





Risorse ~ Webinar I nostri associati costituiscono la nostra rete primaria di conoscenze e competenze ed ogni nuovo membro ha la possibilità di accedere a tale ricchezza multidisciplinare verificando quale sia l'associato pi o a casa sua o l'istituzione, cui egli appartiene, per avere un punto di riferimento cui rivolgersi per avvicinarsi alla



https://www.systemdynamics.it http://www.systemsthinking.it



info@systemdynamics.it





#### Seguici su:

SYstemDynamicsItalianChapter

twitter SYDIC\_ITALIA

Linked in

SYDIC (SYstem Dynamics Italian Chapter)

YouTube System Dynamics Italian Chapter



#### **COVID-19 Resources and Information**

It's time to renew your membership in the Society for 2020!

All Society memberships lapse on January 1st of the year. Please renew now, if you have not already done so. If you are not yet a member, please join now.

2020 SD Conference Coronavirus Update - 26 March 2020





## Thinking in Systems

"The problems we have created in the world today will not be solved by the level of thinking that created them."

--Albert Einstein

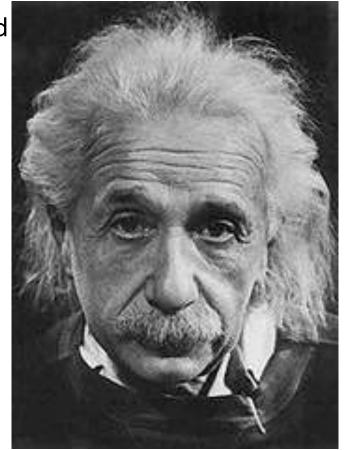


Image Source: Flickr Creative Commons, by mansionwb



## The World's Biggest Problems

- Armed Conflict
- Spread of Infectious Disease
- Growing Population
- Availability of Energy
- International Terrorism
- The Economy
- Climate Change
- Poverty, Hunger, Lack of Water



Date Source: Eurobarometer survey of the EU, 2011

Image Source: 123RF



Why Do These Problems Persist?



## Schools Have Not Prepared Students to Solve Them



### Learning to solve this...

A car averages 27 miles per gallon. If gas costs \$4.04 per gallon, which of the following is closest to how much the gas would cost for this car to travel 2,727 typical miles?

- A. \$44.44
- B. \$109.08
- C. \$118.80
- D. \$408.04
- E. \$444.40



Question Source: ACT Prep Image Source: MarketMixup



## won't teach you to solve this.

The United States consume more than 20% (7 billion barrels) of the world's oil supply annually, yet only have 2% of the world's proven oil reserves. What factors will determine when we reach "peak oil"—the point in time when the maximum rate of

petroleum extraction is reached, after which the rate of oil production is expected to enter terminal decline?



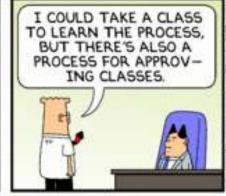
Image Source: OnlineBikeMania

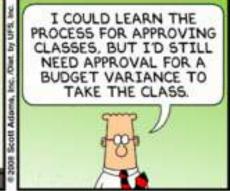


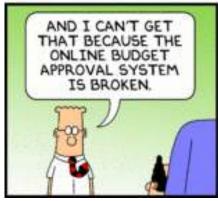
## The Dilbert System

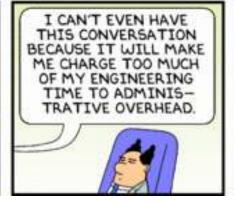








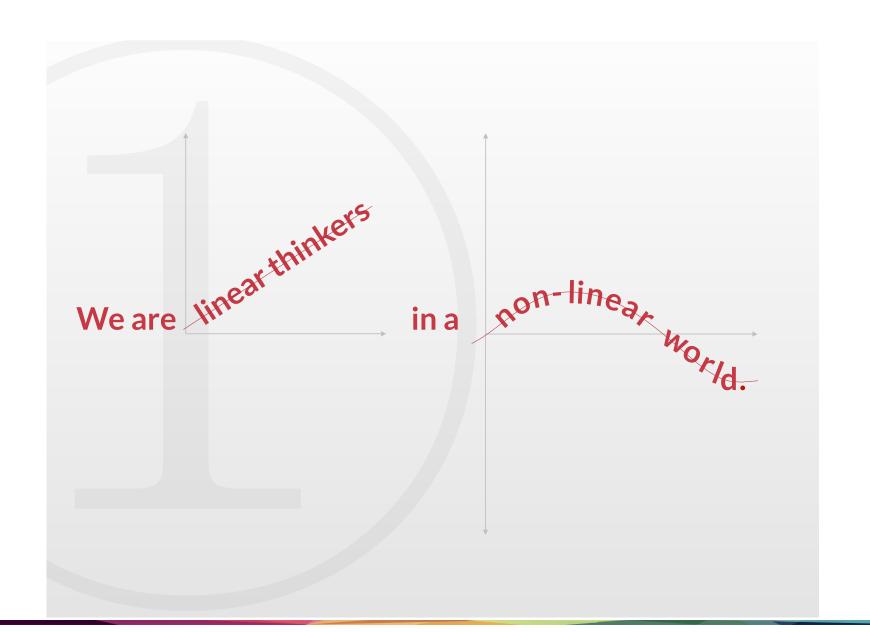






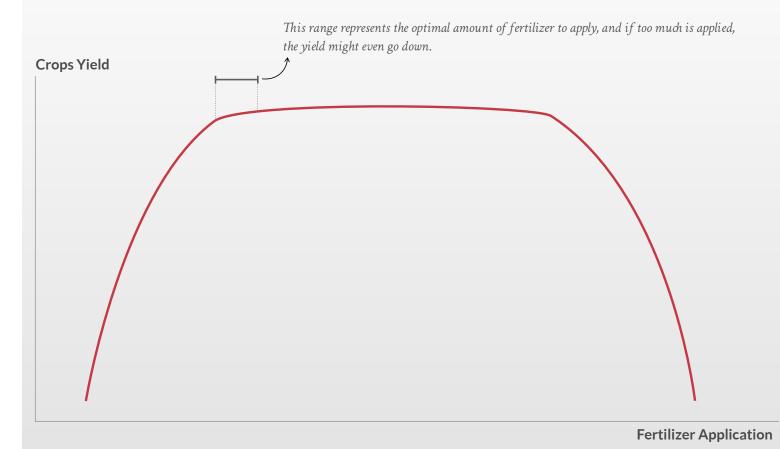








## In a nonlinear relationship, the cause does not produce a proportional effect.





Reality is made up of circles, but we see straight lines. Herein lies the beginnings of our limitation as systems thinkers.

**Peter Senge** 



**BOUNDED RATIONALITY** 

### In decision making, rationality of individuals is limited by the information they have.



Fishermen are not aware of the total number of fish in the ocean or how many fish others harvest. This is a typical example of a dilemma referred to as "The Tragedy of the Commons" - a situation in which a group of individuals act rationally in their own self-interest and deplete a shared limited resource.

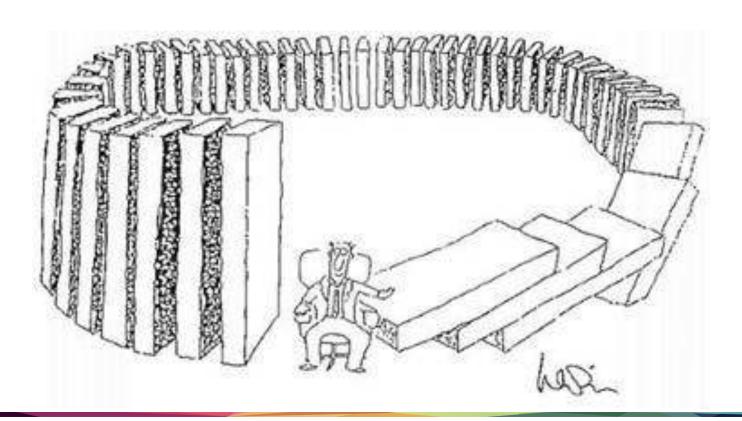


## What you see is "not" what you get...





# Counter-intuitive Behaviours: Misperceptions of Delays





# Counter-intuitive Behaviours: Misperceptions of Feedbacks





# Counter-intuitive Behaviours: policy resistance





#### **Editorial Initiatives**

- Translation into Italian of the seminal book from Donella H. Meadows «Thinking in Systems» (Italian: «Pensare per Sistemi») -<a href="https://guerini.it/index.php/pensare-per-sistemi.html">https://guerini.it/index.php/pensare-per-sistemi.html</a>
- Support to the new italian edition of the book from Peter Senge «The Fifth Discipline» (Italian: «La Quinta disciplina») <a href="https://www.editorialescientifica.com/materia/organizzazione/organizzazione-aziendale-e-management/la-quinta-disciplina-detail.html">https://www.editorialescientifica.com/materia/organizzazione-aziendale-e-management/la-quinta-disciplina-detail.html</a>
- Coordination of several Special Issues on top ranked journals (Journal of Simulation - to be published -, <u>Kybernetes</u>, <u>SYSTEMS</u>, <u>IJASS</u>, etc.)







#### Alberto Stanislao Atzori

Ricercatore di Nutrizione animale (RTDb) all'Università di Sassari







Education
Laurea in Agraria- 2003
PhD in Scienze Zootecniche - 2008
Visiting Scholar UCLM (Spain) - 2004
Post-doc Texas A&M University (USA) - 2011

#### **Docenza**

Produzioni Animali Laurea Tecnologie Alimentari System Dynamics Modeling Dottorato

**Ricerca:** aspetti nutrizionali legati all'efficienza produttiva e all'impatto ambientale degli allevamenti

Ecological footprint della produzione del latte





#### Complex systems understanding and System dynamics modeling

#### Dal 2011:

**VP Secretary of System Dynamics Italian Chapter** 



#### Dal 2016:

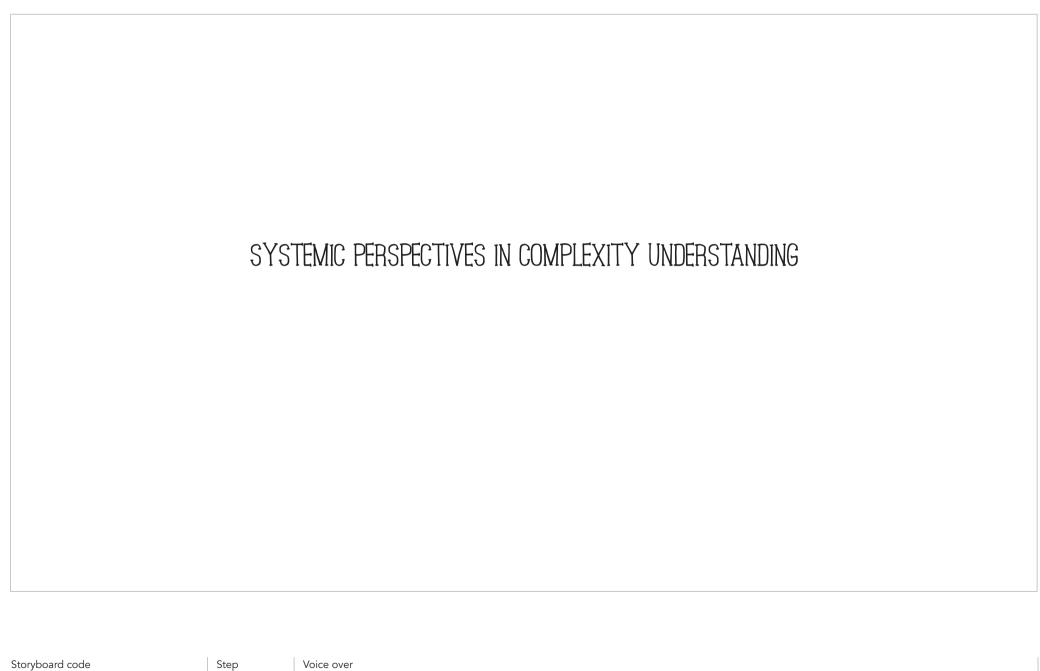
Special interested group in Agriculture and Food



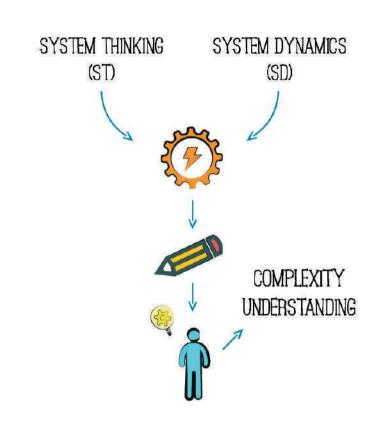
Applicazioni System Dynamics per formulare policy nel settore agroambientale

- Gestione aziende zootecniche
- Impatto ambientale degli allevamenti
- Nuovi metodi didattici in zootecnica
- Gestione delle risorse idriche





10-B (Atzori) 01





Storyboard code

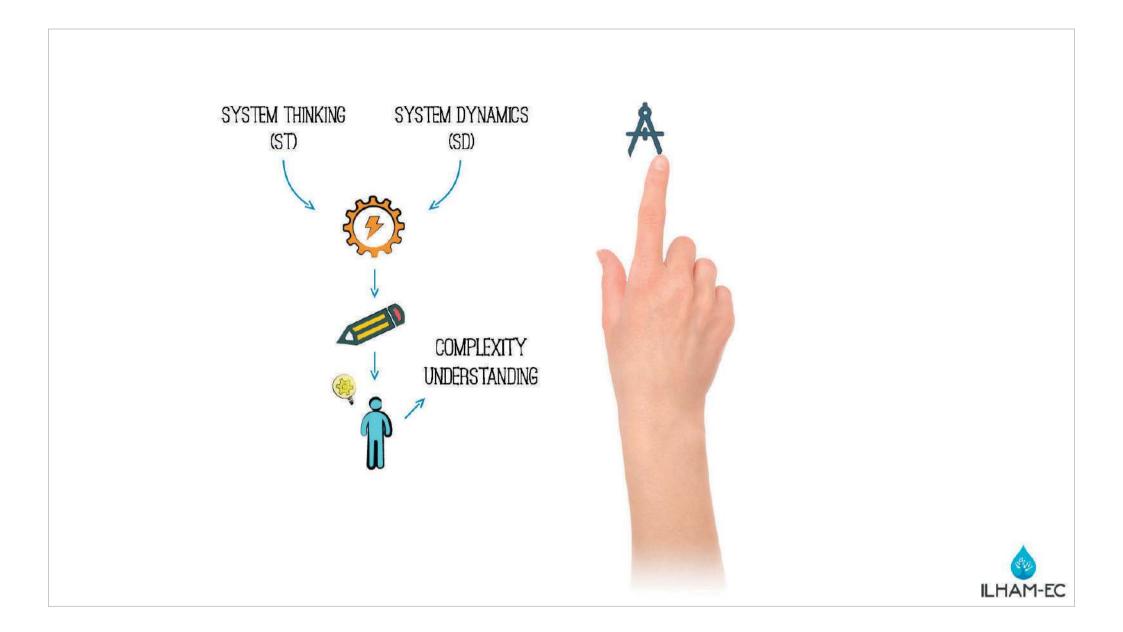
Step

Voice over

10-B (Atzori)

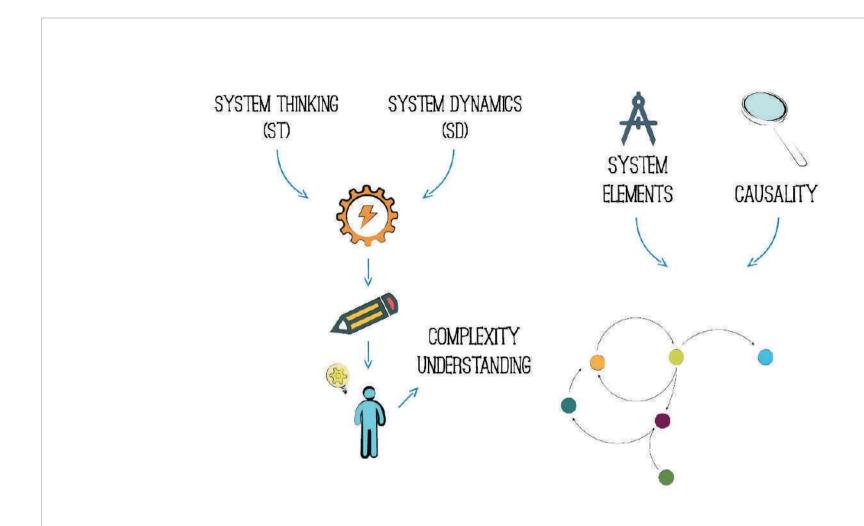
07

complexity understanding.



