

Transforming grasshoppers from pest to resource in the Tibetan mountain steppes



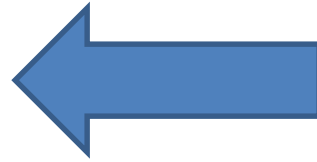
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**International Centre for Tibetan Plateau
Ecosystem Management, Lanzhou University
13 July 2019, Ormea**

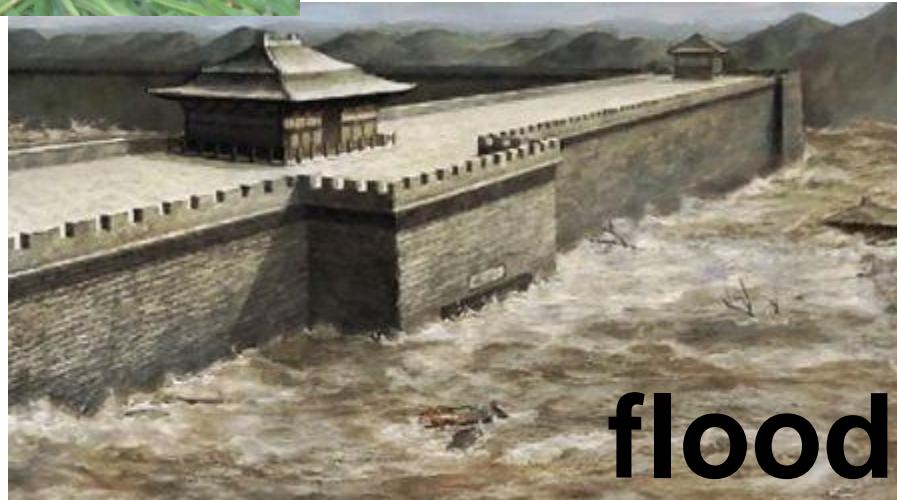
Three major natural hazards in the history of China



