

Sustainable intensification of smallholder livestock production: fact and fiction

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Context

- Livestock Revolution: 2050, 9 billion people who want to consume more eggs, meat and dairy
- FAO: Population growth 77% increase in meat and 86% in milk; income increase main contributor in only few countries
(Pica-Ciamarra and Otte, 2009)
- Intensification of livestock production needed: low producing livestock in areas where increasing demand is expressed
- 'improvements in feeding can increase milk production 4 times'
- Intensive systems the least environmental damage per unit product
(Livestock's Long Shadow, 2006; CG policy paper, 2013)

Context

- Smallholder crop-livestock households 20% world population producing: meat 65%, milk 75% in developing world
- Crop-livestock farms the dominant farming system, this will not change for another 20 years
- 900 million hungry people, 1 billion overweight people
- 1.2 billion poor people (less than 1.25 \$ d⁻¹), 75% in rural areas
- Intensification smallholder livestock unique opportunity for improving livelihoods

Opinions based on facts?

Intensification

- Increased use inputs and services to increase output quantity or value
- Why?
 - Improving income rural households
 - Meeting the increasing demands
 - Environmental sustainability
- Living up to these expectations?



Intensification

Change in management, feeding system, other breeds, increase in numbers



intensification



Intensification



intensification



Contributions to livelihoods

Multiple Production Aims of Tropical Livestock



Quantification approach in \$

Bosman, Moll, Udo, 1997

products

manure

draught

insurance

finance

status



- Quantifying different benefits in different systems
- Understanding decision making farming households
 - allocation of resources
 - decisions not at optimum biological moment
- Smallholders more productive than often assumed



Contributions to livelihoods

Livestock ladder



Village poultry

- Three quarters of rural households keep them
- Drivers:
 - 'the first and last resource of the poor'
 - promoted to improve livelihoods poor women

(Aklilu, 2007)



- People prefer local chickens and eggs
 - better taste
 - better prices
- Production low, economic results low
- Productivity very high
- Environmental impact?
- Poverty alleviation?
- Safety net: sold when small cash is needed

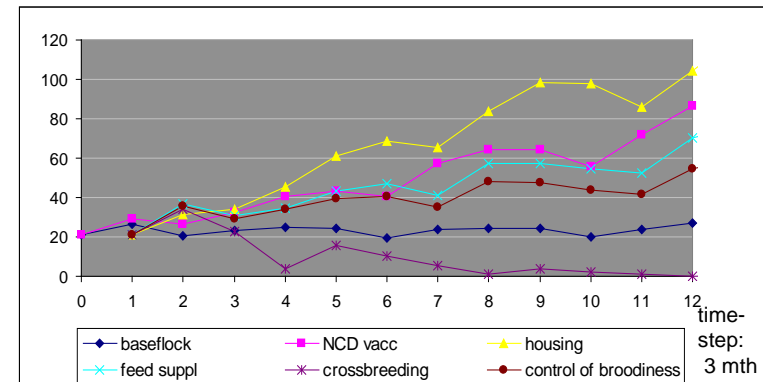
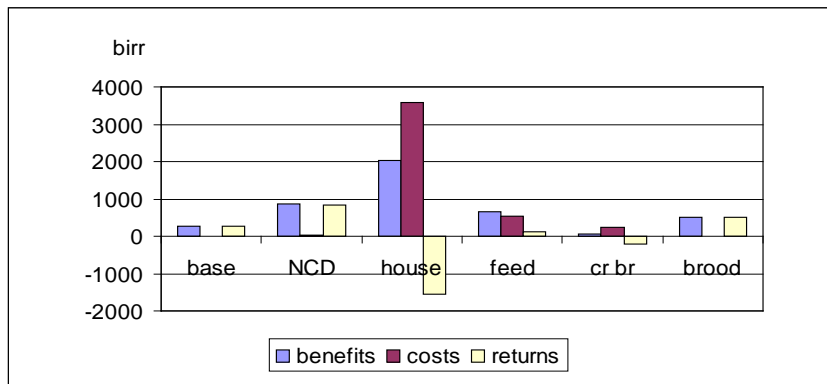
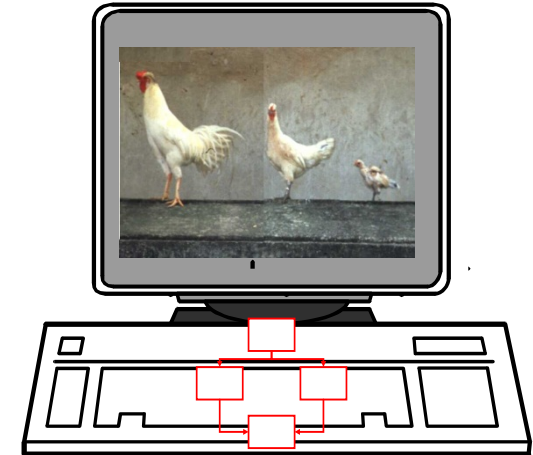