Storyboard code Step Voice over

10-B (Atzori) 08 Mapping





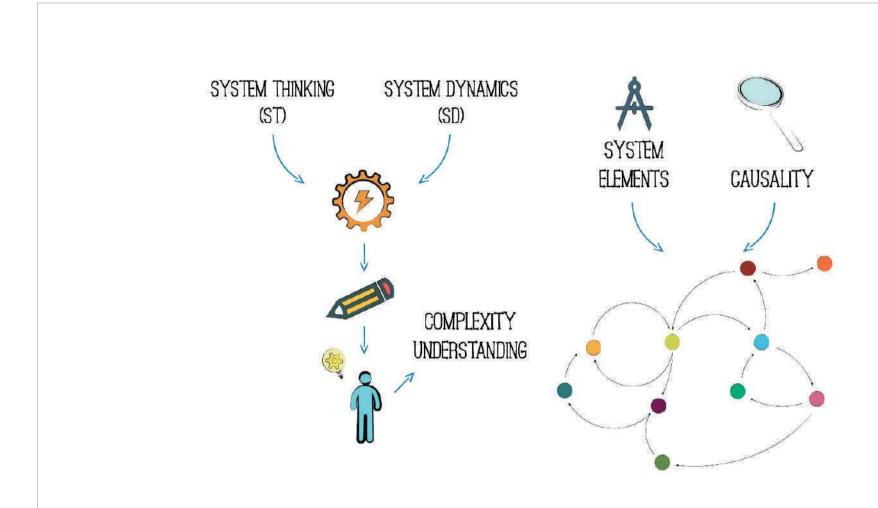
Storyboard code

Step

Voice over

10-B (Atzori)

13 the connections





Storyboard code

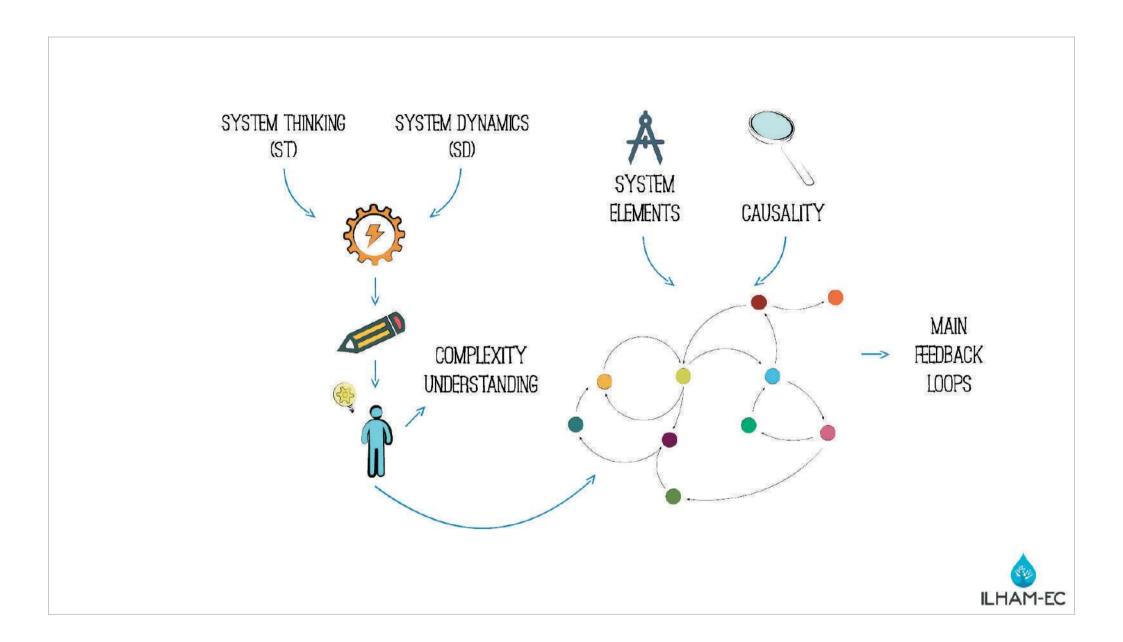
Step

Voice over

10-B (Atzori)

14

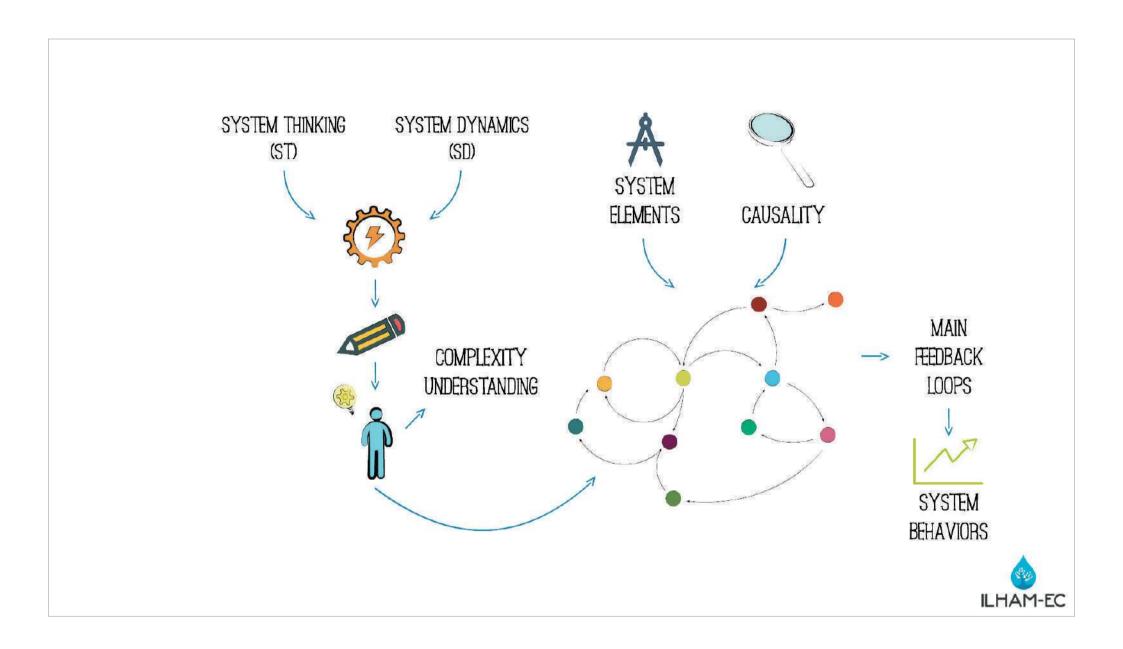
among variables,



Storyboard code Step 16

10-B (Atzori)

Voice over



Storyboard code

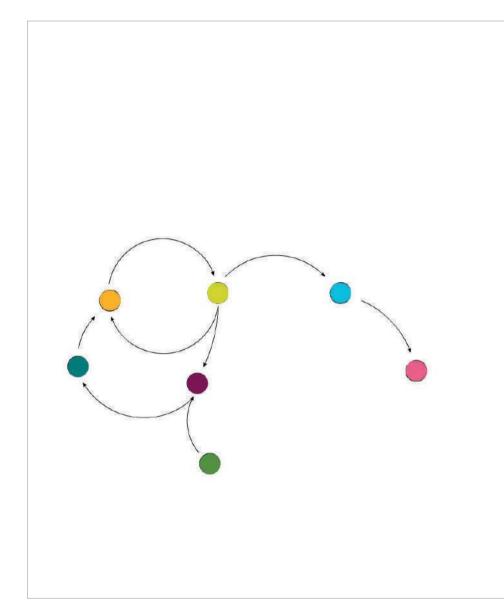
Step

Voice over

10-B (Atzori)

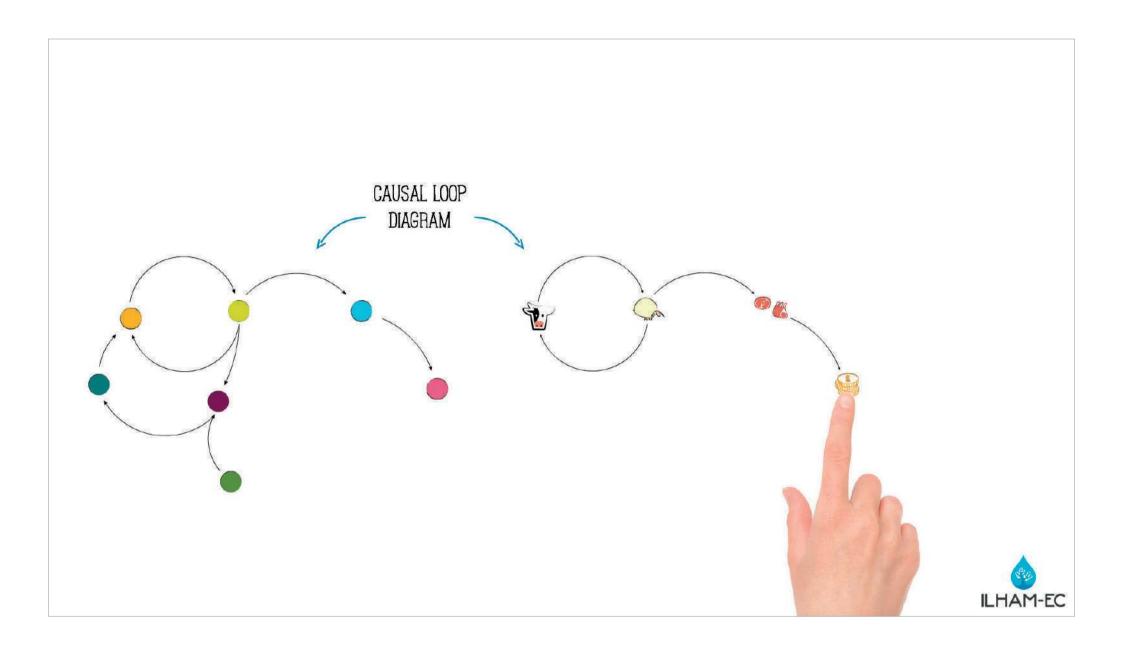
17

They are driving the system behaviors.

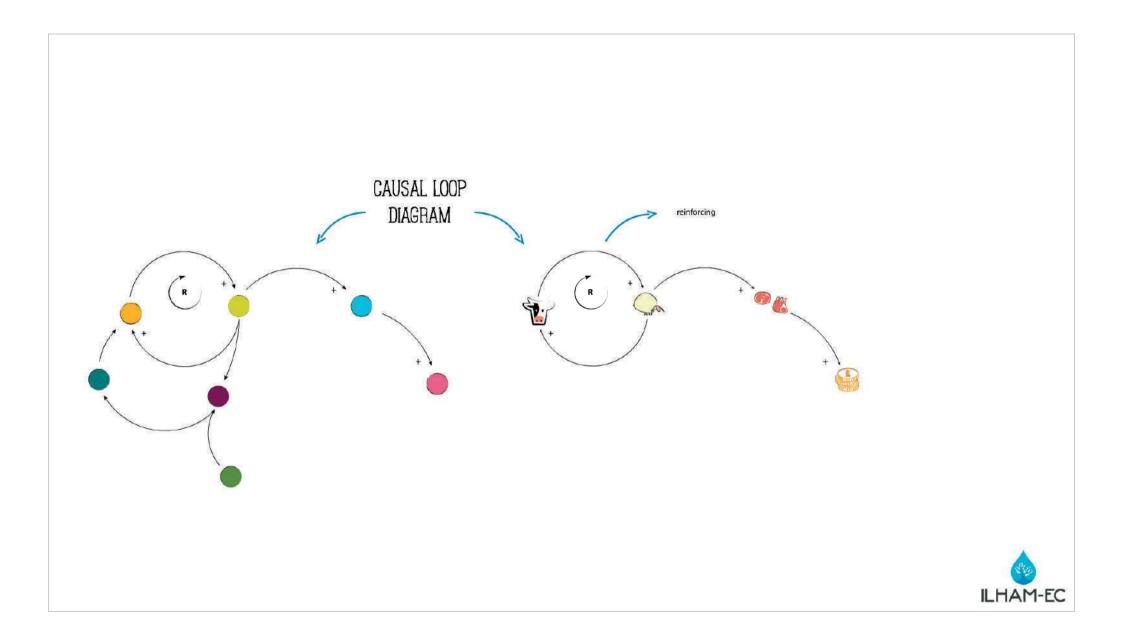




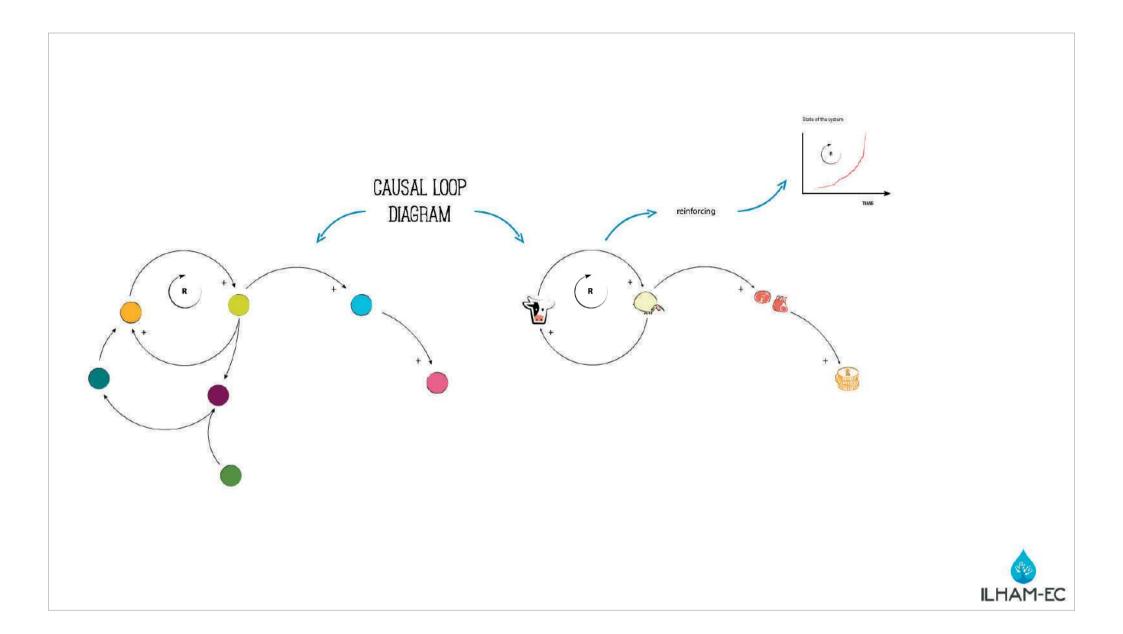
Storyboard code	Step	Voice over
10-B (Atzori)	18	Just qualitatively reading



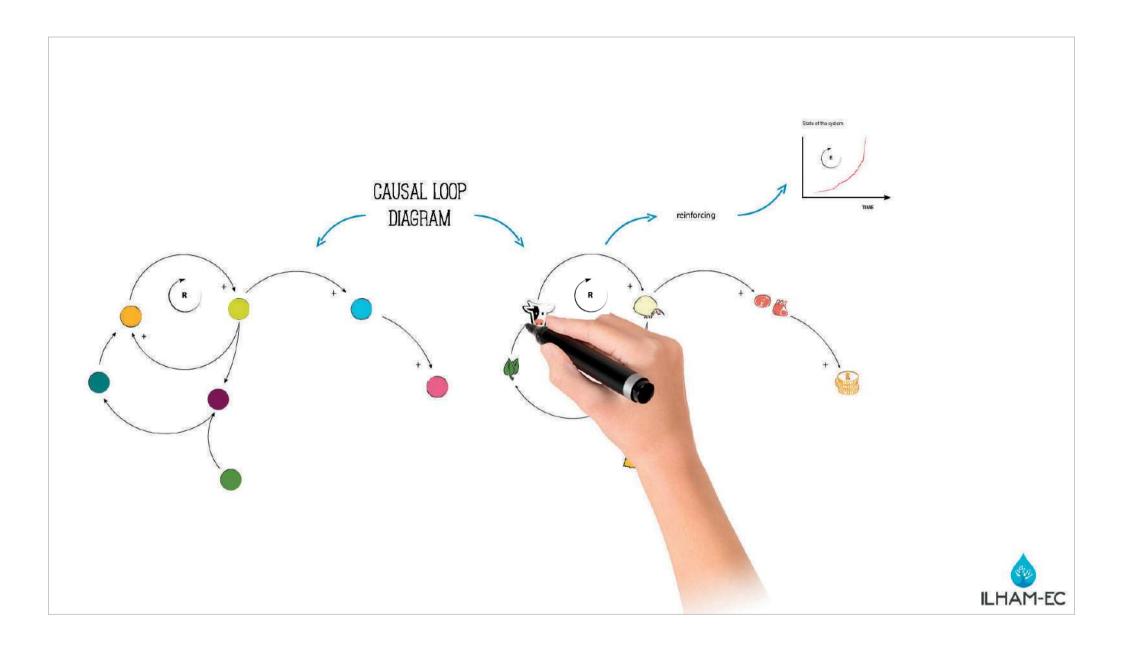
Storyboard code	Step	Voice over
10-B (Atzori)	19	a causal loop diagram,



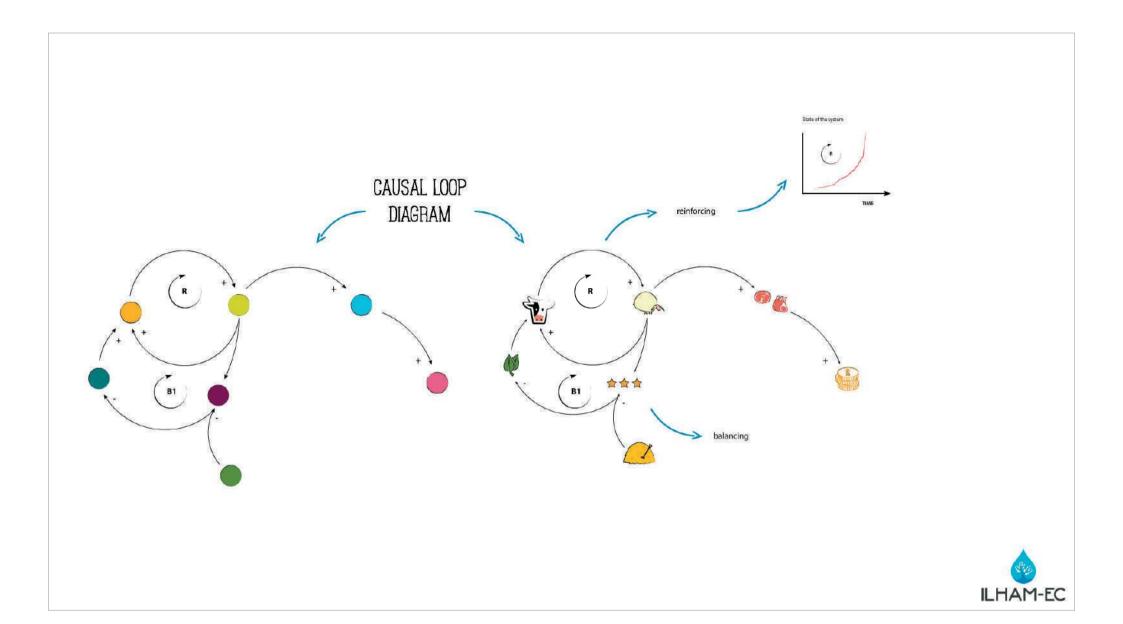
Storyboard code	Step	Voice over
10-B (Atzori)	20	when positive or reinforcing loops are dominant,



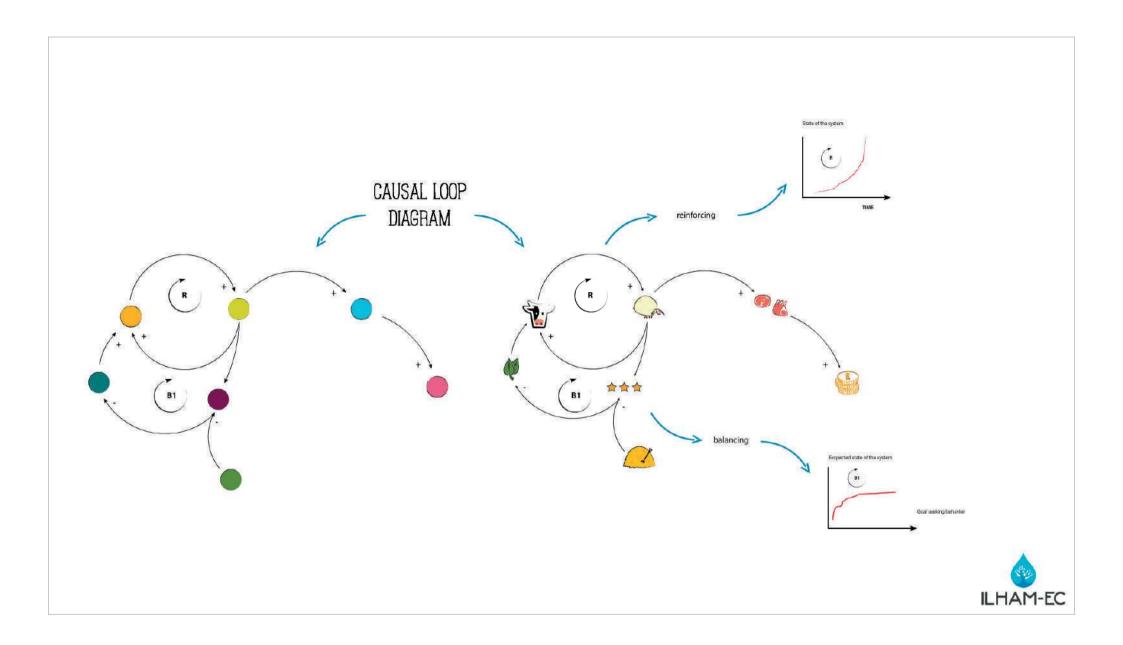
Storyboard code	Step	Voice over
10-B (Atzori)	21	system variables growth exponentially.



