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The U.S. Government's Global Hunger & Food Security Initiative

Research groups and opportunities for crop-livestock research

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Feed the Future Innovation Lab for Livestock Systems

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OUTLINE

- Feed the Future Innovation Lab for Livestock Systems
- Context: Changing crop-livestock systems
- Gaps and Opportunities
- Lessons Learned

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FEED THE FUTURE INNOVATION LAB FOR LIVESTOCK SYSTEMS

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VISION AND APPROACH

- To intensify sustainably smallholder livestock systems through innovative research, technology application, and capacity building.
- To increase animal-sourced food production in order to increase the incomes, livelihoods, nutrition and health of vulnerable people.

Achieved through:

- Country-focused research programs with priorities set in a gender-informed, participatory manner.
- One Health and food systems approaches.

OBJECTIVE AND APPROACH

- To achieve sustainable improvements in livestock productivity, health, marketing and consumption to increase the incomes, health and nutrition of vulnerable livestock holders.

- Additional goals:
  - Increasing the resilience of vulnerable populations
  - Reducing the environmental impact of livestock systems

Approach: Integrated, interdisciplinary, involves researchers from across the University

TARGET COUNTRIES

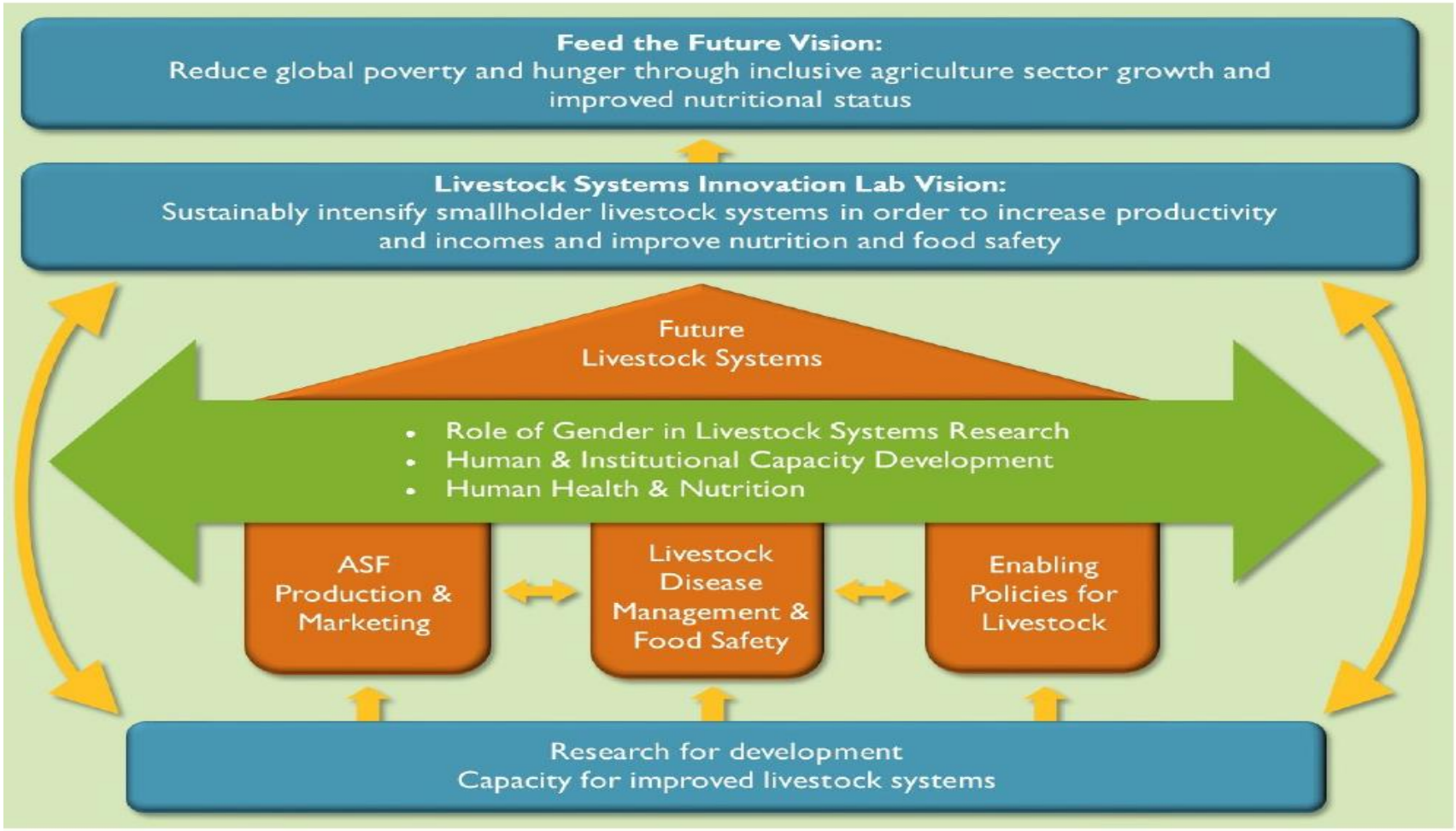
- West Africa – Burkina Faso and Niger
- East Africa – Ethiopia and Rwanda (Tanzania)
- Asia – Nepal and Cambodia
- Efforts focus on the three main systems in target countries
  - ➢Pastoral
  - ➢Mixed crop-livestock
  - ➢Peri-urban, intensive

AREAS OF INQUIRY

- Animal-Source food (ASF) Production and Marketing
- Livestock Disease Management and Food Safety
- Enabling Policies for Livestock
- Future Livestock Systems

CROSS-CUTTING THEMES

- The Role of Gender in Livestock Systems Research
- Human and Institutional Capacity Development (HICD)
- Human Health and Nutrition



