

Agriculture, Nutrition and Health Linkages from a Systems Perspective

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Begin at the End

- Agricultural systems are dynamic and complex
- Linkages between agriculture, nutrition and health are also complex
- A systems framework can be helpful for
 - Designing interventions
 - Building consensus (facilitating participation)
 - Identifying information needs
 - Monitoring and evaluation of outcomes

Example: Livestock System

- Consider hypothesized linkages between animal ownership, health and nutrition
- Developed to guide literature review of livestock-nutrition linkages
 - LeRoy and Frongillo (2007)
 - Randolph et al. (2007)

Animals, Nutrition and Health

What are the linkages?

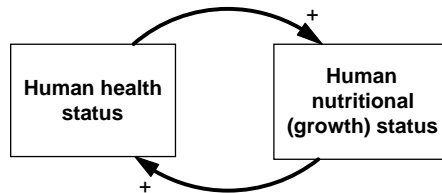
**Animals
owned**

**Human
nutritional
(growth) status**

Animals, Nutrition and Health

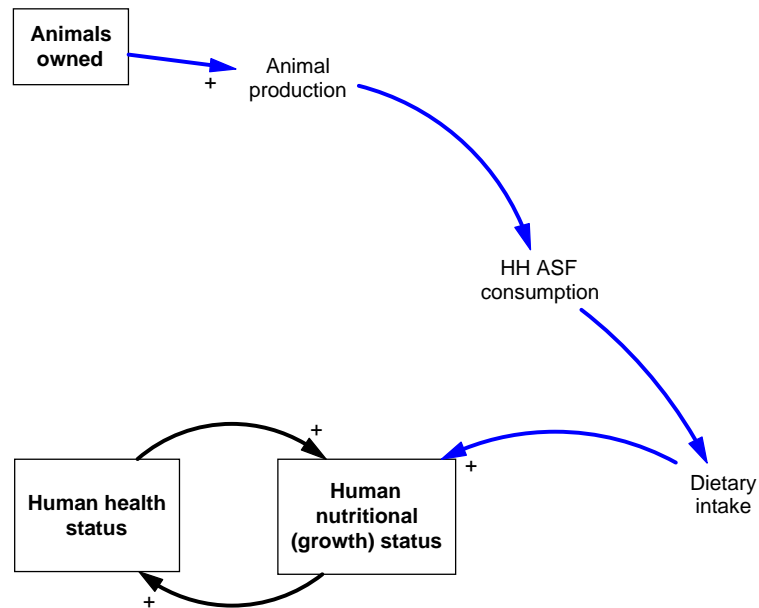
Animals
owned

Health and Nutrition Synergies (what happens to one happens to the other)



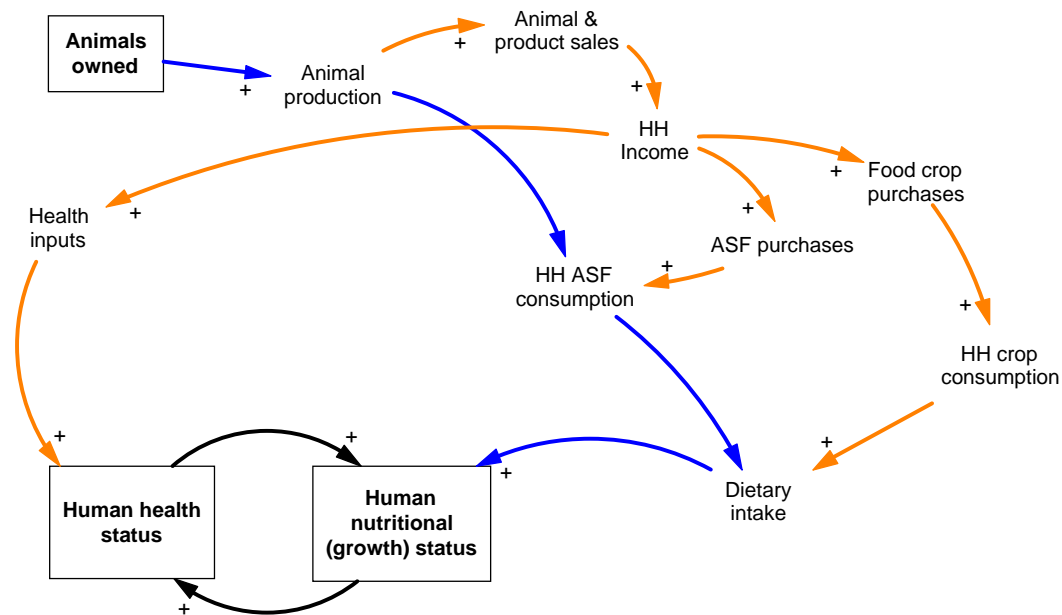
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Direct path: animals raised and eaten



