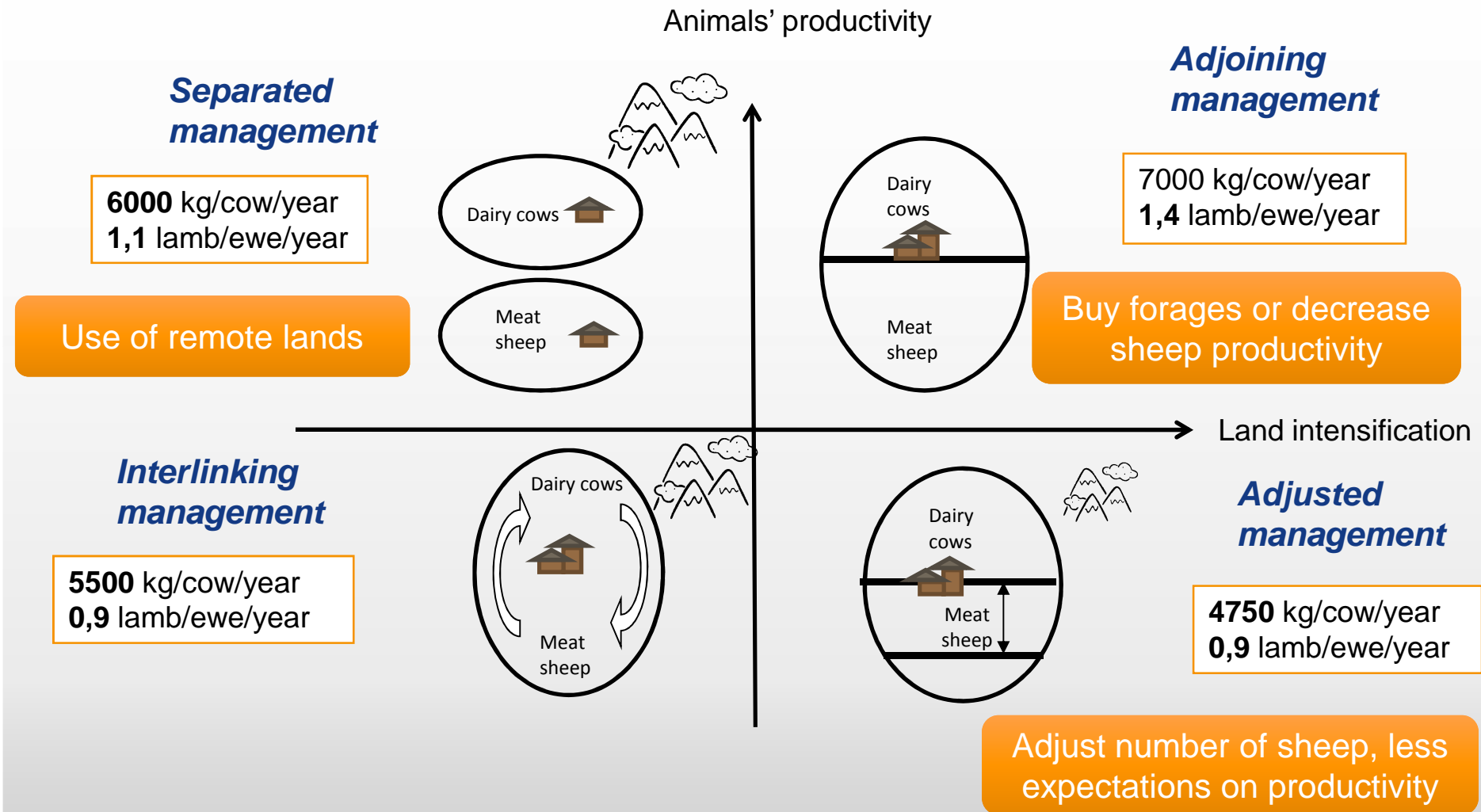
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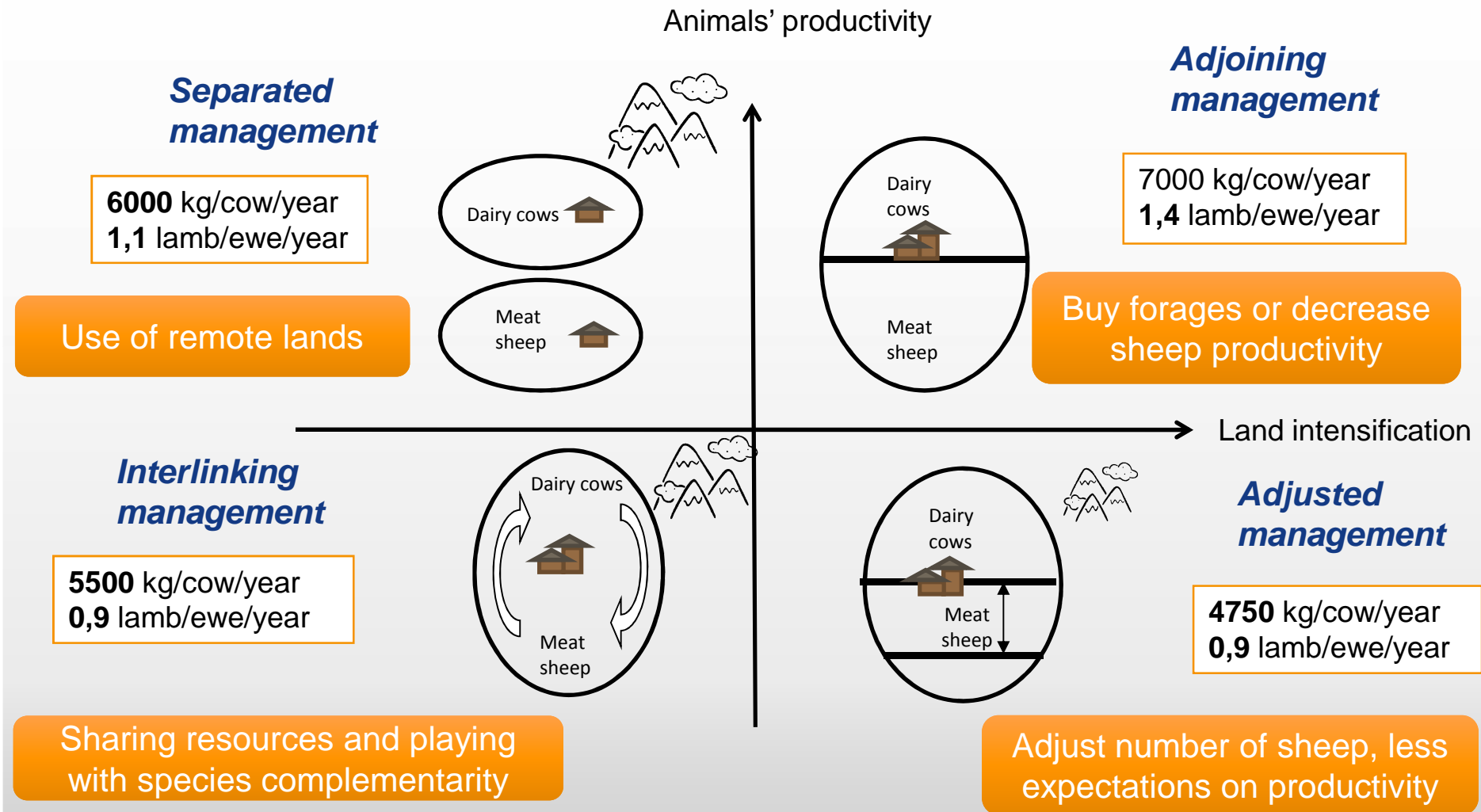
Species diversity (Cournut et al. 2014)



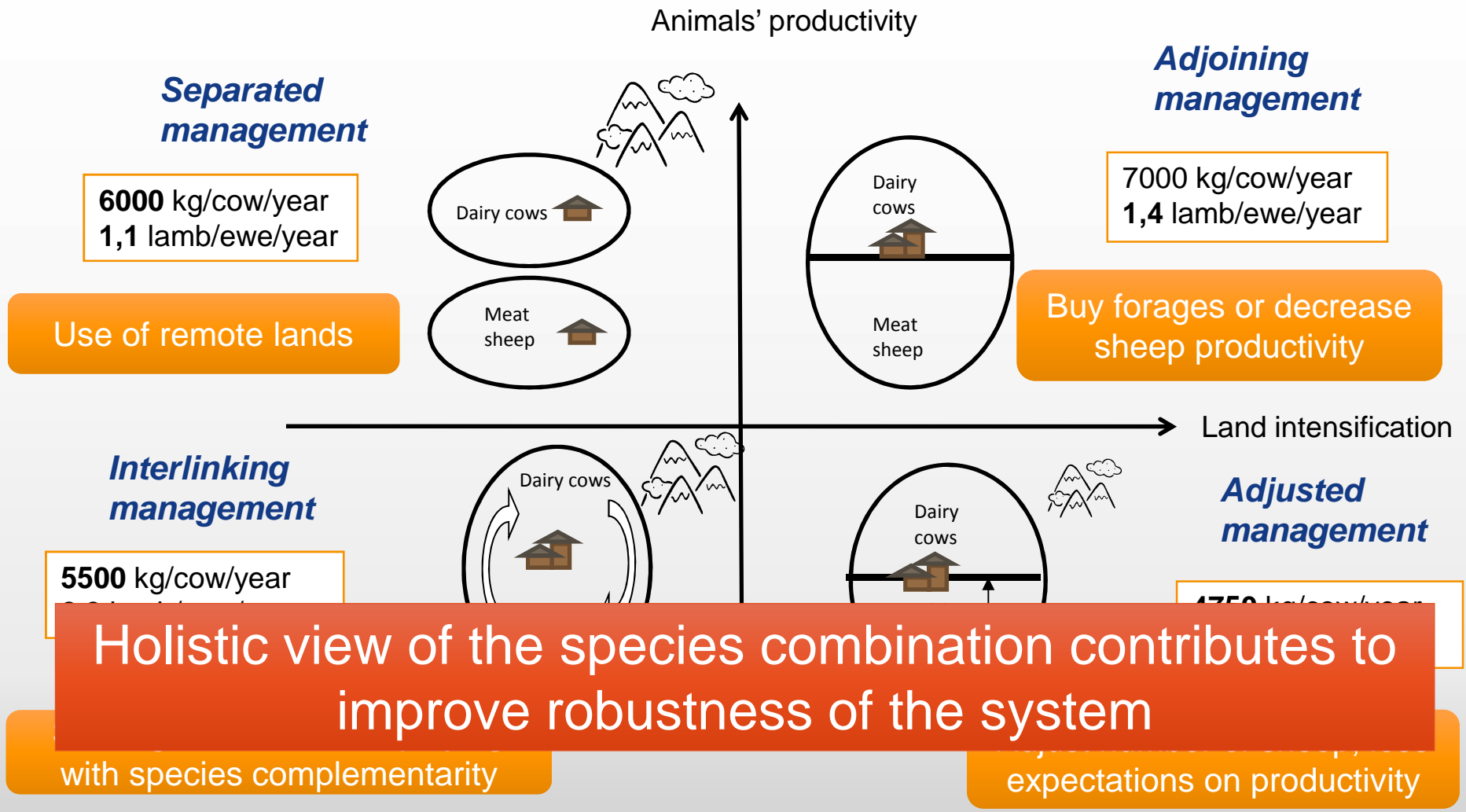
Species diversity (Cournut et al. 2014)



Species diversity (Cournut et al. 2014)



Species diversity (Cournut et al. 2014)