Key: Cross-cutting Themes Areas of Inquiry

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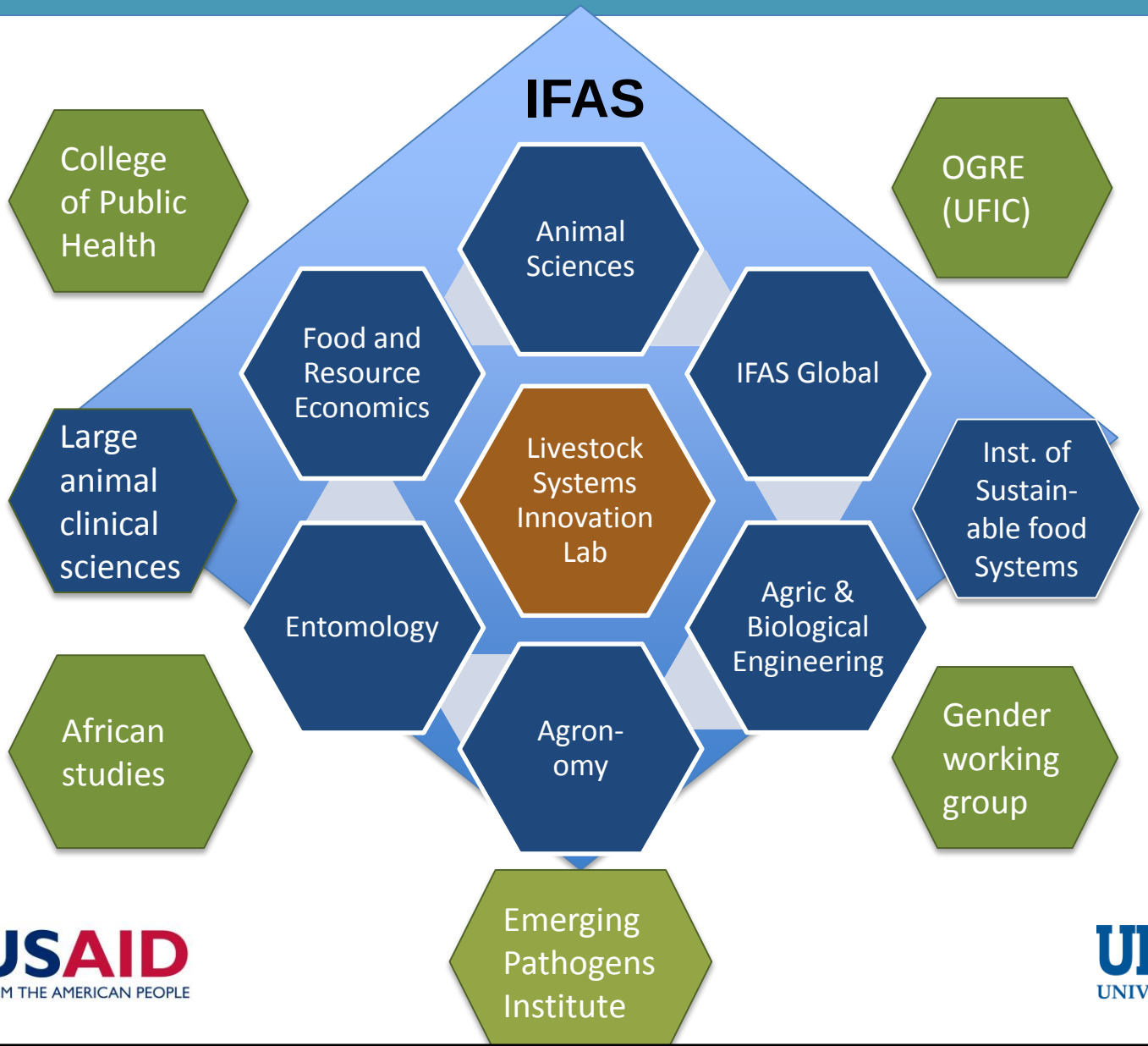

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TYPES OF AWARDS WE PROVIDE

- Competitive (RFA-based) grants
  - Reach grants ($1,000,000 for 4 years)
  - Focus grants ($100,000 for 1 year)
- Non-competitive funds for strategic partnerships and initiatives
- Non-competitive funds for the UF

EFFORTS TO DATE

- Research priorities determined for all 6 countries
  - Scoping visits
  - Innovation Platform meetings
- Ethiopia, Rwanda, and Nepal research projects are awarded
- Cambodia RFA ongoing
- Burkina Faso and Niger RFA: this month

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CONTEXT FOR RESEARCH: CHANGING CROP-LIVESTOCK SYSTEMS

EXAMPLES FROM WEST AFRICA

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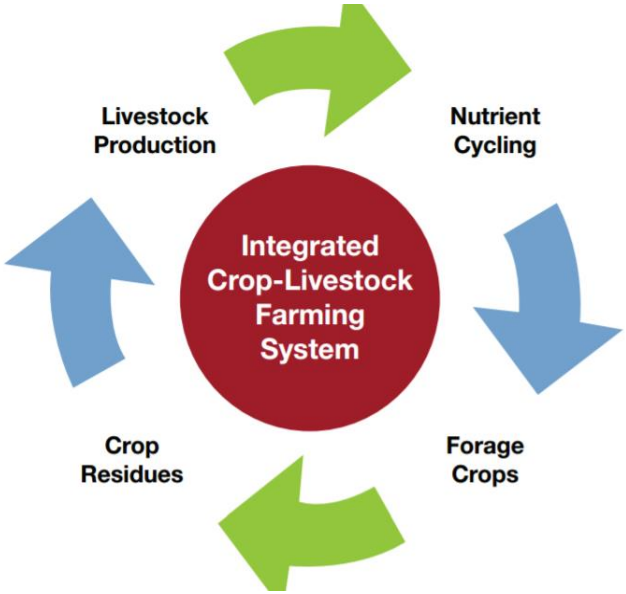
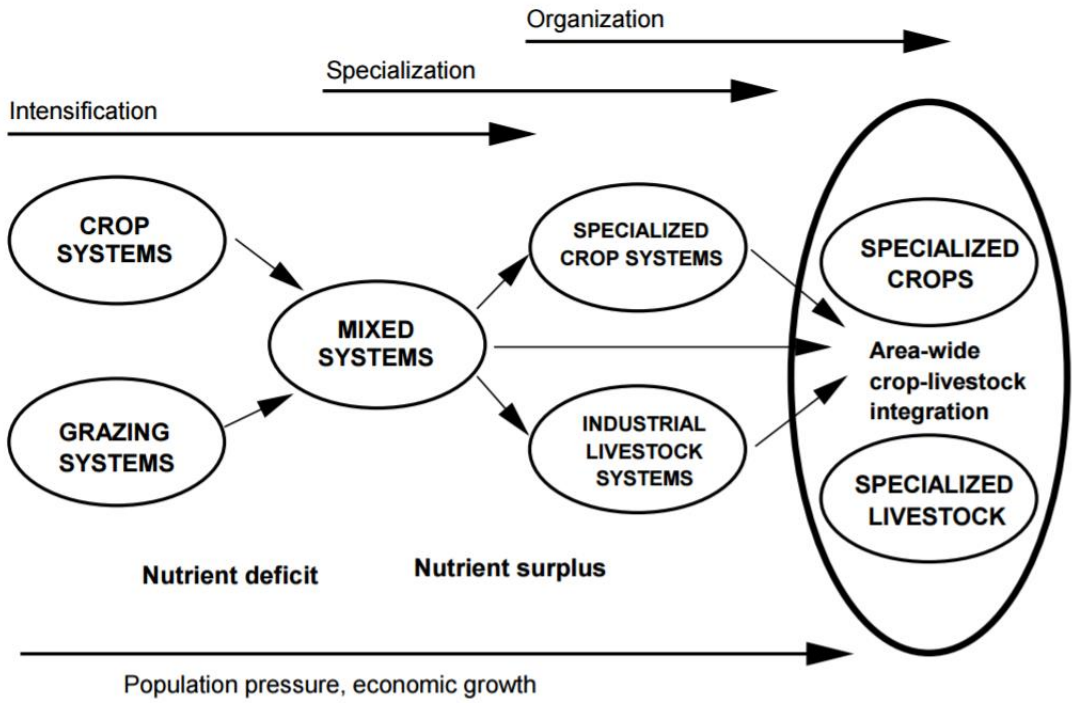
BACKGROUND: COMPONENTS