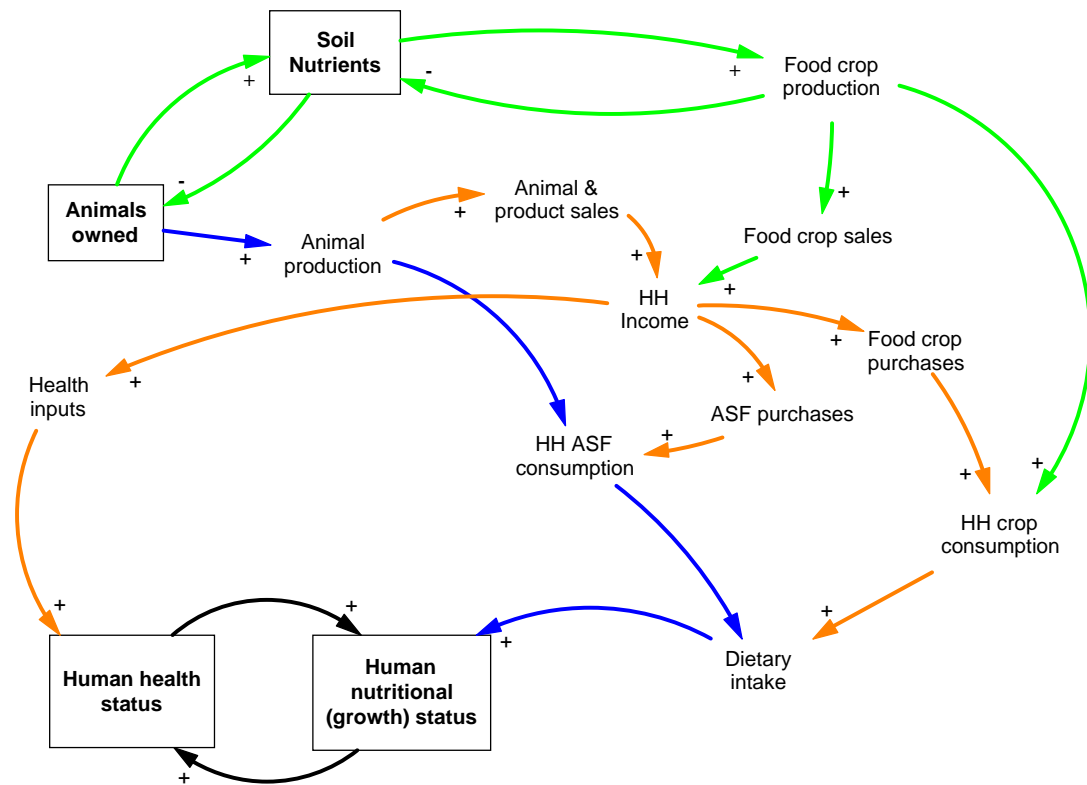
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Indirect path: animals raised and sold, ASF or other food bought

