Stakeholders, social network analysis and participatory innovation for conservation agriculture

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TODAY, WE'LL TALK ABOUT…

- from technology transfer to adaptive management
- building communicative competence
- conservation agriculture and mind-set change
- some social network analysis findings
- discussion

“Transforming conventional agriculture is not just a question of training farmers, but of social learning in complex interwoven networks of interdependent actors. In most instances, we are not dealing with ‘virgin country’ but with situations in which highly interwoven actor networks have already evolved around the needs of conventional farming.”

Röling and Jiggins, 1998

Reflecting on Networks and Technical Change

- How should we think about technical change in agriculture?
- What is the role of learning in the process of innovation?
  - Is learning a matter of information transfer resulting in adoption of innovations?
  - Or, is learning a matter of capacities for on-going adaptation?
- Whose capacities should be developed?
- Where, in fact, does innovation occur?

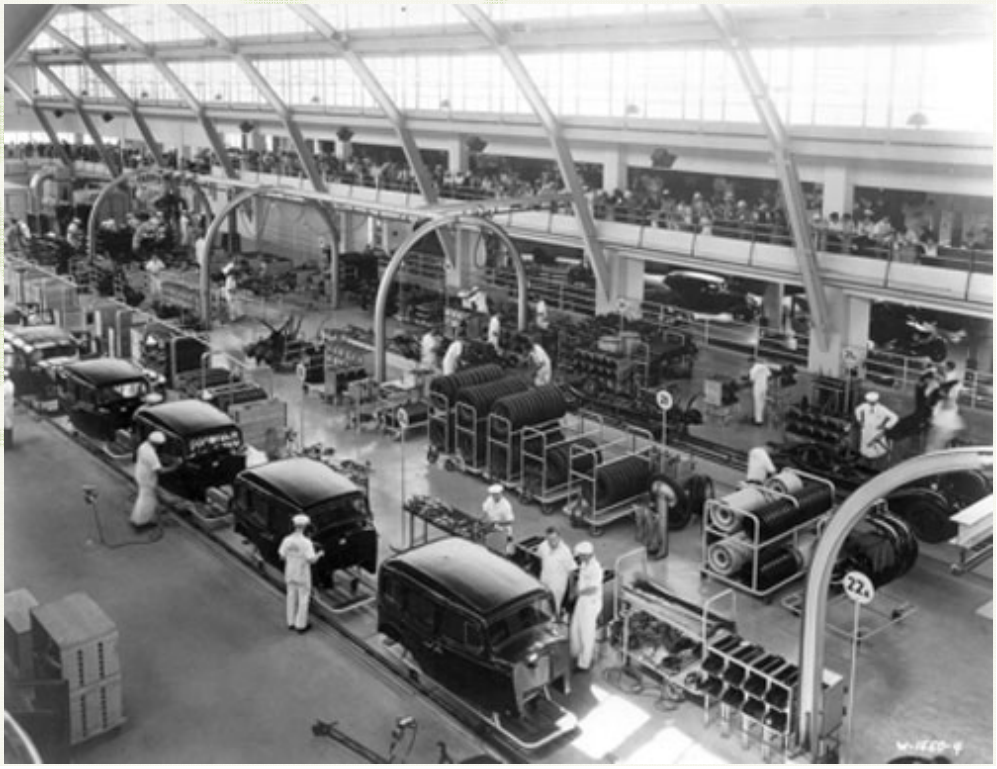
Technology Transfer in the First Green Revolution

Technology Transfer operates well under conditions where:

- Ecological and market conditions are stable and relatively homogeneous
- Technological change is a matter of component replacement
- Shared knowledge systems extend from conception to execution
- Linking investments with outputs allows for quantitative priority setting

Building Communicative Competence - I

- U.S. Land Grant Universities - A model of institutional innovation.
  - Well integrated socially with its clientele in the late 19th century.
  - Graduates were sons and daughters of the farming community in each state.
  - Research and education was responsive to local needs.
  - Technology was focused on expressed farm problems.
- Extension was **not** developed until the early 20th century.



The Transition to Complex Adaptive Systems

- All of science has shifted.
- A series of differentiated revolutions for Africa
- Learner-focused scholarship
  - Farmer problem solving
  - Innovation systems

Social Learning for Adaptive Management

Learning by doing

Local stakeholders innovate management techniques adapted to local conditions

- Negotiation
- Resistance
- Accommodation

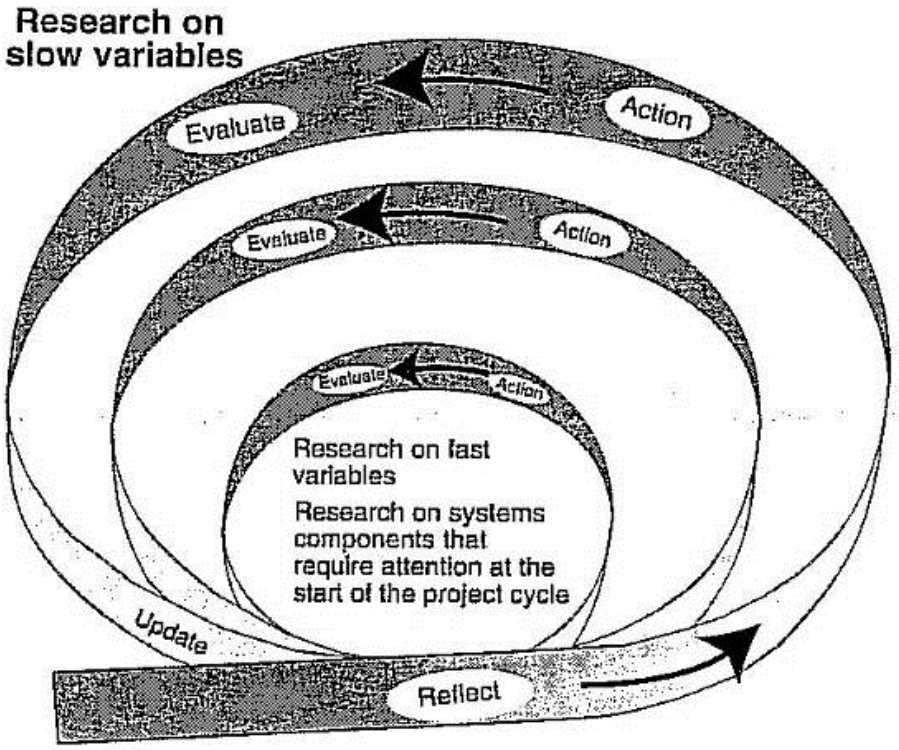


Fig. 4.1. Overlapping learning cycles for processes with different temporal characteristics.

Principles for enhancing innovative performance

- Assess the extent of institutional interactions and power relations
- Evaluate knowledge flows between nodes
- Identify bottlenecks and opportunities for interactive learning
- Assess institutional policy and practices
- Suggest appropriate remedial action

Knowledge Networks/Systems

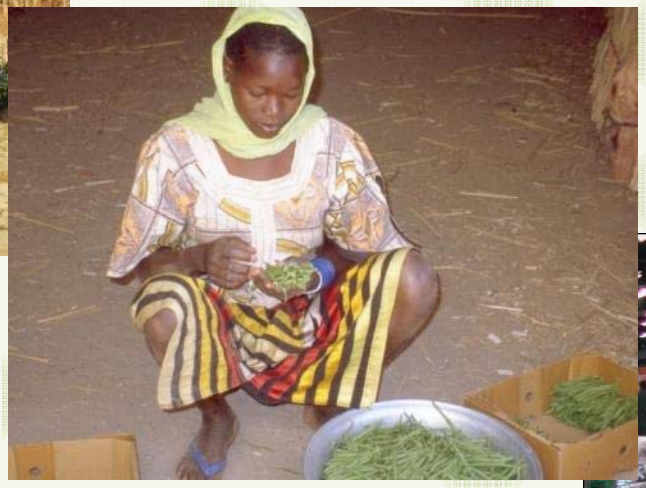
- People and technologies are interconnected in ways that reproduce some types of knowledge and behavioral practices and not others
- Knowledge networks rationalize socio-material relationships in the agro-ecology
- There is often competition between knowledge network segments