- Complexity of components and interactions
- Complexity of context
- Change and drivers



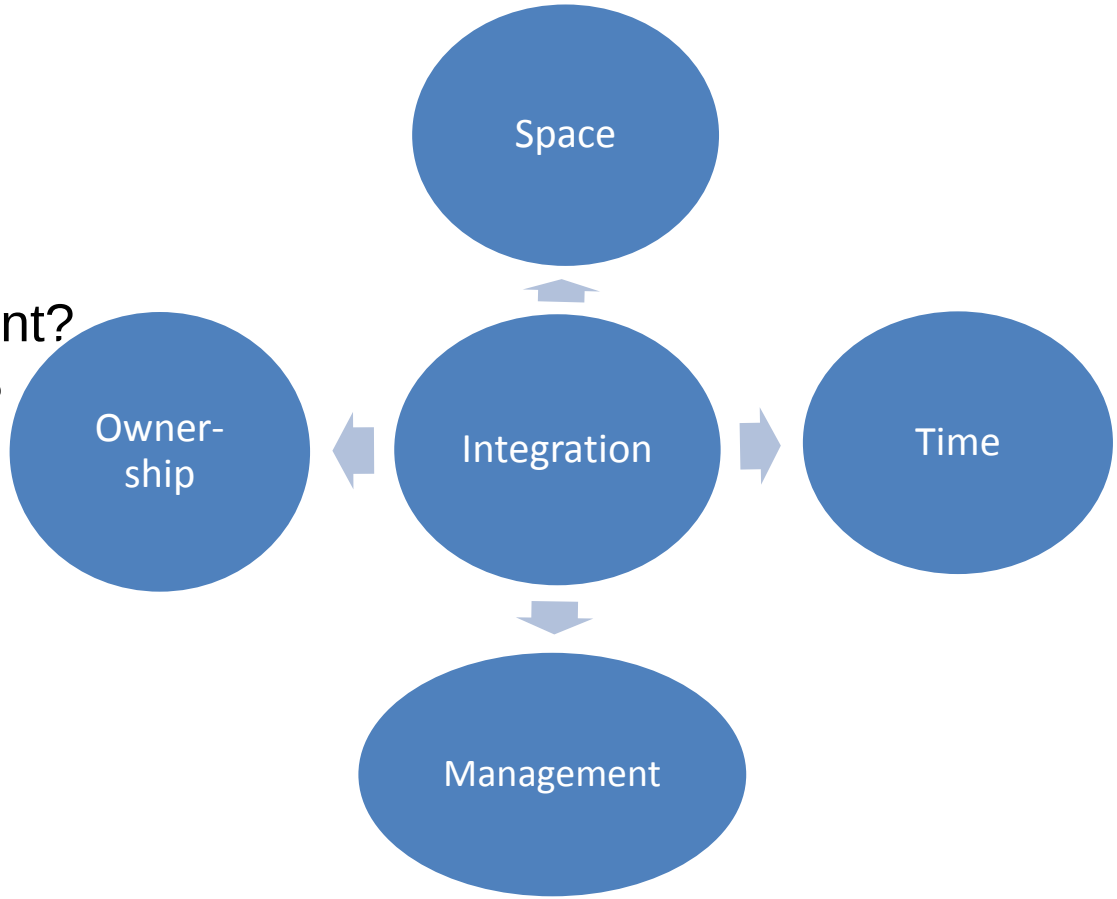
BACKGROUND: PATHWAYS TO INTEGRATION

- Processes of intensification evident but variability: regions, countries, locations
- West Africa
- Implications for research