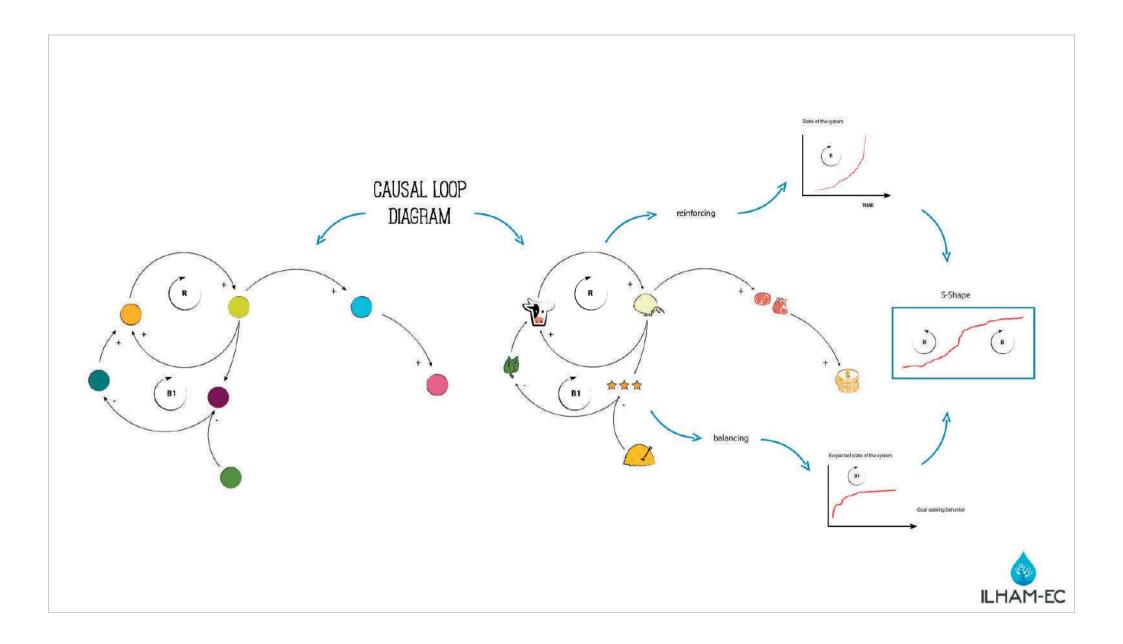
	,	
10-B (Atzori)	22	Whereas when negative



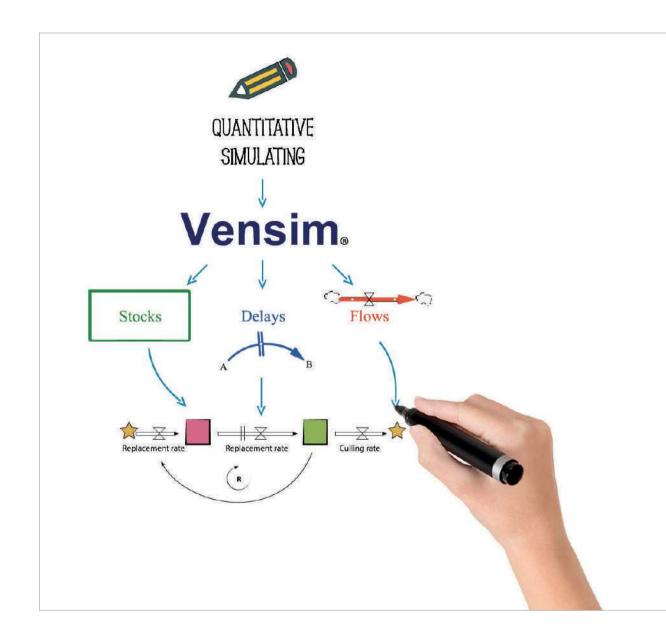
Storyboard code	Step	Voice over
10-B (Atzori)	23	or balancing loops are dominant



Storyboard code	Step	Voice over
10-B (Atzori)	24	the system tends to have a goal seeking behavior.

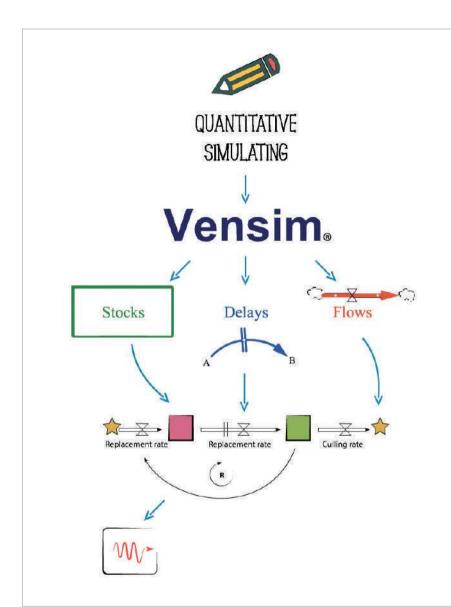


Storyboard code	Step	Voice over
10-B (Atzori)	25	S-Shape growth behavior derivate from their combination



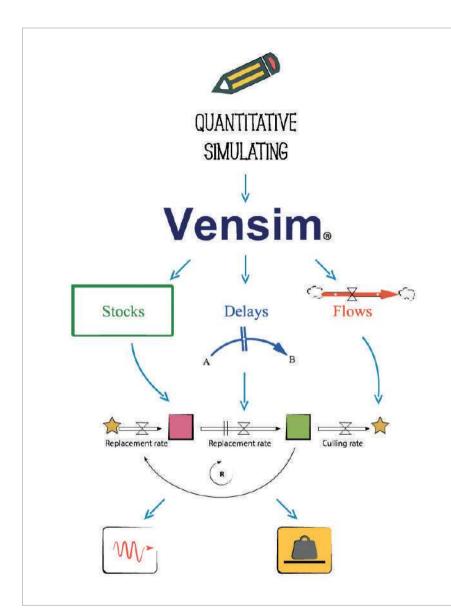


Storyboard code	Step	Voice over
10-B (Atzori)	33	on the syster



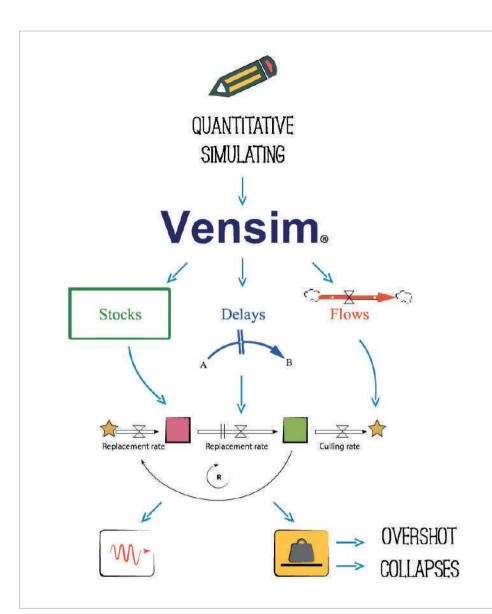


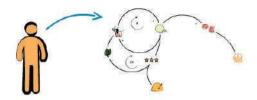
Storyboard code	Step	Voice over
10-B (Atzori)	34	and causing oscillations





Storyboard code	Step	Voice over
10-B (Atzori)	35	or identifying the strongest carrying capacities







Storyboard code

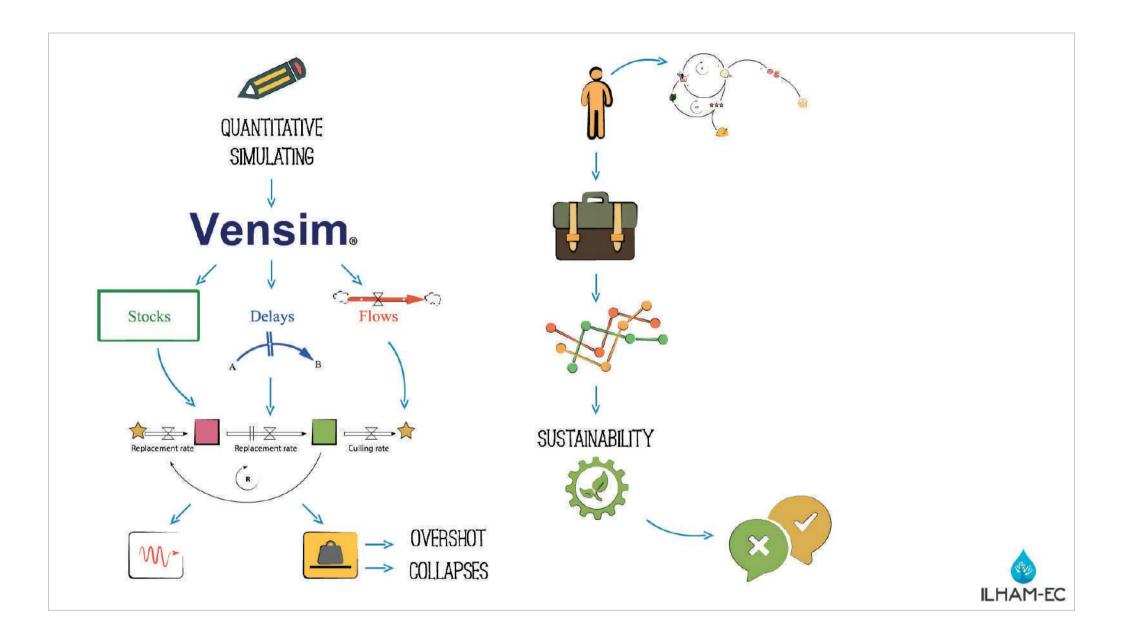
Step

Voice over

10-B (Atzori)

38

We always have



Storyboard code

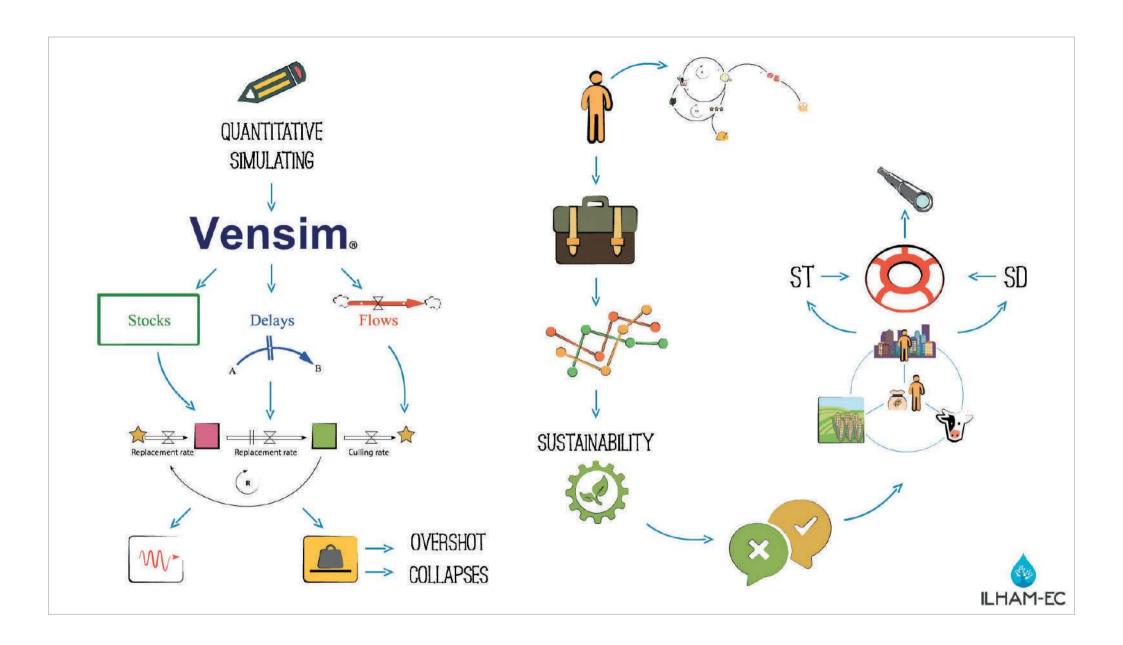
Step

Voice over

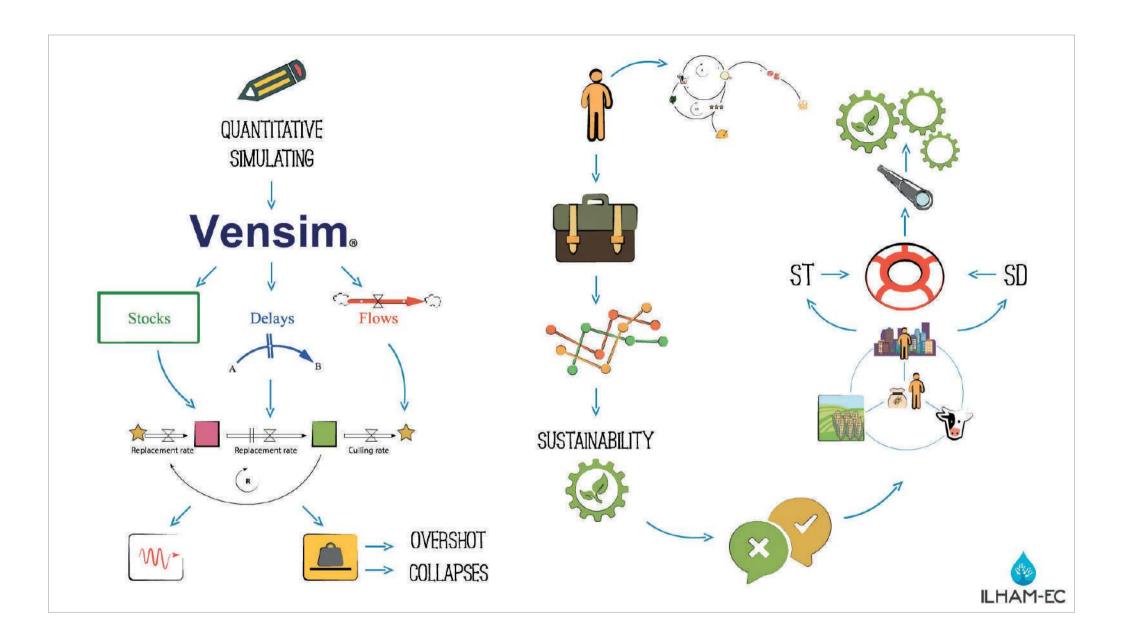
10-B (Atzori)

42

A special debate



Storyboard code	Step	Voice over
10-B (Atzori)	47	to explore



Storyboard code

Step

Voice over

10-B (Atzori)

48

future sustainable dynamics.

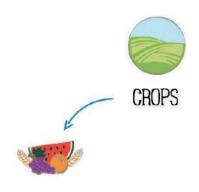






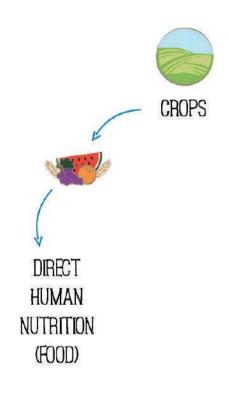
Storyboard code Step Voice over

10-B (Atzori) 50 Crops





Storyboard code	Step	Voice over
10-B (Atzori)	51	for vegetable productions





Storyboard code

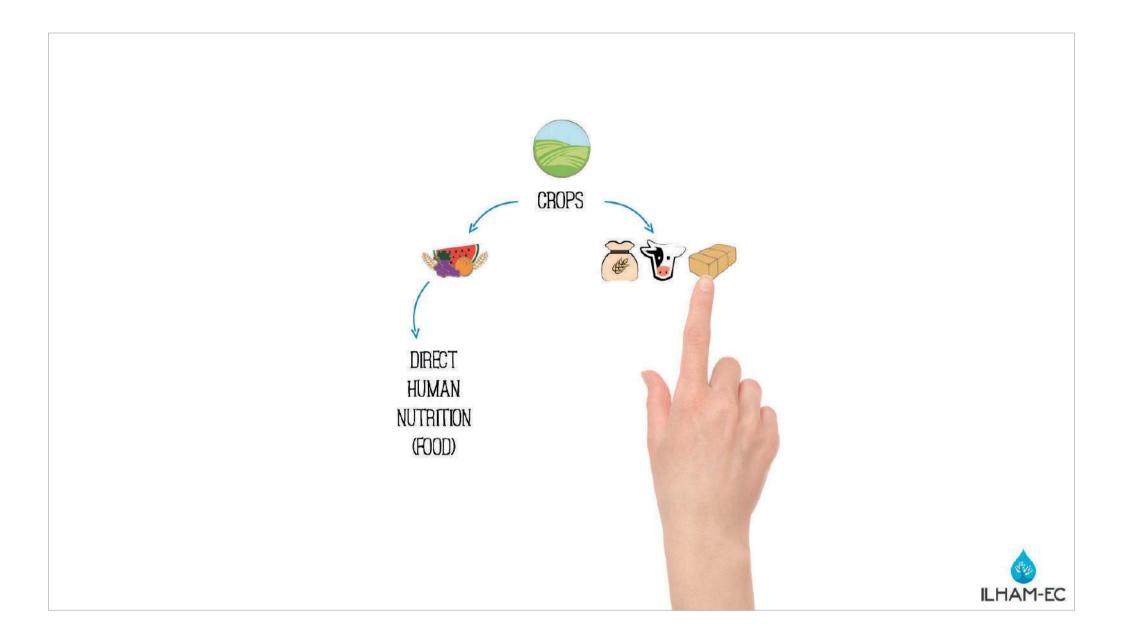
Step

Voice over

10-B (Atzori)

52

goes directly to human nutrition (food)



Storyboard code

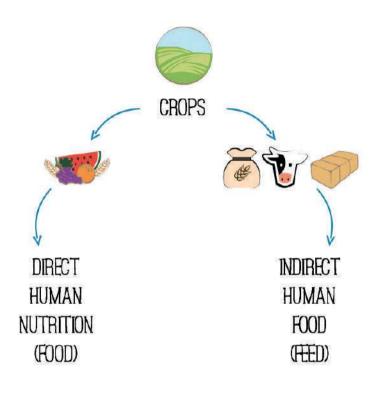
Step

Voice over

10-B (Atzori)

53

or animal diets (feed) which





Storyboard code

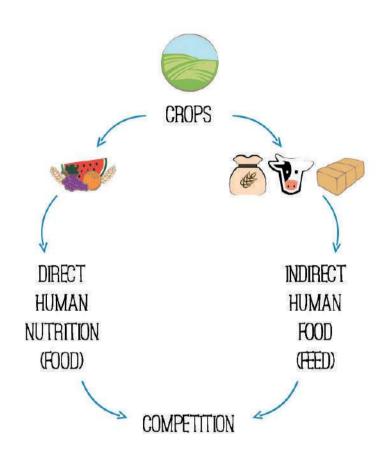
Step

Voice over

10-B (Atzori)

54

is considered indirect human food.