Narratives, stories, and discourses

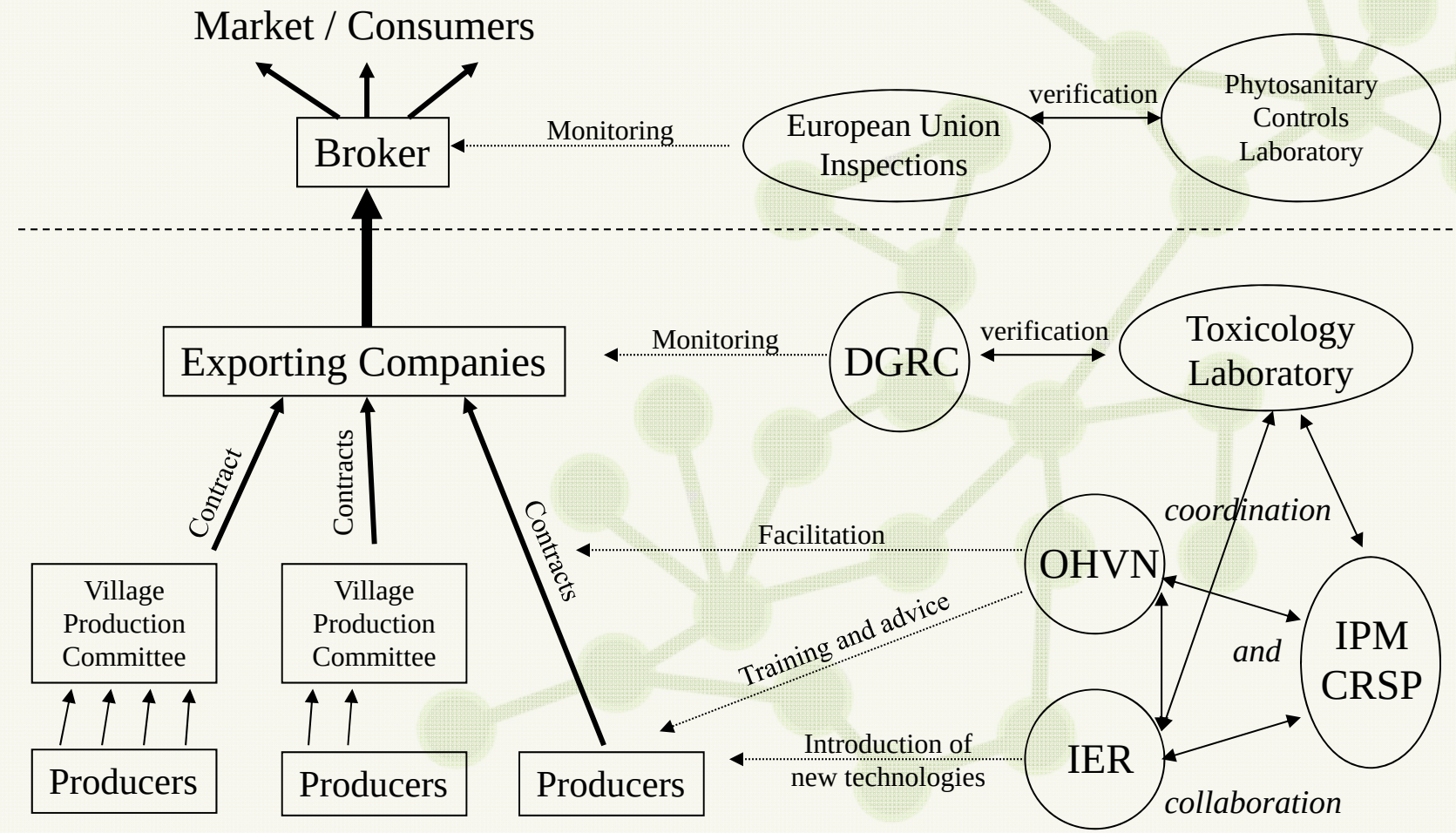
- Stories describe how the nodes are tied to each other
- A social network is a network of
  - meanings,
  - discursive frameworks, and
  - cultural idioms.

green bean producers in Mali

contract with exporters; who contract with importers; who make routine deliveries to wholesalers and retailers for sale to consumers