Within-herd diversity

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Within-herd diversity

⇒ Physiologic status

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Within-herd diversity

⇒ Physiologic status

⇒ Diversity of individual capacities to face disturbances → robustness

▪

Within-herd diversity

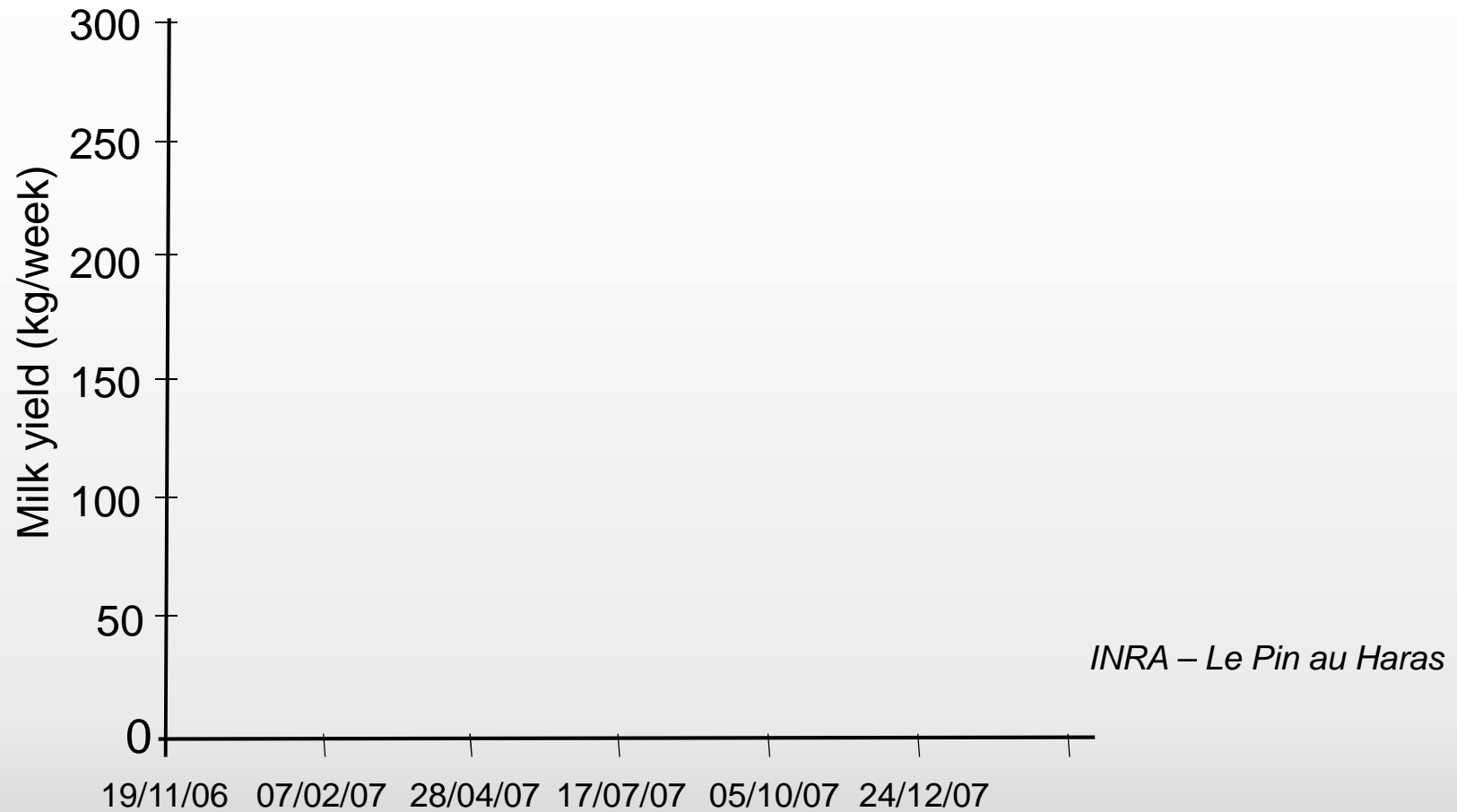
- ⇒ Physiologic status
- ⇒ Diversity of individual capacities to face disturbances → robustness
- ⇒ Case study: dairy cows