Storyboard code

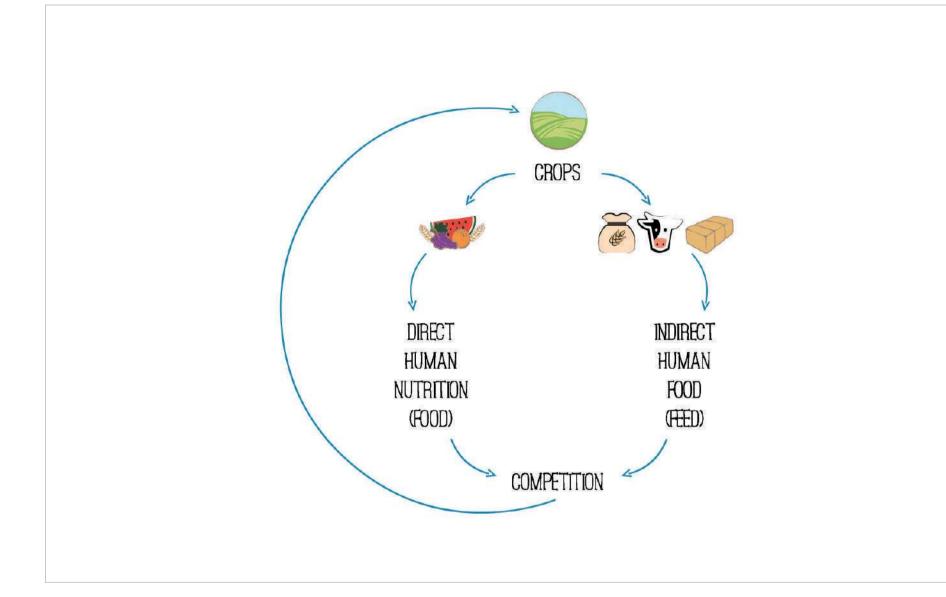
Step

Voice over

10-B (Atzori)

55

It generates a strong food-feed competition



ILHAM-EC

Storyboard code

Step

Voice over

10-B (Atzori)

56

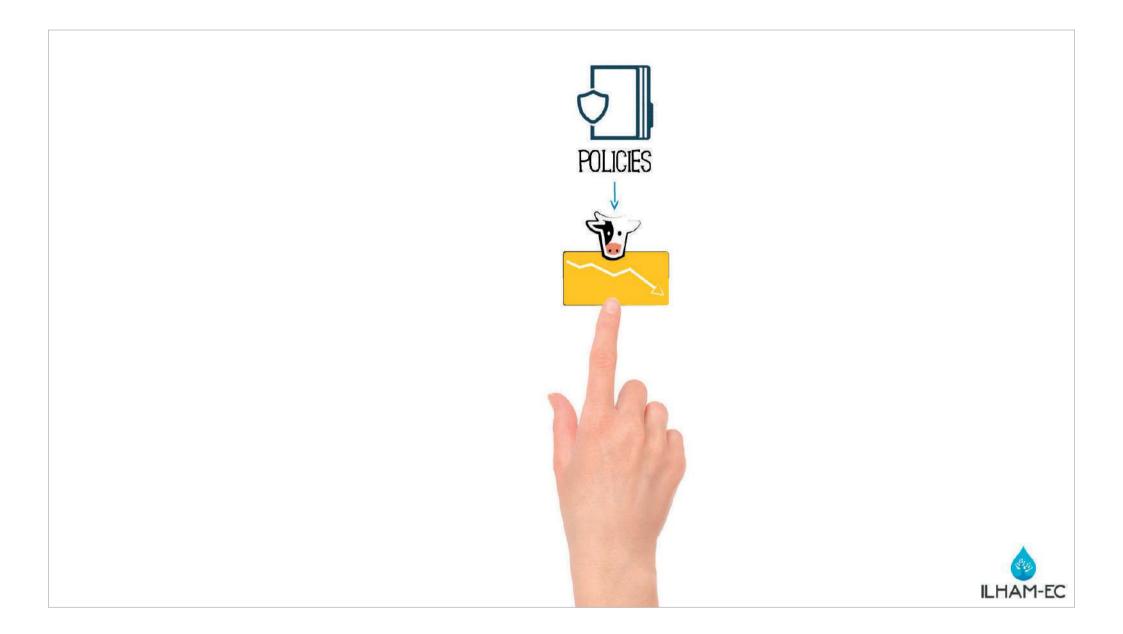
for arable land use.



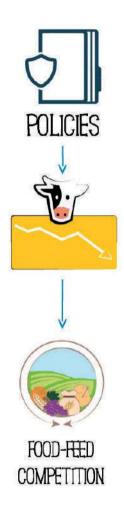


Storyboard code Step Voice over

10-B (Atzori) 57 Policies

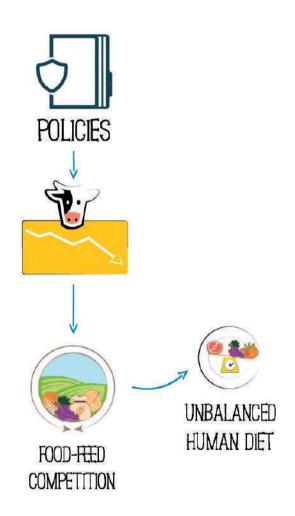


Storyboard code	Step	Voice over
10-B (Atzori)	58	aimed to reduce livestock





Storyboard code	Step	Voice over
10-B (Atzori)	59	to reduce food-feed competition





Storyboard code

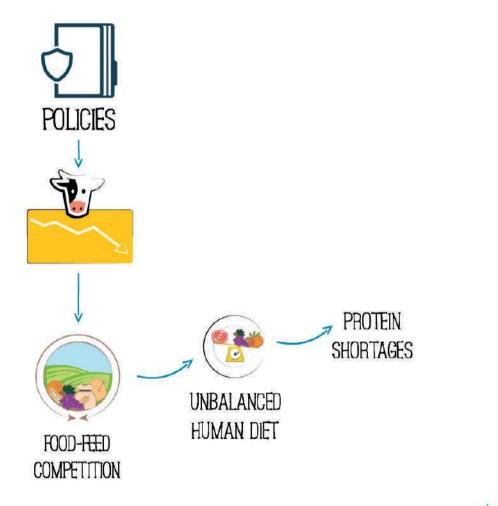
Step

Voice over

10-B (Atzori)

60

might end in 1) unbalanced human diet





Storyboard code

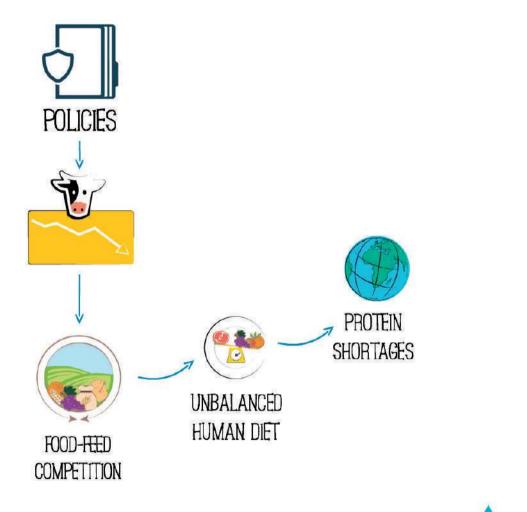
Step

Voice over

10-B (Atzori)

60

for protein shortages





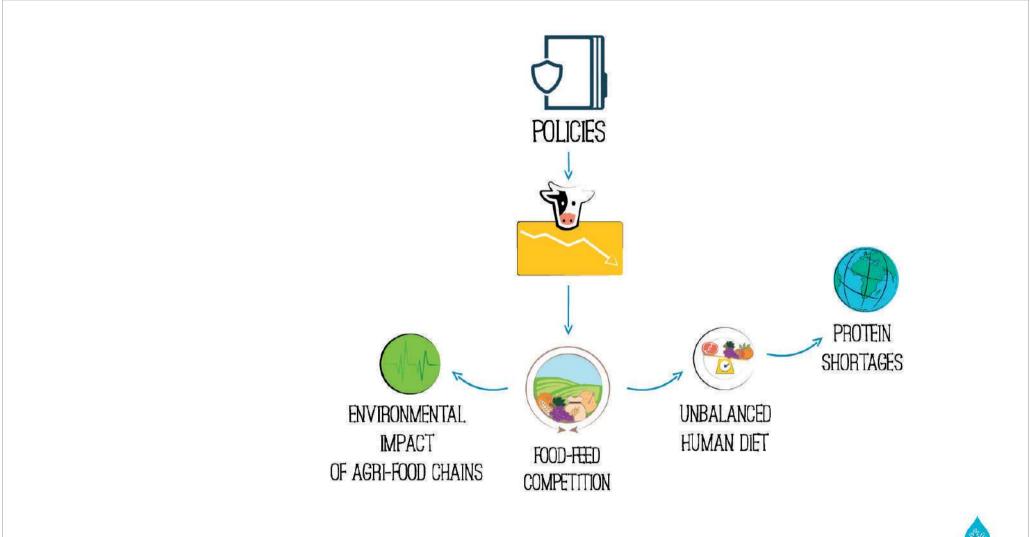
Step

Voice over

10-B (Atzori)

61

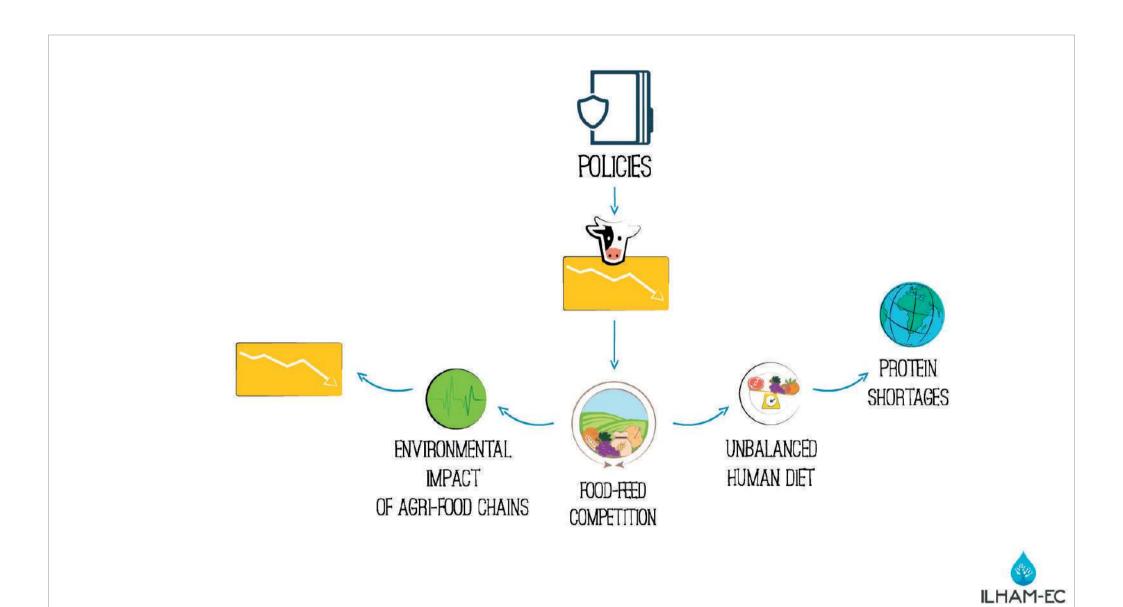
at global level





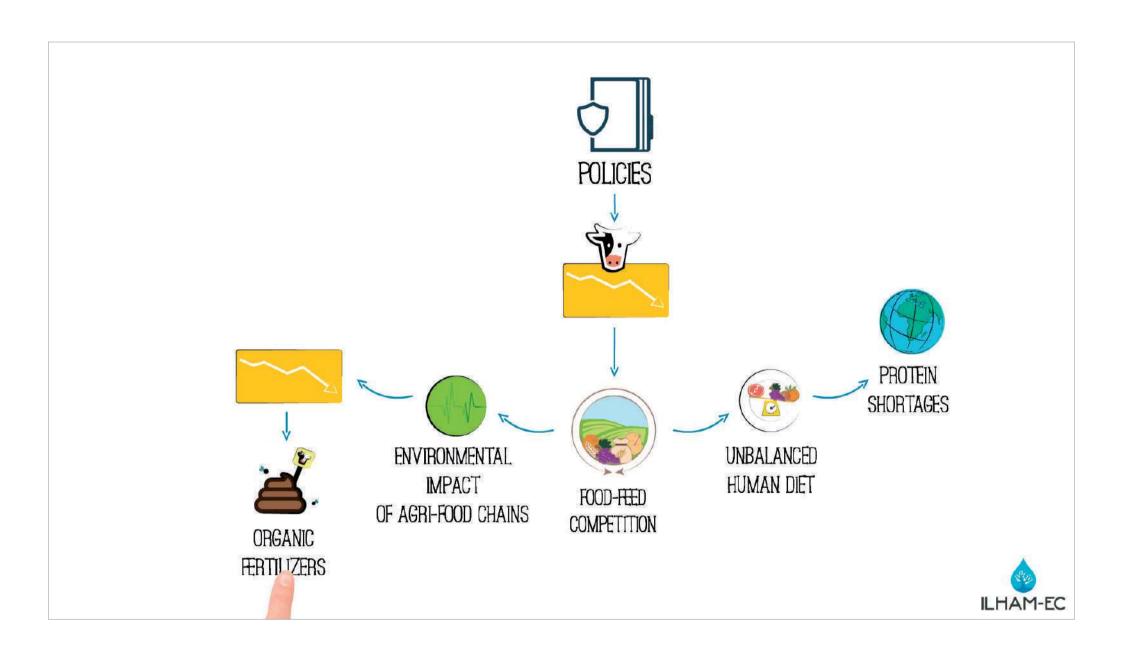
Step

Voice over



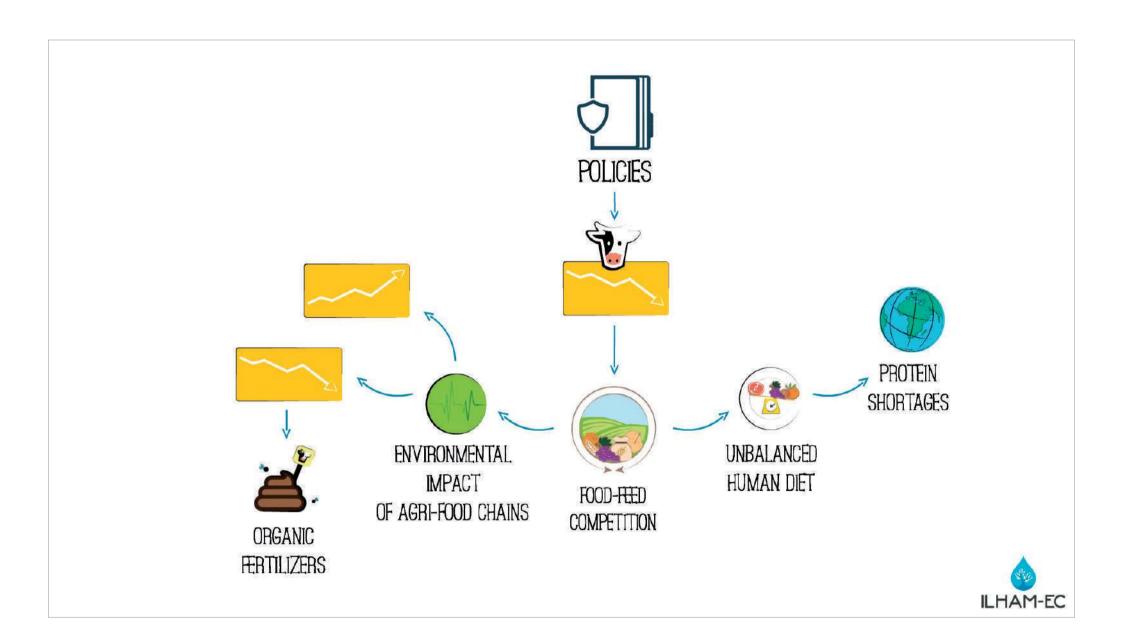
Step

Voice over



Storyboard code Step Voice over

10-B (Atzori) 64 of organic fertilizers,



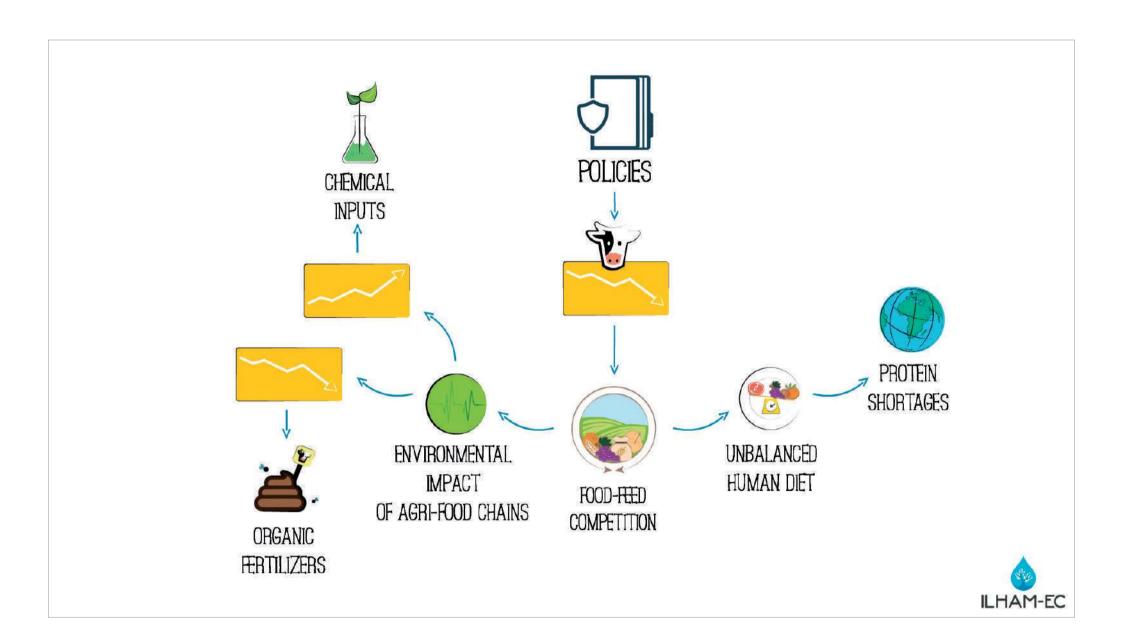
Step

Voice over

10-B (Atzori)