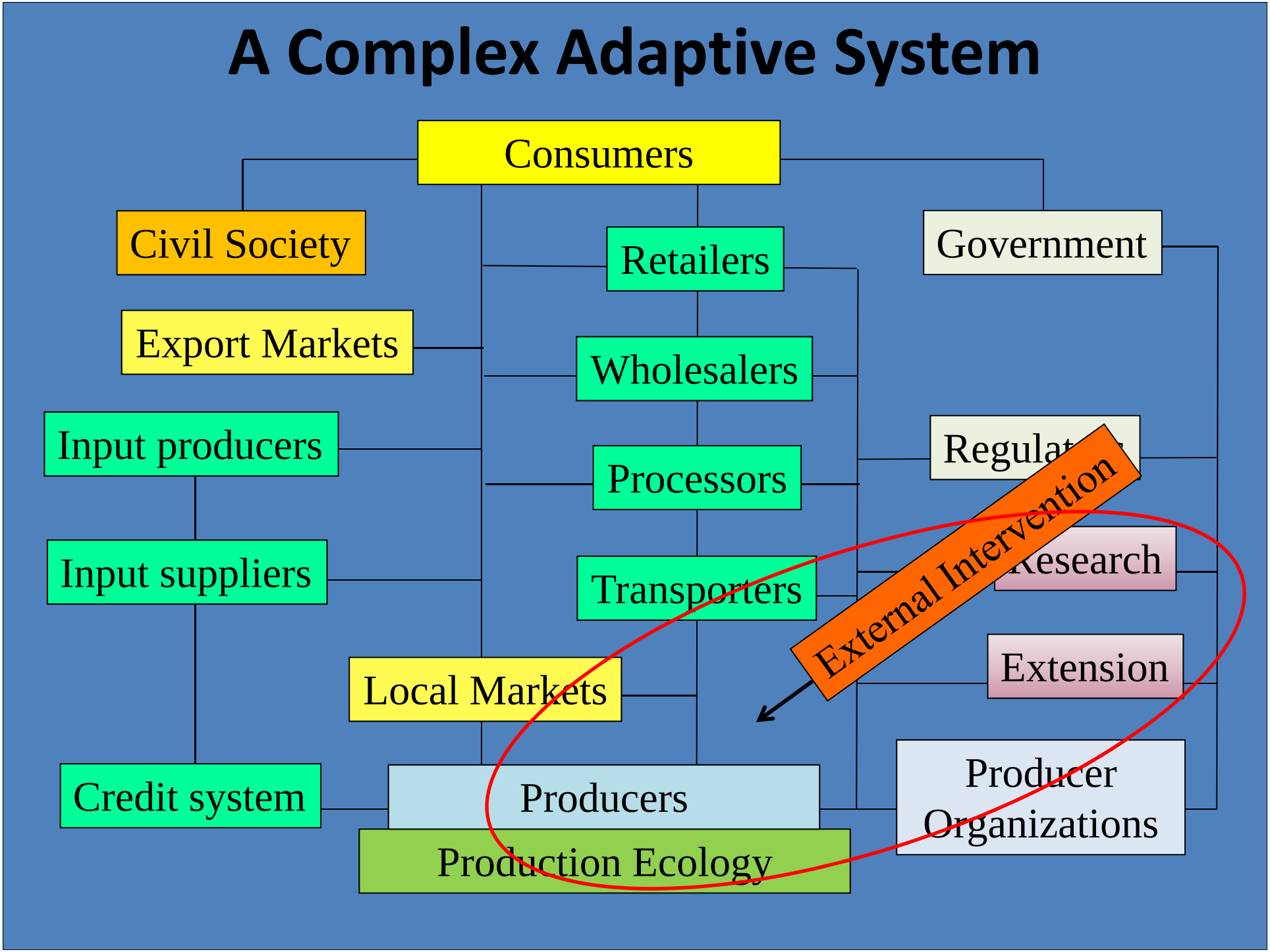


Green Bean Production and Marketing Chain with Monitoring System

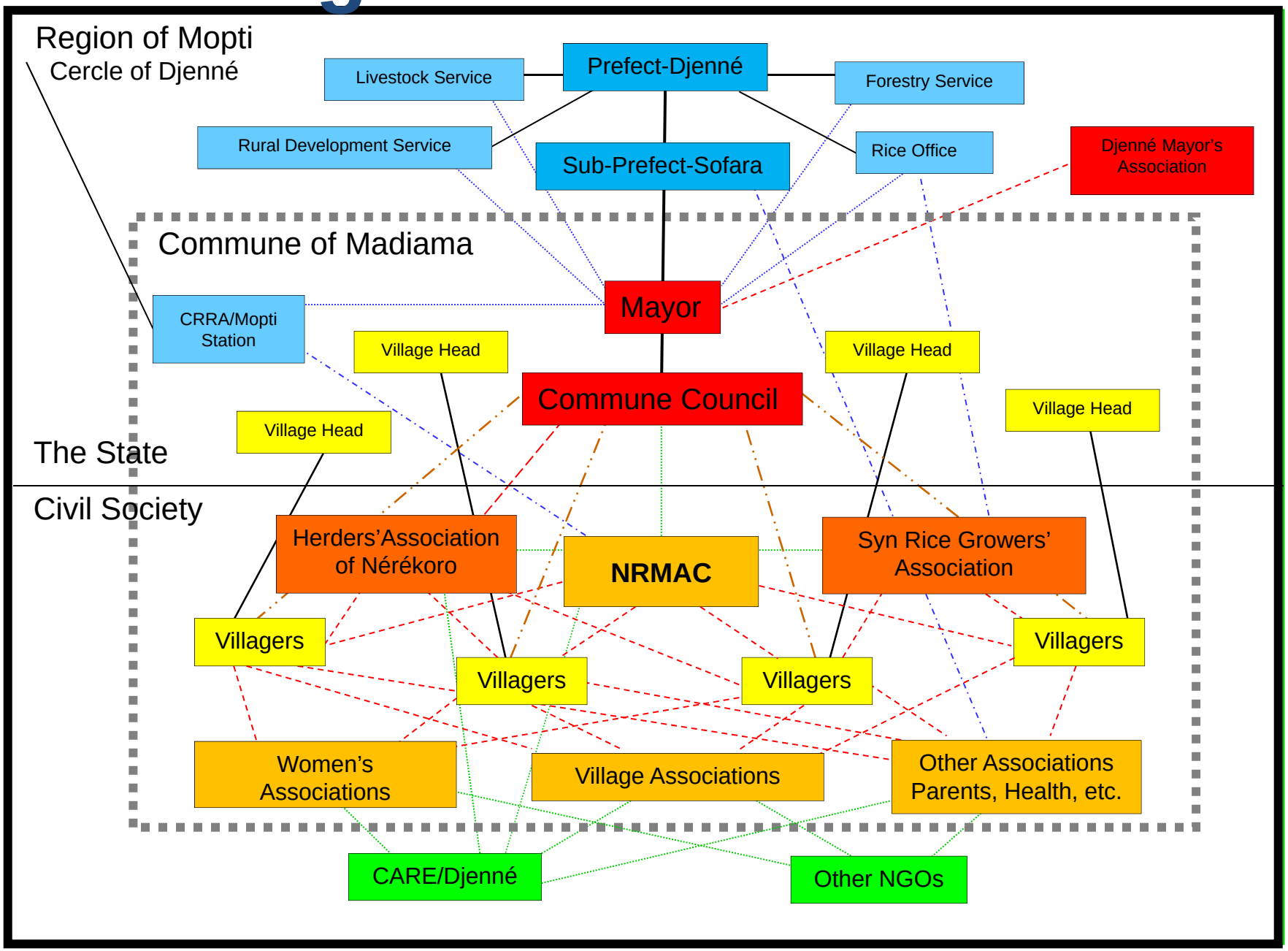


The Environment: Source of Inputs and Contamination

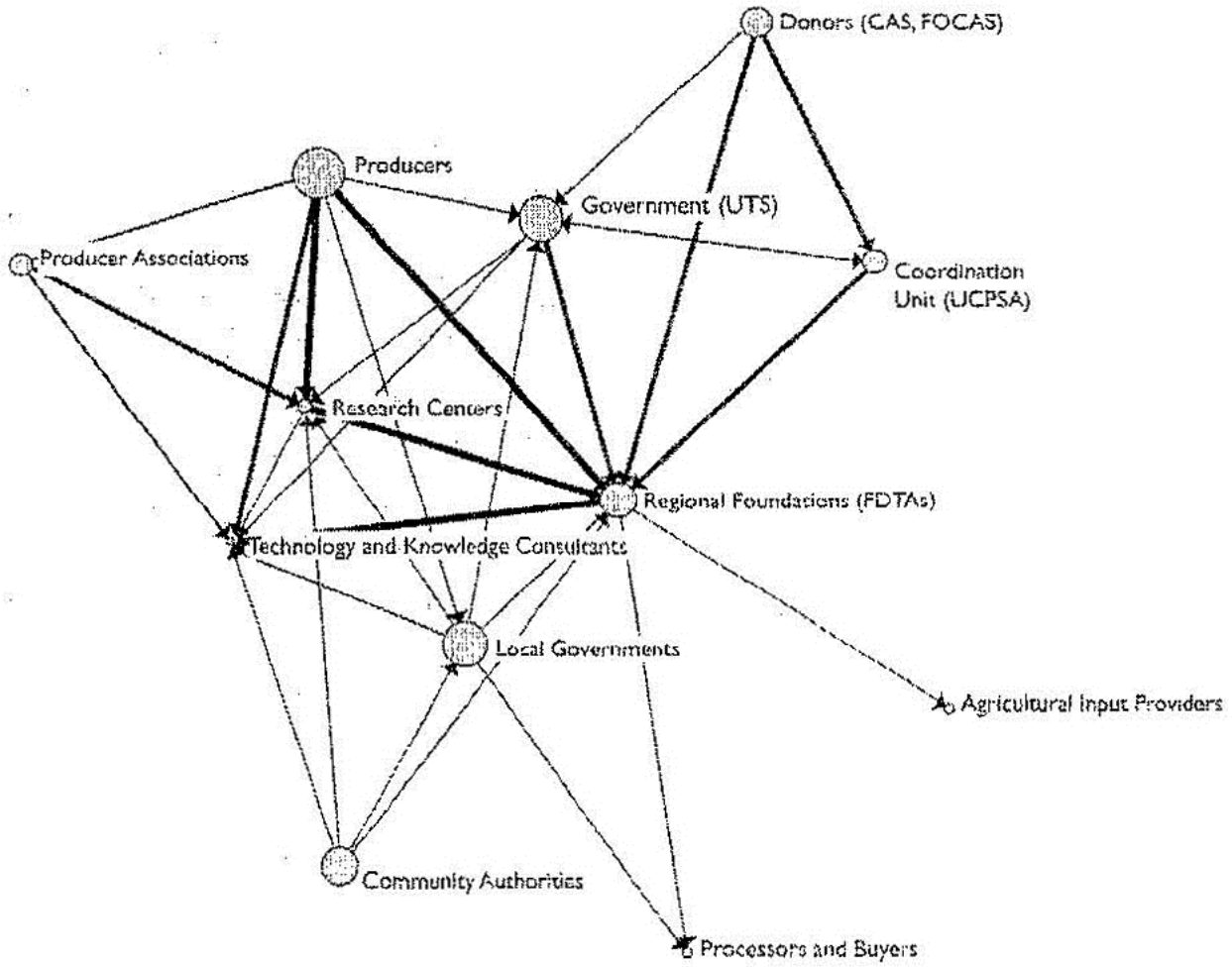
A Complex Adaptive System



Local Ag and NRM Governance



Box 5: Priority-setting relationships among SIBTA actors



Source: Study data.

The directions of the arrows show the nodes that impose and communicate priorities and the nodes that are affected by this. The size of the nodes is proportional to the out-degree centrality, in this case the number of ties a node uses to communicate directives on priorities to other types of actors. Nodes that have high out-degree centrality usually have more power and influence at their disposal and are able to communicate intensively and influence many others. Thicker arrows mean that there is stronger influence (on a scale where 1 is weak and 5 is strong).

Building Communicative Competence – II

- Universities in the global North and South need to be thinking about:
  - New ways of relating to their multiple clienteles.
  - Innovation systems for research and development.
  - Value chains on which resources can be built.
  - Who and how to train new facilitators of innovation.
- Social network analysis provides two new ways to view these relationships.
  - Conventional research to understand production networks and their stakeholders.
  - As a participatory research tool building innovation networks.

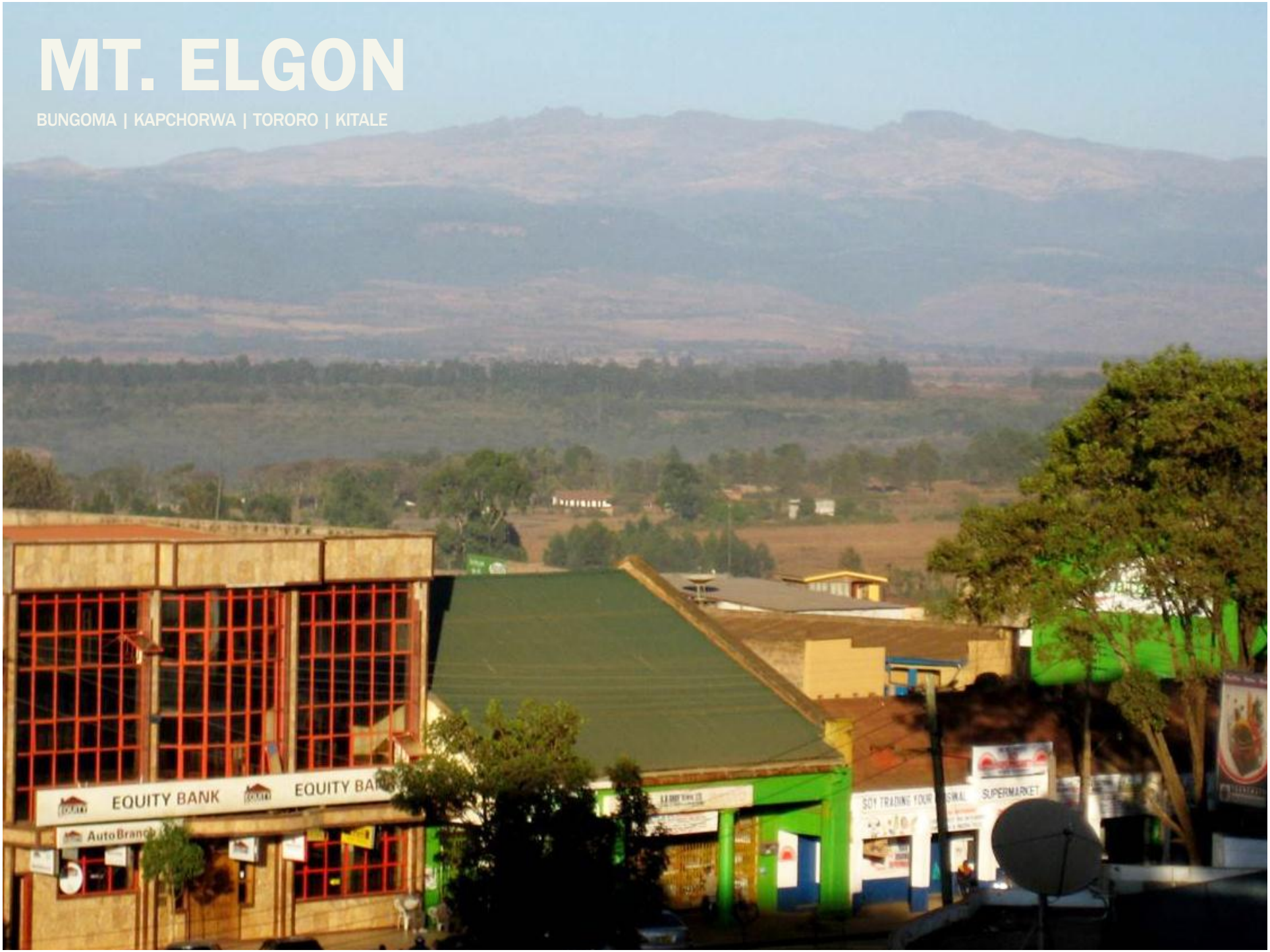
Using social networks to study co-innovation processes