Village poultry

Intensification does it work?

■ Simulations of innovations

- technical results improved remarkably, except for crossbreeding
- often innovations negative economic impact: Ethiopia, Kenya, Mozambique, Tanzania



Village poultry

Intensification how?

- Only small step, low cost improvements will work
 - NCD vaccination, predation,
- Local marketing networks needed
- Not able to supply growing urban markets



Commercial poultry

System jump

- Large- or small-scale?
- Needs cash inputs, feed, labour
- Market-oriented
 - competition with other farmers
 - competition with imports
 - markets easily collapse
 - due to economic crises or imports
 - (Brasil, Dutch inferior cuts)
- Easy to learn, local expertise available



Small ruminants

- Numbers increase, least developed countries
- Literature: small ruminants can help the poor
- Sheep and goat farmers among poorer groups in society
- Tool in poverty alleviation or sign of poverty?



Small ruminants

Indonesia

- 4-6 animals; 4 h d⁻¹
- More animals will not match farmer's resources
- Intensification cropping: grazing lands disappear
- Labour productivity below minimum wage
- Farmers do not consider the family labour as real costs
- A very much appreciated secondary activity
- Safety net (urgent cash needs), Manure
- Religious festivities: sheep (males of 25 kg or more)
- Local market plus market in major cities through
- Poverty alleviation?



Smallholder dairy

Kenya

Drivers: demands, reduced land sizes, agro-ecology

Intensification: Free-grazing \longrightarrow Zero-grazing



Change in breeds

(Bebe, 2003)

- 650 000 (maybe $2 \cdot 10^6$) households in dairying, 80% of milk production
- Labour productivity higher than for crops and wage labour
- Also dairy cattle have various livelihoods functions
- Feed the main constraint: quality!
- Milk yield about 5 kg per lactation day
- Households with dairy cattle relatively well-off

(Moll, Staal, Ibrahim, 2007)

(Bebe, Udo, Thorpe, 2004)