65

for increases



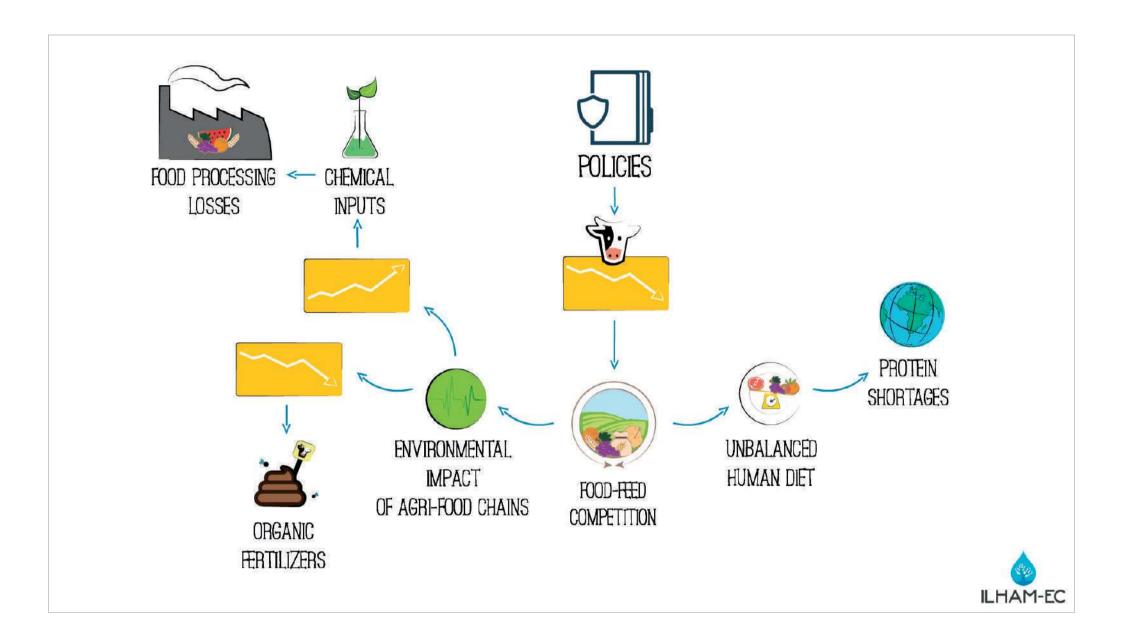
Step

Voice over

10-B (Atzori)

66

in chemical inputs



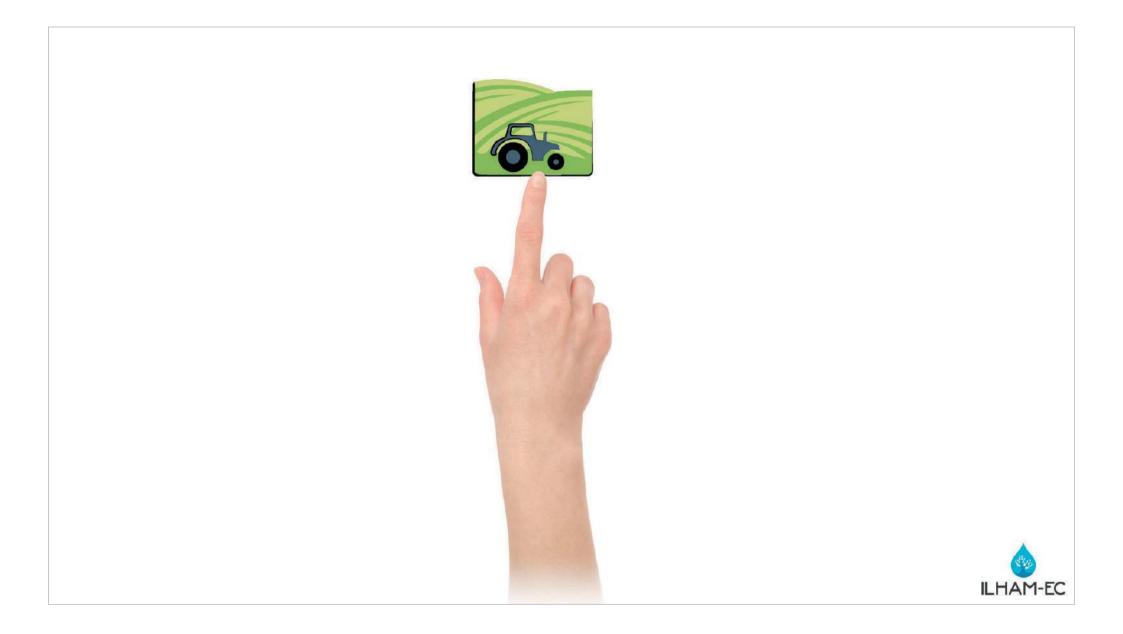
Step

Voice over

10-B (Atzori)

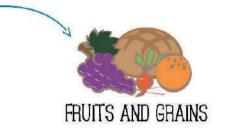
67

and for higher volumes of food processing losses.



Storyboard code	Step	Voice over
10-B (Atzori)	68	Land use provides







Storyboard code

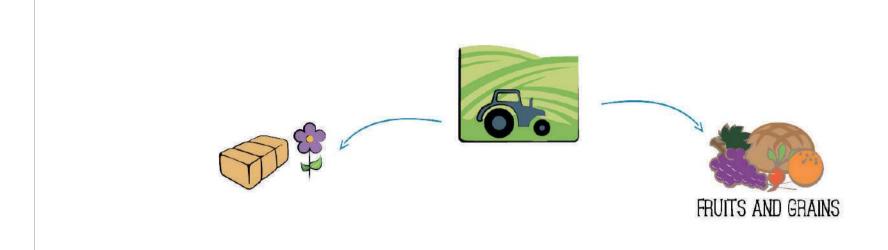
Step

Voice over

10-B (Atzori)

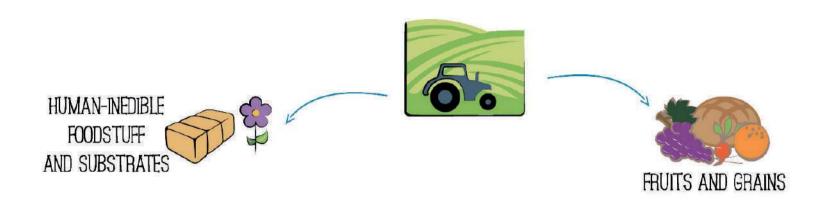
69

fruits and grains





Storyboard code	Step	Voice over
10-B (Atzori)	70	but also pasture





Storyboard code

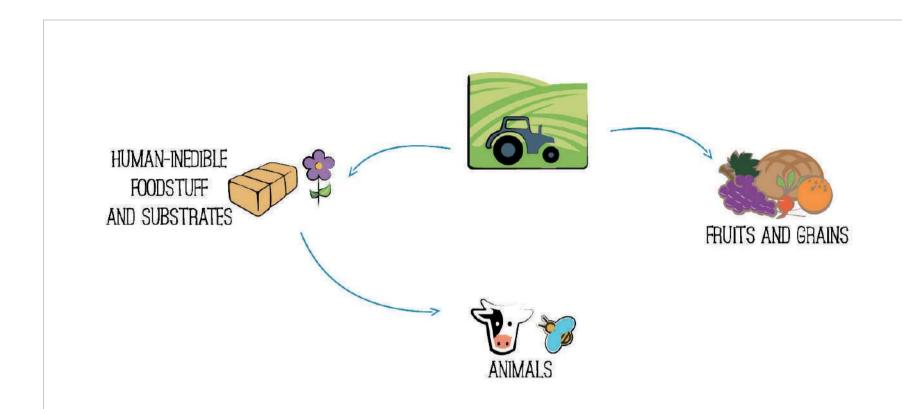
Step

Voice over

10-B (Atzori)

71

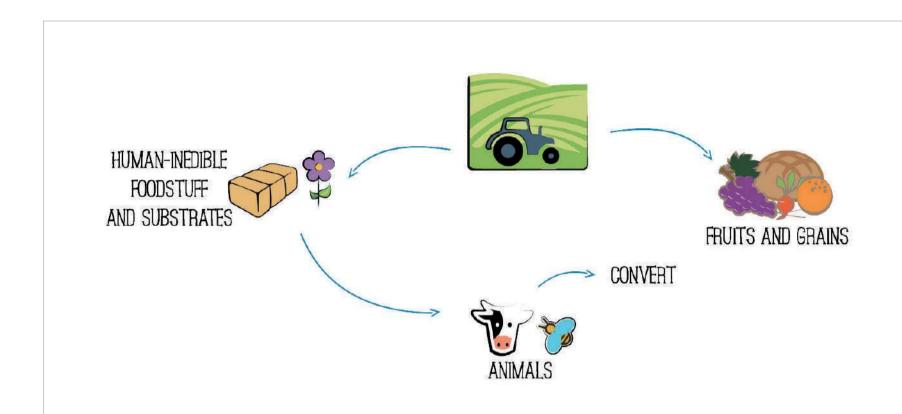
and other human-inedible foodstuff





Storyboard code Step Voice over

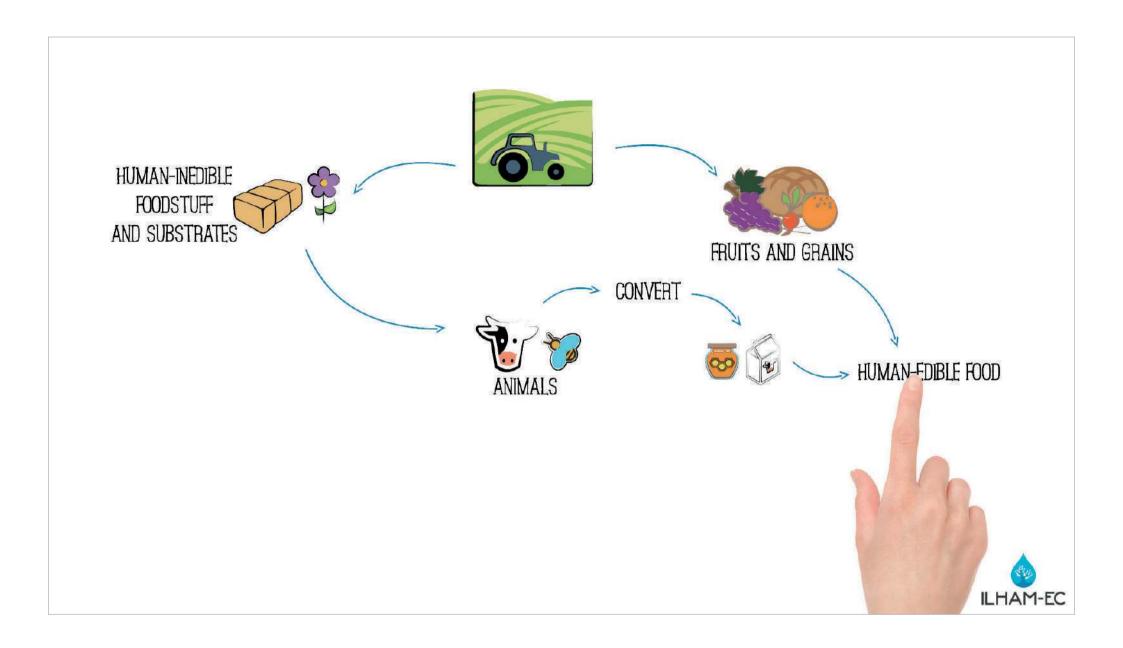
10-B (Atzori) 72 that animals





Storyboard code Step Voice over

10-B (Atzori) 73 can convert



Storyboard code

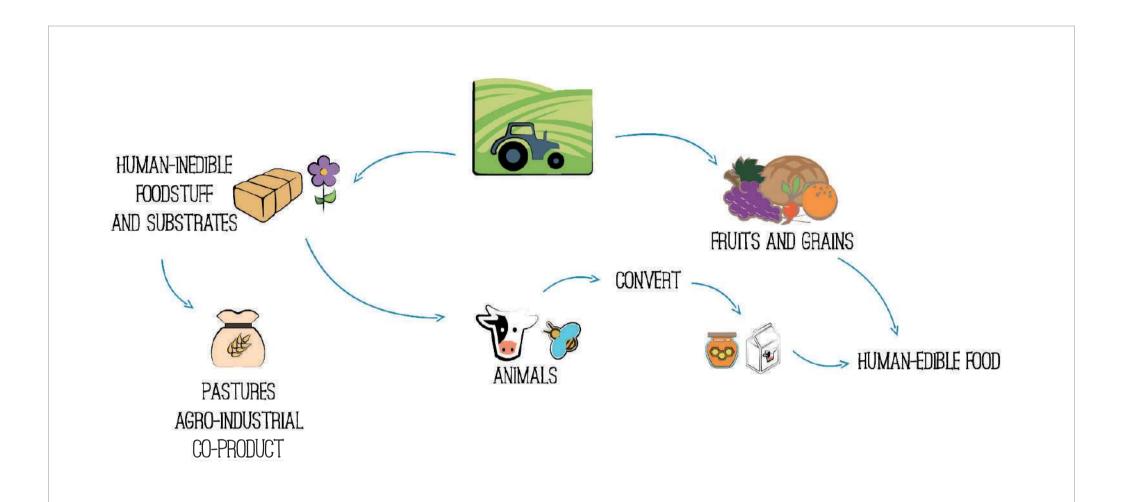
Step

Voice over

10-B (Atzori)

74

to human-edible food.





Storyboard code

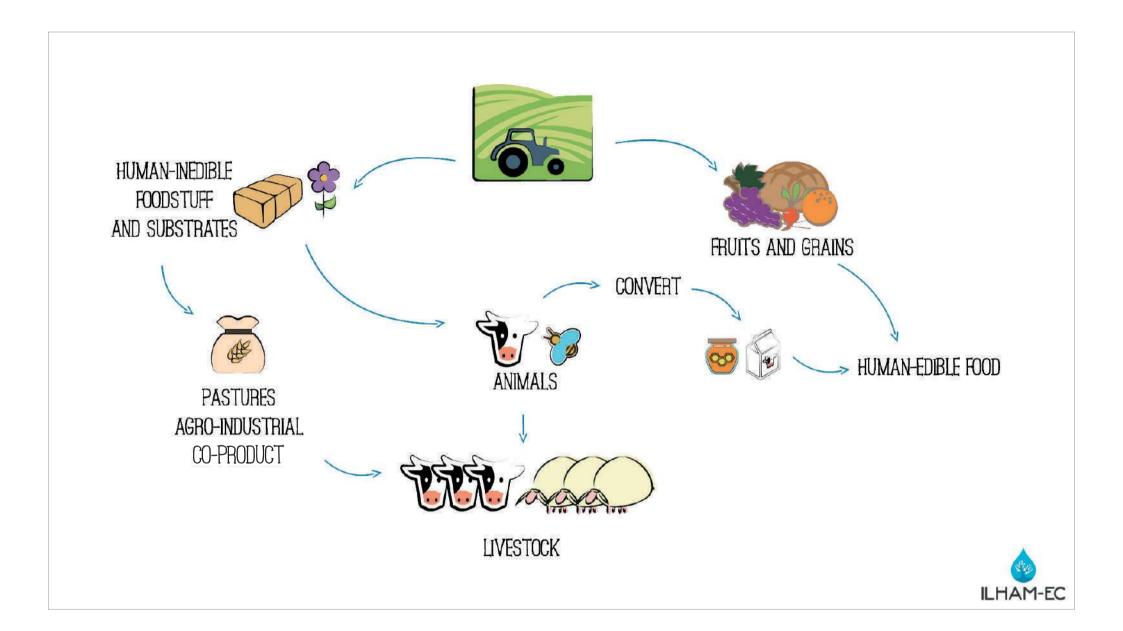
Step

Voice over

10-B (Atzori)

75

In particular, pasture and agroindustrial coproducts



Storyboard code

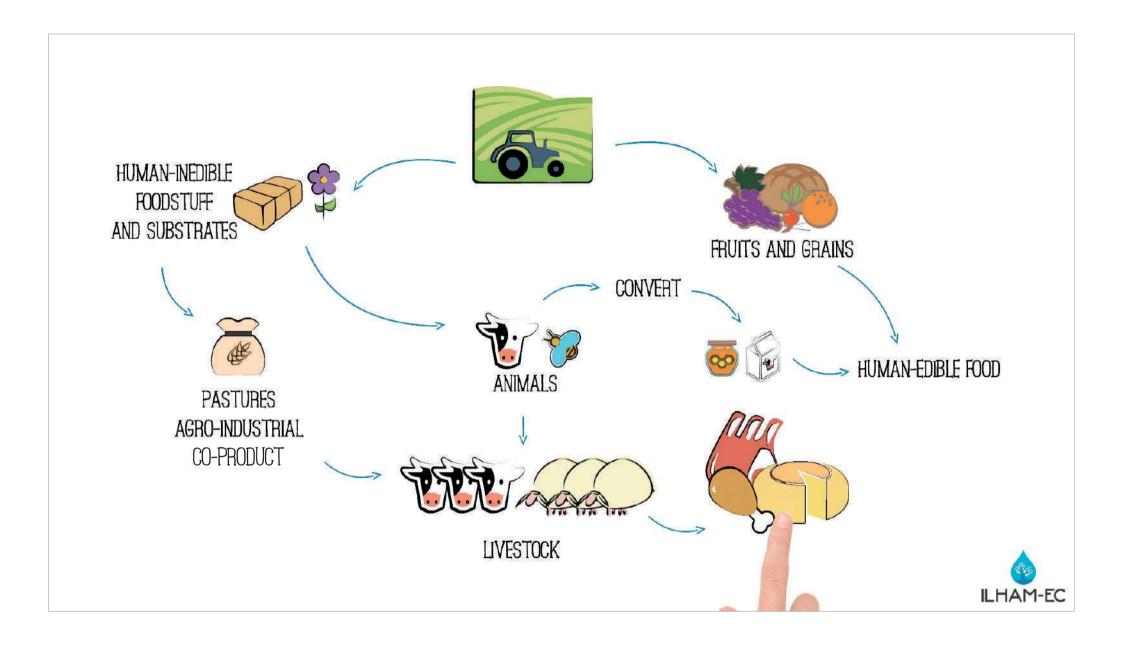
Step

Voice over

10-B (Atzori)

76

fed to livestock ruminants



Storyboard code

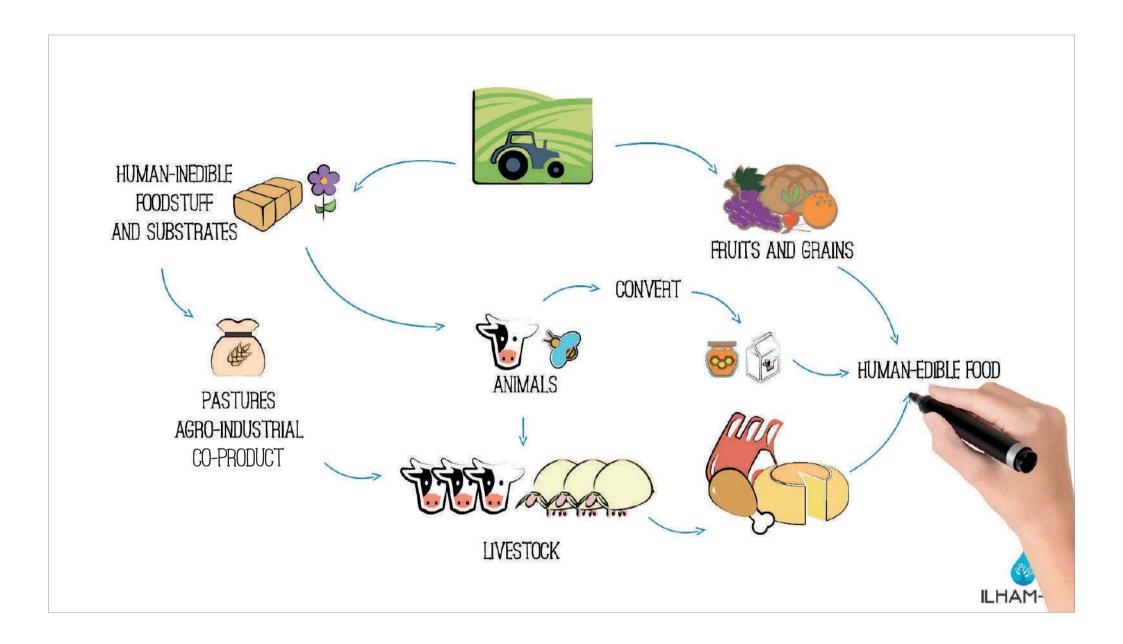
Step

Voice over

10-B (Atzori)