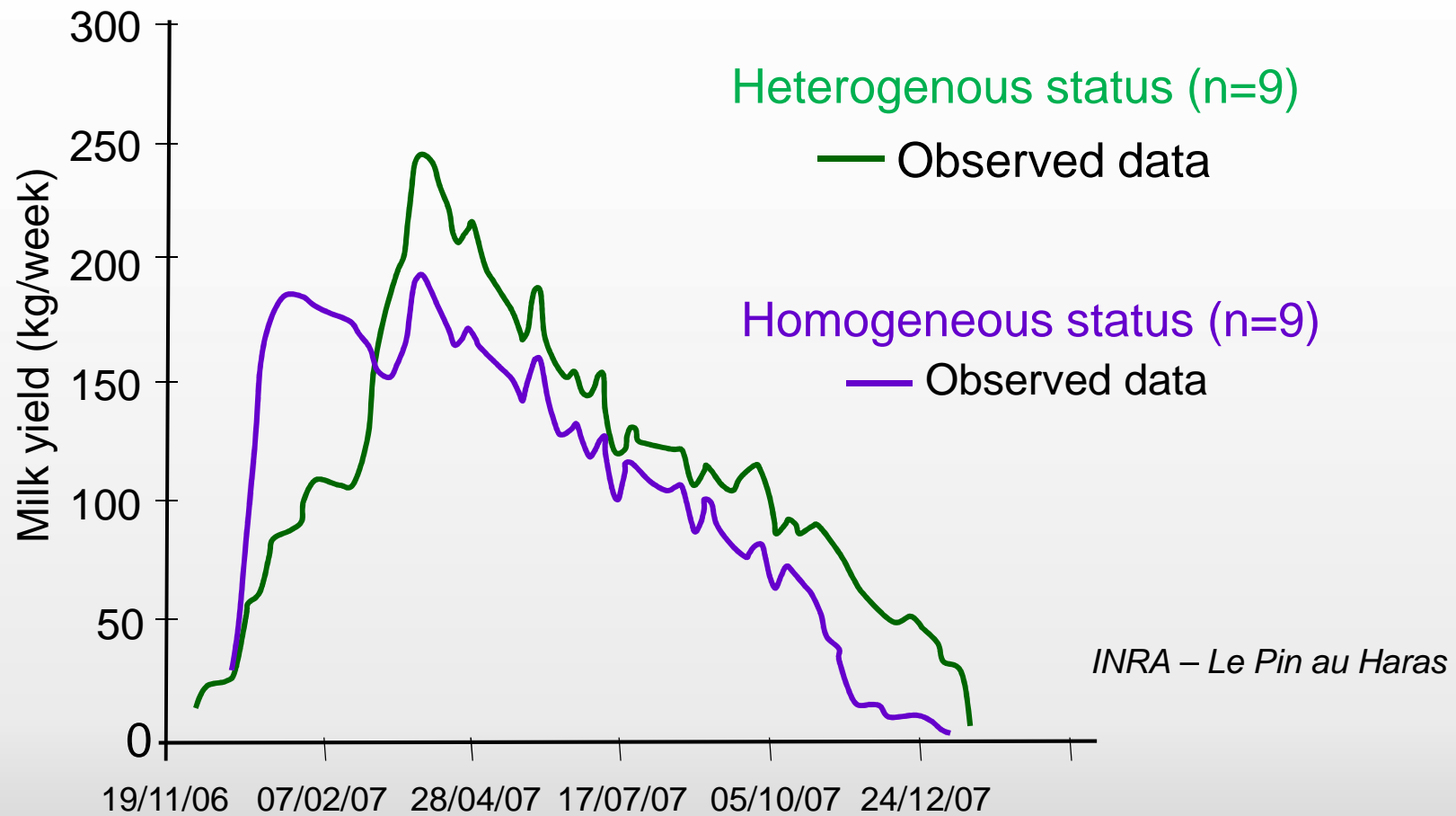
Diversity of physiological status



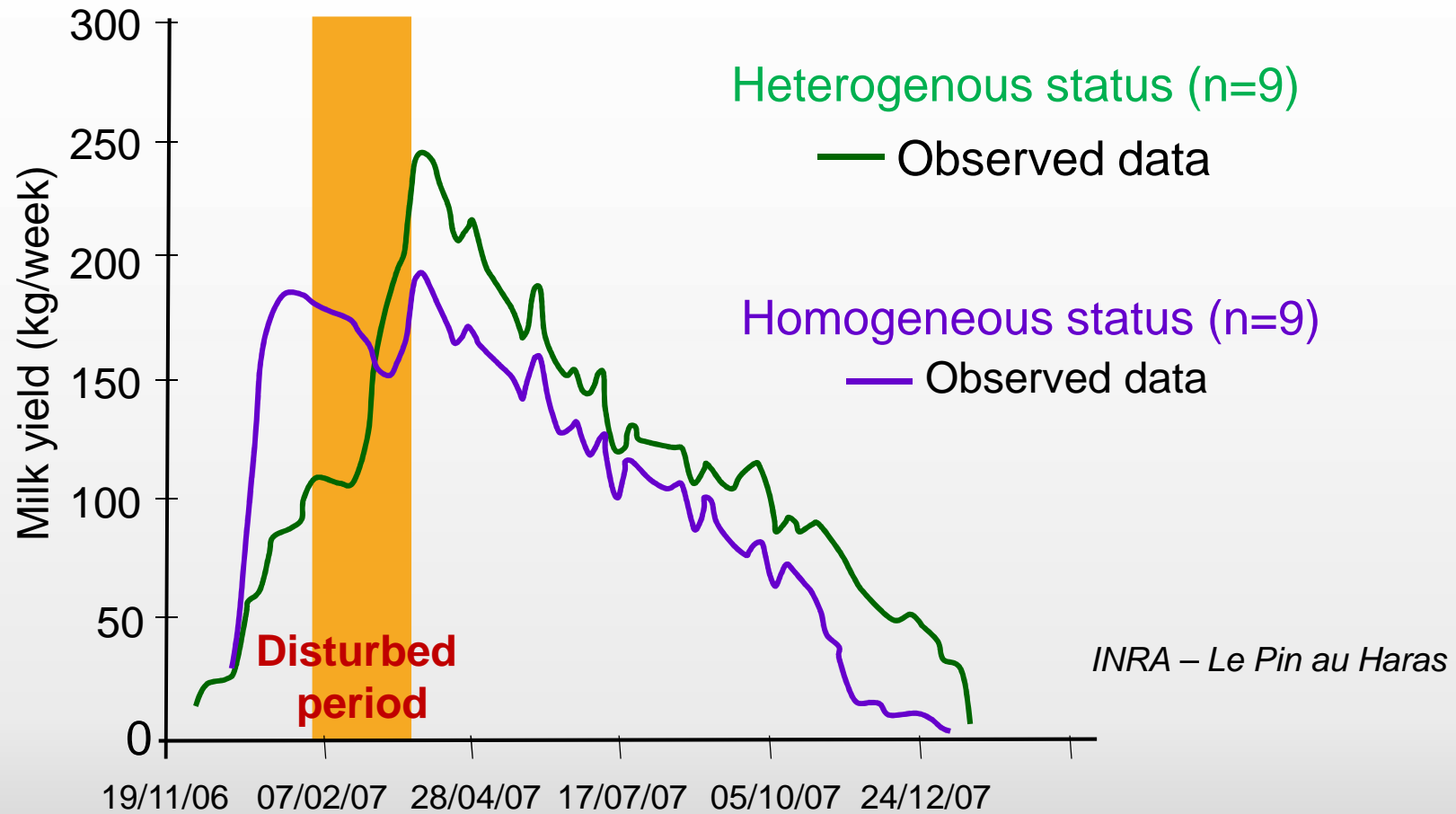
Diversity of physiological status



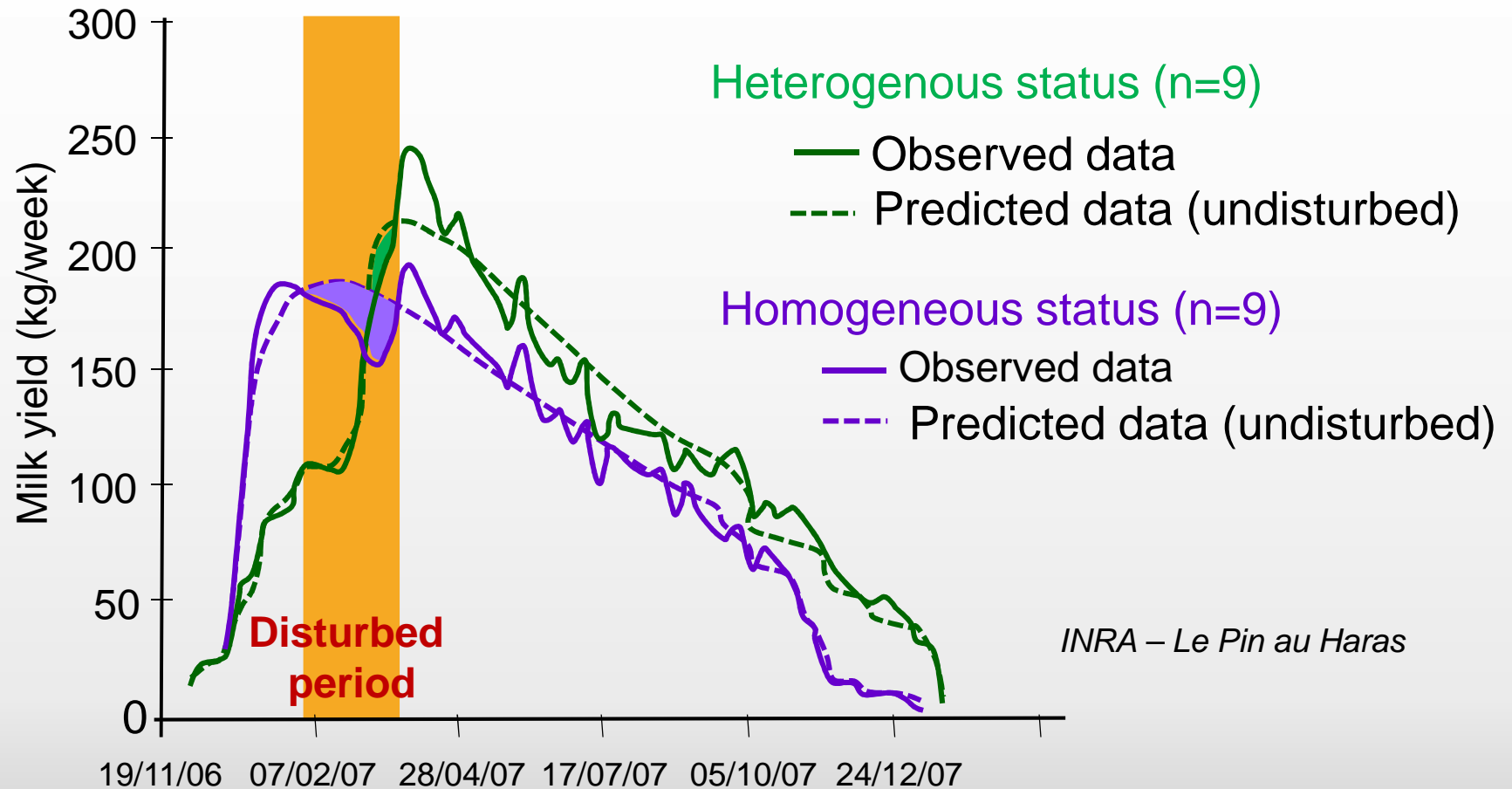
Diversity of physiological status



Diversity of physiological status

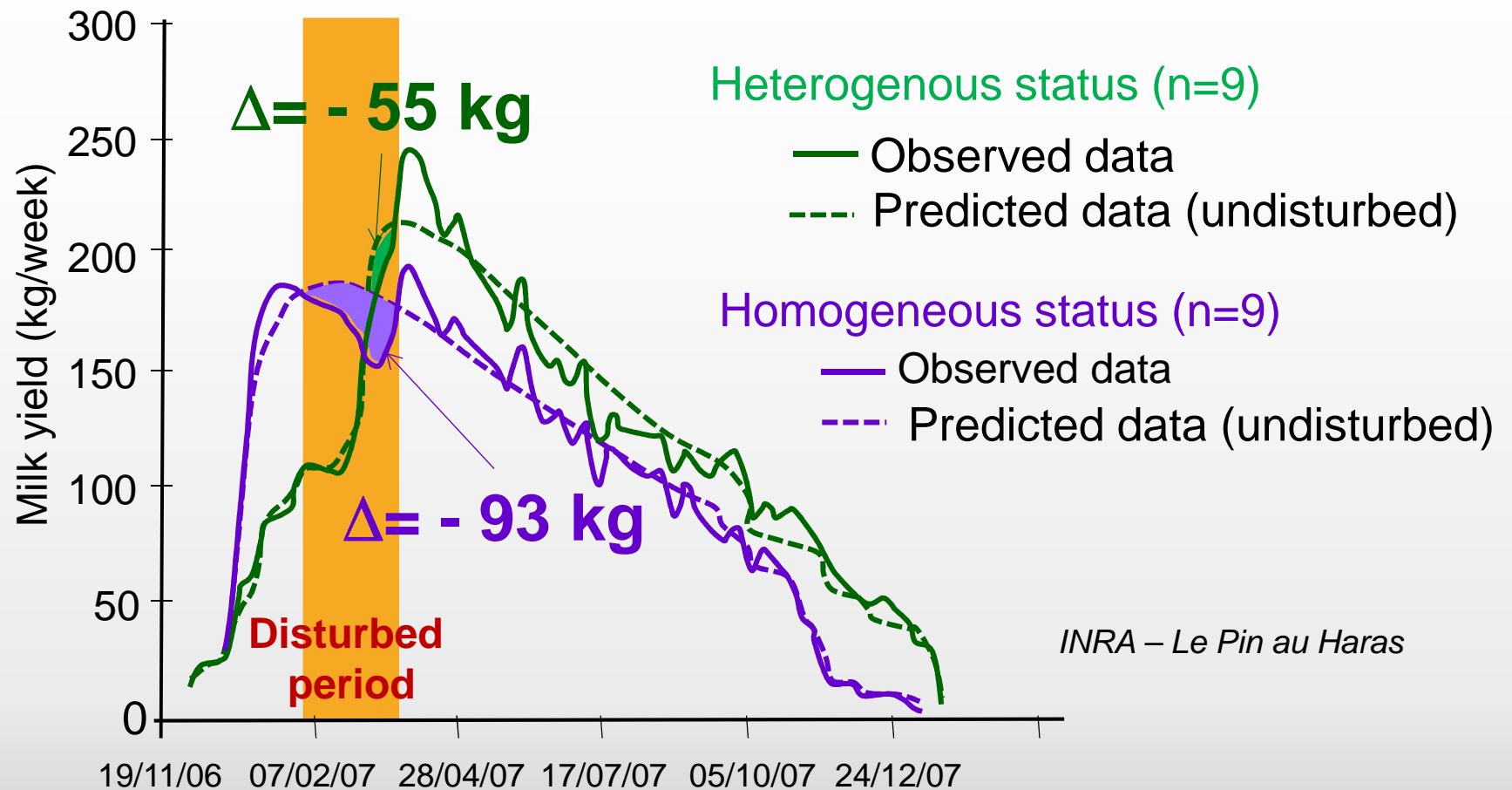


Diversity of physiological status

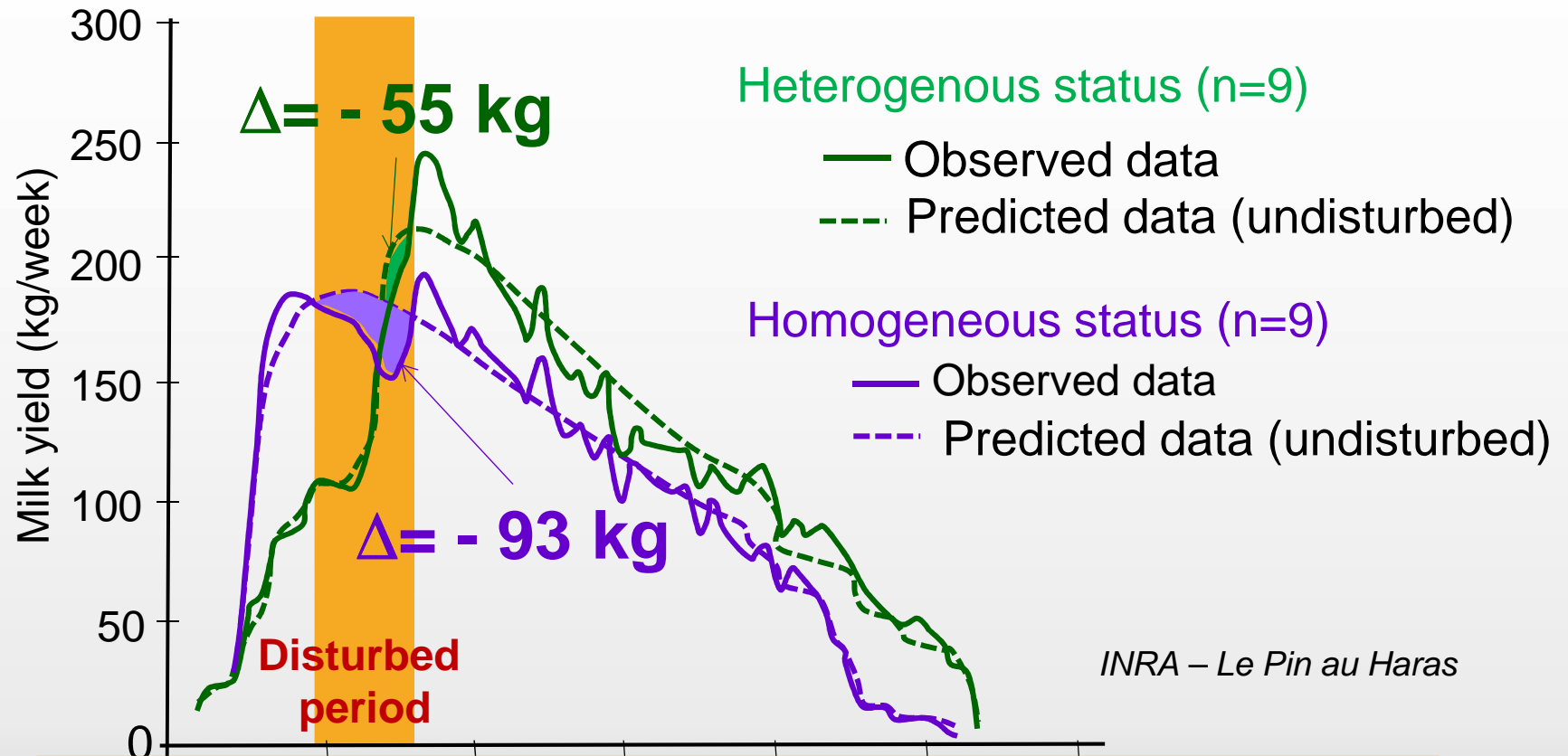


INRA – Le Pin au Haras

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

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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)

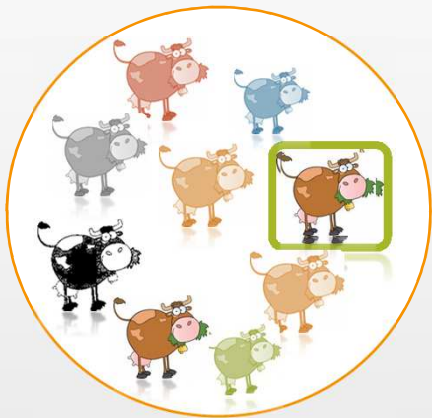
Diversity of individual robustness

⇒ Robust cows:

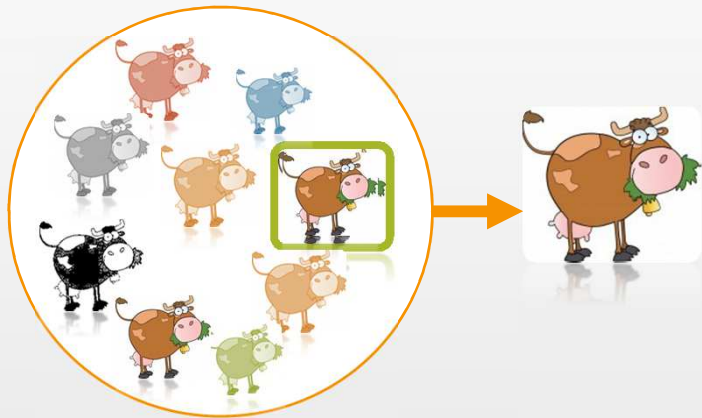
- Able to produce and reproduce in a wide range of environments (Knap, 2005)
- “A cow that you do not hear in the herd, a cow lasting in the herd” (Ollion et al. unpublished)