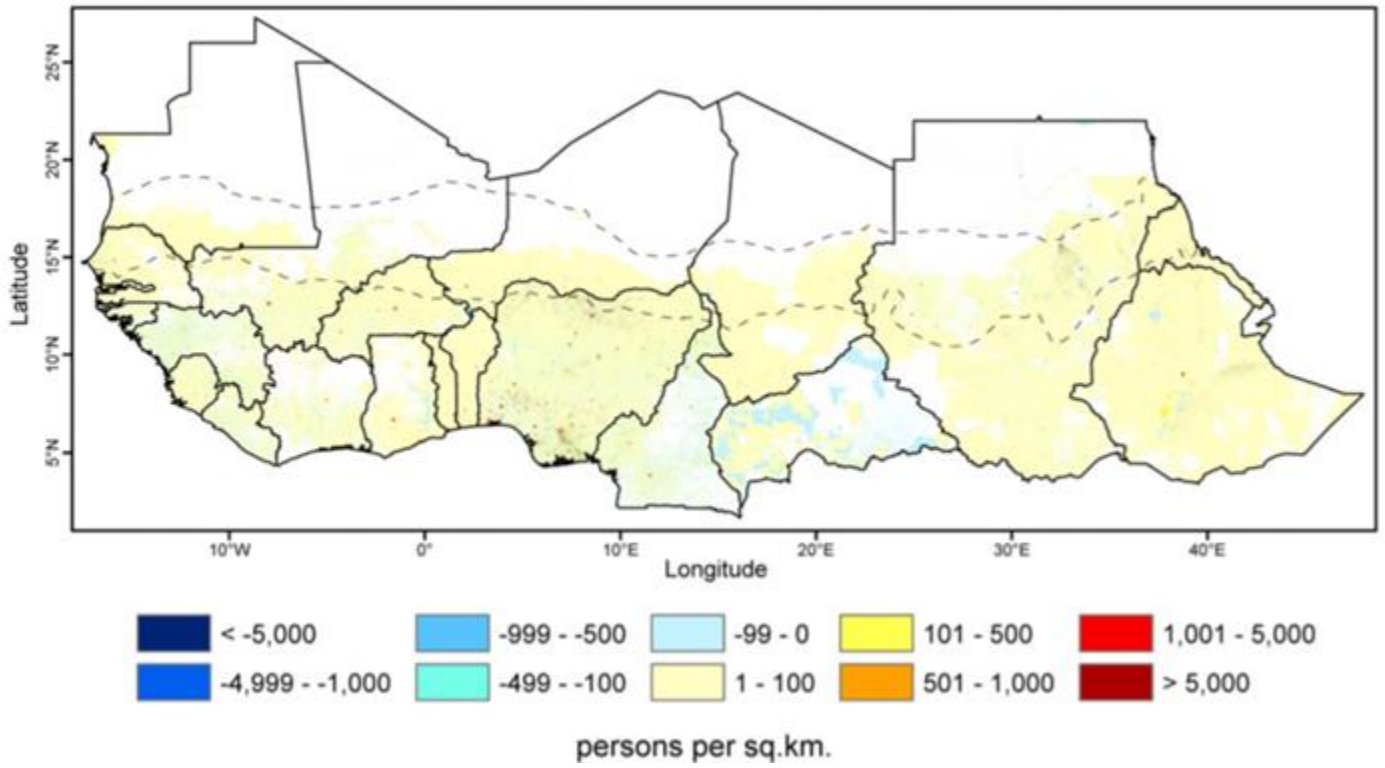


BACKGROUND: BROADER VIEW ON INTEGRATION

- Space: far or close?
- Ownership: same or different?
- Time: simultaneous or not?
- Management: by whom?