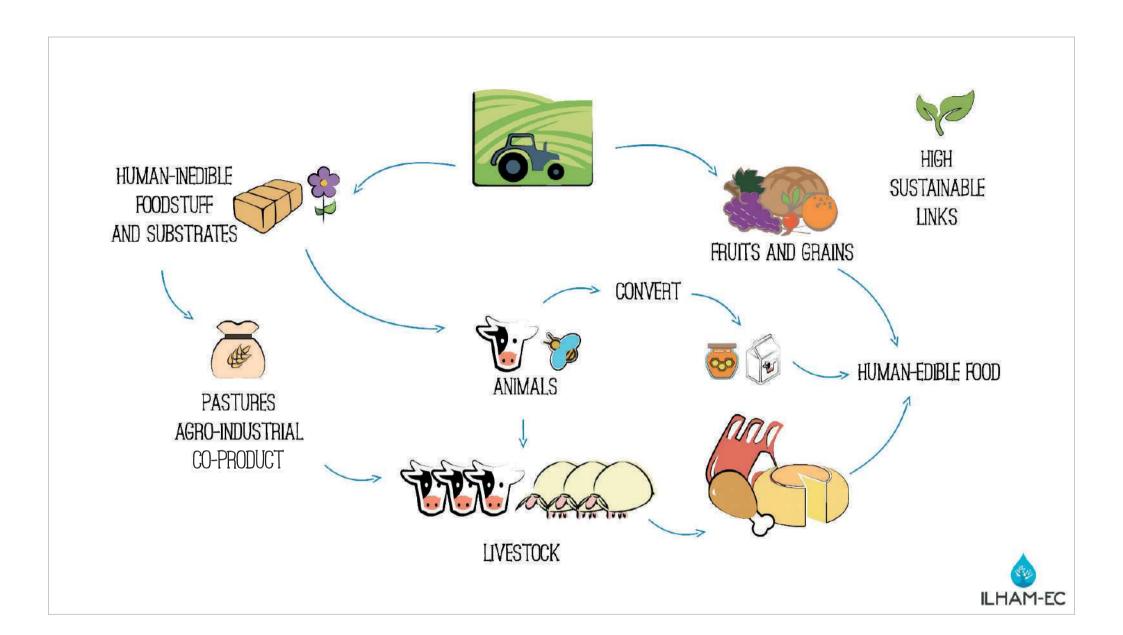
77

can be transformed in meat and cheese



Storyboard code Step Voice over

10-B (Atzori) 78 enabling



Storyboard code

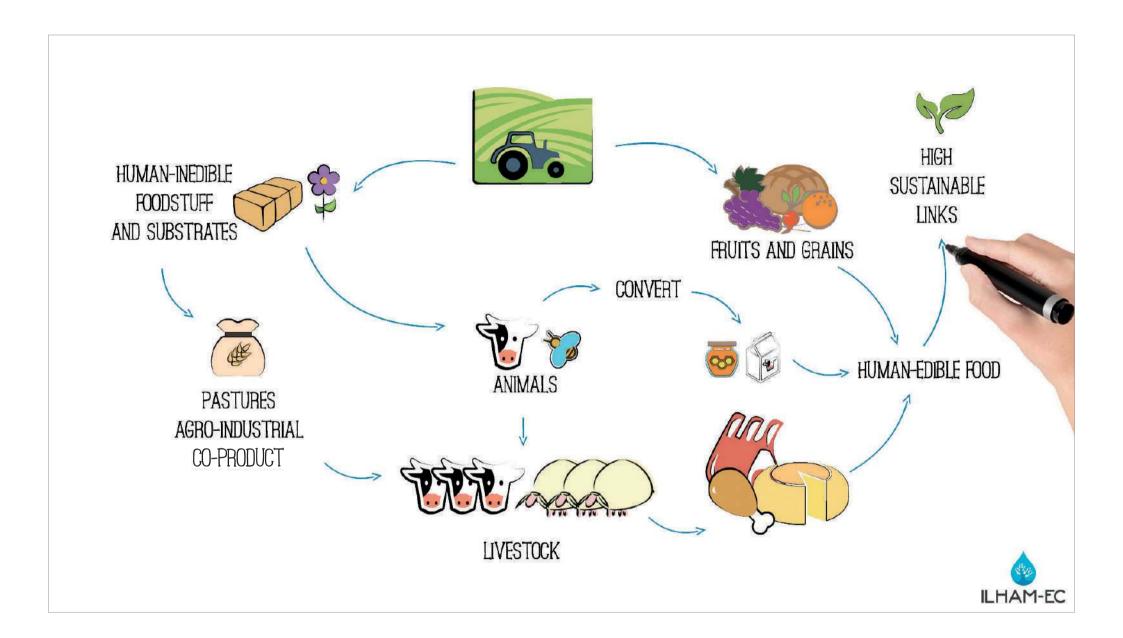
Step

Voice over

10-B (Atzori)

79

high sustainable links



Storyboard code

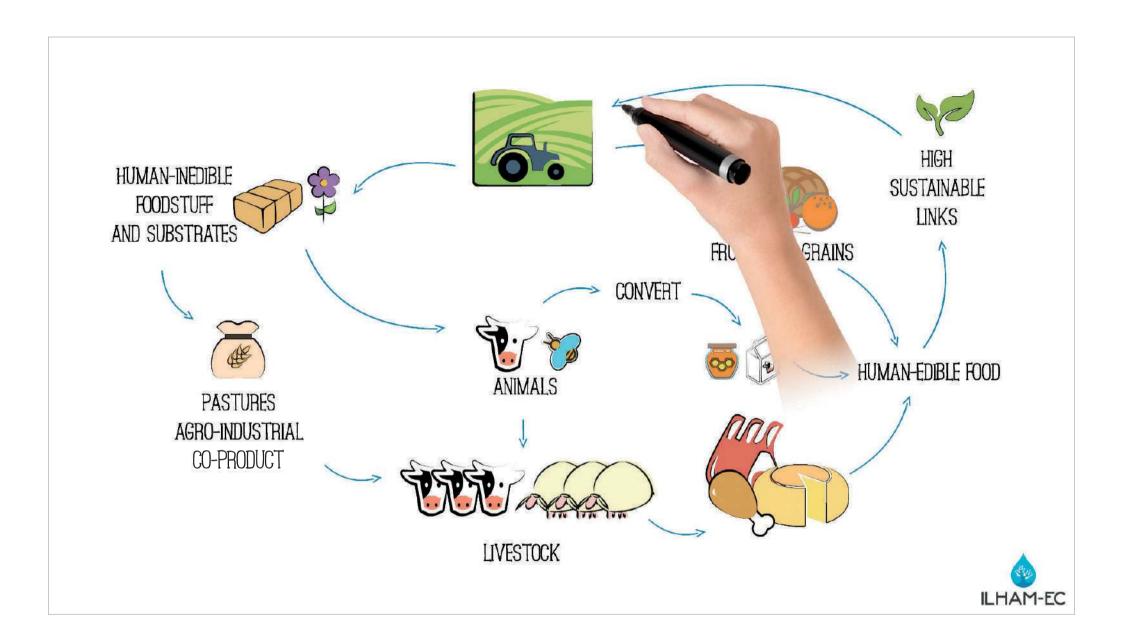
Step

Voice over

10-B (Atzori)

80

among food production



Storyboard code

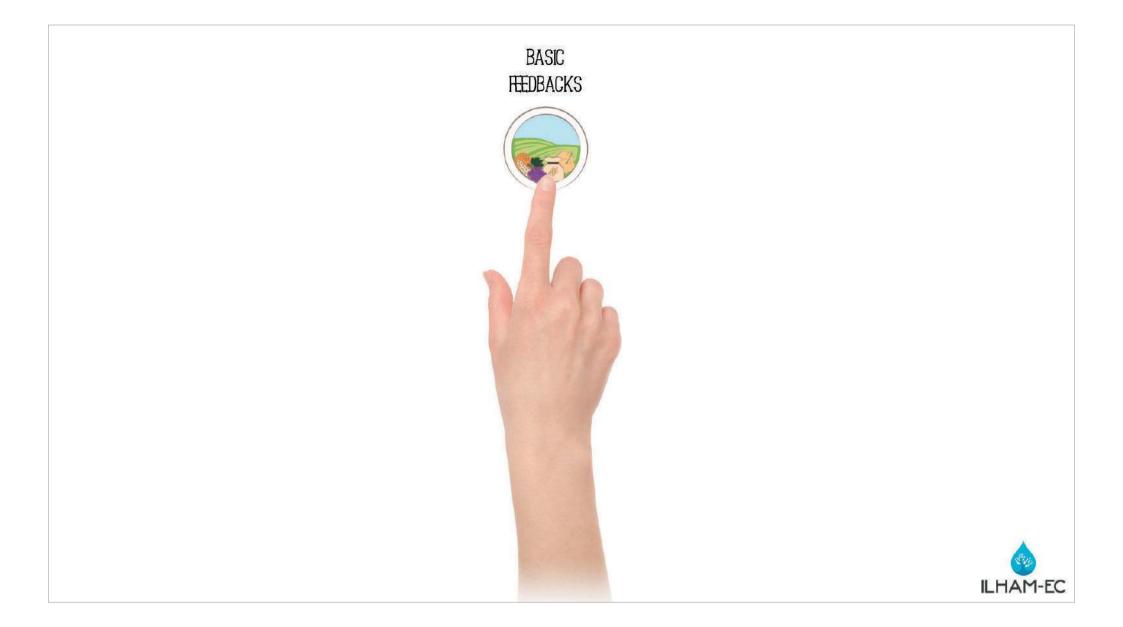
Step

Voice over

10-B (Atzori)

81

and optimized land use.



Storyboard code	Step	Voice over
10-B (Atzori)	83	close the loops

BASIC HEDBACKS



COMPETITION



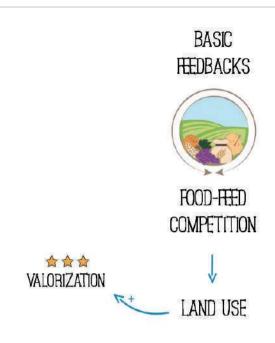
LAND USE



Storyboard code

Step

Voice over





Storyboard code

Step

Voice over

10-B (Atzori)

86

I) husbandry valorization





Storyboard code

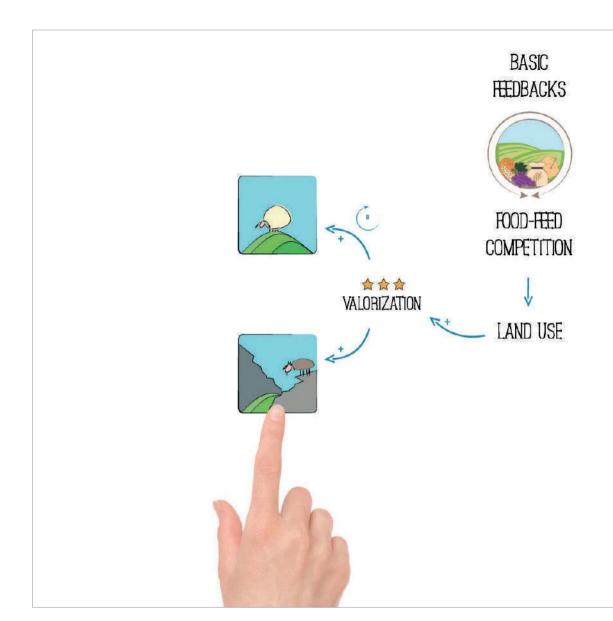
Step

Voice over

10-B (Atzori)

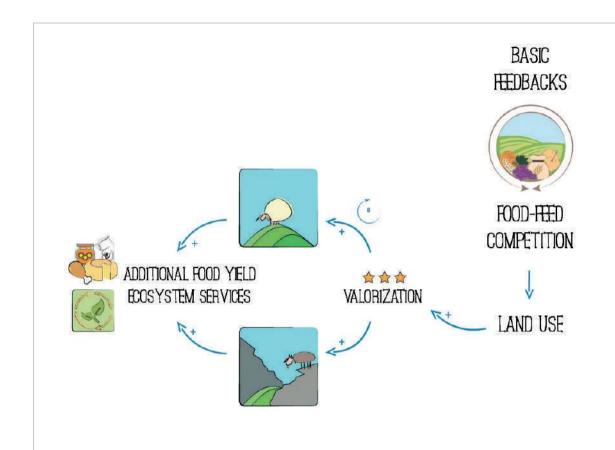
87

of natural pastures,



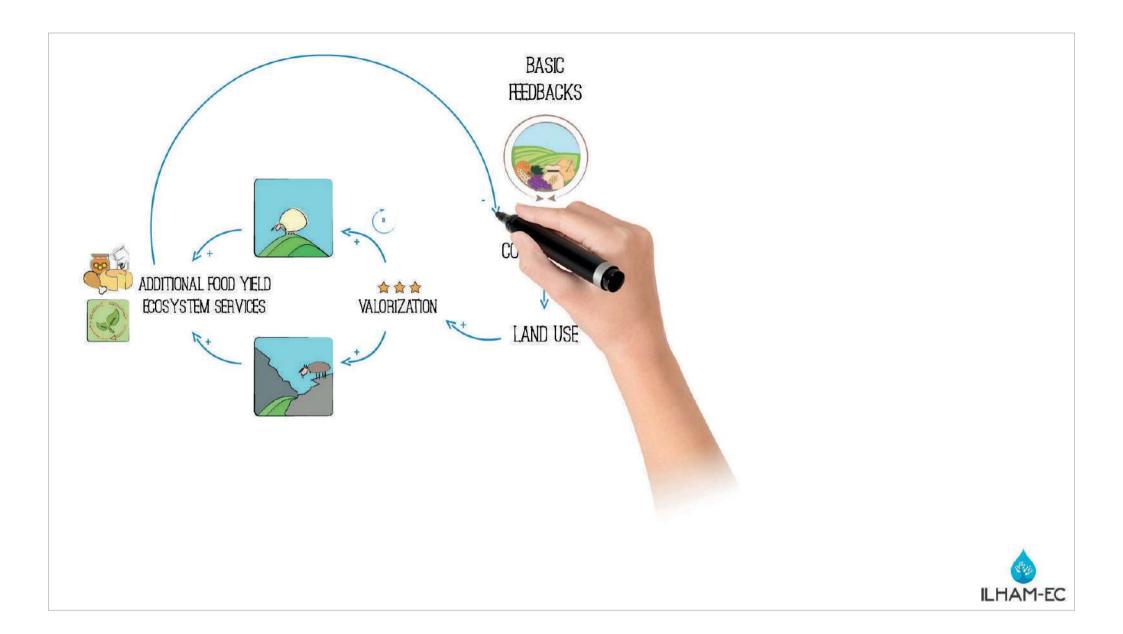


Storyboard code	Step	Voice over
10-B (Atzori)	88	agroforestry exploiting non-arable land

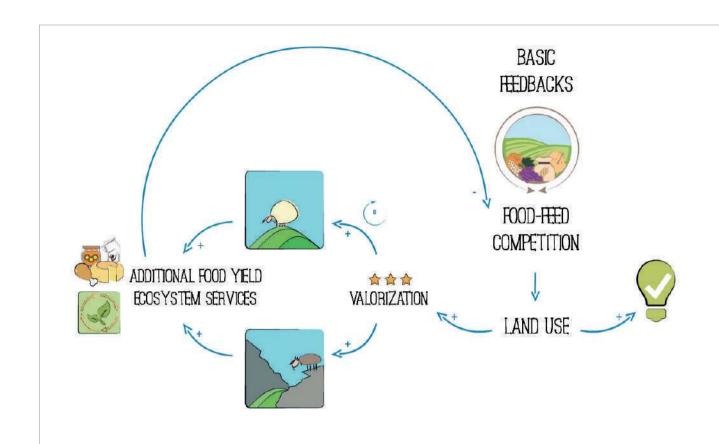




Storyboard code	Step	Voice over
10-B (Atzori)	89	to get additional food yield and ecosystem service



Storyboard code	Step	Voice over
10-B (Atzori)	90	reduces competition





Storyboard code

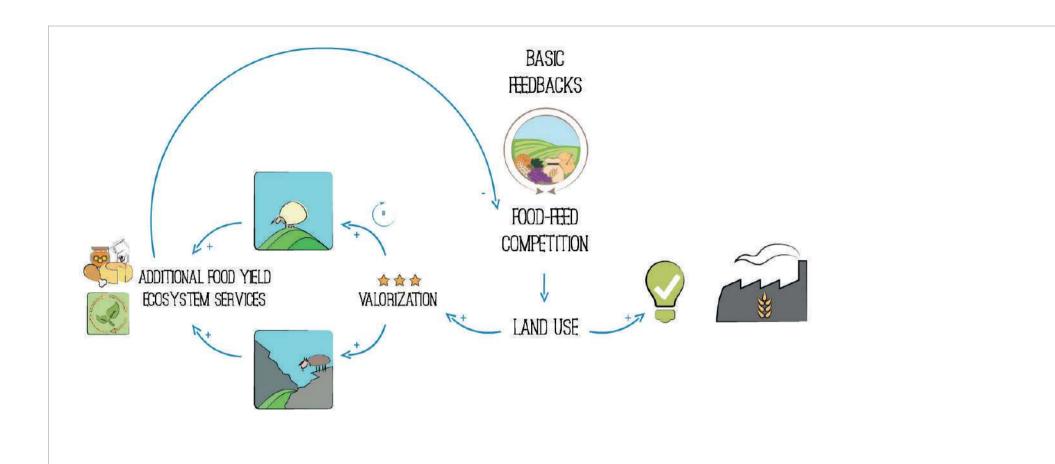
Step

Voice over

10-B (Atzori)