- Networks in the development context:
  - Adoption studies (Conley and Udry 2001)
  - Natural resource management (Crona and Bodin 2006 & 2009)
- Use networks to explore relationships and idea development
  - Professional structures (Wolf 2006; Rycroft and Kash 1999)
  - Measurement/evaluation (Biggs and Matsaert 2004)
  - Network structure (Spielman et al. 2011)
- Attitudes and beliefs of network members

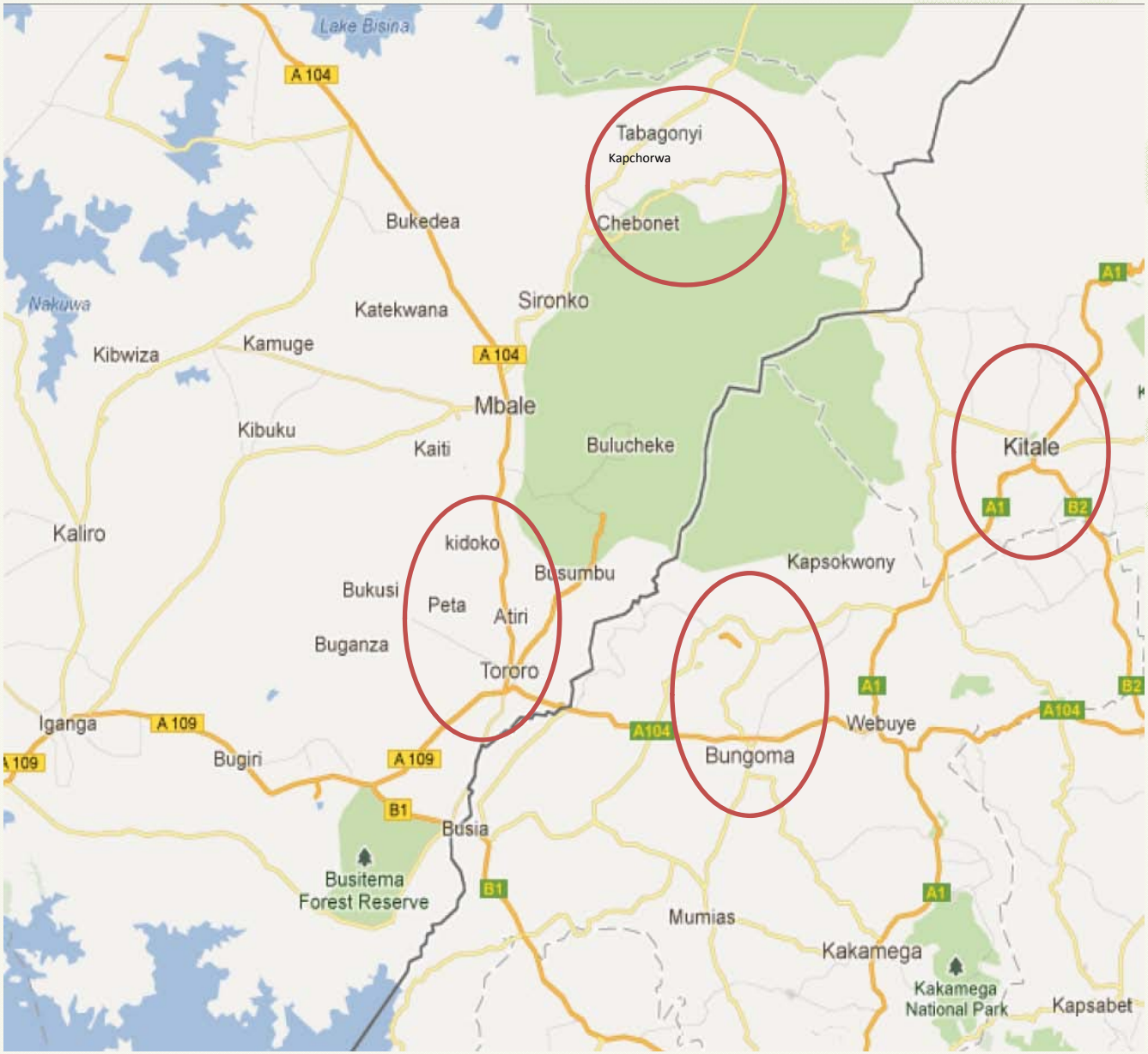
  (Knock and Yang 2008)

MT. ELGON

BUNGOMA | KAPCHORWA | TORORO | KITALE



THE COMMUNITIES



KAPCHORWA |

TORORO |

BUNGOMA |

TRANS NZOIA |

Conservation Agriculture Production Systems – a complex, multi-purpose technology

- Three Principles based in adaptive knowledge:
  - Minimize soil disturbance
  - Maintain a permanent soil cover
  - Rotate and mix crops
- Goals:
  - Improve food security through stabilizing yields
  - Reduce erosion
  - Improve fertility
  - Sequester carbon/reduce greenhouse gas emissions

OUR RESEARCH PROBLEM

- **Purpose |** How to engage with local mind sets in ways that are transformative and yield positive outcomes

- Change agent perspectives |

  Agricultural change agents are trained in conventional production practices and memorized scientific “facts”

- Farmer agro-ecological knowledge |

  agro-ecological knowledge and its application in production informs farming discourse in local social networks

- Conservation agriculture requires adaptation |

  CA doesn’t fit well with that memorized knowledge and challenges conventional farming wisdom

Research Process

- Focus Groups in 2010
  - Meet with community members and describe project
  - Identify and list key contacts/actors for agricultural production
- Household Survey conducted in 2010
  - Targeted farm households were asked about their key contacts for agricultural information/resources (N = 400; 100 per community)
- Snowball survey of non-farm agents conducted in spring 2011 with
  - Community agents
  - Agricultural service providers
- Follow-up stakeholder workshop in winter 2012
  - Community agents
  - Agricultural service sector providers
  - Representative farmers (women and men)