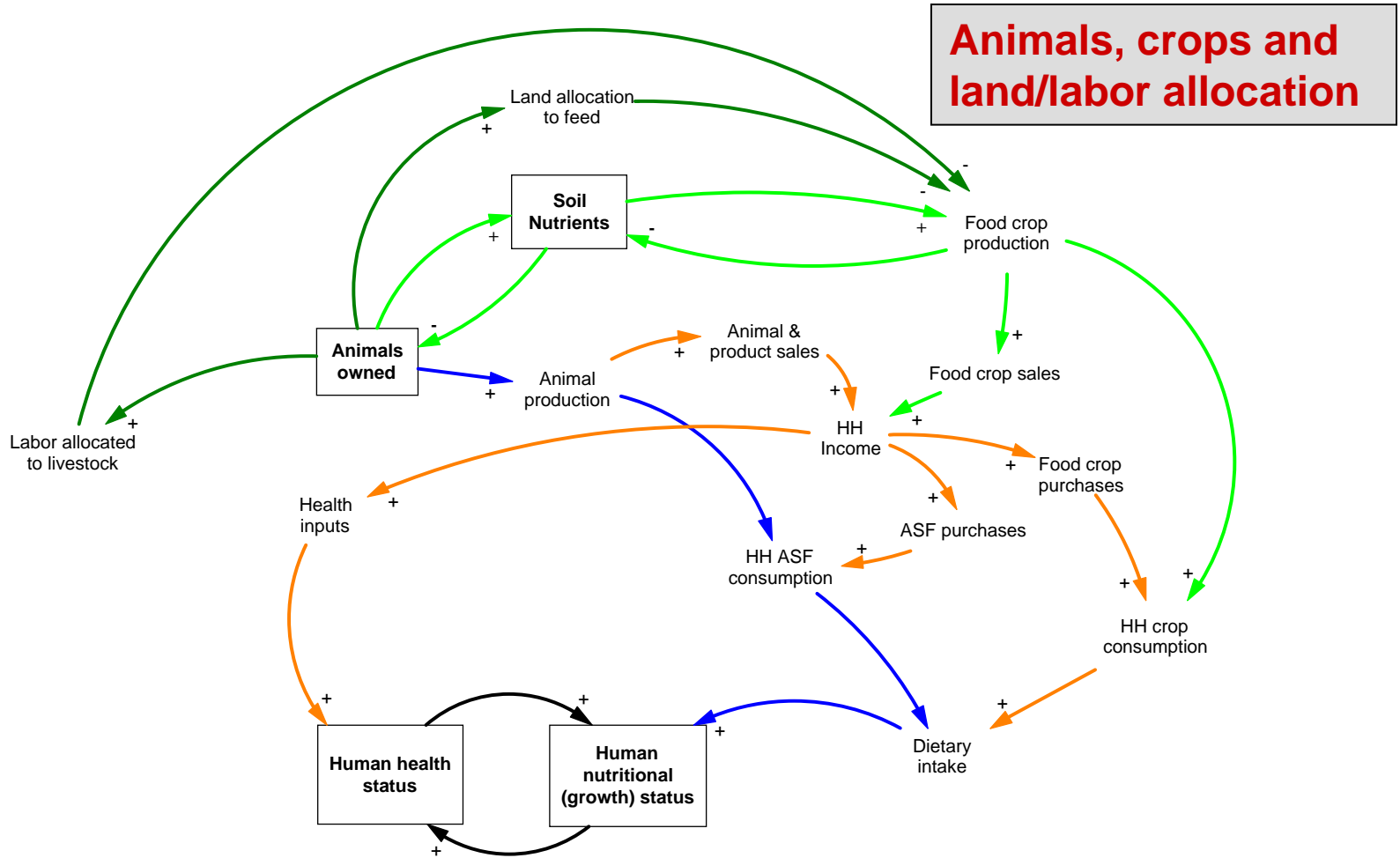


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