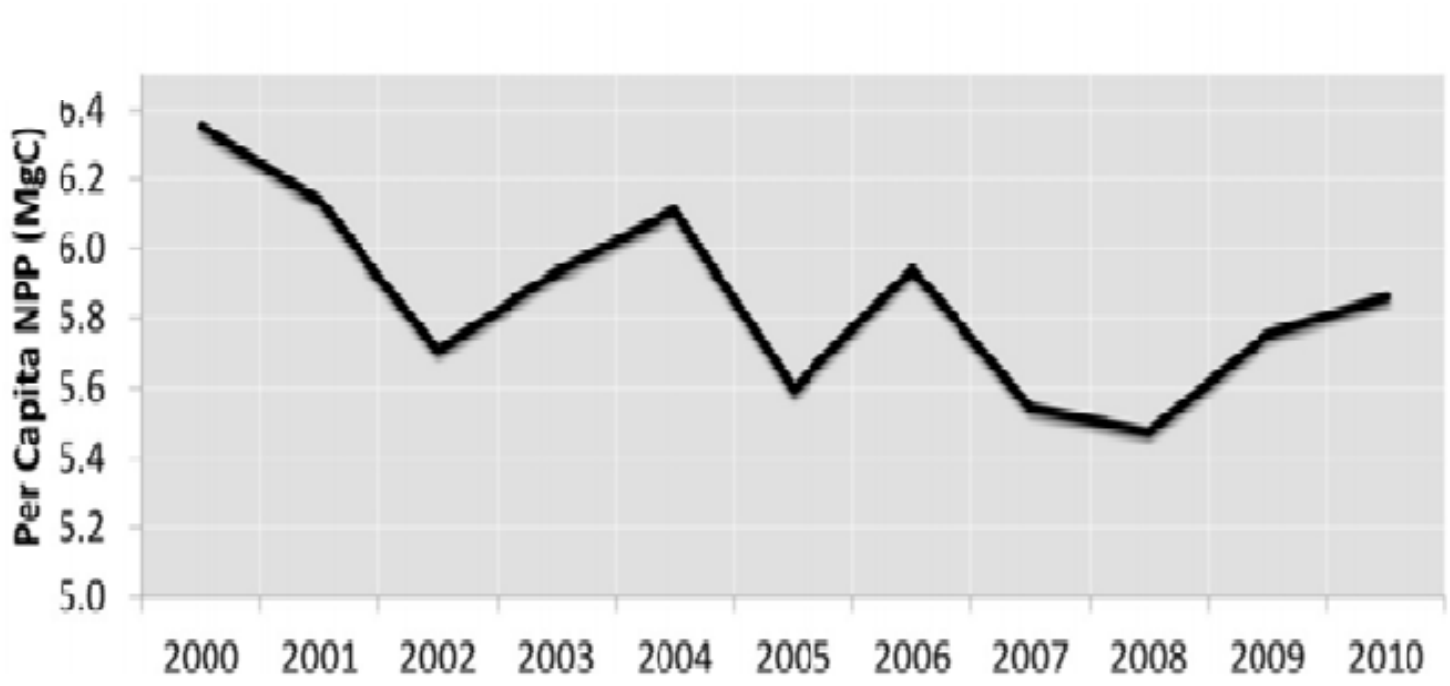


DRIVERS FOR CHANGE: POPULATION

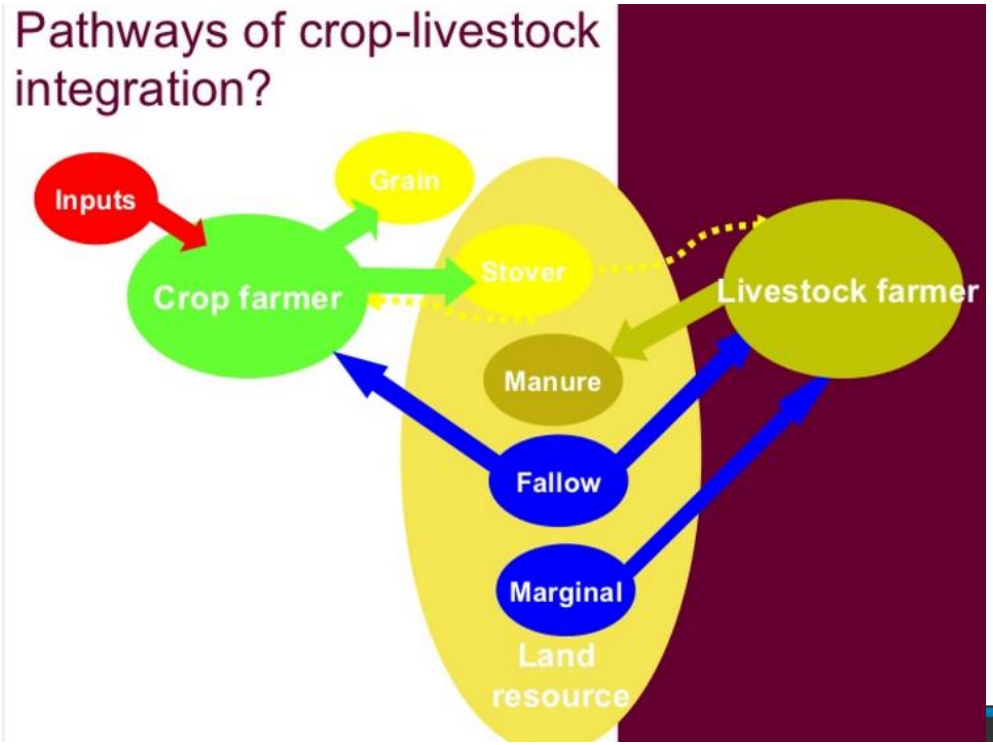


Source: Abdi et al., 2014

DRIVERS FOR CHANGES: RESOURCE AVAILABILITY



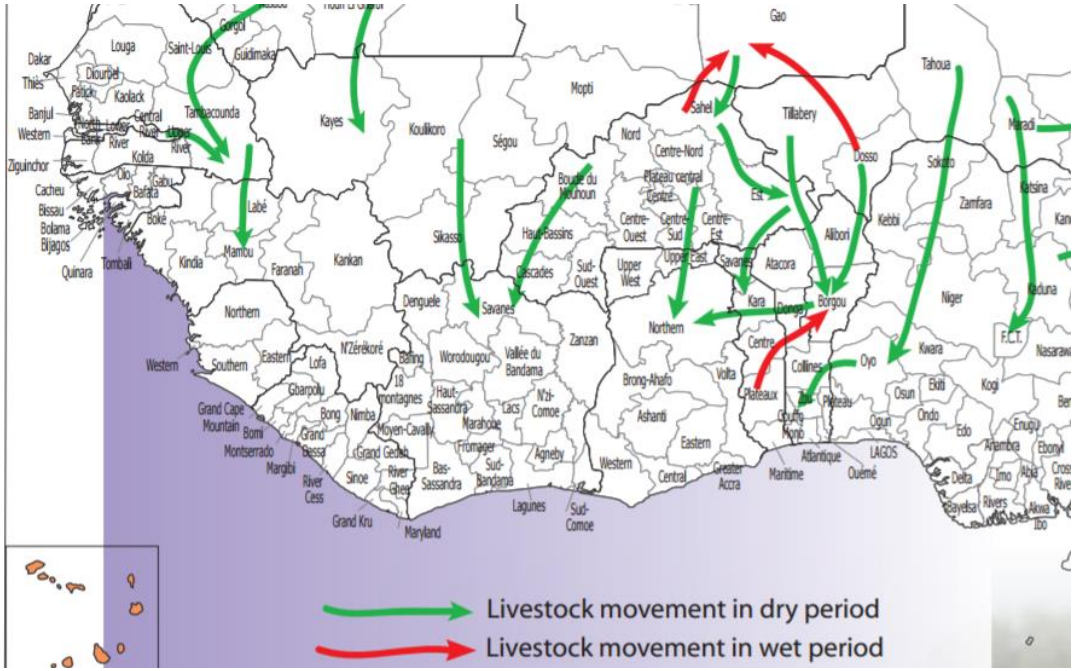
BACKGROUND: PATHWAYS



Source: Tarawali, 2012

UNDERLYING DYNAMICS: LIVESTOCK MOVEMENT

- By nomadic and semi-nomadic herders
- Involves herds of sedentary farmers
- Profound impact on Integration of crops and livestock



POSSIBLE CONSEQUENCES

- Human and livestock population growth
  - Resource squeeze: pastures, crop residues, water
  - Creation of demand for feed – interaction with supply changes
- Crop farmers adding livestock, livestock farmers crops
  - Crop residues increasingly used on farm, for livestock – soil fertility impacts?
  - Impacts on gender roles (milk?), livestock markets, prices
- Manure contracts monetarized

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RESEARCH GAPS AND OPPORTUNITIES

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RESEARCH GAPS

- Feed: synergies/tradeoffs, evaluation, variety development, increasing productivity, processing, conservation, feed markets – and incentives
- Rangeland improvement and management – including policies
- Disease impacts from changing systems
- Understanding and developing markets for livestock products (milk, meat)

FEED IS NUMBER 1 PRIORITY IN ALL LSIL TARGET COUNTRIES

- Total quantity
- Seasonality
- Quality
- Safety

Associated issues:

- Business models; *market opportunities, and consequent impacts*
- Additional benefits
- Incentives

Choice of species, cropping system, management have large implications on the system