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

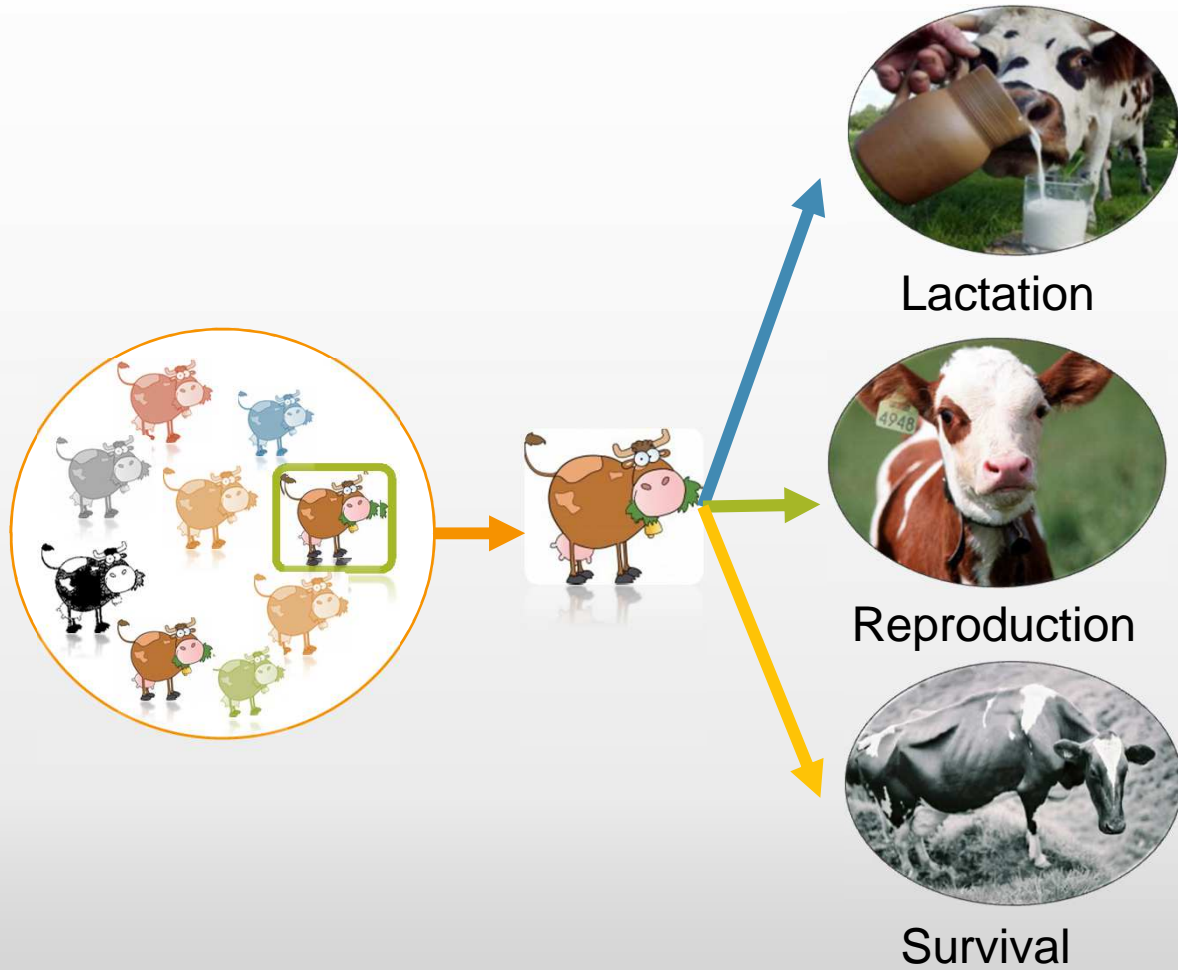


Diversity of individual robustness



Diversity of individual robustness

Essential functions



Diversity of individual robustness

Limited resources
Low energy



Essential functions



Lactation

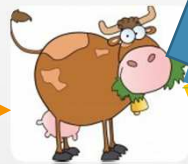
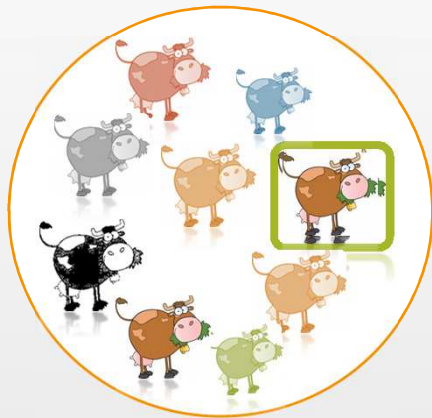


Reproduction



Survival

Selection



Diversity of individual robustness

Limited resources
Low energy



Essential functions



Lactation

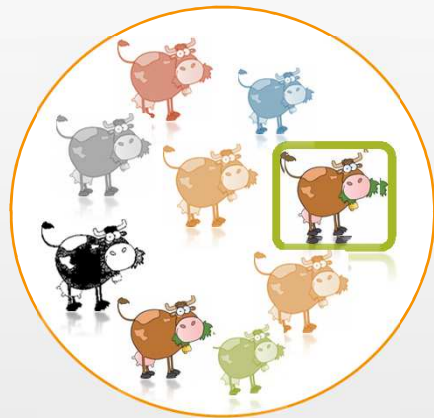


Reproduction



Survival

Selection



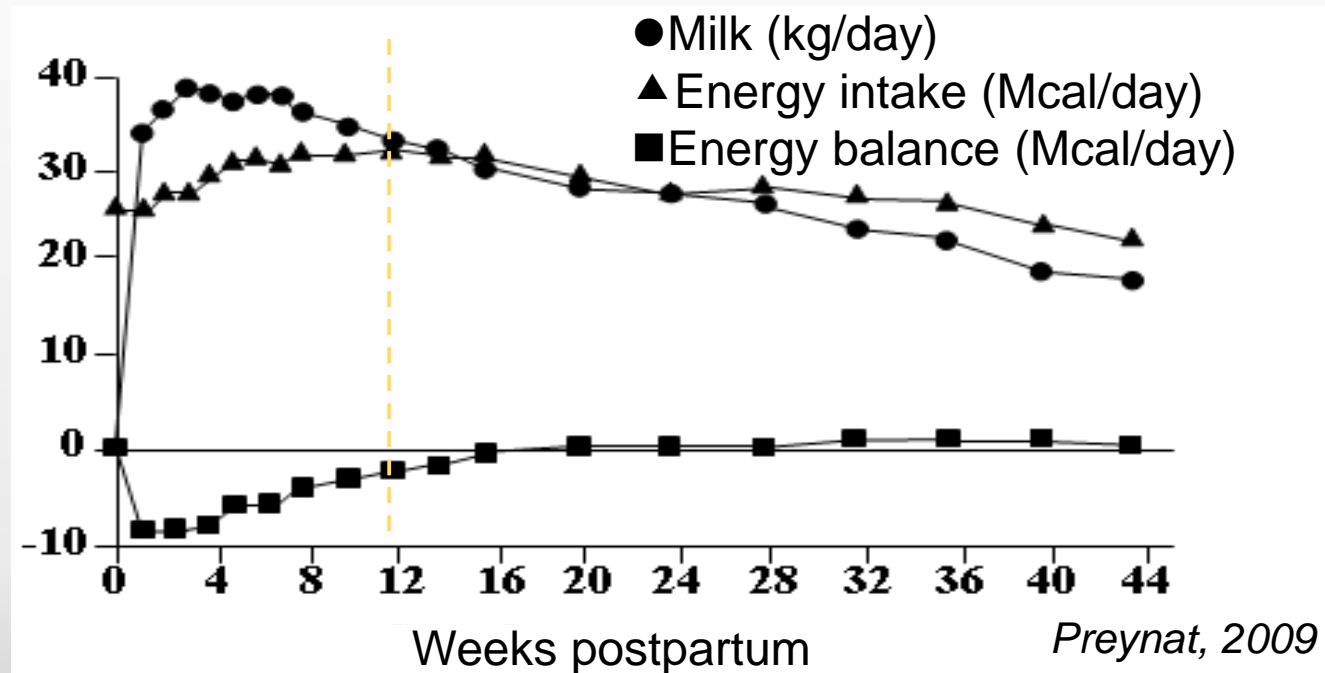
Trade-off profiles

Diversity of individual robustness

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

Diversity of individual robustness

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Diversity of individual robustness

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

Diversity of individual robustness

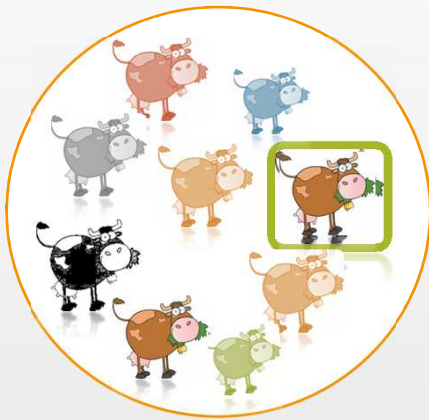
- Used the period 0-90d postpartum: suboptimal nutritional period (negative energy balance)
- Data from Inra experimental units of Mirecourt (2002-2012) et du Pin-au-Haras (2006-2011)
 - Data on milk yield, BCS, reproduction, individual characteristics (number lactation, âge at 1st calving...)
 - ➔ 334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

Diversity of individual robustness

Limited resources



Essential functions



Lactation



Reproduction

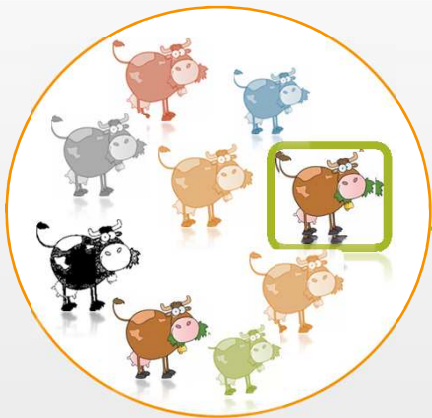
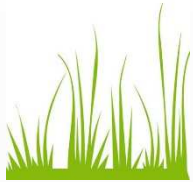


Survival



Diversity of individual robustness

Limited resources



Essential functions



Lactation



Reproduction



Survival

Period from 0 à 90j
postpartum

Milk production

- kg
- Shape of lactation curve

Length and success

- Insemination
- Conception
- Success rate

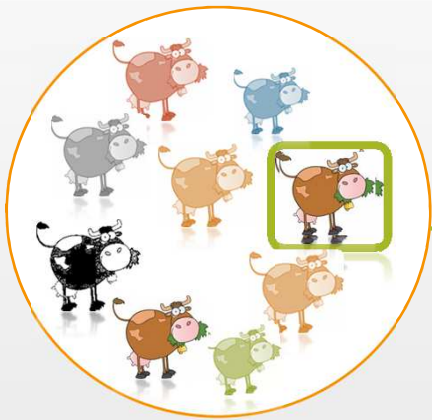
Body condition

- Score at calving
- Change



Diversity of individual robustness

Limited resources



Essential functions



Lactation



Reproduction



Survival

Period from 0 à 90j postpartum

Milk production

- kg
- Shape of lactation curve

Length and success

- Insemination
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Body condition

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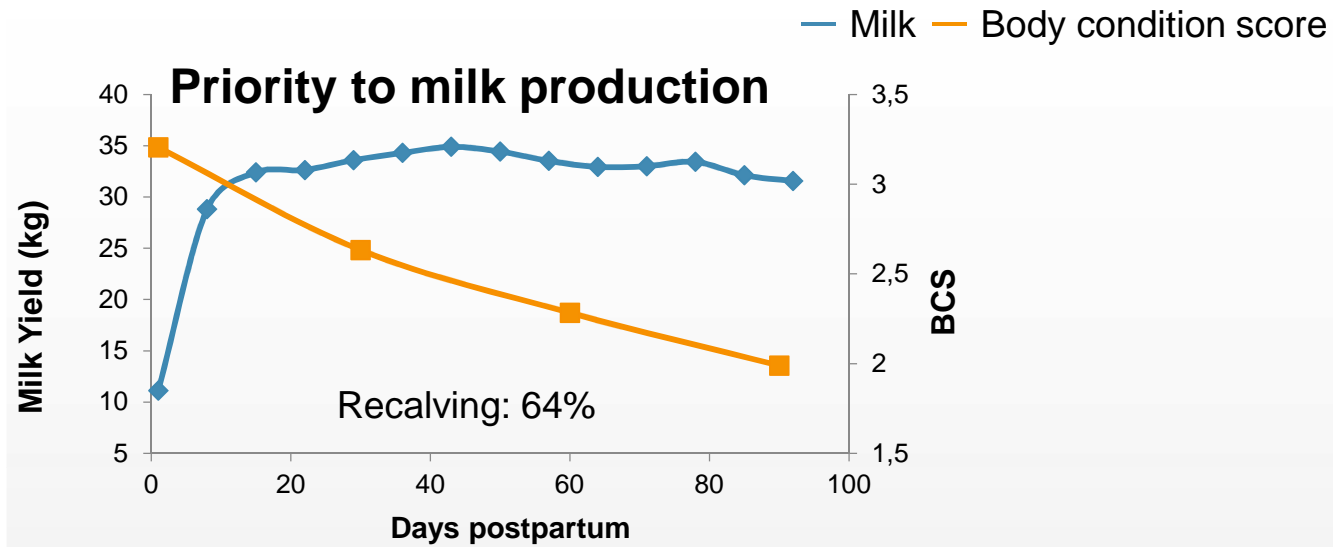