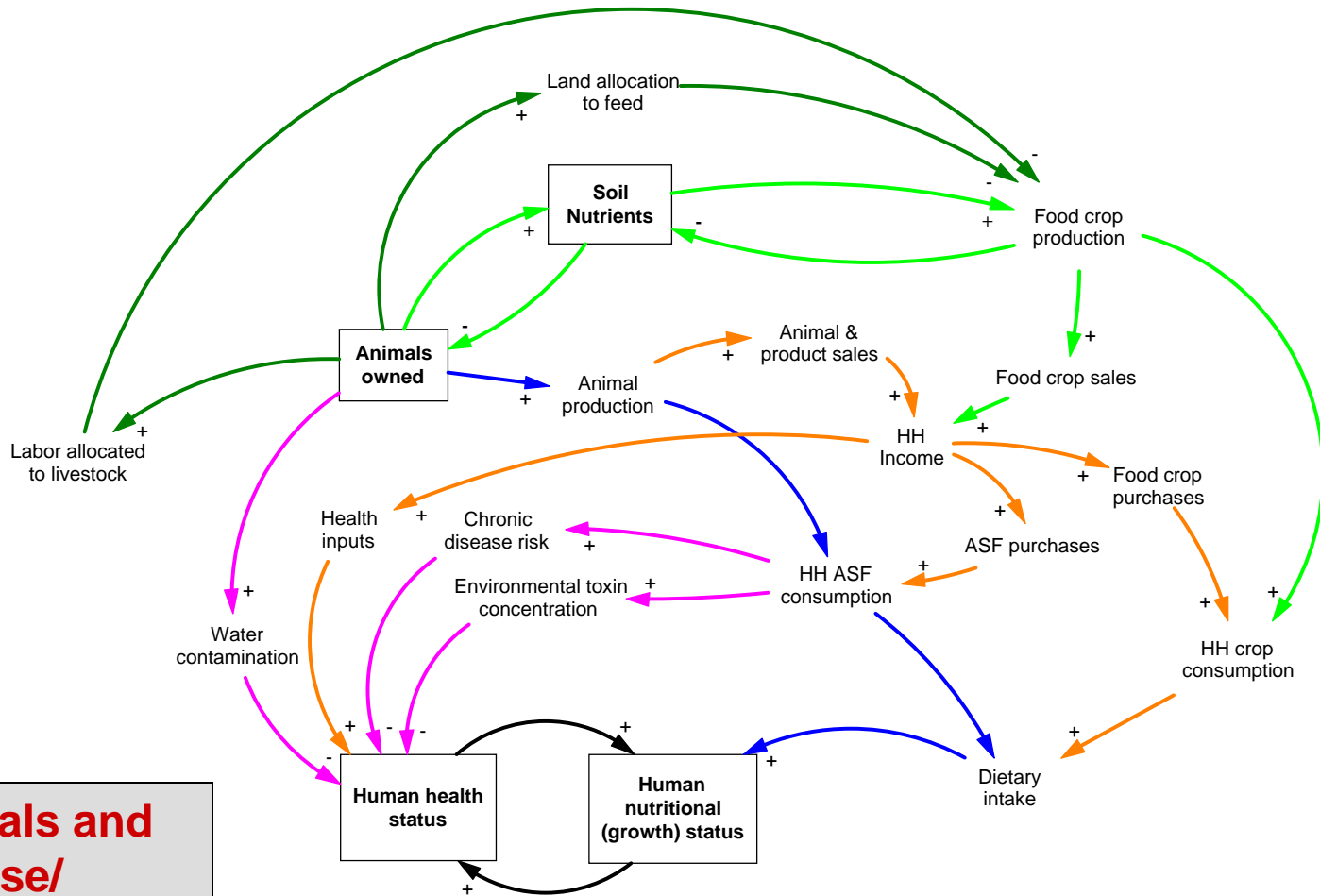
Animals, crops and nutrient cycling