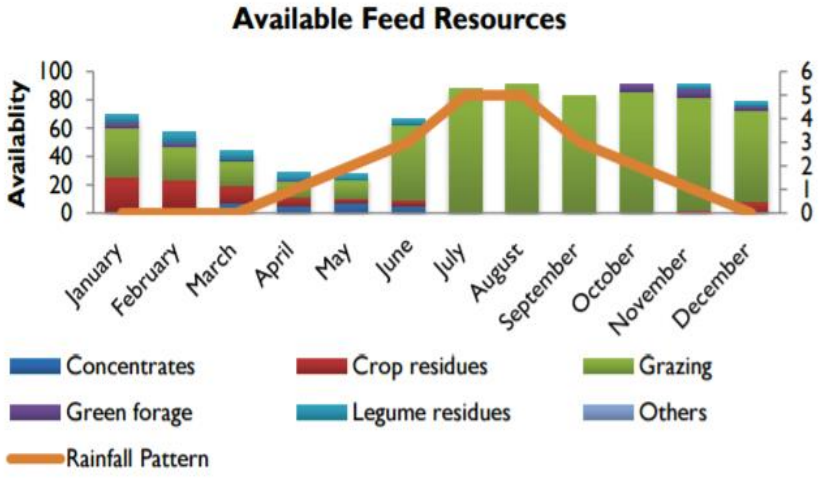
FEED ISSUES AT HEART OF INTEGRATION

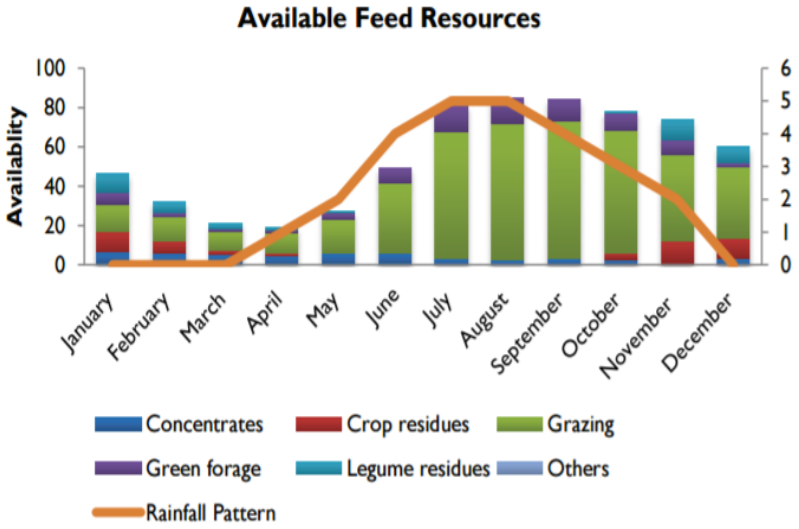
Increased food, fuel and feed demand and population (%) in West Africa, from 2000 to 2010

Country	Food	Fuel	Feed	Total population
Burkina Faso	34.4	27.0	22.0	33.4
Ghana	19.9	19.4	18.6	33.2
Guinea	14.8	5.1	29.2	27.3
Liberia	2.7	20.8	23.2	40.3
Mali	38.8	7.5	26.0	36.1
Mauritania	13.5	14.5	5.0	30.9
Niger	46.0	44.0	22.4	42.0
Nigeria	11.2	6.7	13.2	28.1
Senegal	17.8	4.8	8.6	30.8
Sierra Leone	54.3	2.2	48.5	41.6

Source: Abdi et al., 2014

AVAILABILITY OF FEED RESOURCES IN SW BURKINA FASO





Amole and Ayantunde, 2014

1. DUAL-PURPOSE CROPS

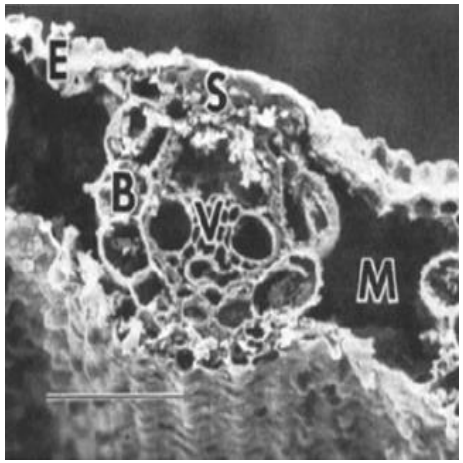
- Food and feed (and soil fertility) – cowpeas, groundnuts
- Food: Taste preferences, marketability, storability
- Feed: Biomass production, improving stover / stem/ haulm/ pericarp digestibility, development of feed products
- Soil fertility: N-fixation
- BMR hybrids / low ferulate hybrids?

2. SUSTAINABLE CEREAL/GRASS-LEGUME INTERCROPS AND ROTATIONS

- Legumes: Without food use, have found little adoption (cf. Mucuna), despite proven benefits (e.g., N fixation, higher yields, less weeds, etc.)
- Continued intensification - demand for feed will improve adoption? Marketability will incentivize?
- Cereals/grasses: improving digestibility

C4 VS. C3 GRASSES

Leaf blades after 48 h of rumen fluid incubation

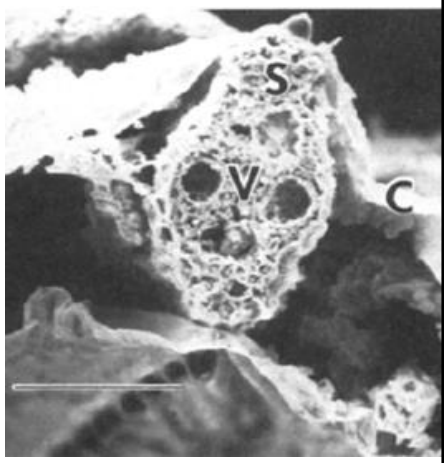


Akin, 1989

(%)	Bermudagrass (C_4)	Orchardgrass (C_3)
NDF	73.3	59.6
ADF	36.8	33.8
CP	10.4	12.8
TDN	52.9	65

*Bermudagrass: Hay, early head; Dairy NRC (2001)
*Orchardgrass: Hay, sun-cured early bloom; Beef NRC (1998)

Leaf blades after 48 h of rumen fluid incubation



Akin, 1989

M= mesophyll, E= epidermis, B= parenchyma bundle sheath, S= sclerenchyma, V= vascular tissue and C= cuticle.