locust



drought



flood

Grasshopper Plague in the world



Measures of grasshoppers control

Fire



Yao Chong,
Tang Dynasty

Chemicals



- Unfriendly to the environment
- Unsafe to food chain
- Influenced by weather



Fungus

Metarhizium
anisopliae



- High costs,
- Influenced by weather conditions

Physical



**Difficult to
apply on
the fields**

**High-voltage electrostatic
spray multi-function car**

Biological-1

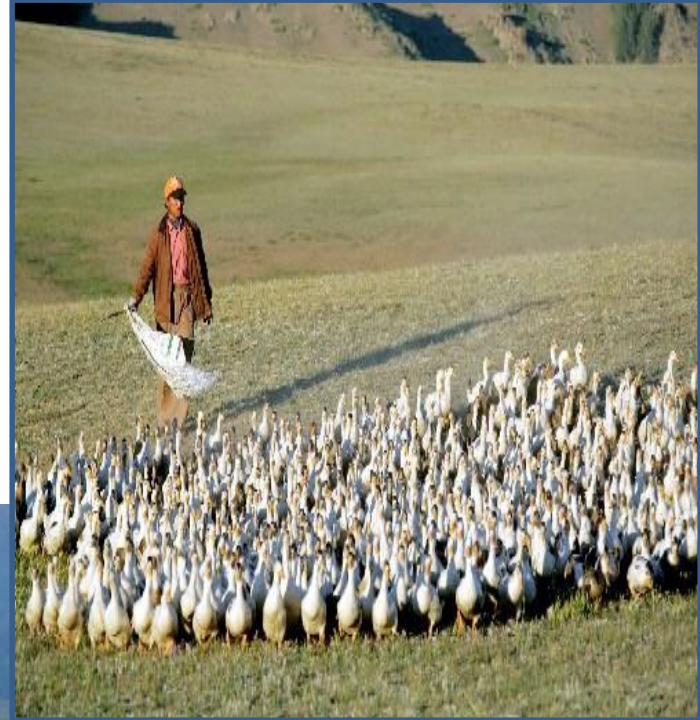
Rosy starling



- A migratory bird
- Effective but limited in time and area

Biological-2

Grazing ducks



- Quick moving
- Short staying
- High density
- Effective, but small range

Biological-3

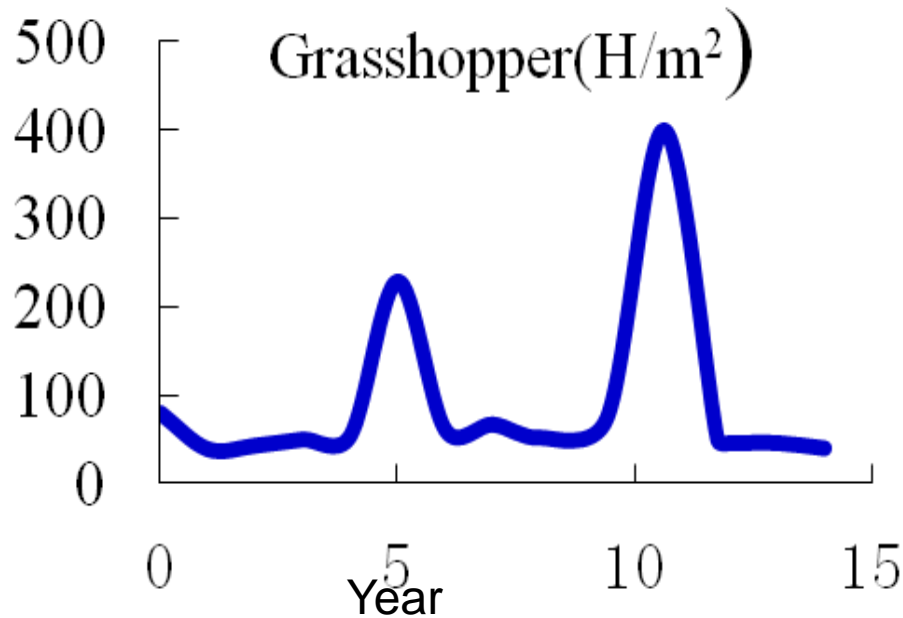
Fattening chickens on pastures



- High density
- High concentrate
- Un-grasshoppers control
- Fattening birds

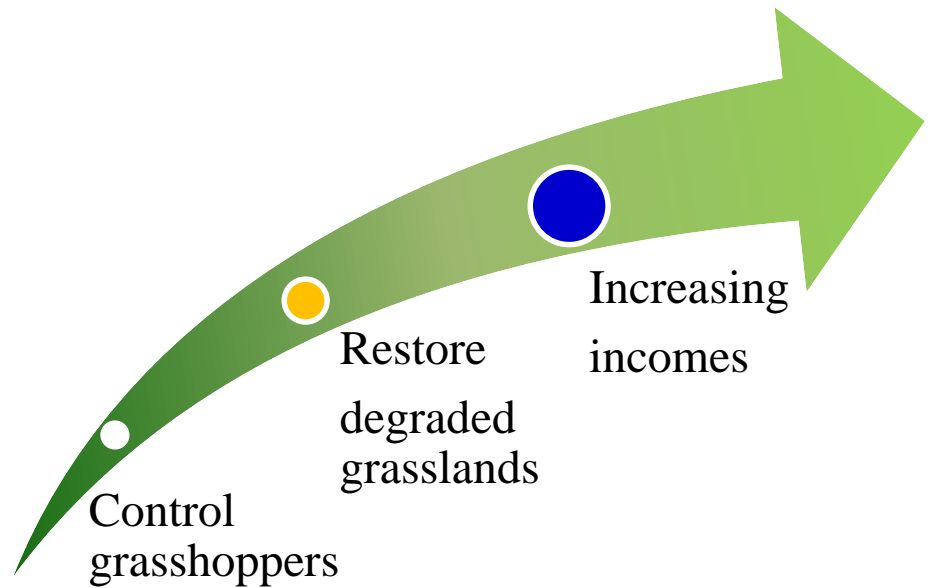
Question?

Global warming



- In North China—a year
- 20 million ha pasture damaged by grasshoppers
 - 1.6 billion kg of DM lost (can feed 30 million sheep)
 - 16.3 million USD to control grasshoppers

Can we find a approach to achieve the following targets?