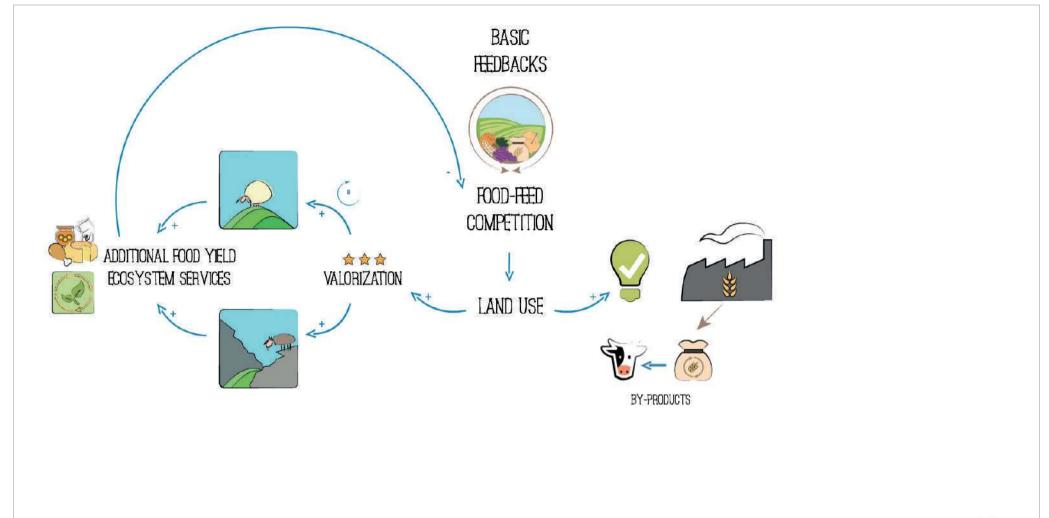
91

II) enhancement





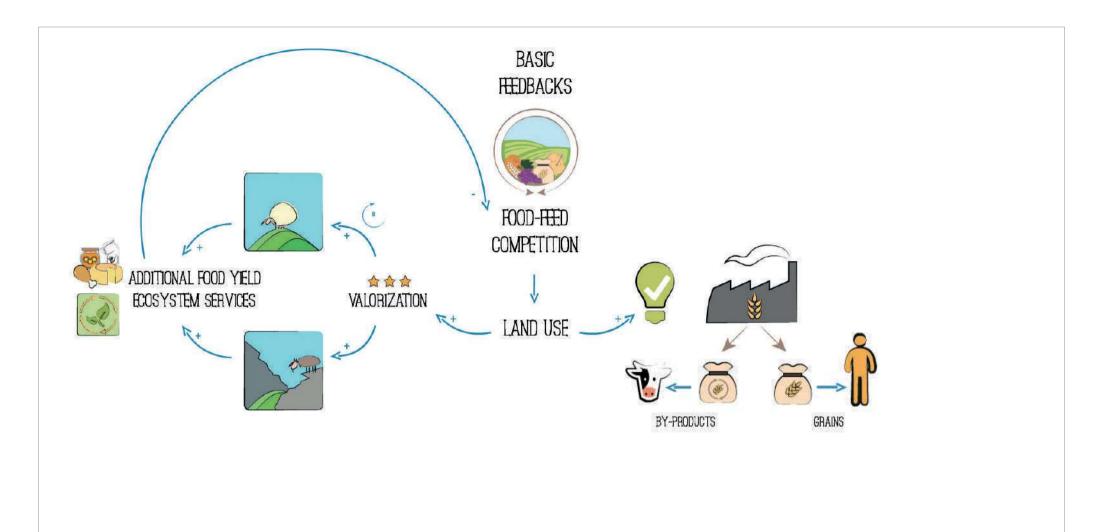
Storyboard code	Step	Voice over
10-B (Atzori)	92	of agro-industrial byproducts





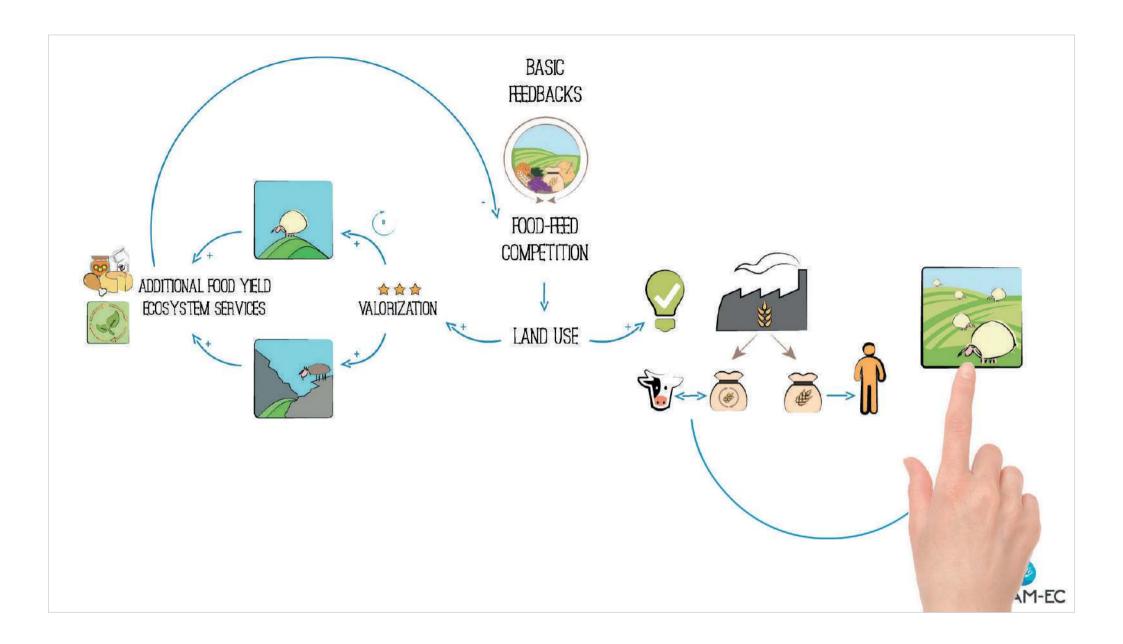
Storyboard code Step Voice over

10-B (Atzori) 93 use in animal feed,

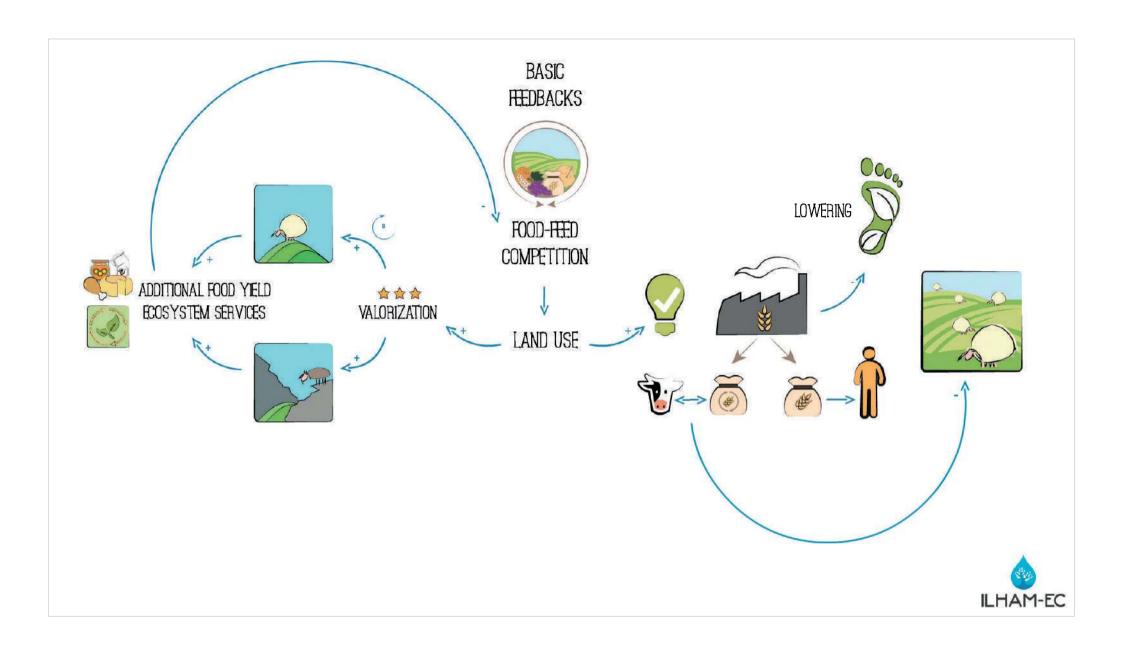




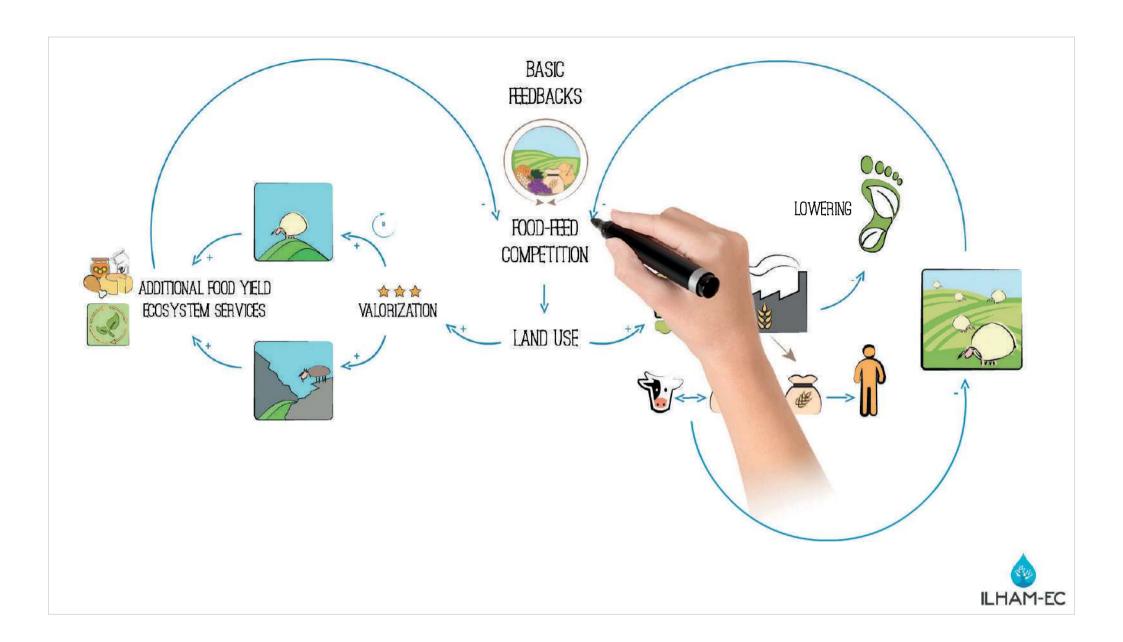
Storyboard code	Step	Voice over
10-B (Atzori)	94	leaving grain crops for humans



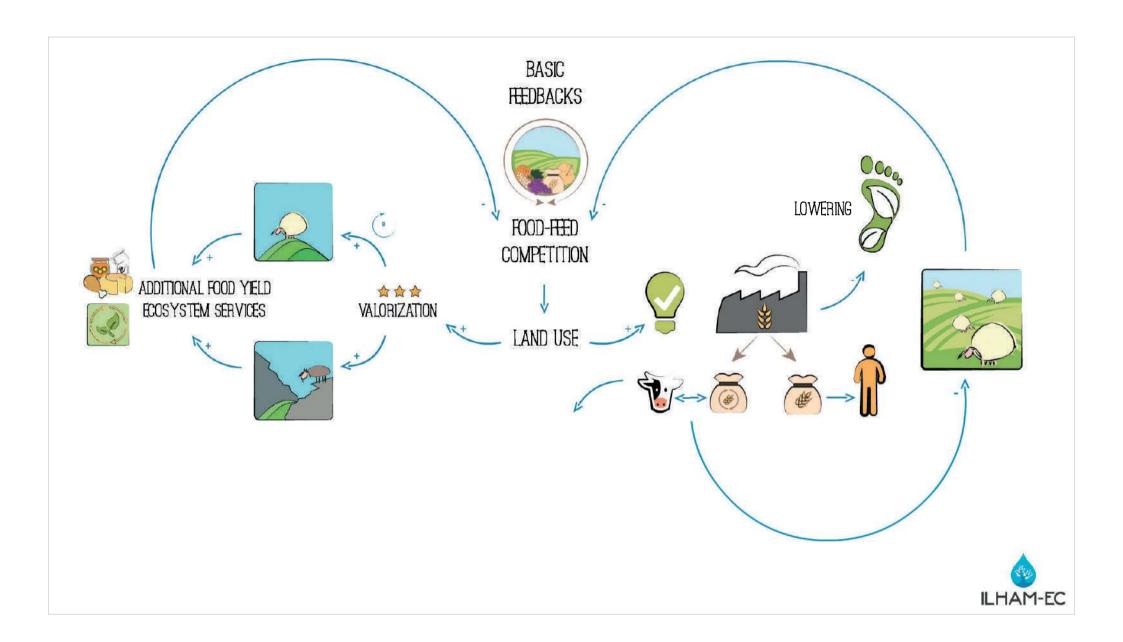
Storyboard code	Step	Voice over
10-B (Atzori)	95	reducing land for livestock



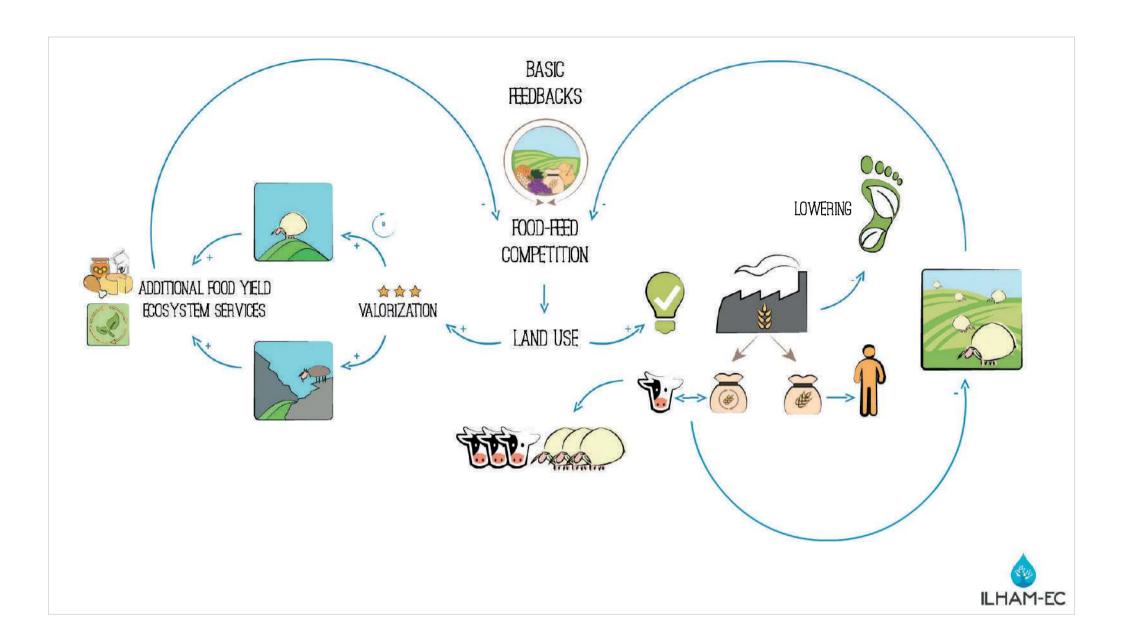
Storyboard code	Step	Voice over
10-B (Atzori)	96	and lowering the ecological footprint



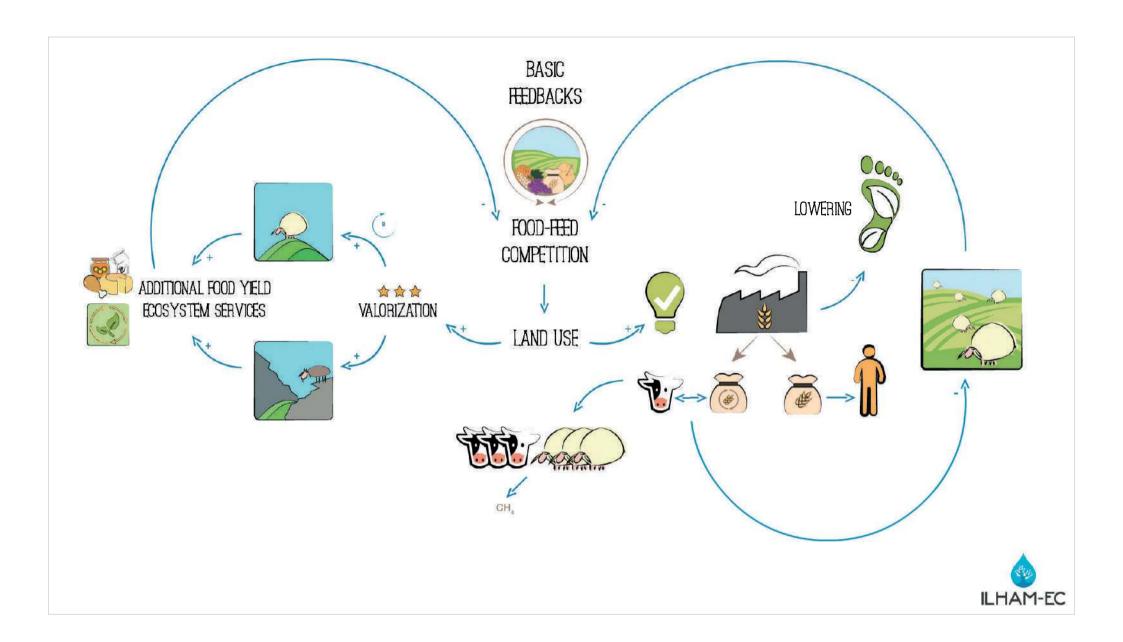
Storyboard code	Step	Voice over
10-B (Atzori)	97	of direct food chair



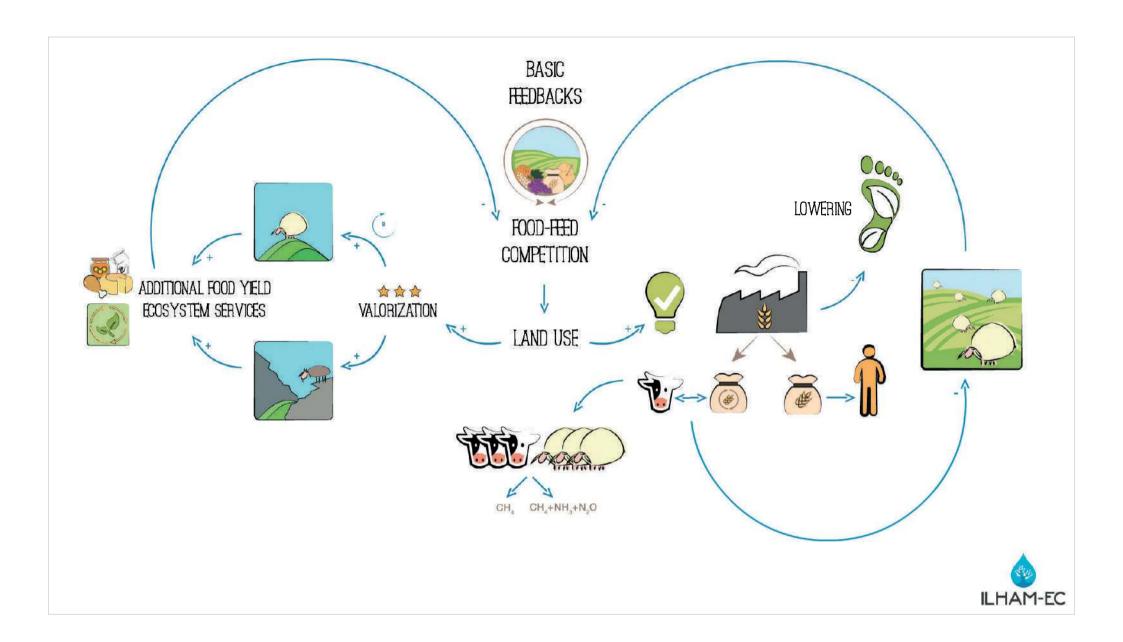
Storyboard code	Step	Voice over
10-B (Atzori)	98	A weakness