LOCATION-APPROPRIATE SOD-BASED ROTATION SYSTEMS

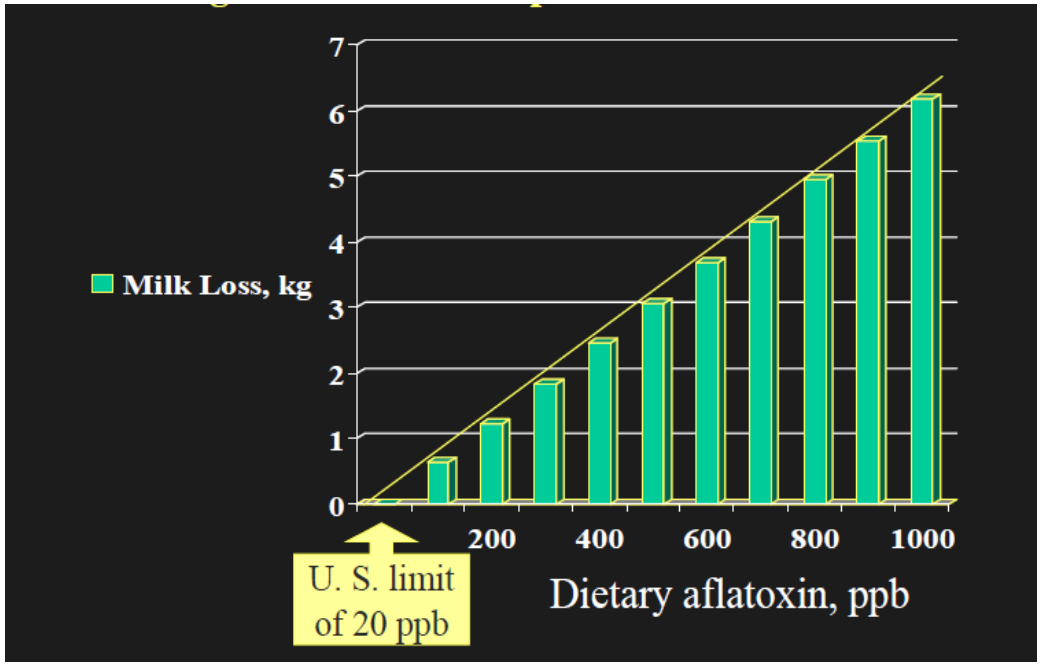
- UF developed system; in testing in SE USA
- Bahiagrass with legumes

3. TAILORED FORAGES AND FORAGE CONSERVATION

- Drought / heat tolerant varieties
- Reclamation of land
- Expanding adapted forages (borgu)
- Stockpiling (limpograss, Hemarthria)
- Silage: simple construction solutions using innovations (BMR, low ferulate)

4. FEED SAFETY: MULTIDISCIPLINARY EFFORTS

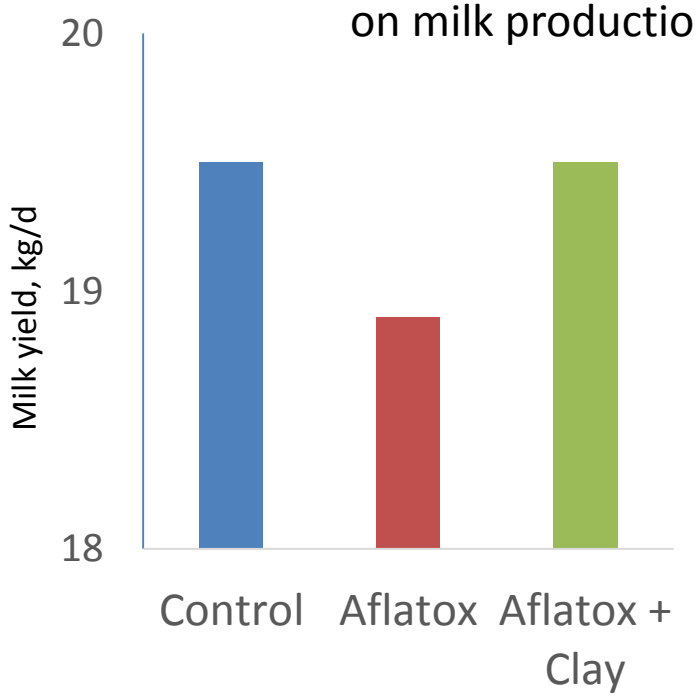
Estimated milk production loss after 1 month of exposure to aflatoxin



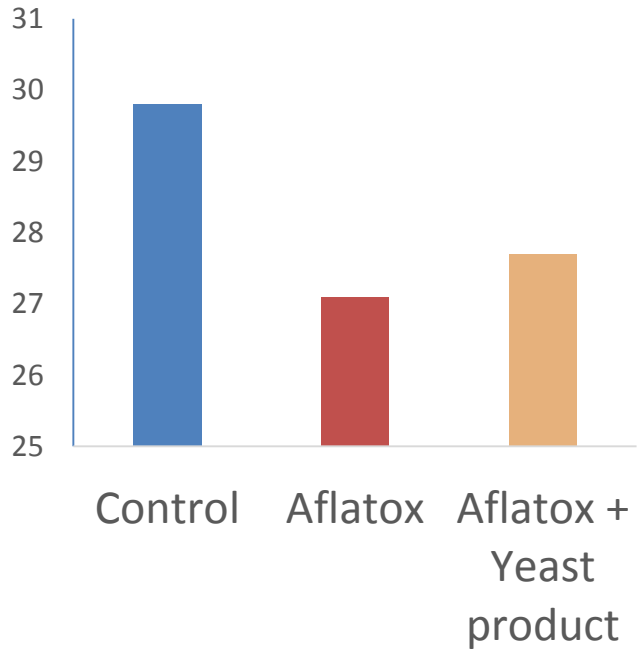
(Whitlow, 2013)