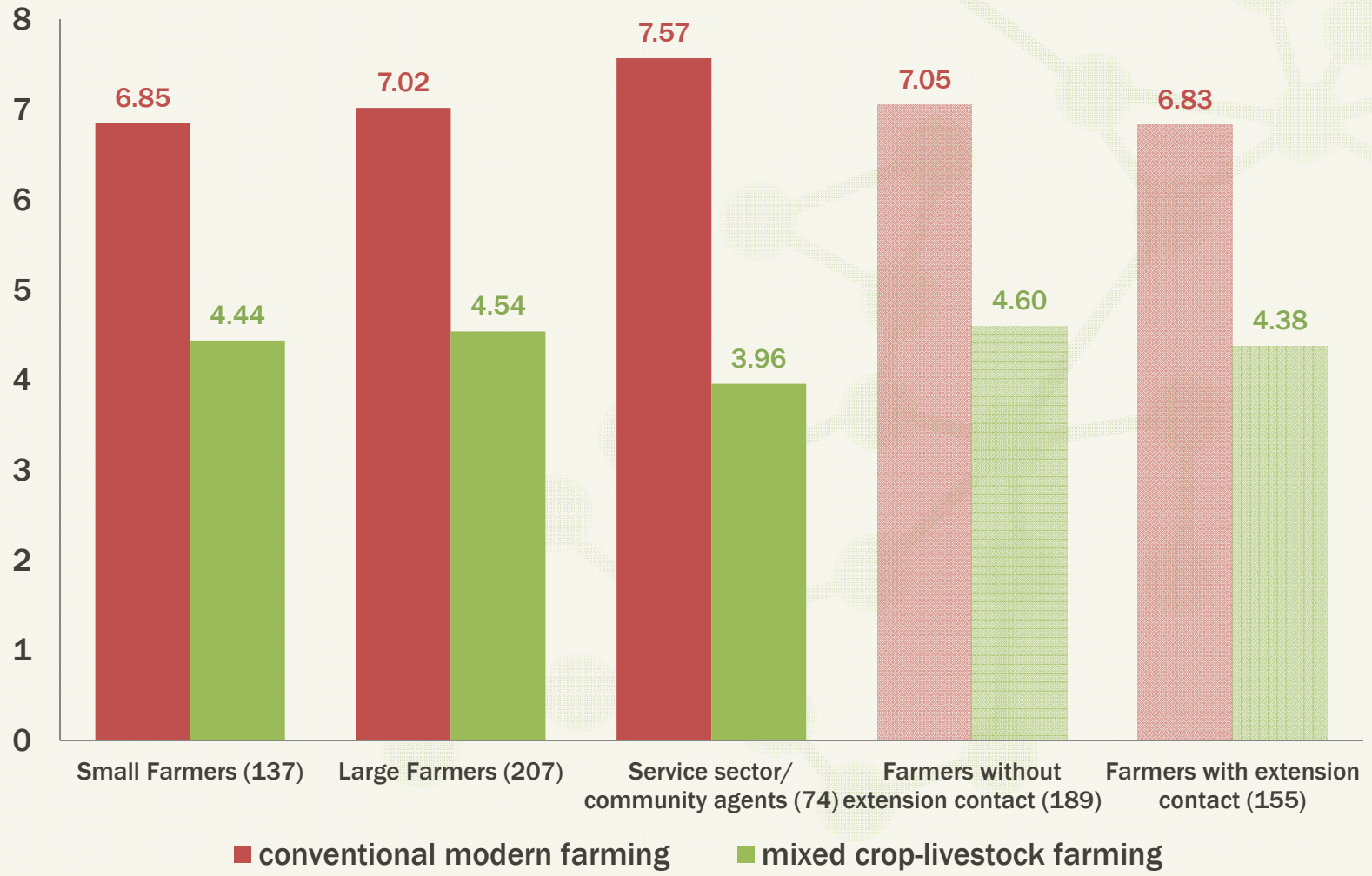
Dependent variables in the analysis

- Built from 20 Likert-scale items in questionnaire
  - Measuring conventional, risk-averse, and conservation agriculture knowledge and beliefs
  - Variance ranges from: agree strongly (code=5) to disagree strongly (code=1)
- Factor analysis (principle components) identified two predominant dimensions of variation
  - Modern capital intensive farming
  - Mixed crop-livestock farming
- Two single indicators of conservation agriculture
  - The importance of maintaining permanent crop cover
  - Tillage causes soil degradation

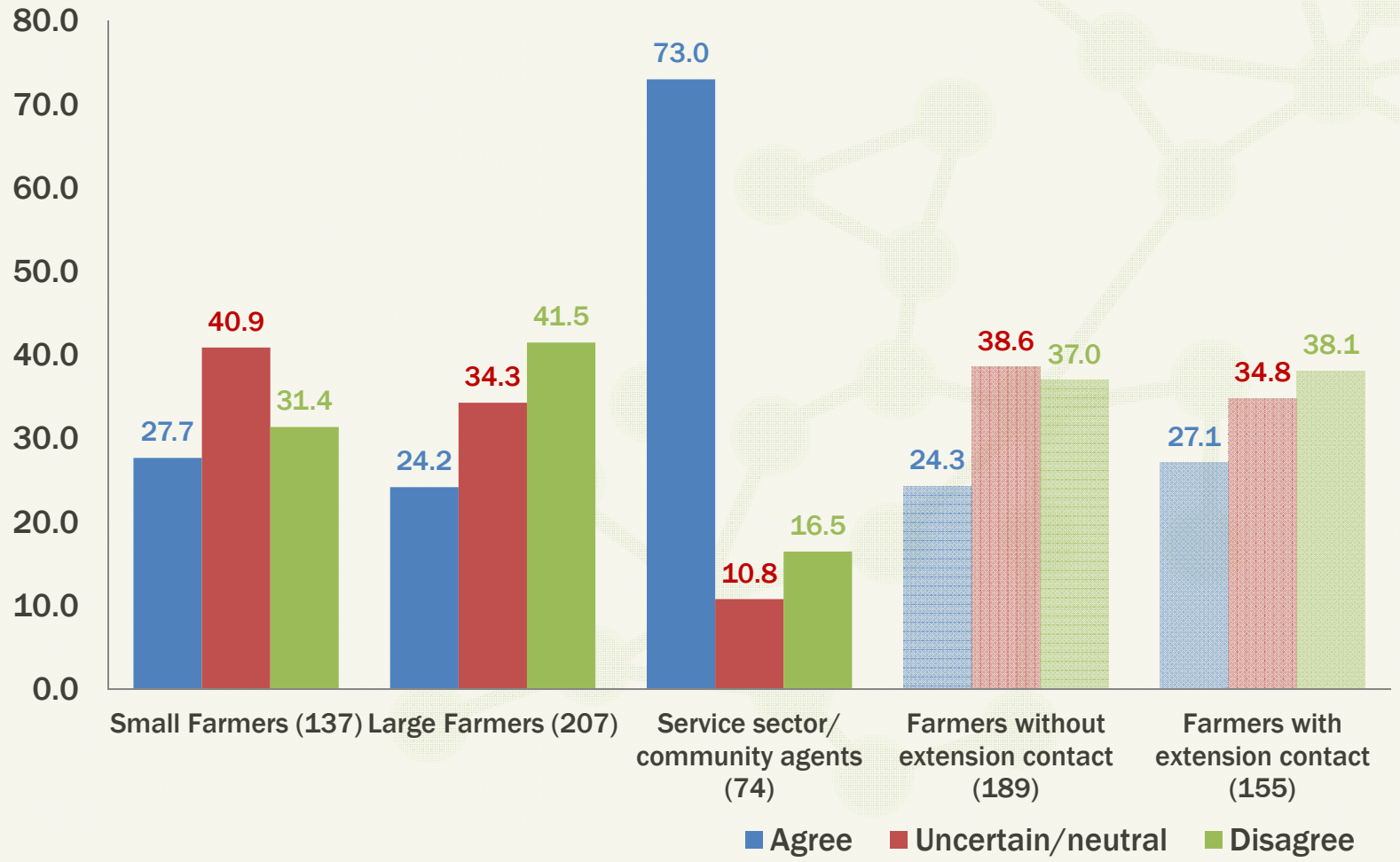
Independent variables

- **Contextual characteristics**
  - **Local agro-ecosystems** (by research site)
  - **Network connectivity** (type and frequency of contacts)
- **Individual characteristics**
  - **Resource endowments**
    (tractor, animal traction, area farmed, wealth, off-farm income, credit)
  - **Personal characteristics**
    (Age, gender, education, female household head, health, % energy from staples)

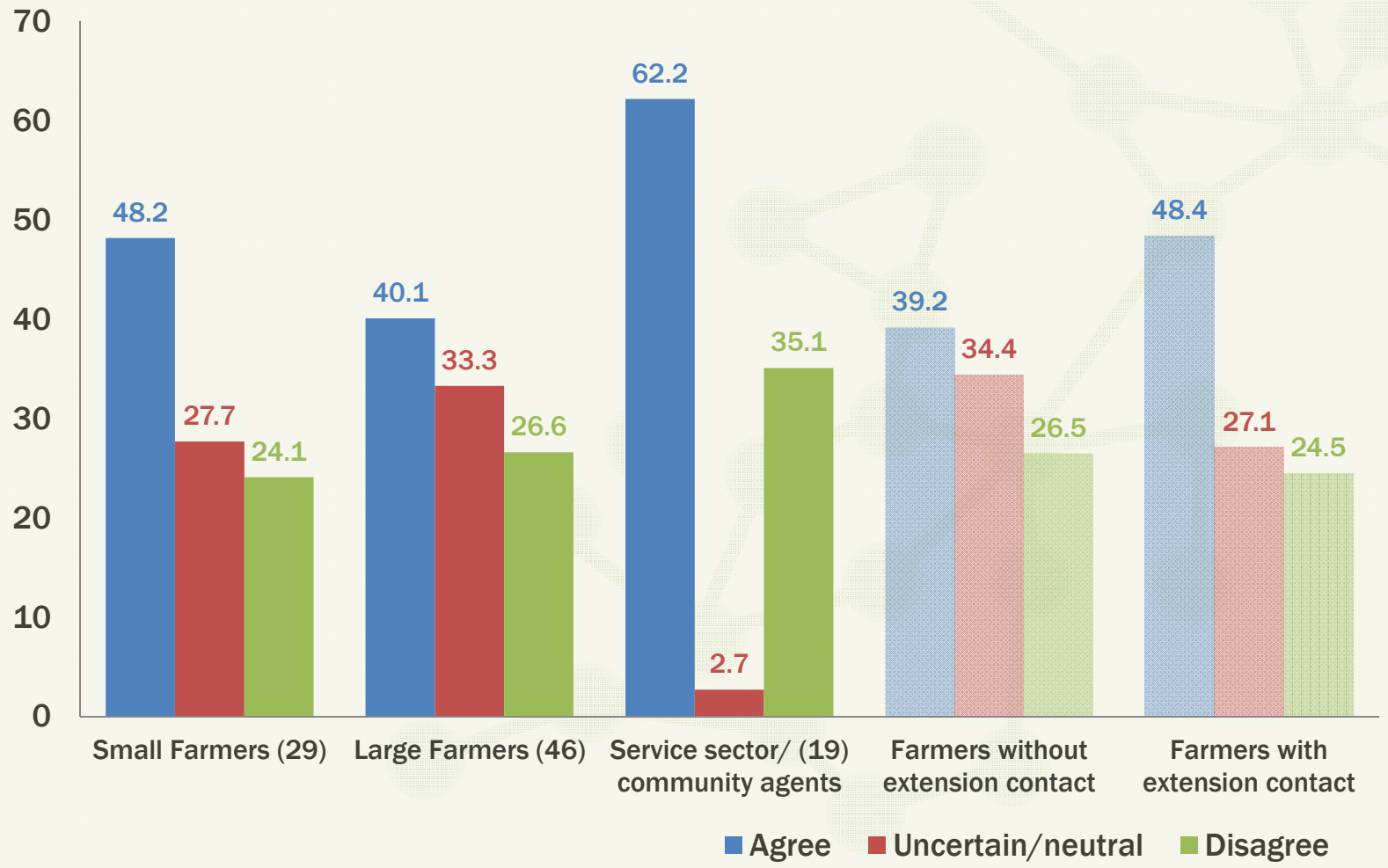
Mean scores for Kenyan and Ugandan farmers and non-farm agents level of agreement on basic farming perspectives