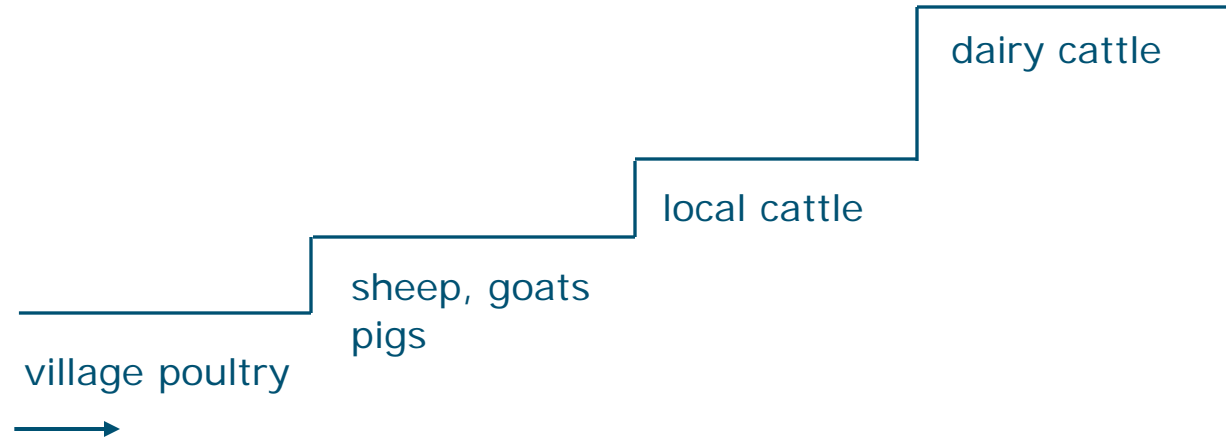


Smallholder dairy Contributions to livelihoods

- Dairying gives substantial income improvement: Bhutan, India, Tanzania, Philippines, Kenya
- Not for the really poor
- Milk production 5-6 kg lactation day⁻¹ plus milk for calf
- Market the major pull factor
 - informal market the largest share (Staal, ILRI)
 - higher prices for farmers, lower prices for consumers
 - Kenya: 12-18 fte employment for every 1000 kg handled
- Smallholders competitive: family labour, less investments
(diseconomies of scale)



Contributions to livelihoods



- Contributions hh^{-1}



- Paying back animals/loans



- Helping the poor



Meeting demands

- Can smallholders meet the increasing demands?
- Supply and demand
- Asia: 80% increase in demands from commercial pigs and poultry
- Livestock revolution is bypassing the poor?
- Collapse commercial poultry sector (small and large-scale) in W. Africa due to imports from Brazil and Europe (inferior cuts)



Meeting demands

Dual structure

Smallholder livestock	Rural markets	Urban markets	Large-scale livestock
Village poultry	√√	√√√	Commercial poultry
Small comm. poultry	√	√	
Small ruminants	√	√	
Pigs	√	√√	Commercial pigs
Local cattle	√	√√	Grazing systems
Dairy cattle	√	√√√	Dairy cattle

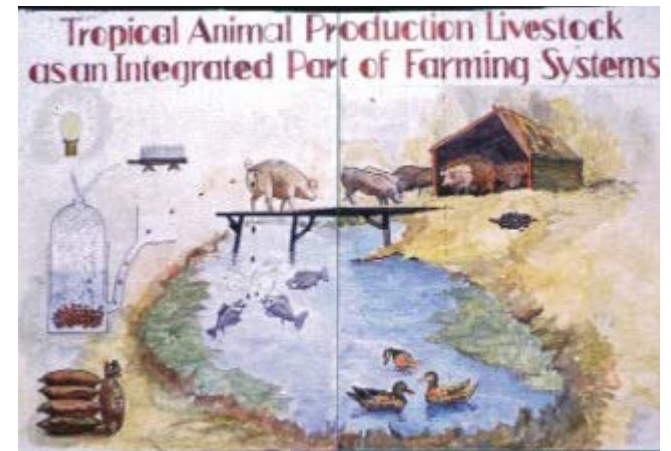
√: small contribution; √√: large contribution

- Cooperation or competition?