Mountain livestock farming systems

Summer pasture:

livestock grazes from July to August



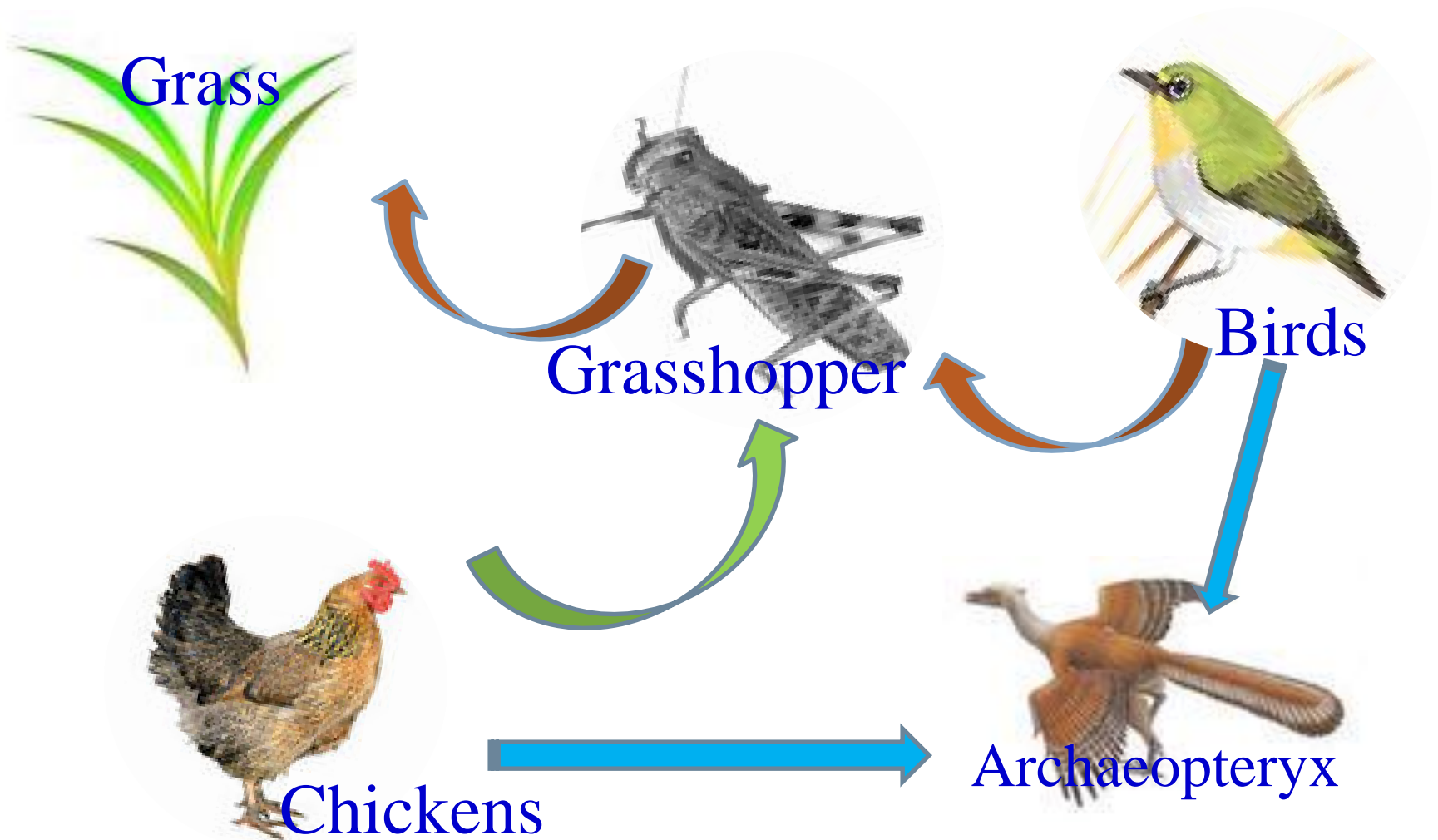


Autumn pasture: livestock grazes in September



**Winter & Spring pasture: livestock grazes from
October to June**

Adding chickens to traditional yak/sheep framing system to extend the food chain



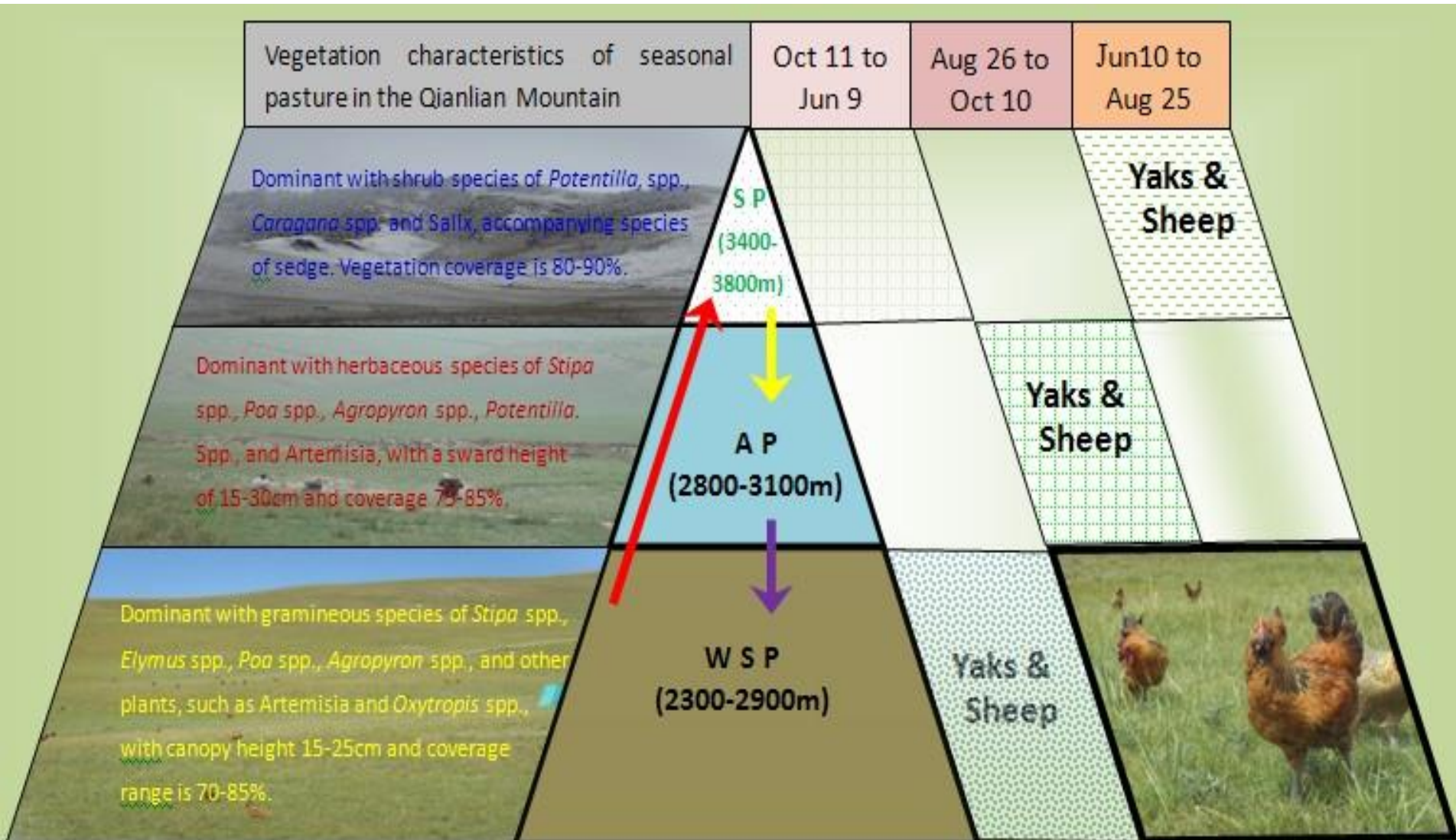


The winter pasture in summer and autumn is free from livestock grazing for about 120 days (June to October); the height of sward is about 20-30cm, the cover rate vegetation is between 70 to 80%.
The winter pasture is suitable to forage chickens in spatial-temporal demands.



The experiment of foraging chickens in alpine pasture

A novel model developed from the traditional transhumance grazing system for Tibetan livestock and chickens.