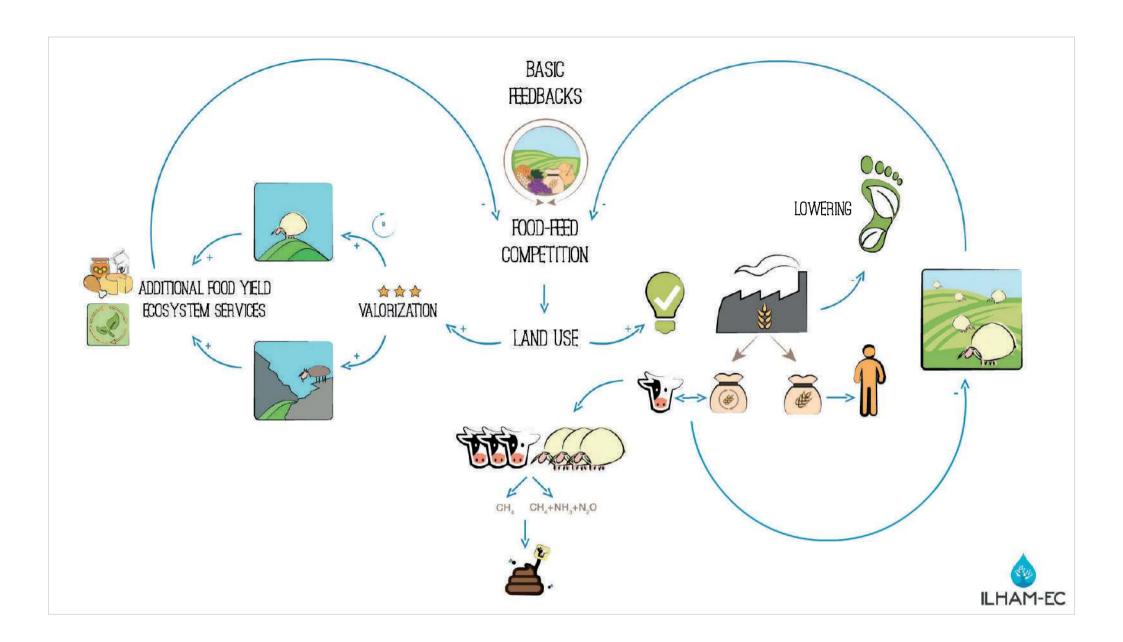
Storyboard code	Step	Voice over
10-B (Atzori)	99	of livestock production



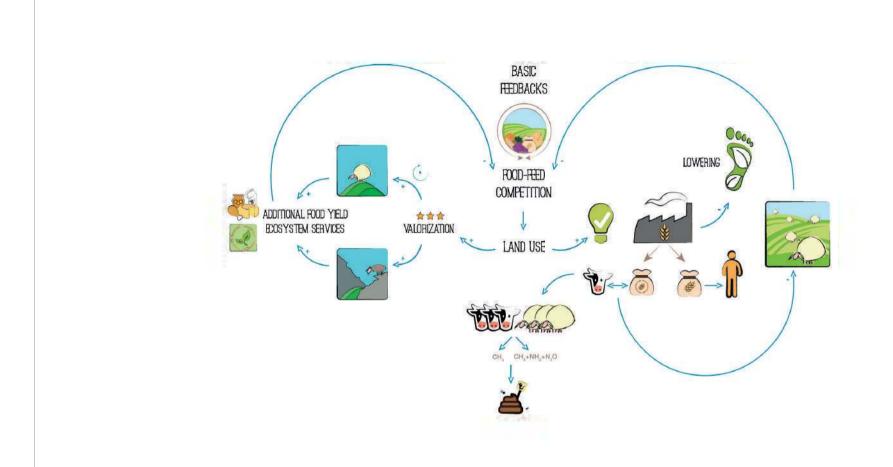
Storyboard code	Step	Voice over
10-B (Atzori)	100	is methane



Storyboard code	Step	Voice over
10-B (Atzori)	101	and nitrogen emission



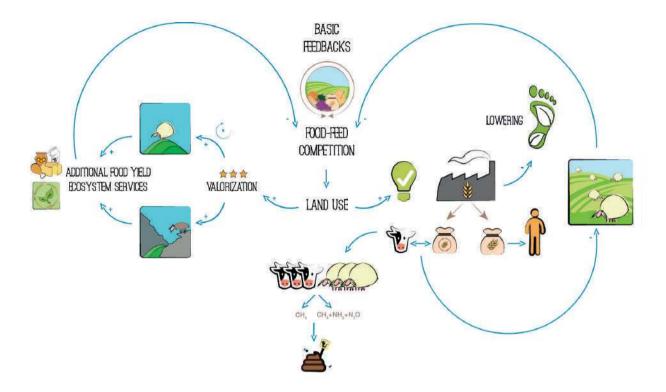
Storyboard code	Step	Voice over
10-B (Atzori)	102	from ruminants and manure management.





Storyboard code	Step	Voice over
10-B (Atzori)	104 (- zoom)	

### KEY POLICIES

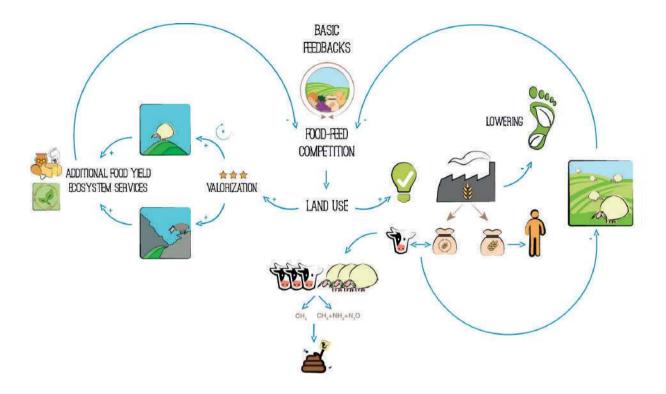




Storyboard code Step Voice over

10-B (Atzori) 105 Key policy

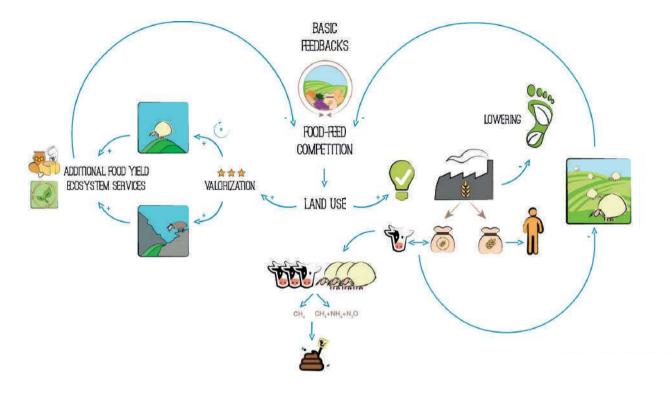
#### KEY POLICIES





Storyboard code	Step	voice over
10-B (Atzori)	106	aim to reduce both the food feed competition

### KEY POLICIES





Storyboard code

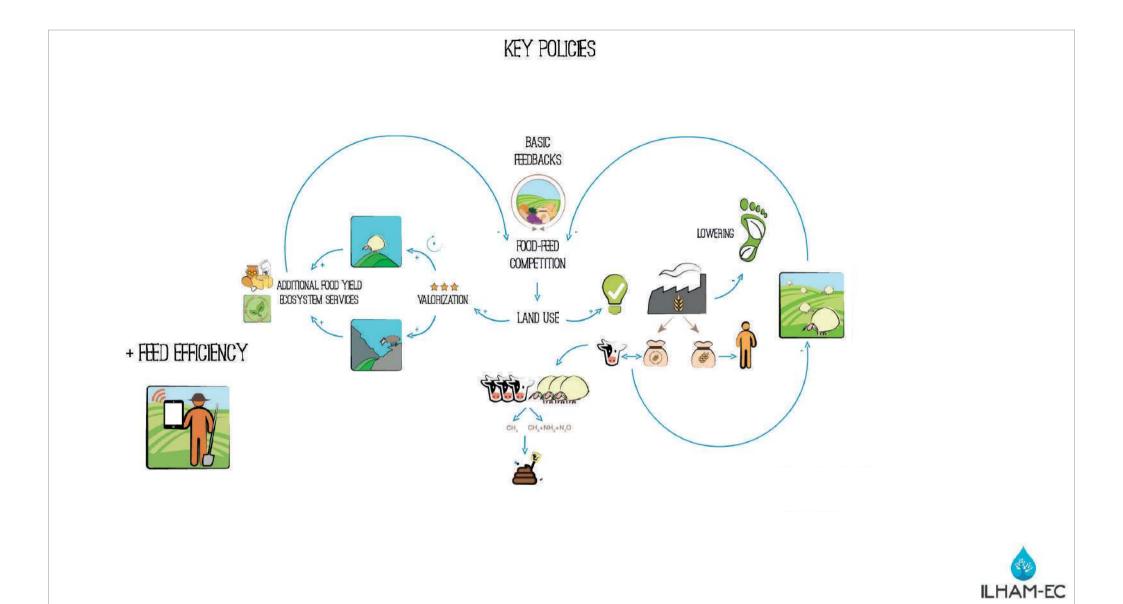
Step

Voice over

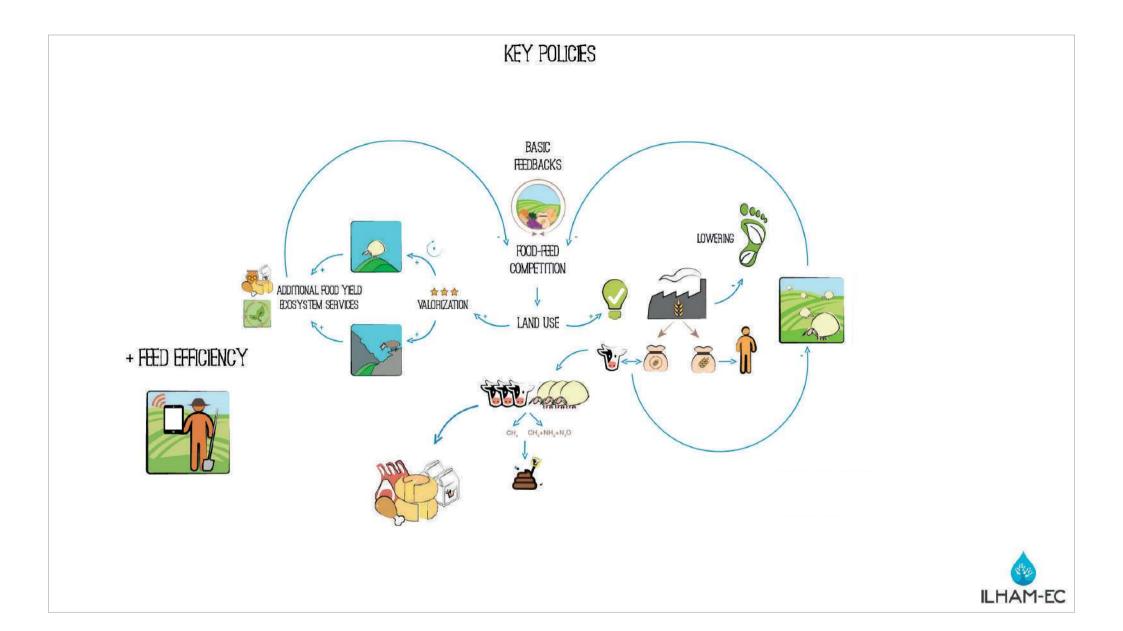
10-B (Atzori)

107

and the environmental impact and includes:



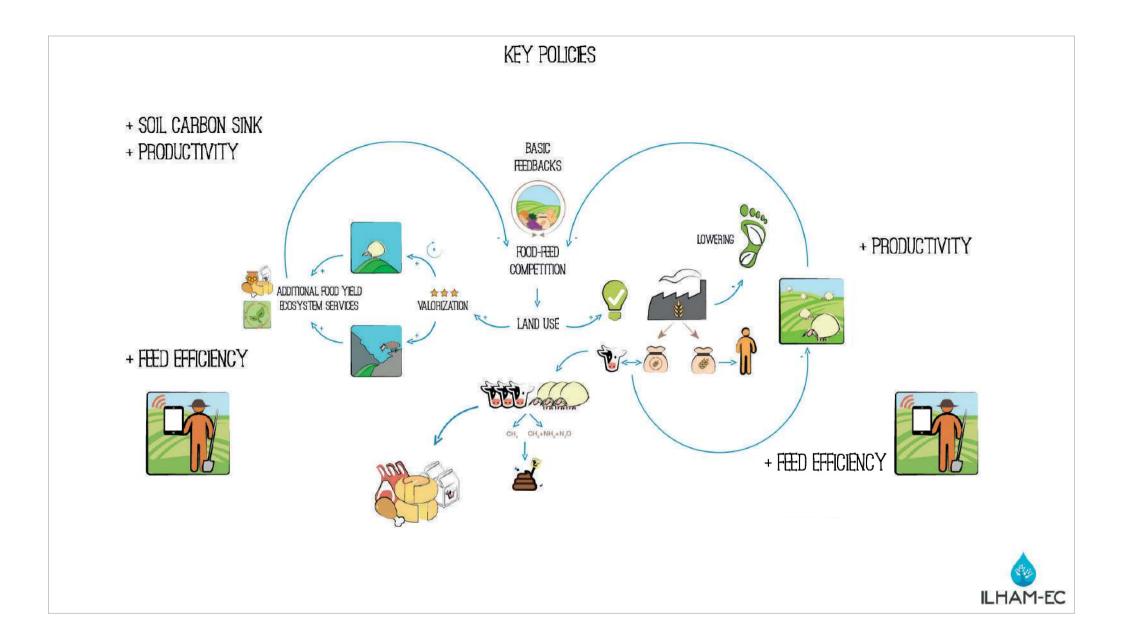
Storyboard code	Step	Voice over
10-B (Atzori)	108	I) precision feeding practices



Storyboard code	Step	Voice over
10-B (Atzori)	109	to increase animal production levels

# KEY POLICIES + SOIL CARBON SINK BASIC REDBACKS COMPETITION ADDITIONAL FOOD YIELD ♠ ♠ ♠ VALORIZATION ECOSYSTEM SERVICES + FEED EFFICIENCY CH, CH,+NH,+N,O + FEED EFFICIENCY ILHAM-EC

Storyboard code	Step	Voice over
10-B (Atzori)	111	II) to enhance the soil carbon sink



Storyboard code

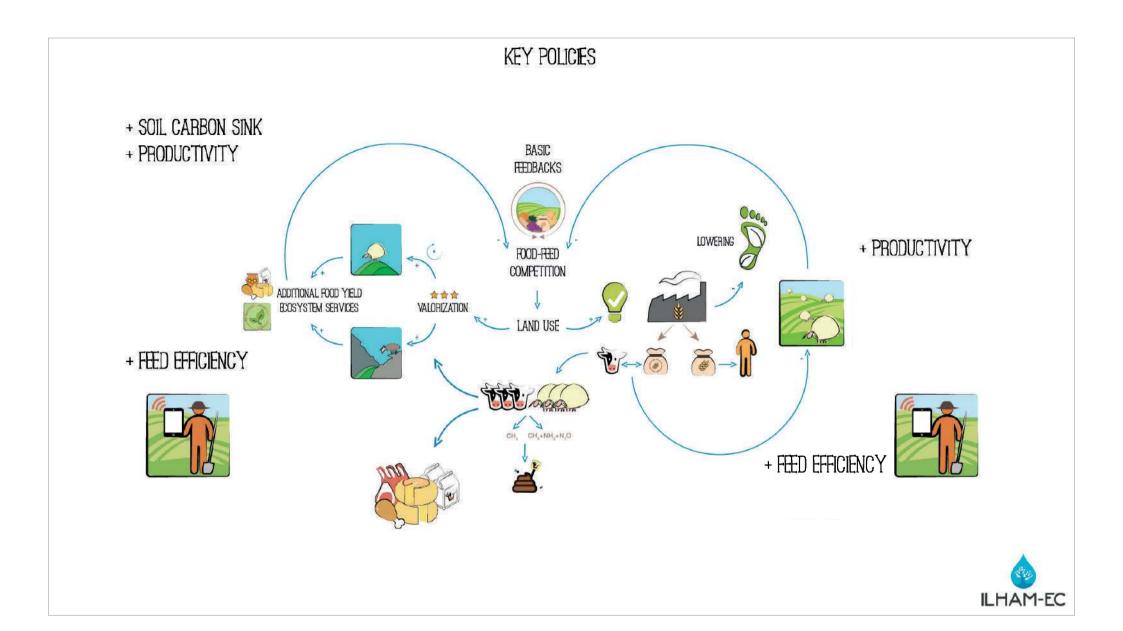
Step

Voice over

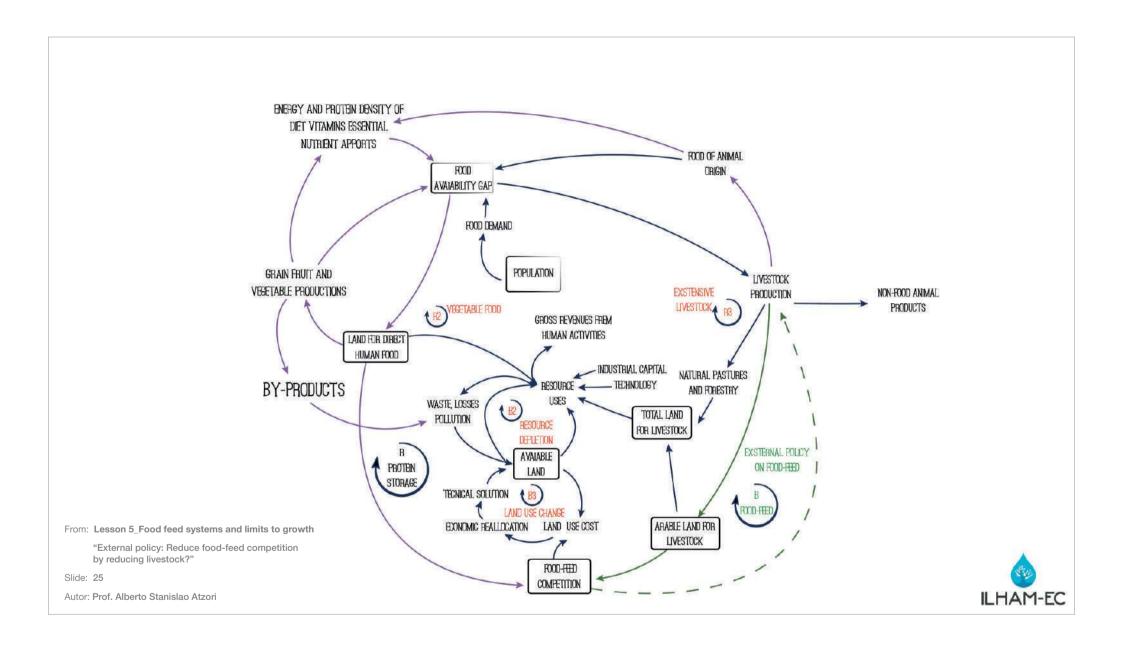
10-B (Atzori)

112

and productivity



Storyboard code	Step	Voice over
10-B (Atzori)	113	of pasture and forage crops.



Storyboard code	Step	Voice over
10-B (Atzori)	114	



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Storyboard code

Step

Voice over

10-B (Atzori)

115 (end)



## Divertitevi dialogando con System Dynamics!

asatzori@uniss.it

System dynamics è imparare giocando!

(...learning by doing; Sterman, 2000)