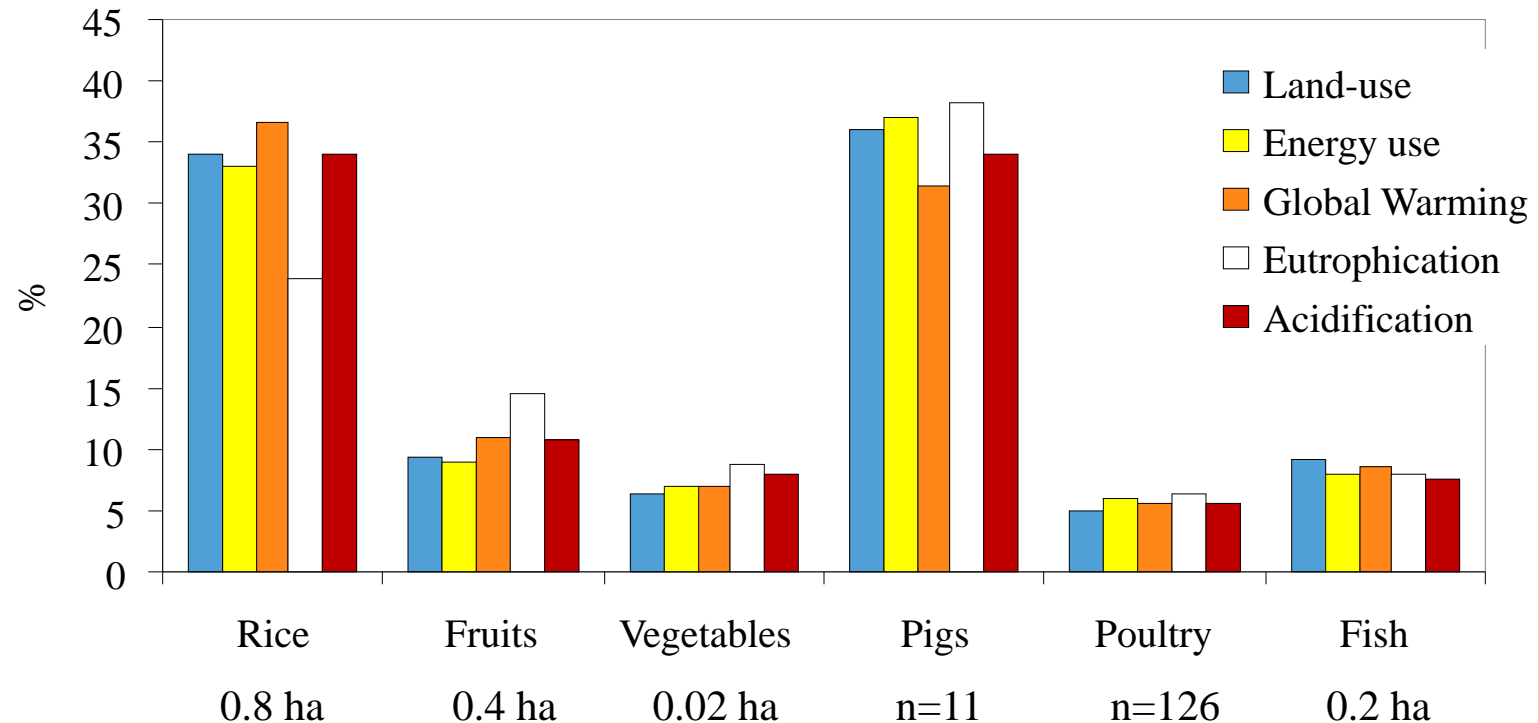


Impact on environment

- Hypothesis: intensive systems the least environmental damage per unit product (Livestock Long Shadow, 2006; Gerber, Vellinga, Opio, Steinfeld, 2011; CG Policy paper, 2013)
- Two case-studies:
 - Integrated Agriculture-Aquaculture (IAA) systems Vietnam
 - dairying Kenya



Impact on environment IAA systems Vietnam



Impact farm components on environmental categories (LCA)

(Phong, 2010)

- impact pigs (hybrids) due to off-farm feed production



Impact on environment IAA systems Vietnam

- Integrated Agriculture-Aquaculture systems:
 - pigs or poultry: impacts per kg similar
 - impacts 1.6 (global warming) to 1.8 (land use) higher per kg pig and poultry protein than per kg fish protein