Diversity of individual robustness

— Milk — Body condition score

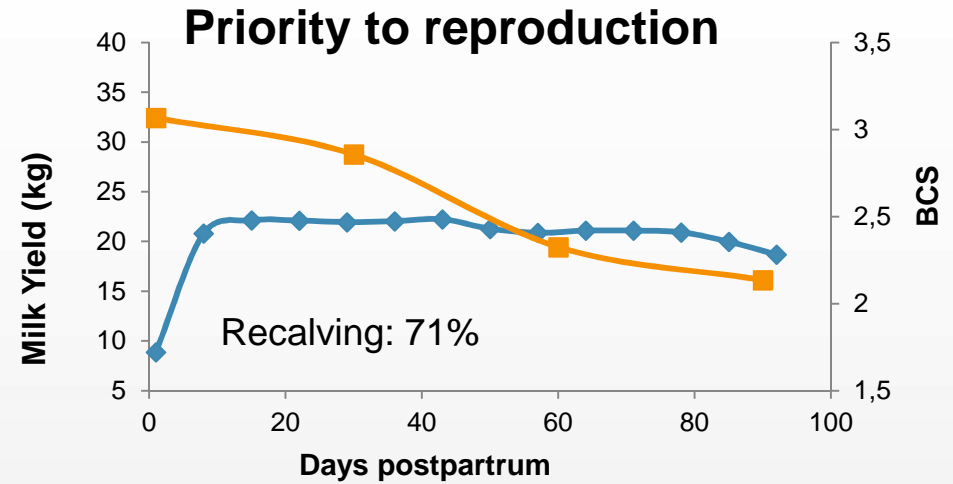
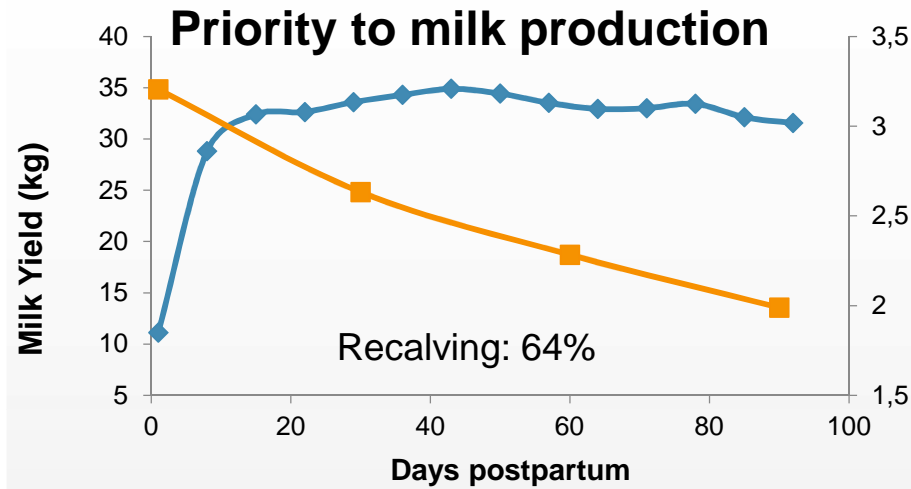


Diversity of individual robustness



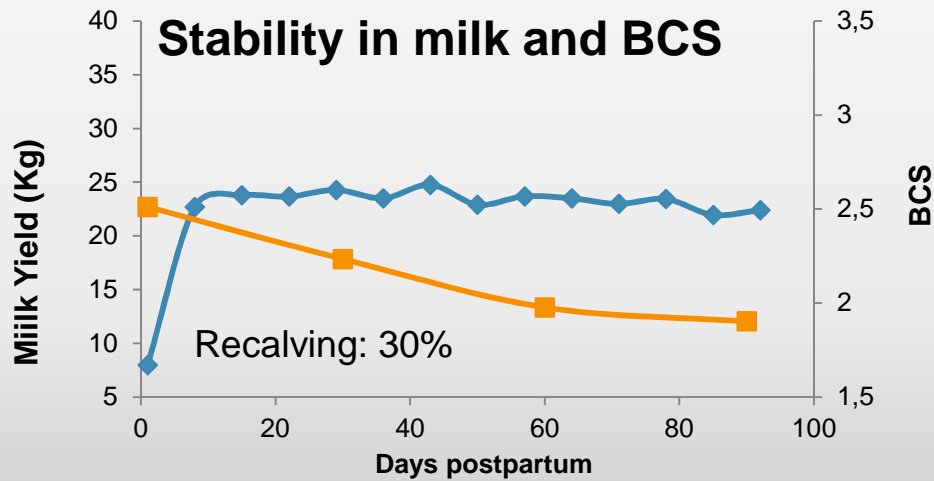
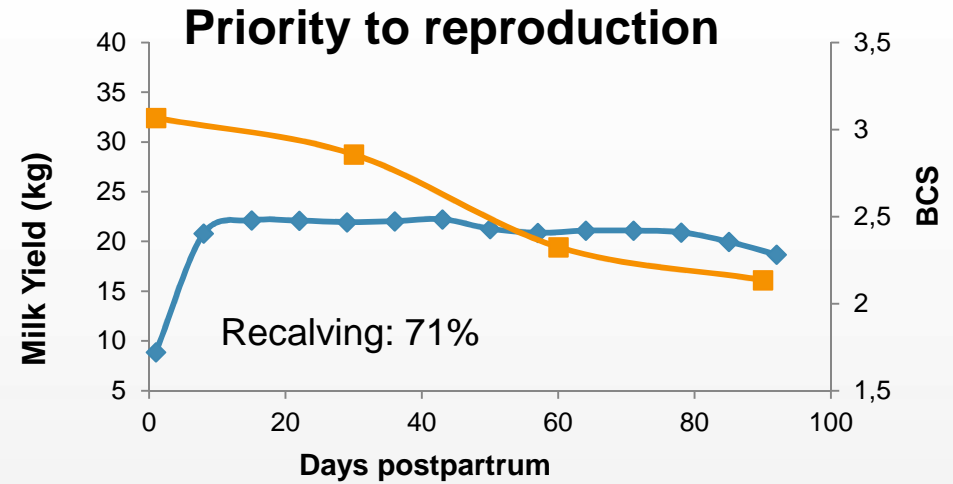
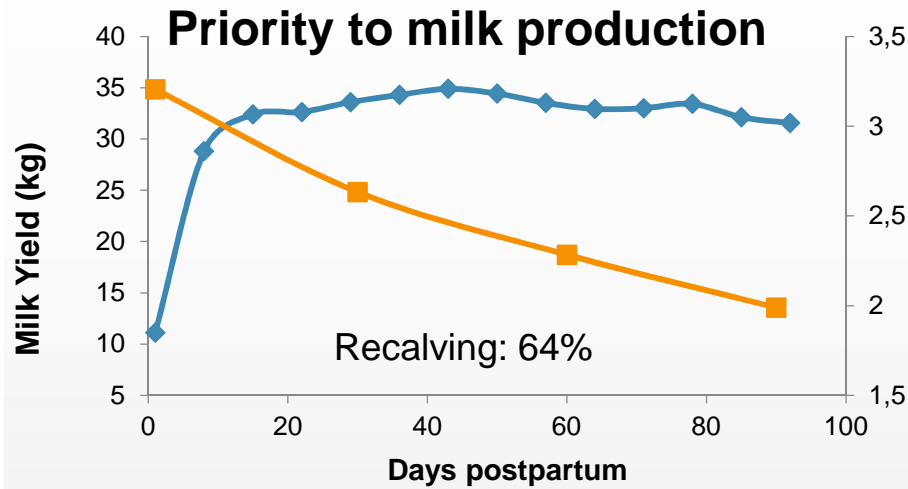
Diversity of individual robustness

— Milk — Body condition score



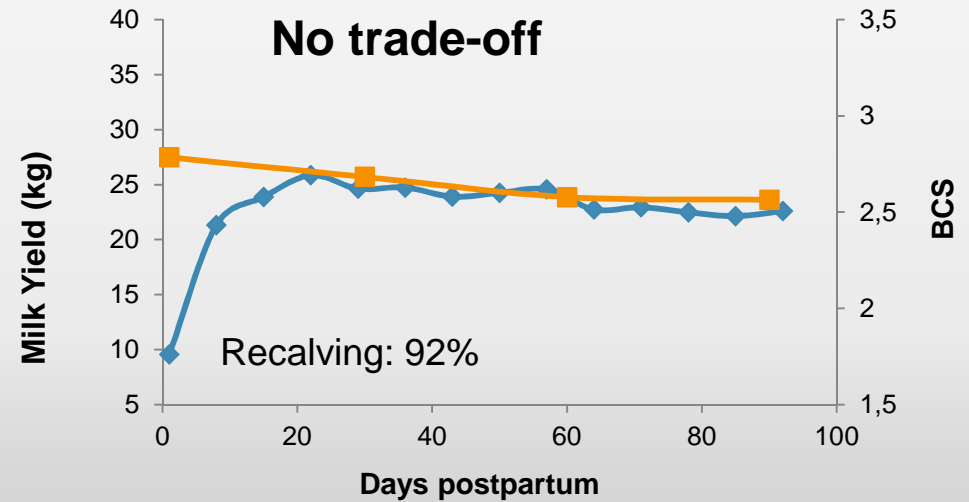
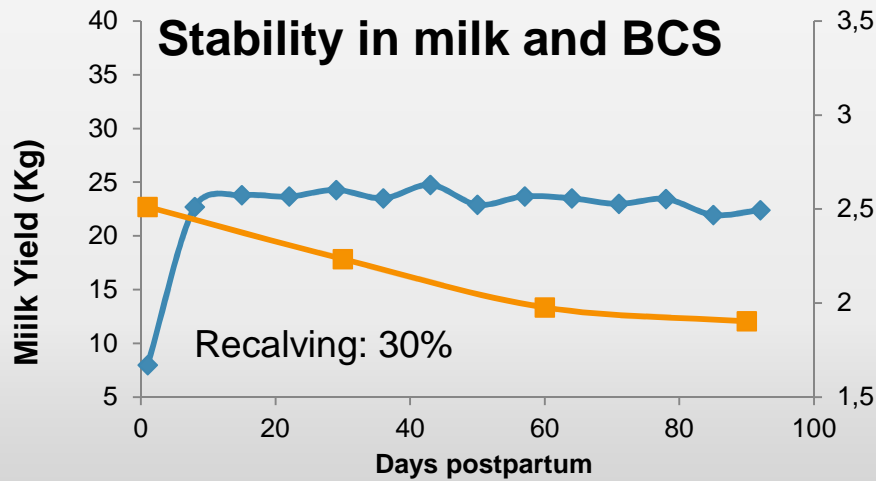
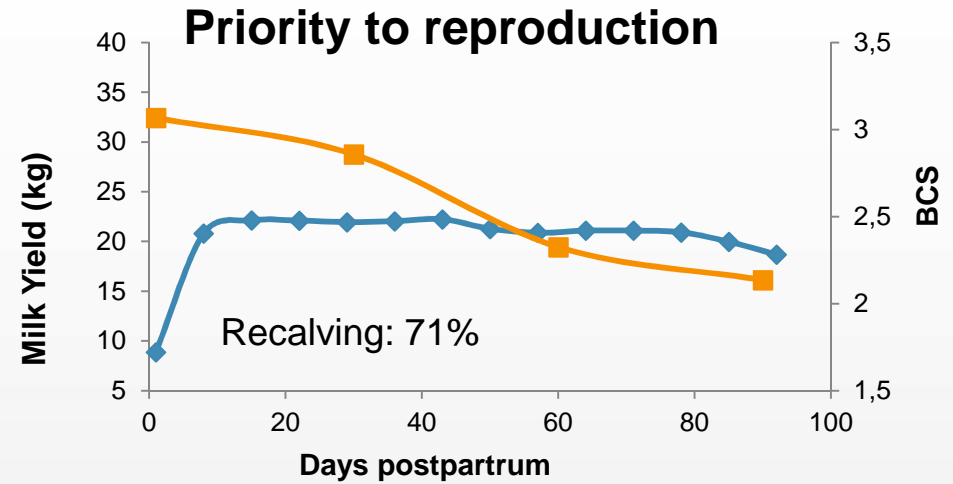
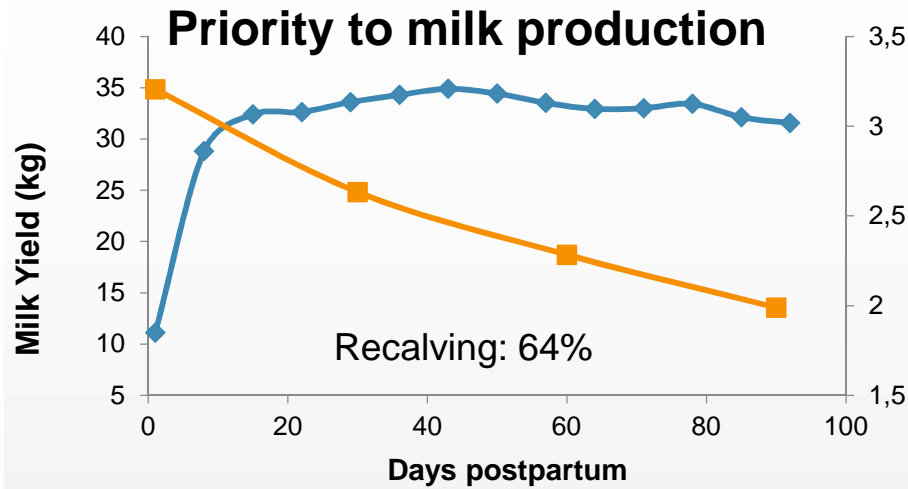
Diversity of individual robustness