STATEMENT: One should maintain a permanent crop cover.



STATEMENT: Tillage causes land degradation.



Regression Table 6.1:

Modern capital intensive farming

INDEPENDENT VARIABLES	VARIABLE GROUPS		ALL		BEST MODEL	
	Beta	sig	Beta	sig	Beta	sig
Agro-ecological Zone						
Tororo	.166	.01	.450	.02	.221	.00
Kapchorwa	-.126	.06	.234	.08		
Bungoma	-.034	.60	.216	.04	.102	.06
Adj. R^2	.053	.00				
Resource endowments						
Tractor	-.039	.54	.254	.00	.237	.00
Animal traction	-.087	.12	-.048	.41		
Area farmed	.007	.91	-.017	.76		
Wealth index	.016	.80	.084	.25		
Importance of off-farm income	-.081	.14	-.063	.26		
Access to credit	.153	.01	.089	.16		
Adj. R^2	.014	.09				
Personal Characteristics						
Age-respondent	.040	.49	.043	.57		
Gender-respondent	.024	.69	.058	.31		
Education-respondent	-.007	.90	-.017	.78		
Female household head	-.015	.81	-.090	.17		
Poor health	-.117	.04	-.105	.05		
% energy from staples	.088	.11	.065	.21		
Adj. R^2	.002	.36				
Network connectivity						
Extension contact	.224	.04	.289	.01	.300	.01
Frequency extension contact	-.271	.02	-.378	.00	-.390	.00
NGO Contact	-.013	.91	-.007	.95		
Frequency NGO contact	.164	.15	.156	.17	.185	.00
Vendor contact	-.100	.22	-.131	.13		
Frequency vendor contact	.032	,77	.099	.37		
Average contact frequency	-.018	.75	.079	.58		
Total network contact frequency	-.255	.02	-.250	.02	-.270	.00
Adj. R^2	.087	.00				
Adjusted R^2			.145	.00	.150	.00

Regression Table 6.2:

Mixed crop-livestock farming

INDEPENDENT VARIABLES	VARIABLE GROUPS		ALL		BEST MODEL	
	Beta	sig	Beta	sig	Beta	sig
Agro-ecological Zone						
Tororo	-.348	.00	-.052	.89		
Kapchorwa	-.014	.25	.063	.64	.153	.02
Bungoma	-.299	.00	-.285	.01	-.197	.00
Adj. R^2	.107	.00				
Resource endowments						
Tractor	.161	.01	-.109	.25		
Animal traction	-.007	.90	.029	.63		
Area farmed	-.015	.80	-.004	.94		
Wealth index	.008	.90	-.064	.31		
Importance of off-farm income	-.001	.99	-.011	.84		
Access to credit	-.013	.83	.138	.03	.126	.04
Adj. R^2	.008	.19				
Personal Characteristics						
Age-respondent	.029	.62	.001	.99		
Gender-respondent	-.018	.77	-.071	.21		
Education-respondent	.053	.36	.024	.69		
Female household head	.038	.54	.074	.21		
Poor health	.012	.83	.017	.75		
% energy from staples	.021	.71	.011	.84		
Adj. R^2	-.013	.94				
Network connectivity						
Extension contact	-.145	.18	-.237	.04	-.140	.01
Frequency extension contact	.012	.91	.124	.30		
NGO Contact	-.217	.05	-.208	.07	-.116	.05
Frequency NGO contact	.142	.22	.108	.35		
Vendor contact	.145	.08	.093	.28		
Frequency vendor contact	-.303	.01	-.254	.02	-.201	.02
Average contact frequency	.196	.00	.279	.05	.229	.00
Total network contact frequency	.242	.02	.244	.03	.273	.00
Adj. R^2	.078	.00				
Adjusted R^2			.133	.00	.149	.00

Regression Table 7.1:

One should maintain a permanent crop cover

INDEPENDENT VARIABLES	VARIABLE GROUPS		ALL		BEST MODEL	
	Beta	sig	Beta	sig	Beta	sig
Agro-ecological Zone						
Tororo	-.200	.00	-.224	.24		
Kapchorwa	-.245	.00	-.194	.15		
Bungoma	-.351	.00	-.399	.00	-.236	.00
Adj. R^2	.076	.00				
Resource endowments						
Tractor	.098	.12	-.100	.29		
Animal traction	-.108	.05	-.014	.81		
Area farmed	-.058	.32	-.106	.06		
Wealth index	.076	.22	.054	.39		
Importance of off-farm income	-.089	.10	-.075	.18		
Access to credit	.083	.15	.131	.04	.139	.01
Adj. R^2	.040	.00				
Personal Characteristics						
Age-respondent	.193	.00	.142	.02	.182	.00
Gender-respondent	.159	.01	.112	.05	.100	.05
Education-respondent	.006	.92	-.034	.57		
Female household head	-.031	.60	-.026	.66		
Poor health	-.118	.03	-.086	.11		
% energy from staples	.080	.03	.061	.24		
Adj. R^2	.048	.00				
Network connectivity						
Extension contact	-.019	.86	-.044	.70		
Frequency extension contact	.060	.61	.104	.39		
NGO Contact	-.458	.00	-.386	.00	-.420	.00
Frequency NGO contact	.360	.00	.290	.01	.343	.00
Vendor contact	.167	.05	.156	.07	.132	.01
Frequency vendor contact	-.188	.09	-.081	.46		
Average contact frequency	.018	.77	-.029	.84		
Total network contact frequency	.100	.35	.080	.46		
Adj. R^2	.050	.00				
Farming Perspectives						
Modern capital intensive	.138	.01	.107	.06	.105	.04
Mixed farming system	-.014	.77	-.051	.36		
Adj. R^2	.015	.02				
Adjusted R^2			.157	.00	.153	.00

Regression Table 7.2:

Tillage Causes Land Degradation

INDEPENDENT VARIABLES	VARIABLE GROUPS		ALL		BEST MODEL	
	Beta	sig	Beta	sig	Beta	sig
Agro-ecological Zone						
Tororo	-.073	.27	-.049	.80		
Kapchorwa	-.173	.02	.205	.14	.268	.00
Bungoma	-.089	.17	-.007	.95		
Adj. R^2	.045	.00				
Resource endowments						
Tractor	.051	.41	048	.62		
Animal traction	.065	.24	.052	.39		
Area farmed	-.074	.21	-.059	.32		
Wealth index	.161	.01	.149	.02	.143	.01
Importance of off-farm income	-.023	.68	-.008	.89		
Access to credit	-.191	.00	-.115	.08		
Adj. R^2	.037	.00				
Personal Characteristics						
Age-respondent	.012	.83	-.004	.94		
Gender-respondent	-.142	.02	-.148	.01	-.149	.01
Education-respondent	.060	.28	.036	.56		
Female household head	.075	.22	.116	.06	.109	.05
Poor health	.007	.90	-.001	.99		
% energy from staples	.163	.00	.130	.02	.132	.01
Adj. R^2	.033	.01				
Network connectivity						
Extension contact	.085	.46	.028	.81		
Frequency extension contact	-.004	.97	.109	.38	.106	.04
NGO contact	-.101	.38	-.199	.08		
Frequency NGO contact	.131	.28	.183	.12		
Vendor contact	.113	.19	.101	.25		
Frequency vendor contact	-.151	.19	-.137	.23		
Average contact frequency	.058	.35	-.012	.94		
Total network contact frequency	-.029	.79	-.034	.76		
Adj. R^2	-.003	.53				
Farming Perspectives						
Modern capital intensive	-.003	.95	.135	.02	.130	.01
Mixed farming system	.053	.28	.010	.86		
Adj. R^2	-.002	.56				
Adjusted R^2			.104	.00	.118	.00