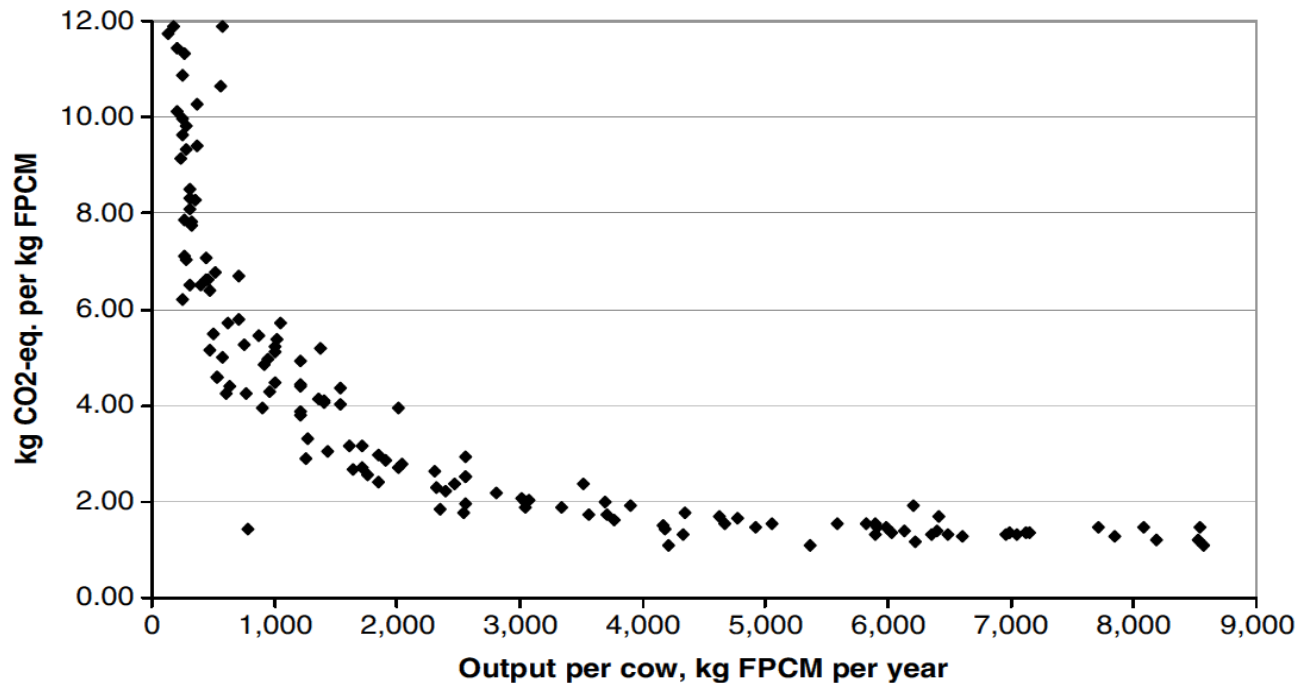
(Phong, de Boer, Udo, 2011)

- Environmental comparison specialised (430 t ha⁻¹) and integrated striped catfish production (3.5 t ha⁻¹):
 - specialised systems higher impact per t for 7 out of 9 environmental impact categories
 - feed production contributed most
 - environmental performance better in integrated systems

(Kluts, Potting, Bosma, Phong, Udo, 2012)