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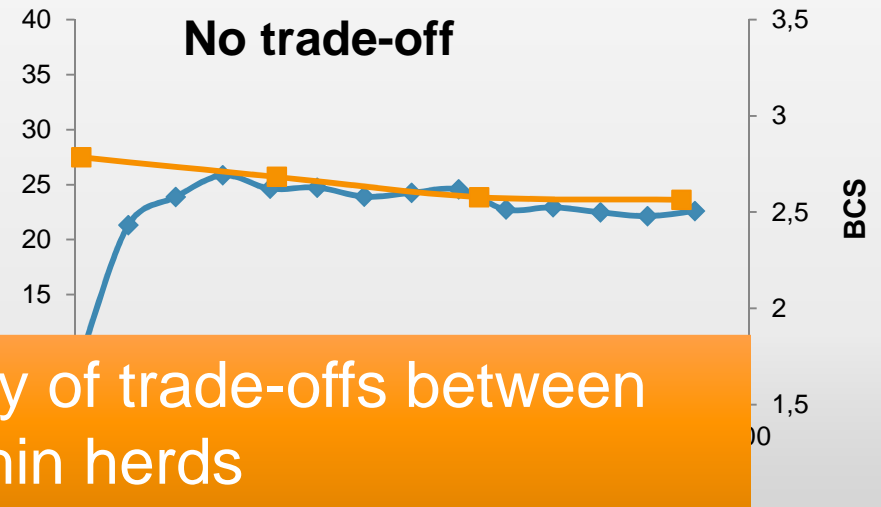
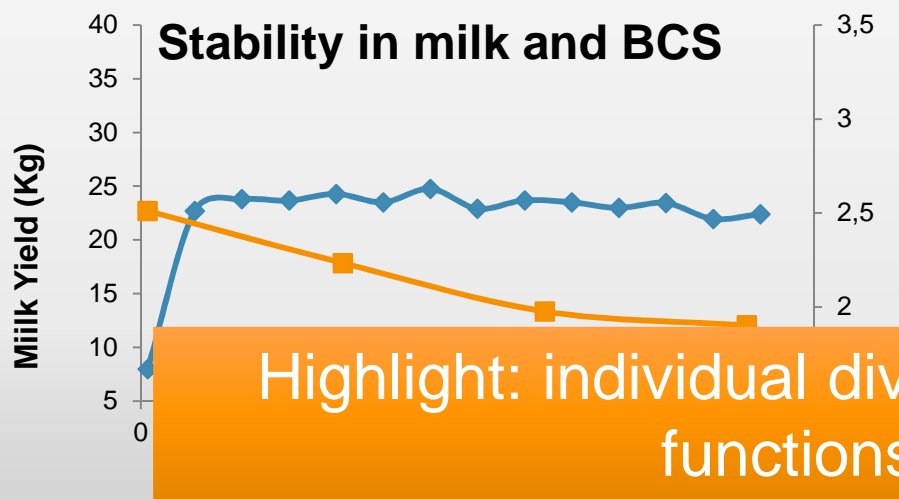
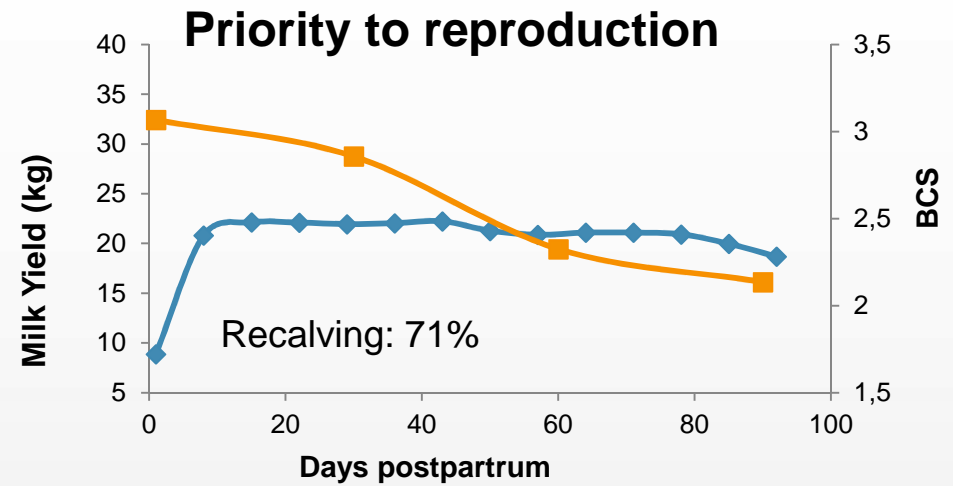
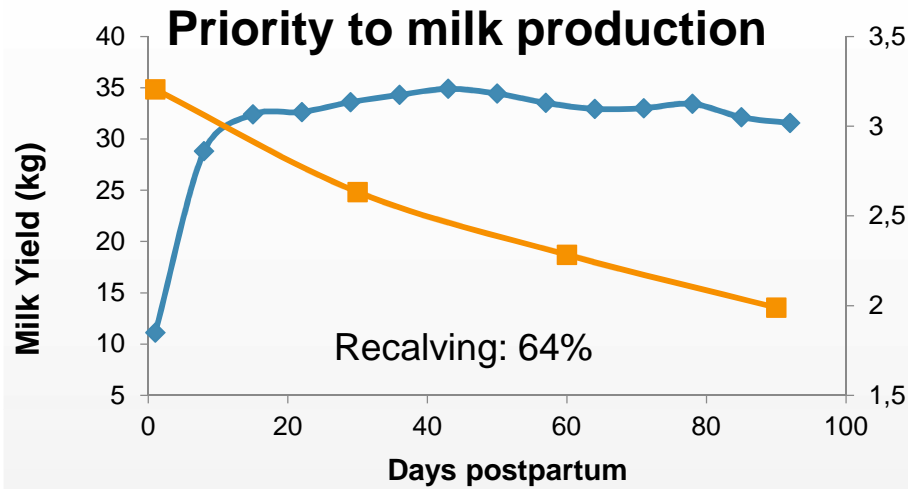
Diversity of individual robustness

— Milk — Body condition score



Diversity of individual robustness

— Milk — Body condition score



Highlight: individual diversity of trade-offs between functions within herds

Diversity of individual robustness



Profile 1



Profile 2



Profile 3

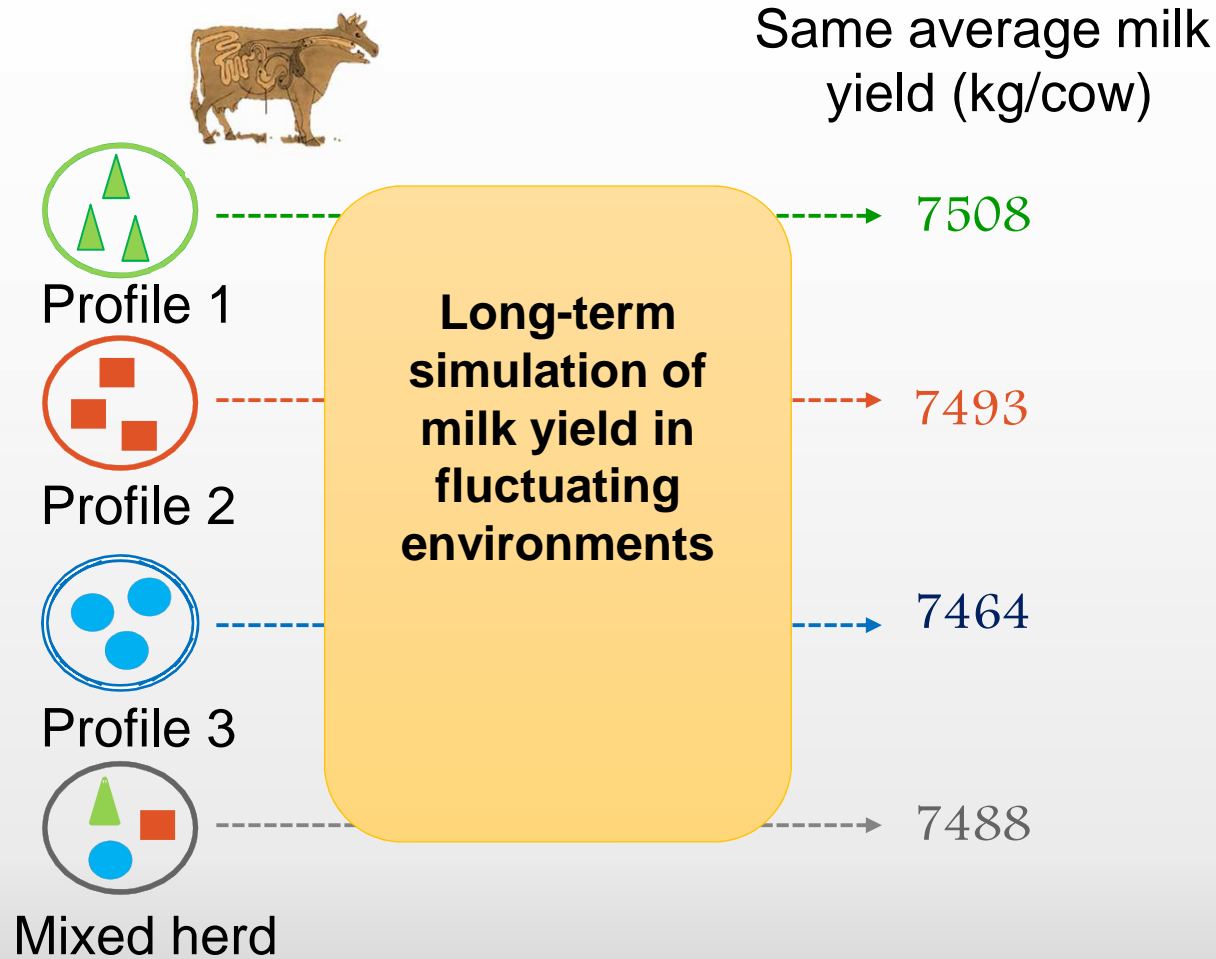


Mixed herd

**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



Profile 1



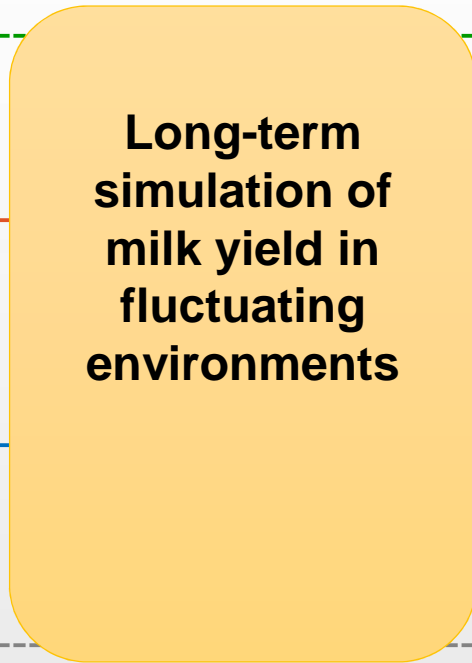
Profile 2



Profile 3



Mixed herd



Long-term
simulation of
milk yield in
fluctuating
environments

Same average milk
yield (kg/cow)

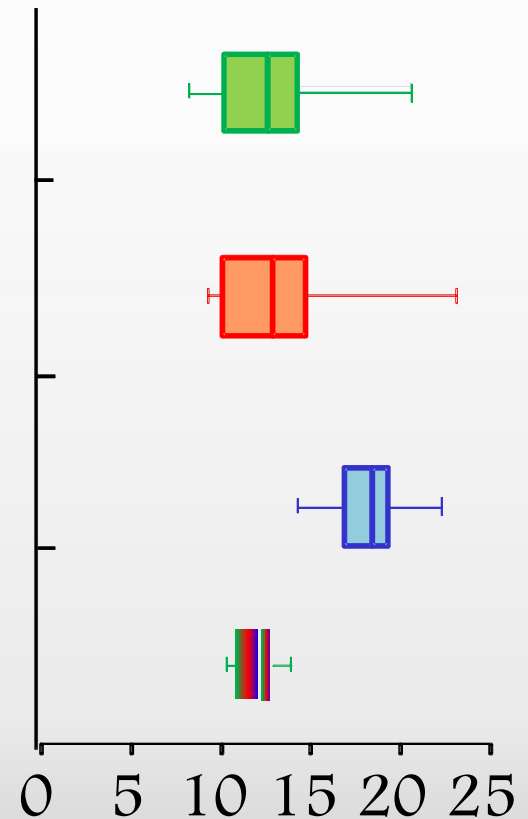
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7493