IMPROVED FEED SAFETY

Dietary aflatoxin B_1 (75 ppb) effects on milk production



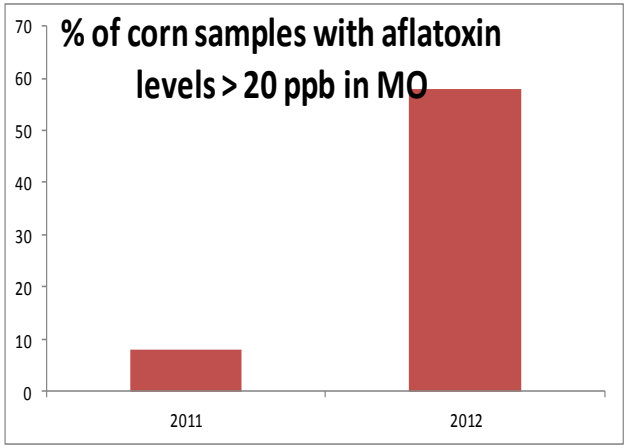
Queiroz et al., 2012

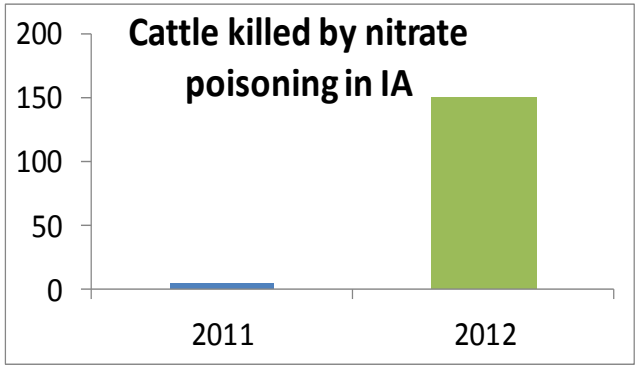


Ogunade et al., 2015

FEED SAFETY DURING DROUGHTS

1. Aflatoxins
2. Nitrates
3. Prussic acid

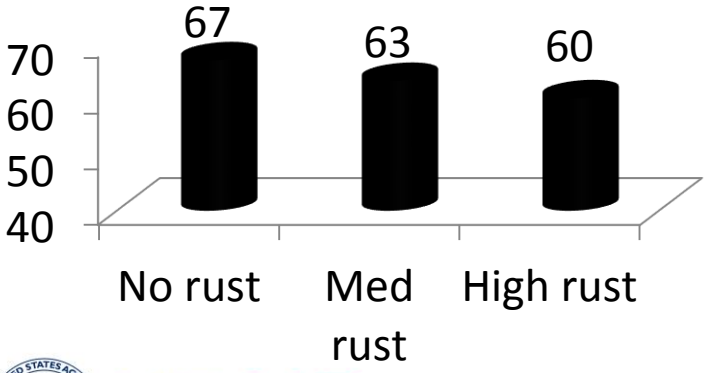




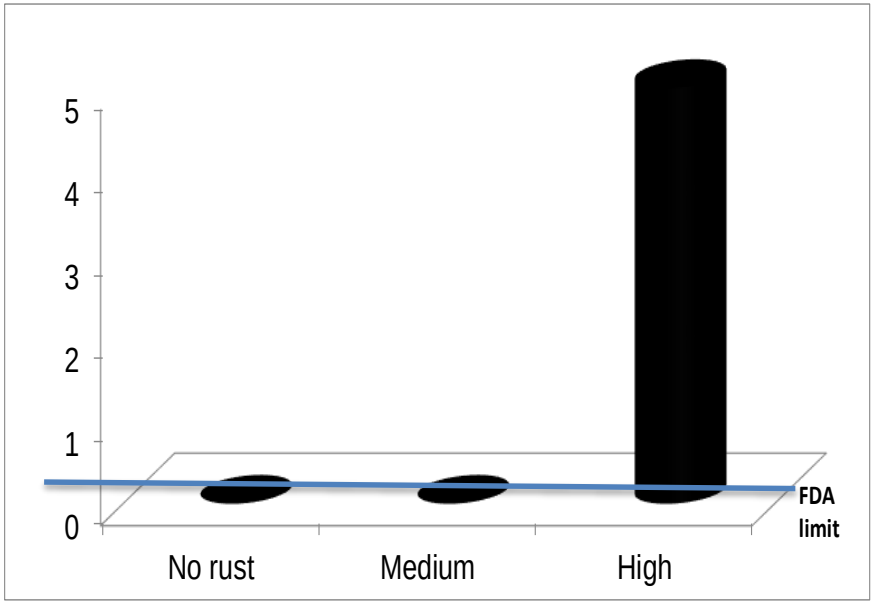
Source: Bienkowski, 2012 (Scientific American)

FEED SAFETY (SILAGE) & DISEASE (RUST)

Effect on digestibility



Effect on aflatoxin (ppm)



DISEASE IMPACTS FROM CHANGING SYSTEMS

- Impacts from intensification, changing pastoral routes, increasing numbers of peri-urban farms – and increasing concerns over ASF
- Diverse general priorities – identified during LSIL prioritization:
  - Surveillance
  - One Health
  - Diagnostic capacity
  - Policies: import regulations + enforcement
  - Residues and antimicrobial resistance

PRIORITIES: ANIMAL DISEASES

- Transboundary diseases an important concern for many countries: FMD and PPR especially
- Zoonotic: Especially Tuberculosis and Brucellosis
  - Newcastle Disease, Avian Influenza
- Others: Environmental Enteropathy
- Strong interest in food safety: milk, meat

PRIORITIES: PPR

- Global Eradication program
- Field test thermostable vaccine (Thermovac) + capacity building for scaling + epidemiological targeting + intensive delivery – high herd immunity
- Efforts starting in Uganda with BVI
- Second country TBN

LESSONS LEARNED

- Context and system important
- Participate in interdisciplinary groups outside your comfort zone
  - Alleviating negative impacts of intensification of crop-livestock systems: livestock housing, environmental enteropathy
  - Pastoralists: improving pastureland + looking at impacts on extremism
- Focus on policy implications, from the onset
- Do not focus on new technologies/practices only, but also their implications on/adaptations for or from US or other countries
- Do not forget to look back – developed technologies may be important for US conditions, e.g., AFLASAFE

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