- FAO: Greenhouse gases and milk yields



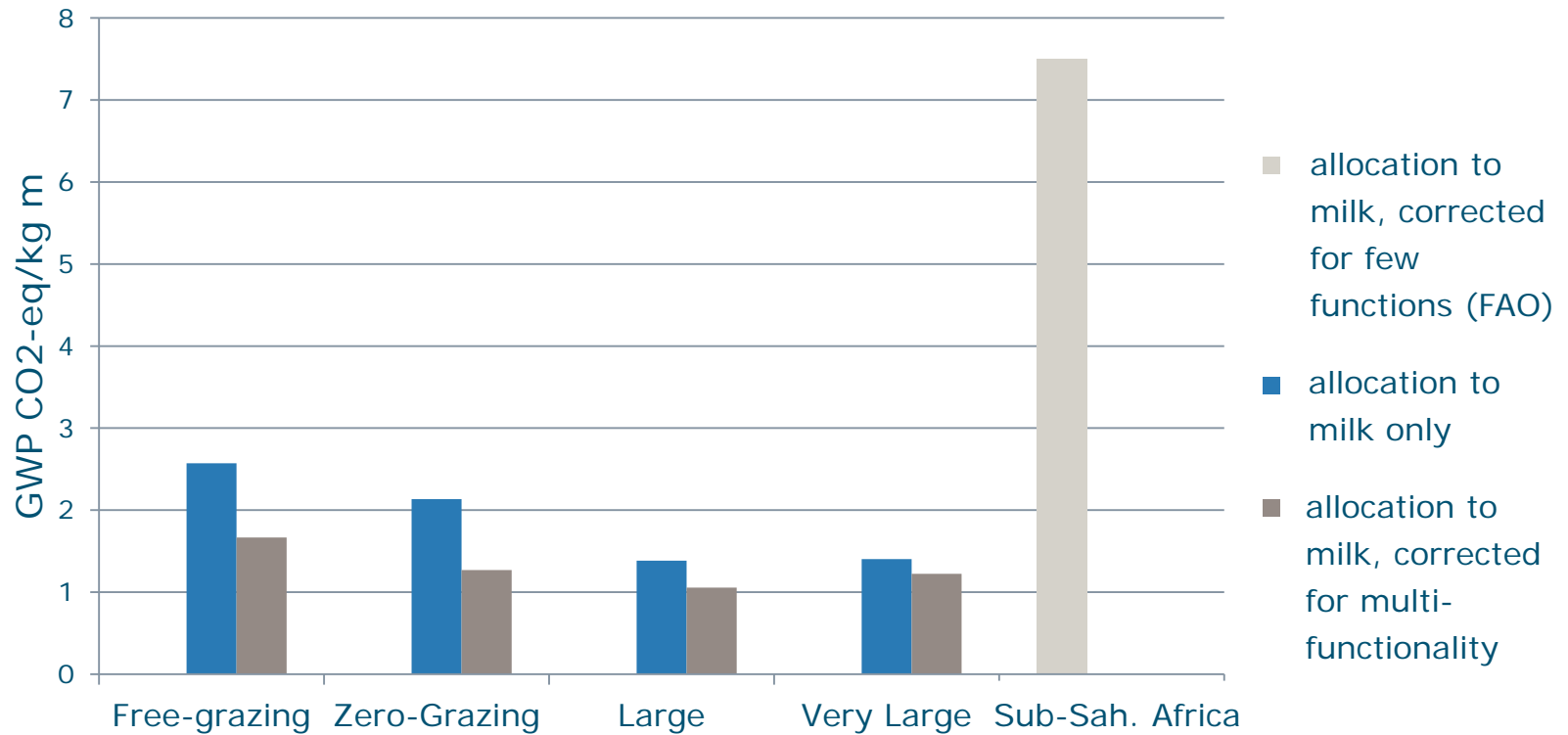
Greenhouse gas emission and milk output per cow for different countries

(Gerber, Vellinga, Opio, Steinfeld, 2011)



Impact on environment

Dairying Kenya



farm size (ha)	2.4	1.1	16	61	
for cattle (ha)	0.3	0.3	6	61	
herd size (n)	5.6	3.2	27	178	
cows (n)	2.6	1.5	14	107	
milk (kg.d ⁻¹)	4.5	5.3	9	9	1.0

(Bebe, 2003

Omiti et al., 2003 Kahi et al, 2000 FAO, 2010)



Impact on environment

Mitigation options

- Manure management
- Shift from ruminants to poultry

- Better diets for ruminants
 - improved pasture management
 - legumes
 - improved fodder technologies
 - supplements, concentrates

Yes, but effect will not be big

Asia: increase in production 80%
due to commercial pigs and poultry;

Grains, cropland?

Other functions ruminants?

Possible?



Better diets

- Global studies, impact better diets: 'productivity increase will satisfy increasing demands and offers a mitigation option'

(Gerber, Vellinga, Opio, Steinfeld, 2011)

- FAO e-conference 2010: why improved feed technologies not adopted?
 - weakness of transfer/extension services
 - top-down research approaches
 - research has failed to demonstrate the economics
- Technologies too expensive, not meeting labour and land resources
- Global studies overestimate opportunities, underestimate constraints



- Feed assessments needed
 - also future smallholder production will be based on resources
- Small step feed improvements
 - Gujarat: modelling and field studies indicate 20% increase in milk production possible by optimal use local feeds (Patil, 2006)
- Feeding has to be done every day in contrast to other innovations