Conclusions from conventional analysis

Sense-Making |

there are real differences between the agricultural production knowledge of non-farm agents and farmers

Contextual knowledge and mutual understanding |

these differences are driven by farmers' lived experience of the agro-ecology and the networks that support living in that environment in contrast to memorized science

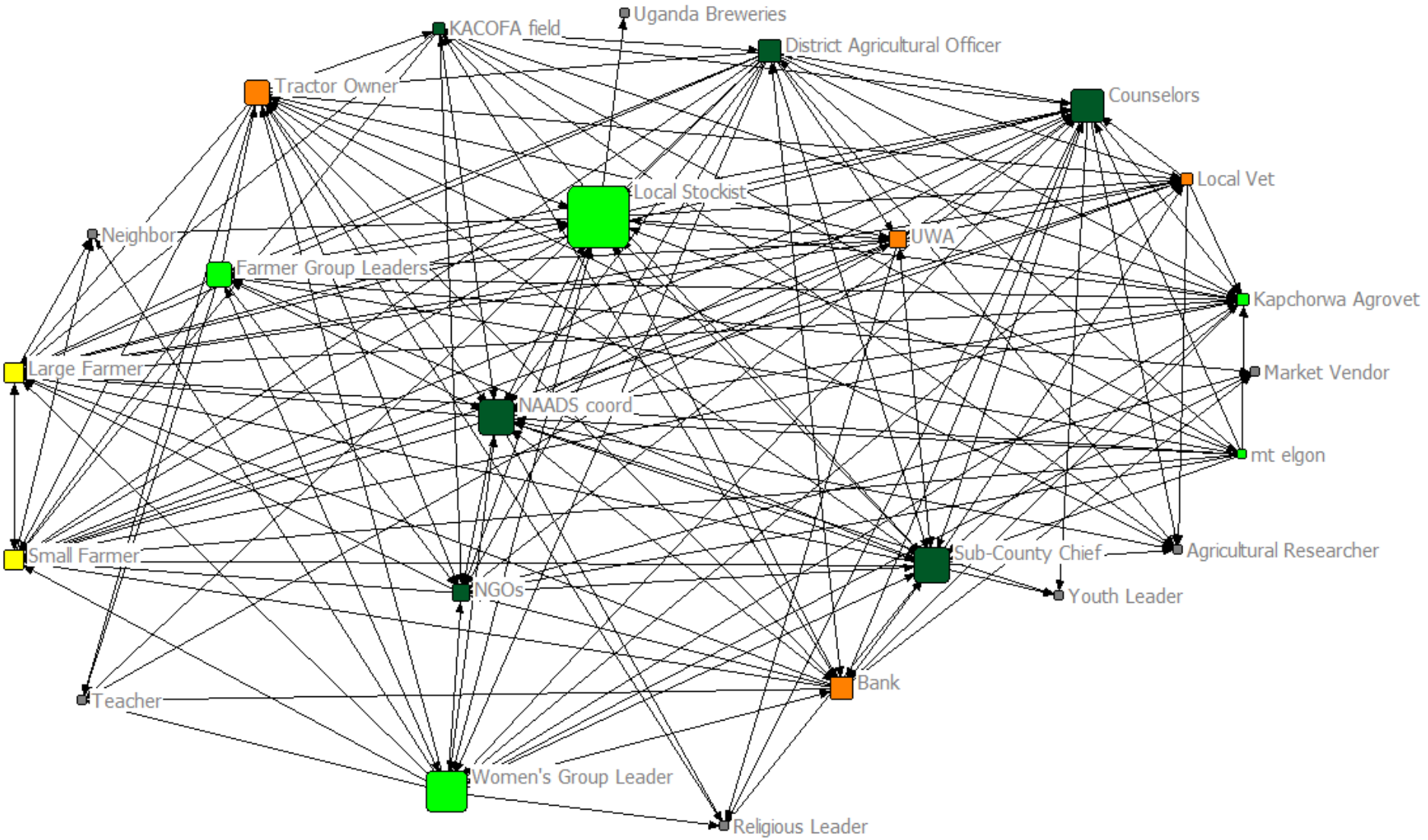
Receptivity to change |

new ideas may find receptivity on the basis of personal characteristics and resource endowments, but sustained only through grounding concepts in local knowledge

Mind-Set change |

Mind-set change requires negotiating new understandings among network members in the process of making adaptations to production practices

Kapchorwa Agricultural Support Network



Bringing the network together

- Farmers are often more receptive to CA than believed by the service sector
  - Crop rotation in Tororo
  - Belief that tillage causes land degradation in Kapchorwa
- Relating farmer knowledge and practice
  - Bungoma: practice is knowledge
  - Trans Nzoia: evolutionary relationship

In Kapchorwa, Uganda farmers recognize the damage from plowing, but it continues to be the dominant practice.

Most frequently reported resource contacts in Tororo, Uganda

Agent Type:	Number of Reports (Out of 93):	Percentage of Farmers Reporting Contact:
Veterinary Service provider	40	43%
Neighbor/friend	38	41%
Vendor in a agro-vet shop	37	40%
Vendor in weekly market	29	31%
NGO/ Development Agent	18	19%
Family Member	17	18%
Vendor in a shop in urban center	13	14%
Leader of farmer organizations	11	12%
Leader of women's organization	11	12%
Village/Subcounty chief	9	10%
Agricultural/Micro Finance Representative	4	4%
Teacher in village	1	1%
Govemment Parastatals	1	1%
Agricultural researcher	1	1%
Leader of youth organisation	1	1%
Minister/Priest/Imam in village	0	0%
Government Extension agent	0	0%
Tractor owner/ animal traction provider	0	0%
Local Political leaders	0	0%

Central Actors in Kapchorwa/Kwosir Agricultural Production Network

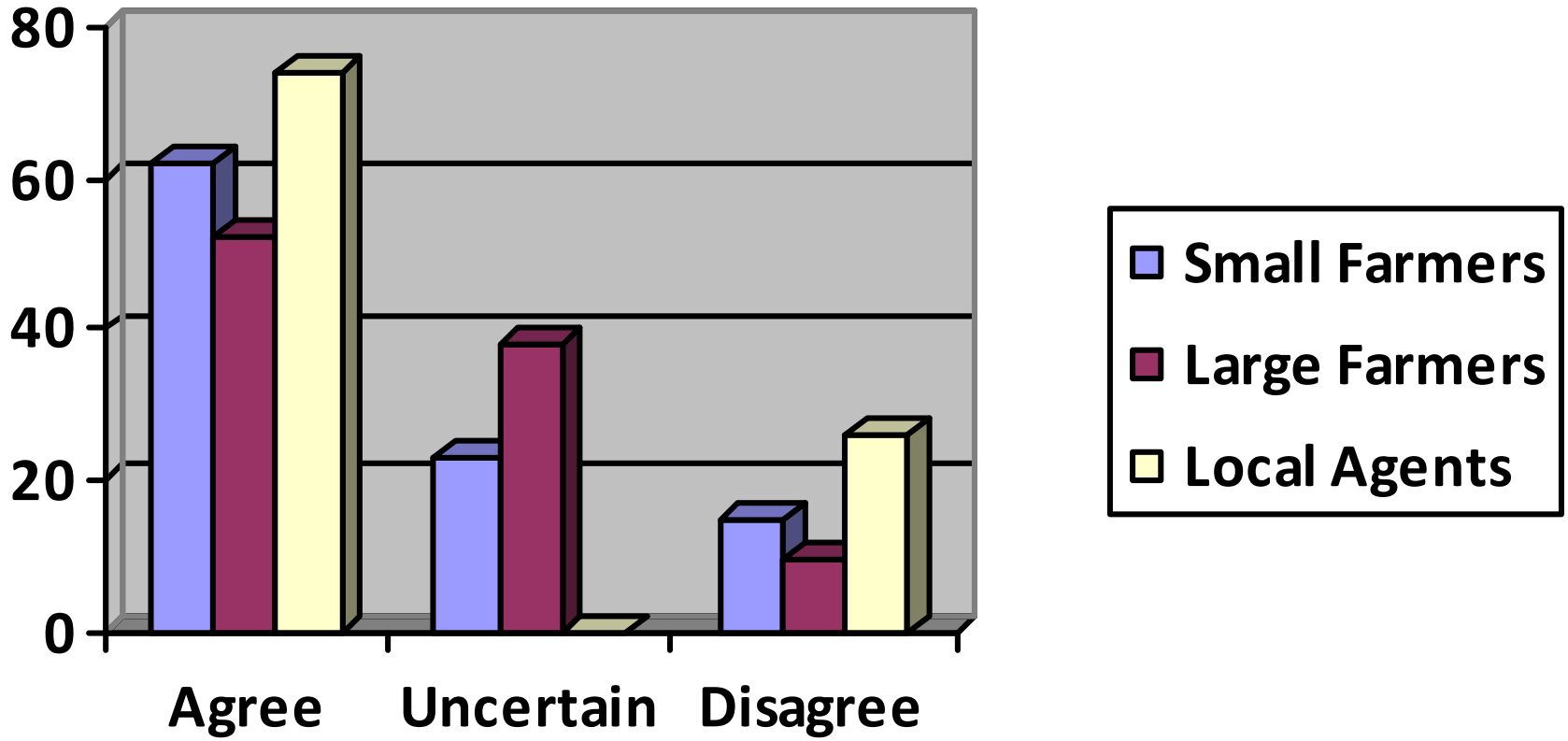
Agent	Degree Centrality	Rank	Agent	Betweenness Centrality
NAADS Coordinator	20	1	Local Agrovet Stockist	28.25
Chief	20	2	Women's Group Leader	16.93
Counselors	19	3	Chief	14.19
Local Agrovet* Women's Group Leader*	18	4	NAADS Coordinator	14.15

* Tied for fourth.