7464

7488

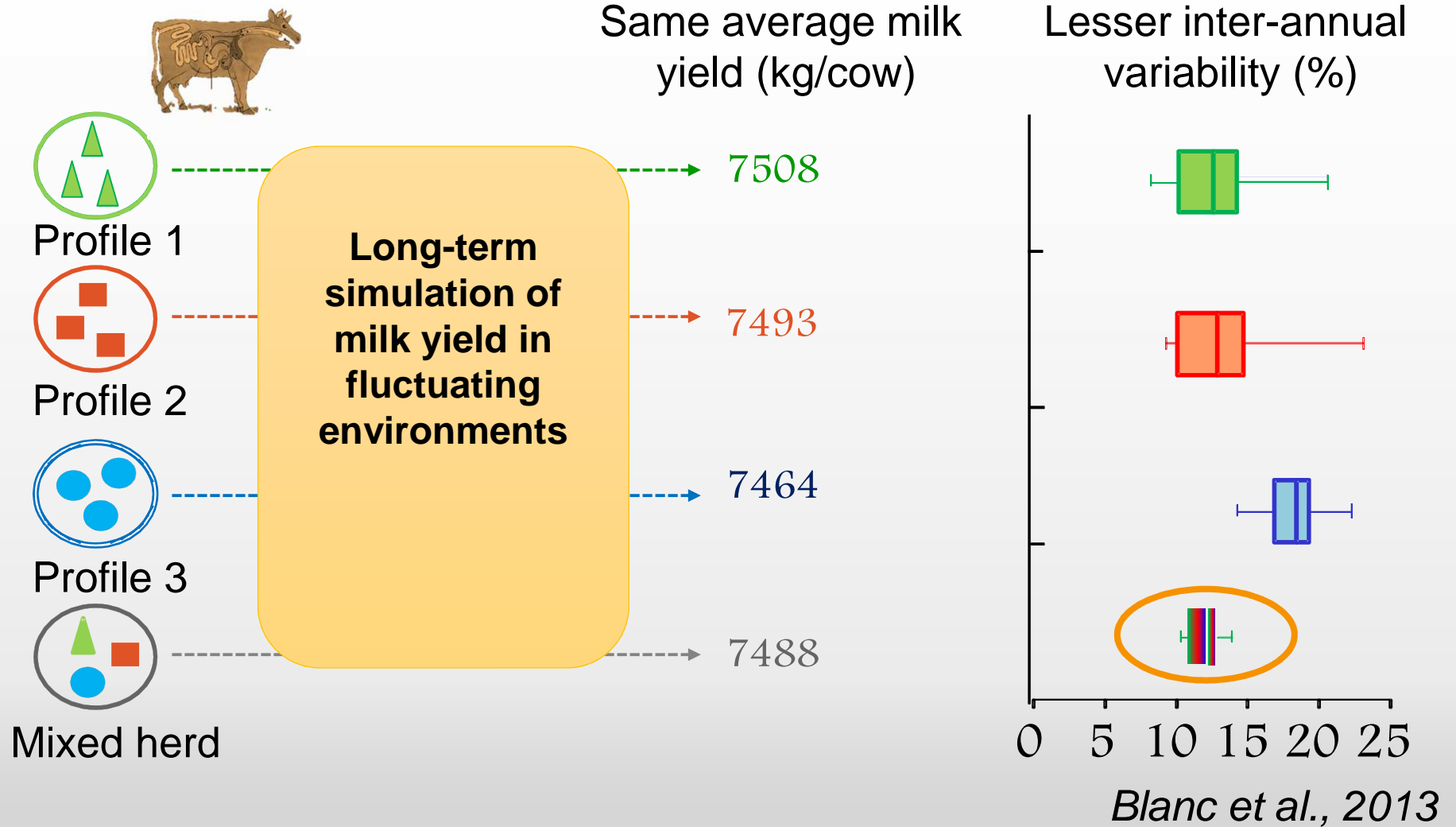
Lesser inter-annual
variability (%)



Blanc et al., 2013



Diversity of individual robustness



Diversity of individual robustness



Profile 1



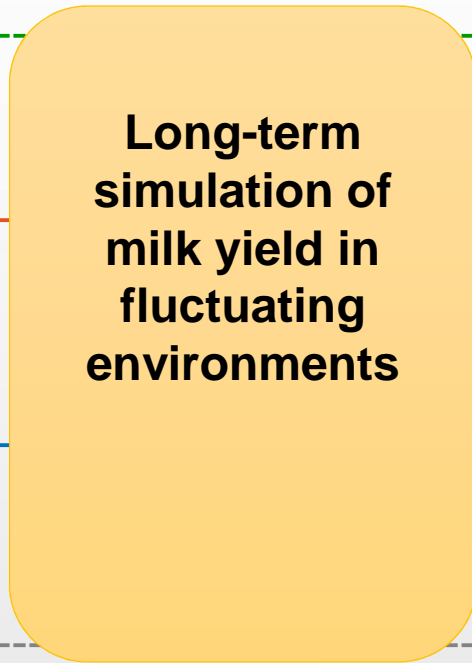
Profile 2



Profile 3



Mix



Same average milk yield (kg/cow)

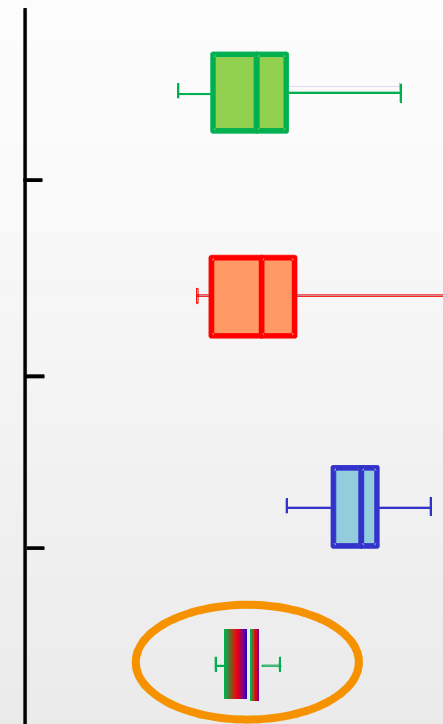
7508

7493

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Lesser inter-annual variability (%)



The diversity of individual trade-off profiles within the herd does not increase production but brings stability

And on the field?

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And on the field?

ELEVAGE

L'homogénéité du troupeau chez les ruminants

L'une des premières causes de mauvaise santé animale en bâtiment vient d'une inadaptation de la ration. Il n'est pas rare que pour faire face à l'hétérogénéité de la production des animaux les individus les moins performants soient suralimentés et les plus performants soient sous alimentés. L'homogénéité du troupeau est une étape indispensable pour adapter au mieux la ration.

Formation

La Maison des Paysans vous propose de former. L'objectif est de redécouvrir la physiologie de la digestion des ruminants et la méthode 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 lieu le 13 janvier dans le secteur de Giat et le secteur de Thiers. **Plus d'infos : 04 73**

la propreté, la vitalité des animaux. Sur un troupeau homogène qui présente un ensemble d'animaux maigres, sales ou fatigués, le paysan aura tout intérêt à adapter l'alimentation de son troupeau afin d'améliorer sa qualité. En revanche, un troupeau hétérogène, avec quelques

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

« il faut

and

sura


ateu

ns. Devant un groupe de paysans des alentours, il précise les objectifs de l'homogénéité du troupeau. Effectivement, sur les photographies qui défilent, la situation est frappante.

doivent se dérouler sur une dizaine de jours (les ruminants n'aiment pas les changements). Il n'est en revanche pas

du comportement social, le troupeau doit également offrir une homogénéité visuelle en ce qui concerne l'état d'entretien,

présentent des symptômes. Il serait contreproductif de se débarrasser des



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

And on the field?

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And on the field?

➔ 39 surveyed dairy farms in three distinct dairy areas

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And on the field?

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And on the field?

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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

▪

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▪

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- ⇒ 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

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⇒ Already existing diversity:

- Herd size: from 25 to 200
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⇒ 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

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Take home messages

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

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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

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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

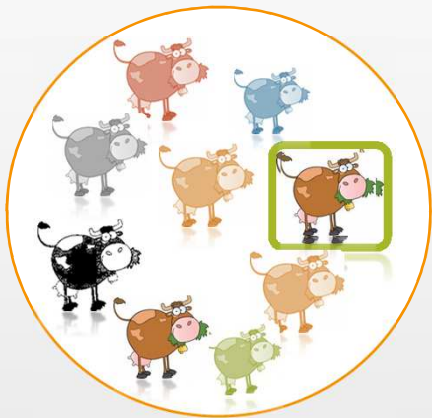
Take home messages

- ⇒ 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

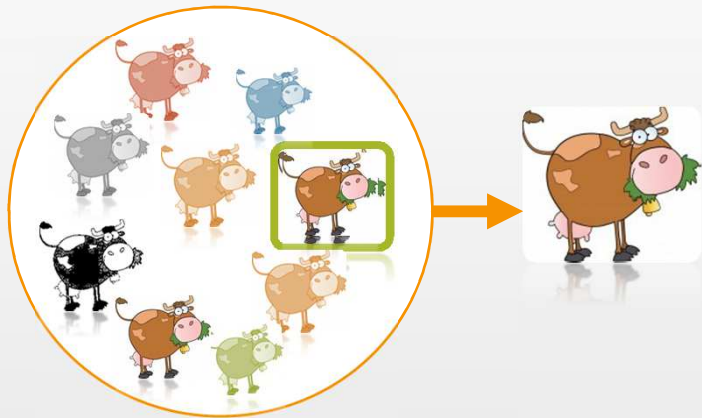
Thank you for your attention



Diversity of individual robustness

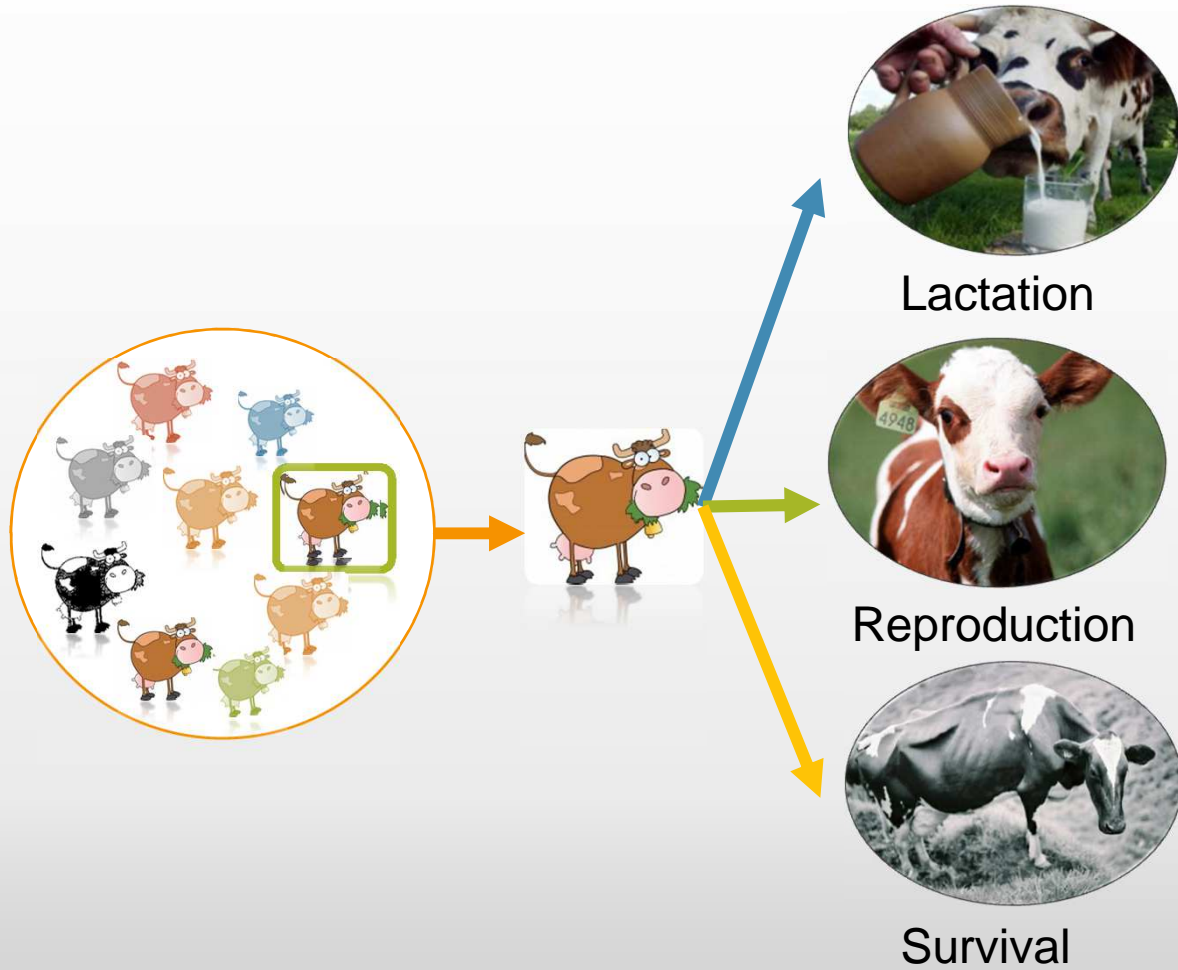


Diversity of individual robustness



Diversity of individual robustness

Essential functions



Lactation



Reproduction



Survival

Diversity of individual robustness

Limited resources
Low energy



Essential functions



Lactation

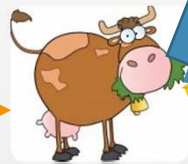
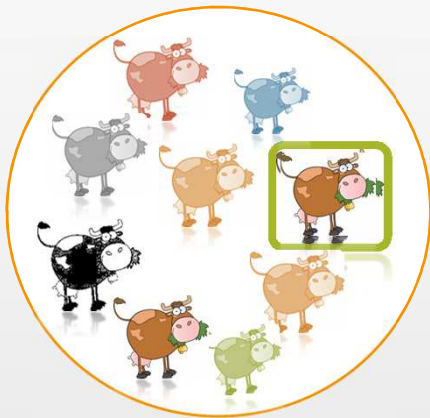