Scientific base –I: Spatial-temporal condition

Temporal
condition

Rotating grazing

Life history

Suitable
condition

Time Synchrony

Spatial
condition

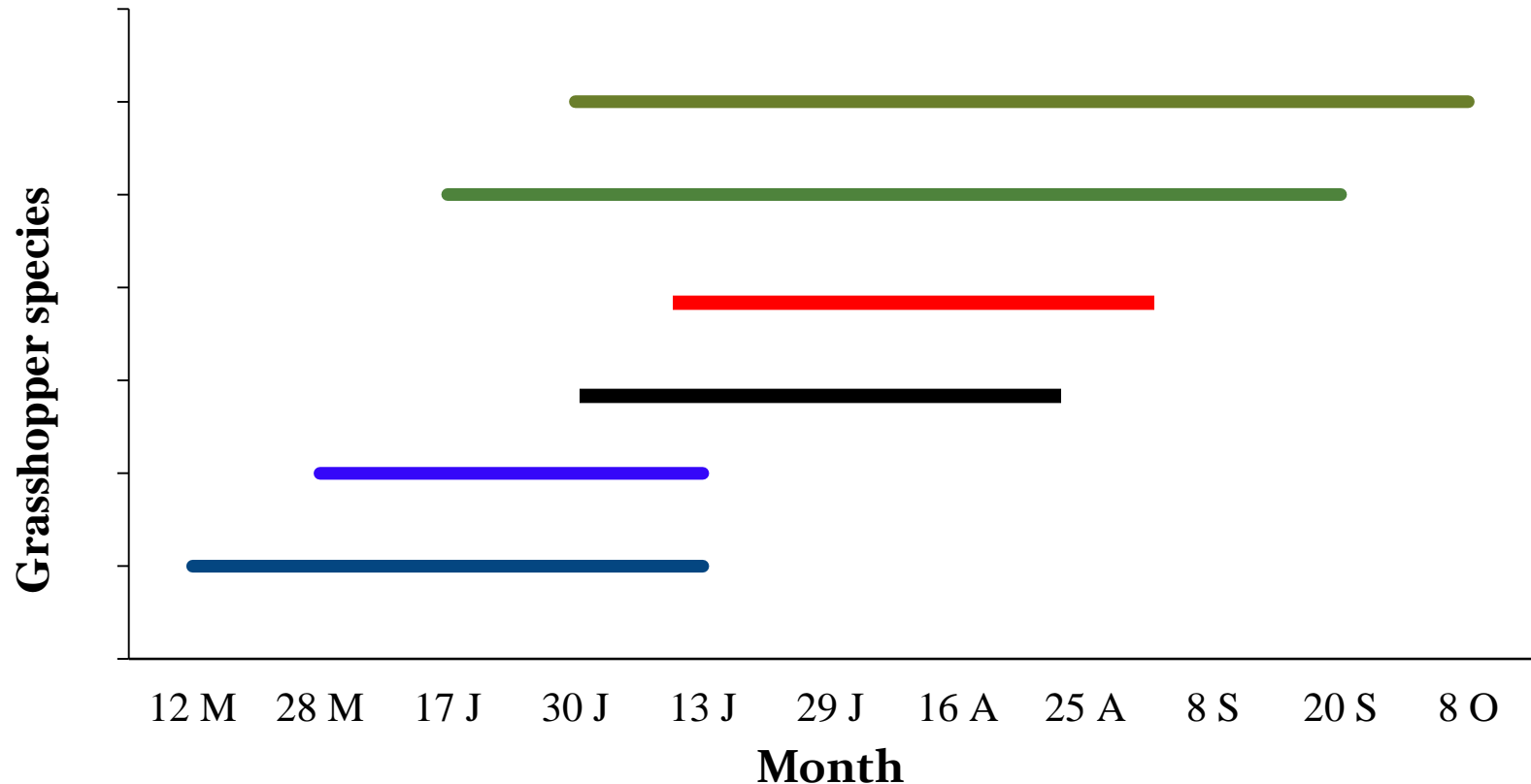
Winter
pasture

Lower height

Nature
enemy

Vast space

Scientific base II: Understanding of grasshopper development



15 species of grasshoppers are recorded

The objectives of the project

- Compare the effect of different control methods on grasshopper population density over different temporal-scales.
- Produce high quality of organic chicken meat.
- Assess and compare the economic benefits from using chickens and other control agents for grasshopper control.
- **Find a Socio-Economic & Biological Approach to achieve win-win solution**

The project area



Free-ranging birds





Free-ranging birds

Chemical control



Biological



The benefits and cost of combining chicken foraging (FC) with sheep grazing (GS) versus just GS in 2007 (in per ha)