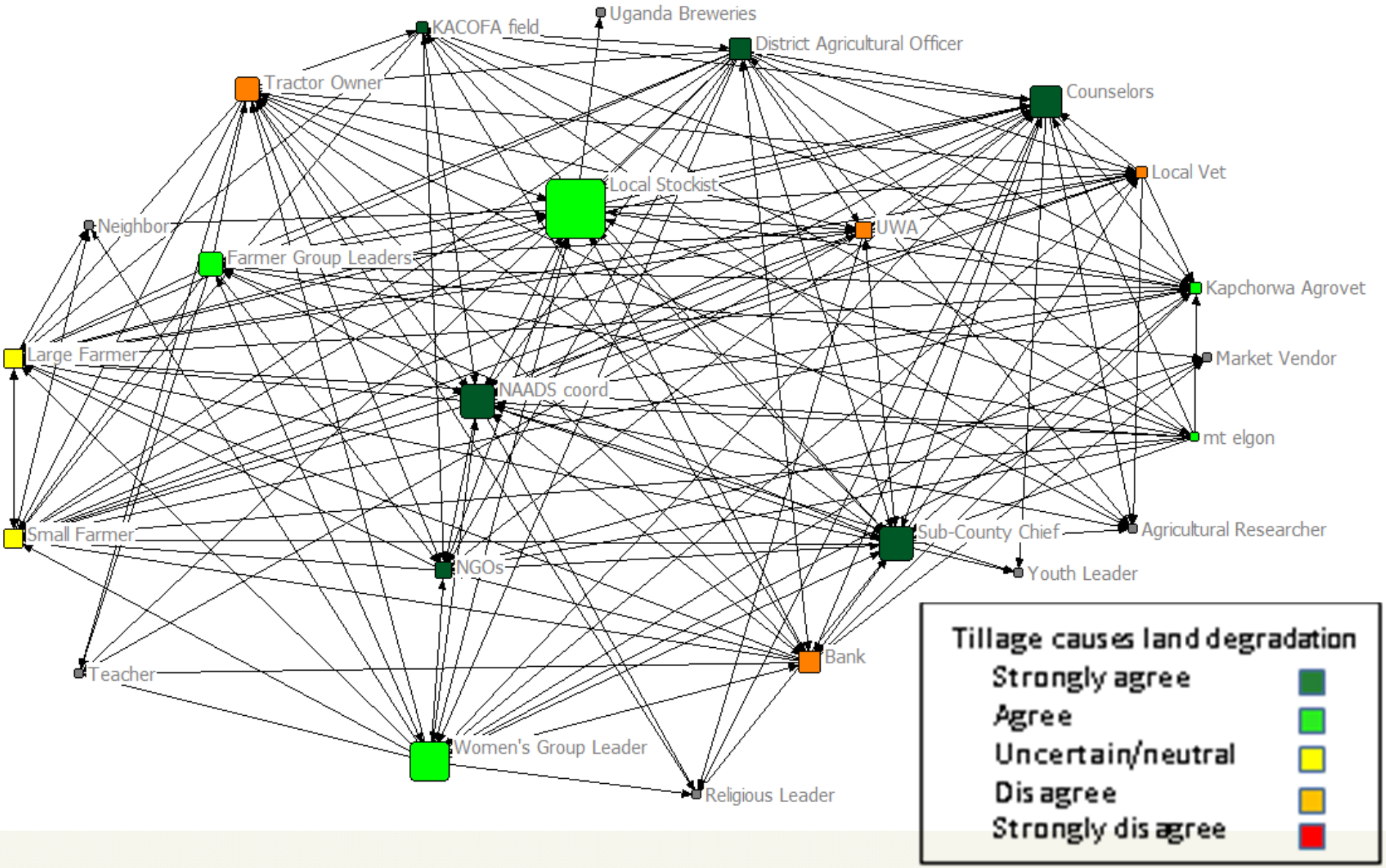
Revealing differences in perceived and reported network contacts

- Extension not in the top 25% in Uganda for resources
  - Conflicts with resource distribution mandate
- Agrovets as the primary contact
  - Various reactions
  - Priority setting
- Increasing contacts for Tororo farmers
- Farmer group leaders desire to expand their reach

Kapchorwa: Tillage causes land degradation



Misunderstanding the perceptions of others



This participatory research process

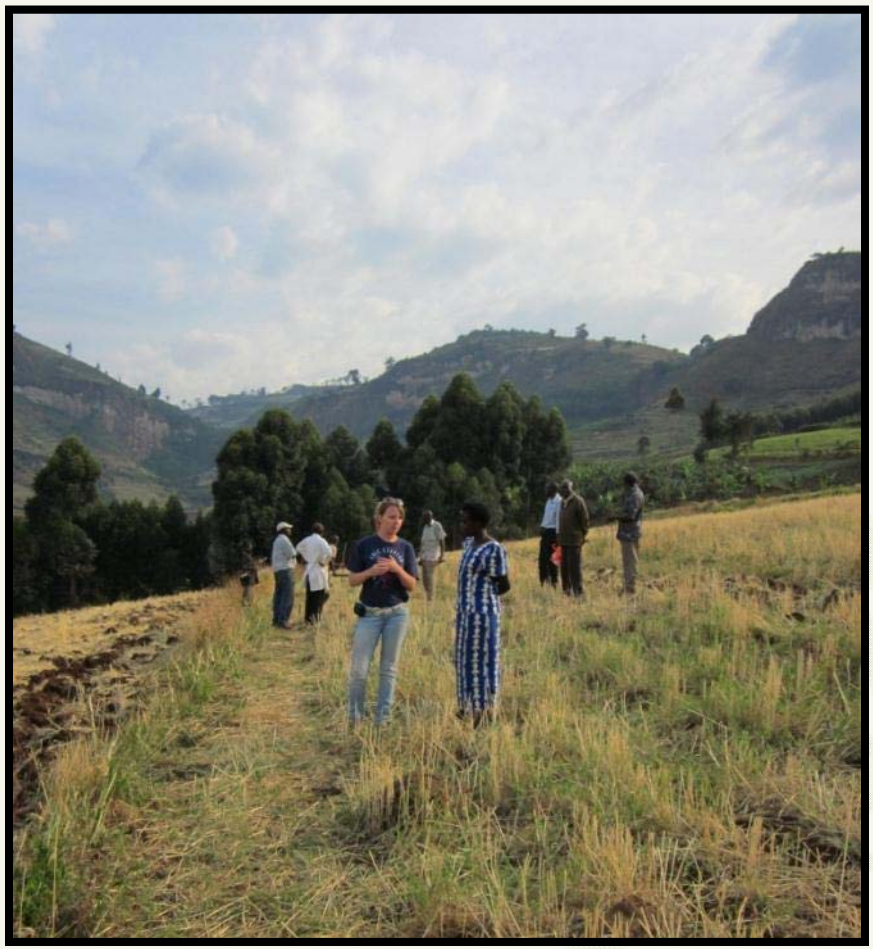
- Built trust between social and agronomic researchers
- Increased legitimacy of participatory research
  - Farmers and service providers recognized personal role in generating the network
  - Maintaining interest beyond direct participants
- Engaged local advisory committees

The network workshops brought together many members of the local advisory committees for the first time since the start of the project.

Managing Project Expectations

- Linear expectation not just from the side of development agents, but farmers too!
  - Expect a finished product
- Changing how we talk about networks for CA
  - A learning process as the networks evolve
  - A different dynamic within project management

Key Contributions of SNA to the project



Developing partnerships for network field research in 2011

- Evidence that a network approach can make valuable contributions
  - Technology development
  - Spontaneous adoption
- Mutual learning:
  1. Revealing differences between perceived and reported network contacts
  2. Ill-informed perspectives about the beliefs of others
  3. Problems regarding actual agricultural technologies

Thank you! Questions?