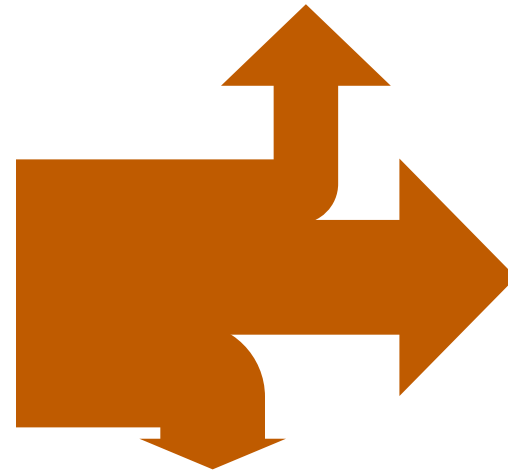


- Be careful in generalizing global data
- Impacts and trade-offs should be assessed at local level
- Trade-offs: impacts per unit product vs impact per unit area; biodiversity; water footprint
- Allocation method will influence mitigation options recommendations
- Livelihoods lens needed



What will happen?

- Dorward (2009), strategies:
 - stepping up
 - hanging in
 - stepping out



- Stepping out: labour scarcity outside agriculture needed



Sustainable intensification

Drivers: increasing demands, policies, climate change
reducing land sizes, intensification cropping, competition

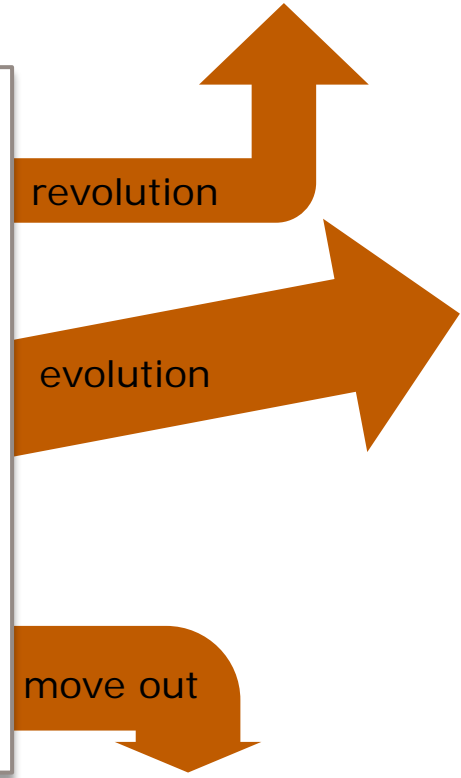


labour, capital, land, feeds, health;
family situation



smallholder crop-livestock systems

- credit
- services
- institutions
- farmers' groups
- knowledge
- research support
- policy support



developments outside agriculture

Sustainable intensification of smallholder livestock production: fact and fiction



?

PhD students: Aklilu, Ayantunde, Barwegen, Bebe, Bosma, Bosman, Duku, Efdé, Ifar, David, Gede, Kondombo, Kosgey, Patil, Petronella, Phong, Tashi, Widi, Wilson; MSc students: Braker, Briejer, Jansen, Kluts, Ba, van der Lee, Meijer, Nettisinghe, Salas, Titus; APS staff: de Boer, Eilers, Steenstra, Brouwer, Cornelissen, Hofs, de Jong, Koops, Oosting, Schiere, Viets, Zemmeling, van der Zijpp, Zwart; WU colleagues: Almekinders, Kluts, Visser, van Arendonk, van Densen, Frankena, Hermans, van Keulen, Kwakkel, van der Lende, Machiels, van Mensvoort, Moll, Noordhuizen, Oldenbroek, Parmentier, Potting, Slingerland, Stoorvogel, Verreth; Colleagues: Baliarti, McCrindle, Nicola, van den Berg, van Dam, Fernandez-Rivera, Hiernaux, Ibrahim, Nhan, Rowlands, Thorpe, Tri, Uzay, Webb, Widodo