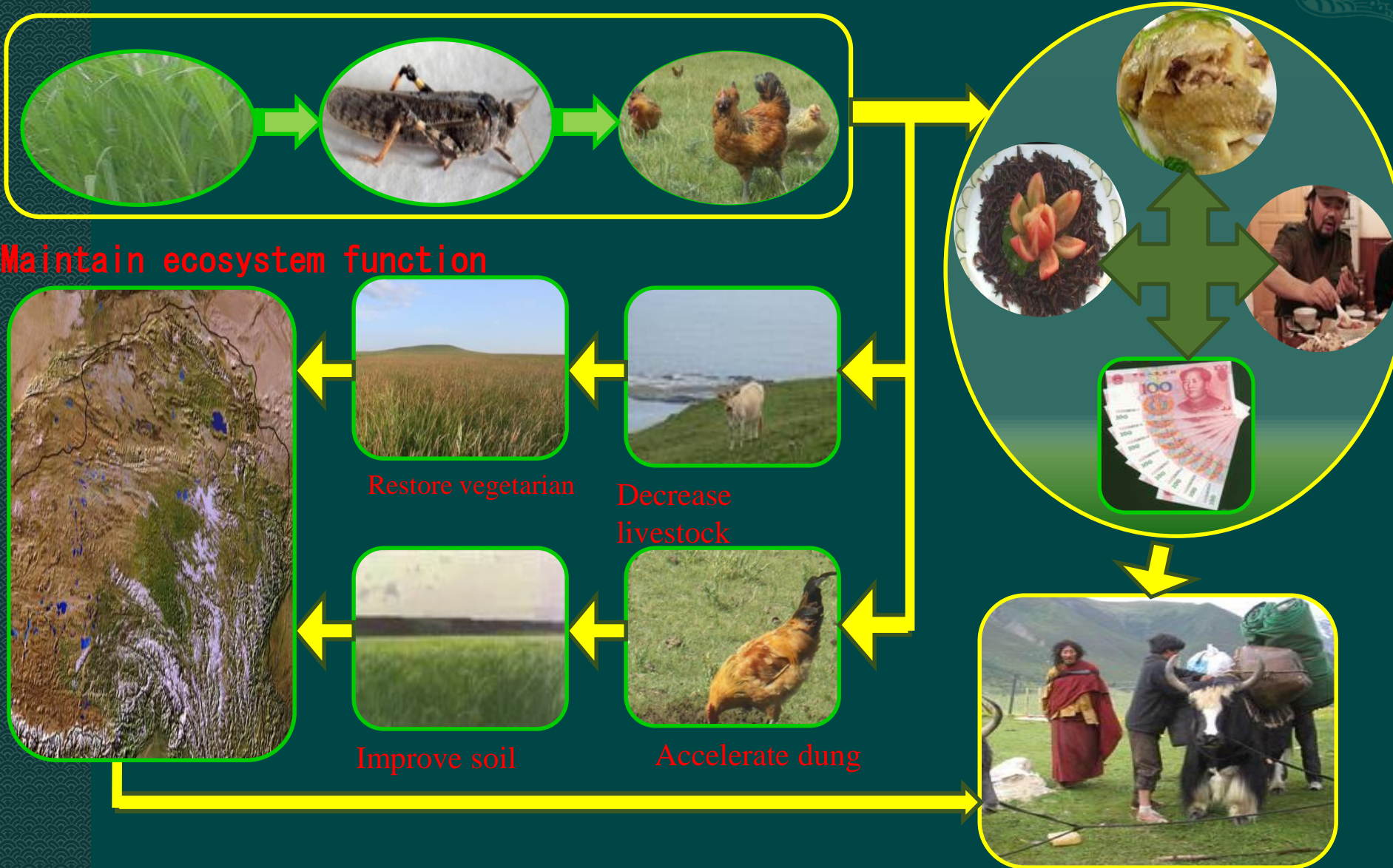
Item			FC+GS	GS
Costs (US\$/ha/year)	Managing rangeland	Weed control	3.8	3.8
		Grasshopper control	0	4.0
		Building enclosure	5.1	5.1
		Employing labourers	1.6	1.6
	Managing sheep and birds	Purchasing young birds	14.0	0
		Supplemented feed	7.8	4.0
		Epidemic prevention	4.0	3.7
		Employing labourers	14.6	8.3
	Total		50.9	30.5
	Benefits (US\$/ha/year)	Selling wool	10.0	10.0
Selling chicken		100.0	0	
Selling sheep		109.8	109.8	
Total		219.8	119.8	
BCR (benefit to cost ratio)			4.32	3.92
NPV (the net present value)			168.9	89.3

Comparison of different control measurements

- **Chemicals & fungus:** only effect these species developed before the date of drug application. Have to apply for every year, chemical contamination, damage food chain.
- **Grazing ducks & fattening chickens:** might prey some species developed before grazing period. Have to graze every year.

- **Foraging chickens:**
- 15-20 chickens/ha,
- Grazing for 3-4 months,
- Prey all species,
- Effective control for 5 years,
- Harvest high quality of organic bird meat,
- More incomes,
- Environmental friendly, less degradation,
- **A Socio-Economic & Biological win-win resilience solution.**

Conclusion





Thank you