Animals, Nutrition and Health

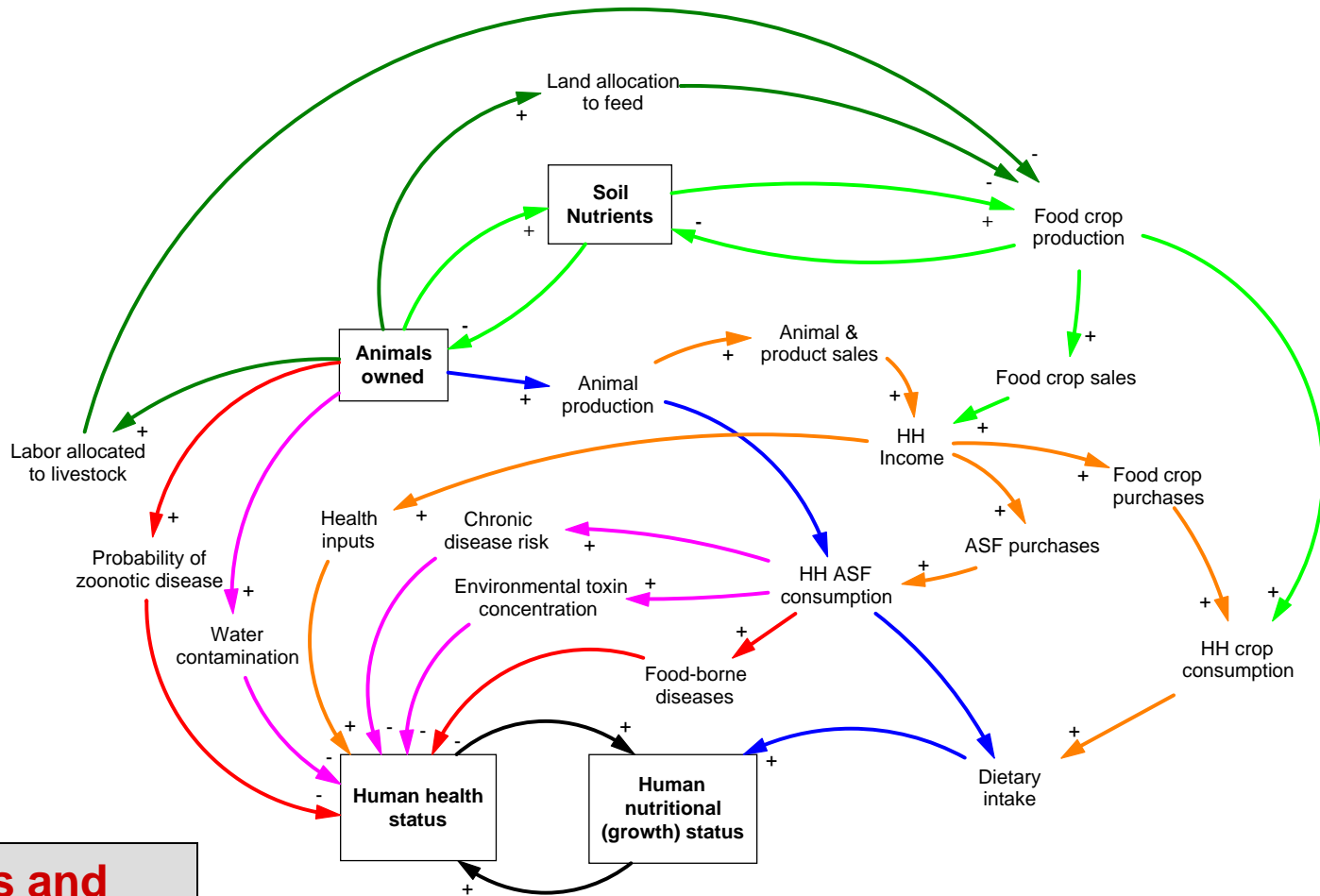


Animals, Nutrition and Health



**Animals and disease/
toxicity risk**

Animals, Nutrition and Health



Animals and zoonoses/FDB

(How) Is this Helpful?

- Helps frame available empirical evidence
 - Individual linkages and overall effects
- Difficult to determine through logic alone what livestock impacts will be
 - Empirical evidence needed
- Relative importance of pathways will probably differ depending on the specific context (Randolph et al., 2007)

Framing, Summarizing Evidence

Outcome of Livestock Intervention	Impact
Animal production	+
Income and expenditure	+
Dietary intake	+/-
Caregiver time and workload	0/?
Incidence of zoonoses	?
Nutritional status (often, for children)	+?

Adapted from Leroy and Frongillo (2007) and Randolph et al. (2007)

(How) Is this Helpful? [2]

- Forces thinking about multiple pathways and complexity
 - Most coupled human-natural systems are “dynamically complex” (Rosser 1999; Sterman 2006)
 - “Complexity” can limit effectiveness of actions
 - Can’t study just one link in the chain
- Highlights the need for interdisciplinary (inter)action
 - No one field of study can do it all

(How) Is this Helpful? [3]

- Can improve design and implementation of agricultural interventions with health and nutritional objectives (?)
 - A working hypothesis
 - Builds on previous nutrition conceptual frameworks (there are many!)

With Extensions, More Helpful?

- Systems-oriented *conceptual framework*
 - Good first step
- *Systems modeling* efforts can complement
 - Build on the conceptual framework
 - Specify, quantify relationships
- “Models” (often mental ones) used for program design
 - More formal models can address limits of these

With Extensions, More Helpful?

- Modeling process can be participatory
 - Allow consensus building and more effective program implementation (Vennix, 1996)
 - All parties discuss the problem and solutions
- Modeling can facilitate monitoring and evaluation (Newman et al., 2003)
 - Where are we now compared to where we were predicted to be?
 - “Worse before better behavior” common

With Extensions, More Helpful?

- Modeling can identify information needs
 - Which part of the diagram don't we know much about?
 - Which effects matter most?
- Weak links in the knowledge chain can be addressed in conjunction with researchers
- Facilitate integration and use of existing knowledge base (value-added science)

Summary

- We can't escape the complexity of agriculture, nutrition and health linkages
 - For effective interventions
- Systems thinking and modeling can be useful (and feasible)
 - For design, monitoring evaluation, consensus
 - As complement to experience (trial & error)
- Disciplines need to work together

References

- Leroy, JL and EA Frongillo. 2007. Can Interventions to Promote Animal Production Ameliorate Undernutrition? *The Journal of Nutrition*, 2311-2316.
- Newman J, Martin L, Velasco MA and Fantini A-M. 2003. A system dynamics approach to monitoring and evaluation at the country level: An application to the evaluation of malaria control programs in Bolivia. Paper prepared for the fifth biennial World Bank conference on evaluation and development 'Evaluating development effectiveness: Challenges and the way forward', Washington, DC, USA, 15–16 July 2003. Operations Evaluation Department, The World Bank, Washington, DC, USA.
- Randolph, TF et al. 2007. Role of livestock in human nutrition and health for poverty reduction in developing countries, *Journal of Animal Science*, in press.
- Rosser JB. 1999. On the complexities of complex economic dynamics. *Journal of Economic Perspectives* 13(4):169–192.
- Sterman J. 2006. Learning from Evidence in a Complex World. *American Journal of Public Health*, 96:505-514
- Vennix JAM. 1996. *Group model building: Facilitating team learning using system dynamics*. JohnWiley and Sons, Chichester, UK.