Reproduction



Survival

Selection



Diversity of individual robustness

Limited resources
Low energy



Essential functions



Lactation

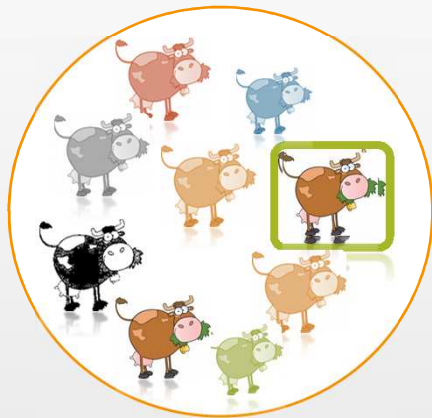


Reproduction



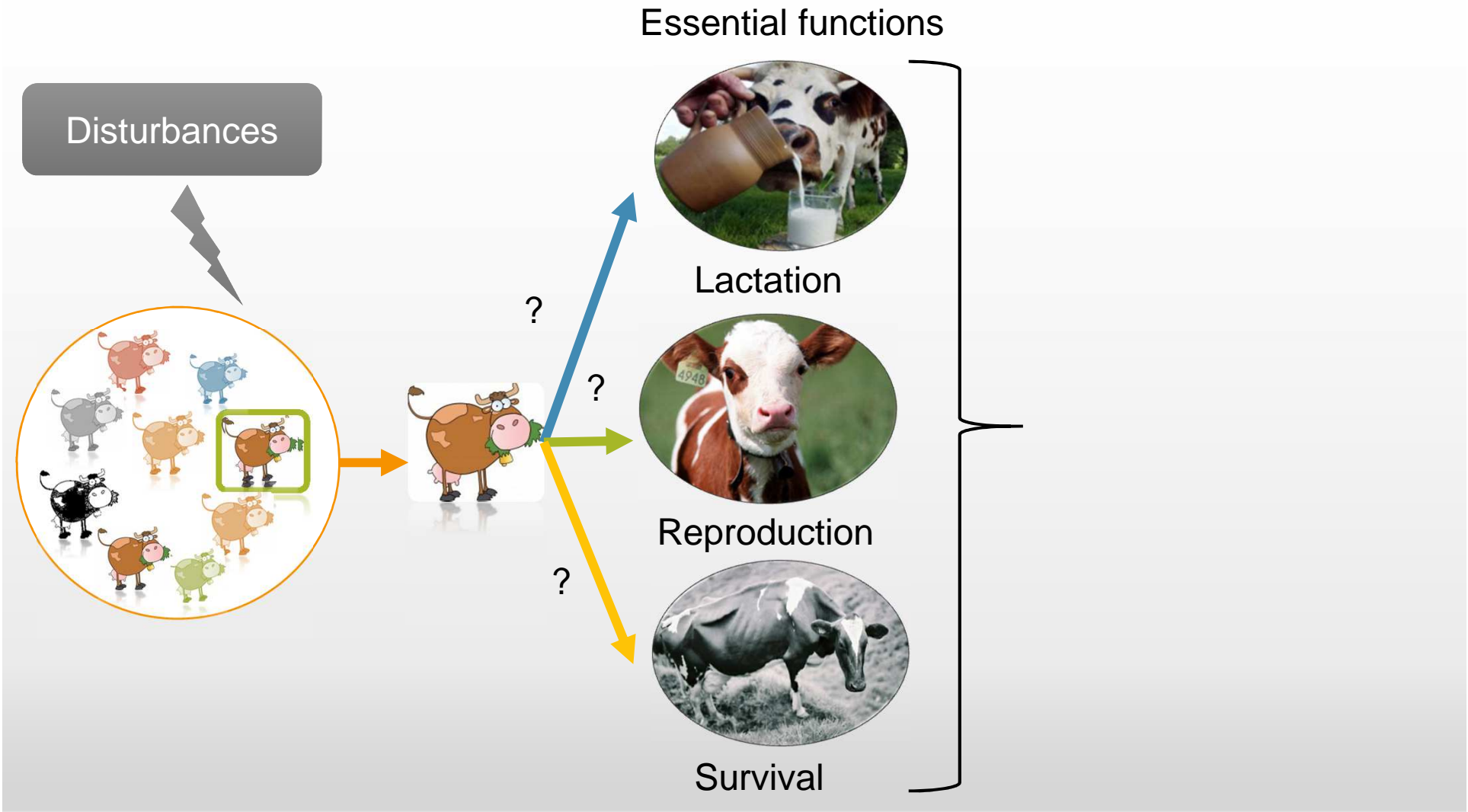
Survival

Selection

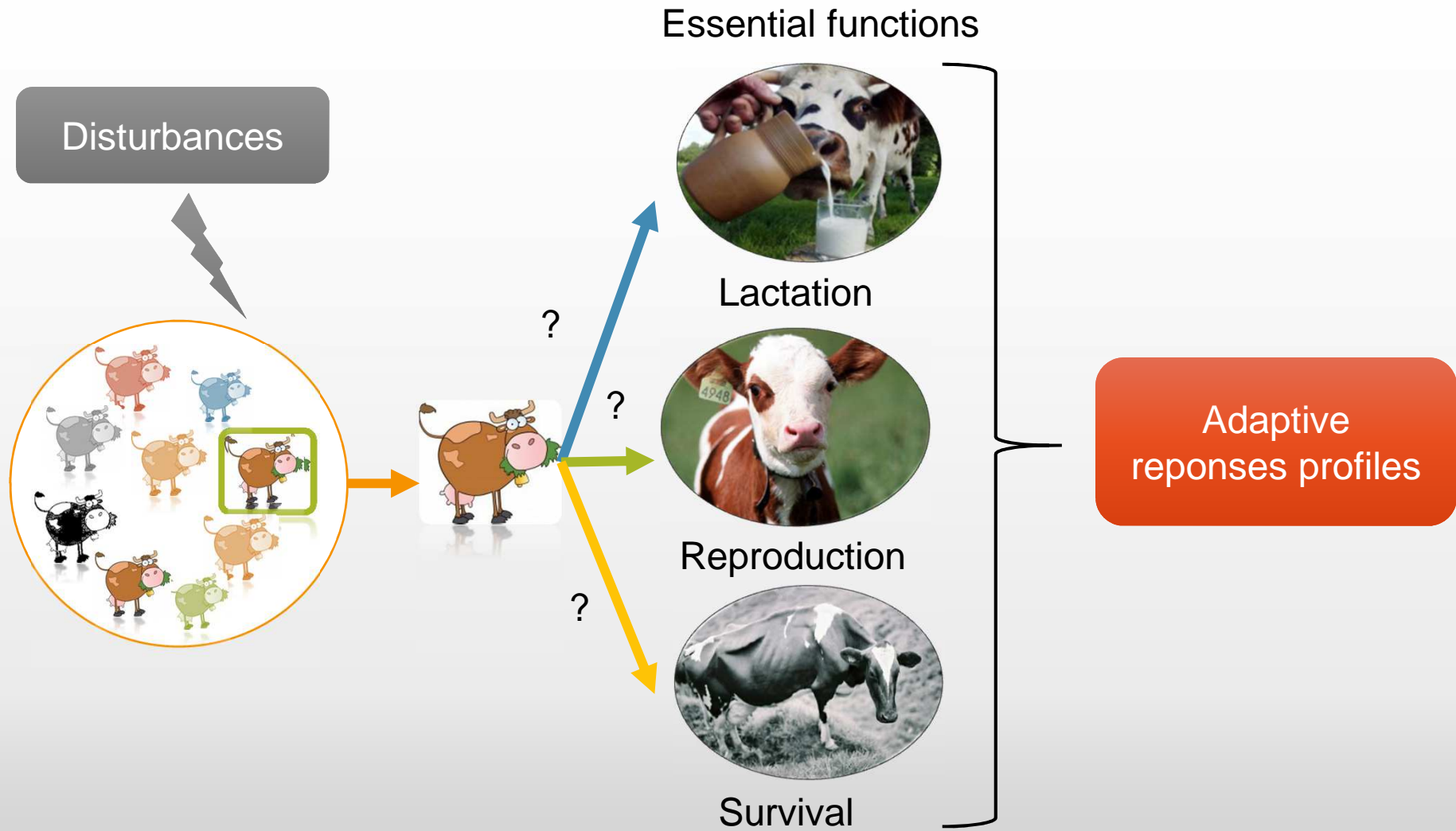


Trade-off profiles

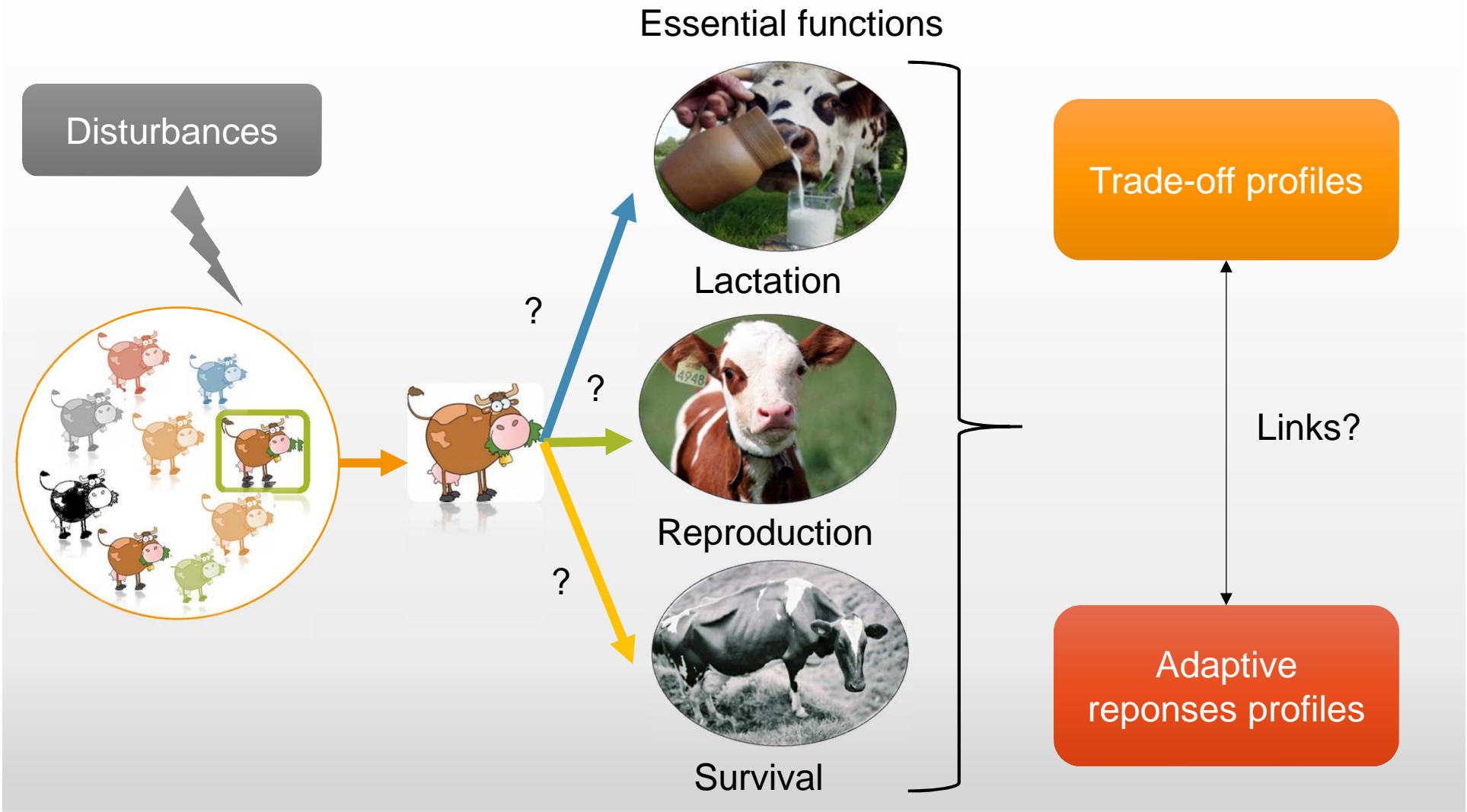
Diversity of individual robustness



Diversity of individual robustness



Diversity of individual robustness



Diversity of individual robustness

