Transitioning Cereal Systems to Adapt to Climate Change

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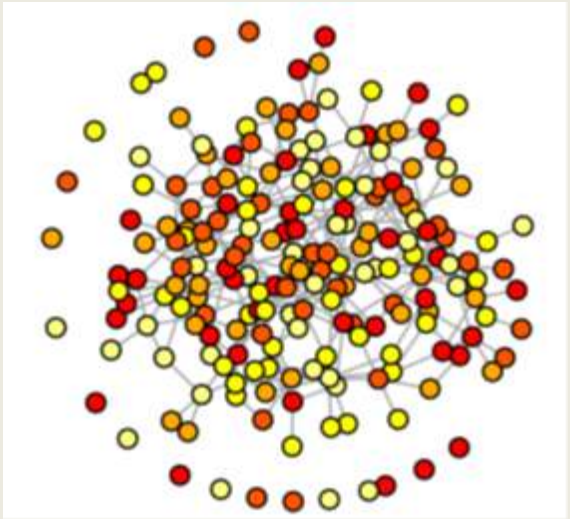
A framework for optimizing participatory research



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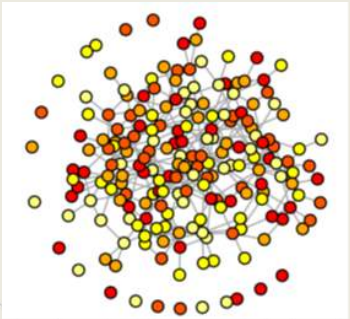
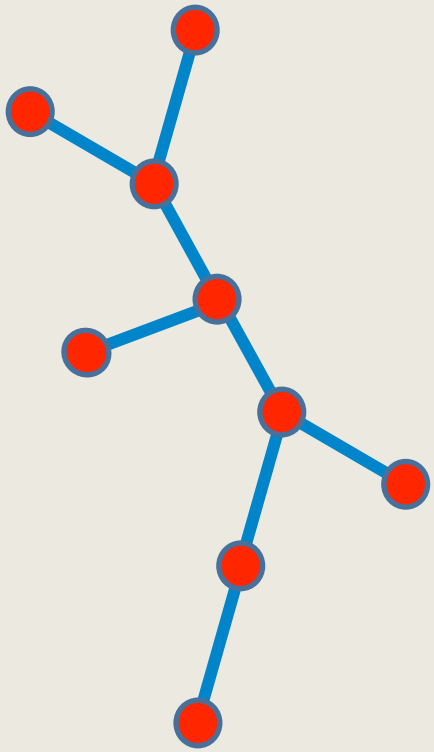
Defining success in participatory research

- For farmers
  - Increase profit and financial stability (and productivity)
  - Increase "agency"
- For researchers
  - Increase quality of research products
  - Increase probability that farmers will use research products
  - Development goals: increase success of resource-poor farmers
- For society in general
  - Increase food availability and stability (food security)
  - Decrease environmental costs of food production



How can we draw on network theory to enhance the success of participatory research?

Traits of network nodes

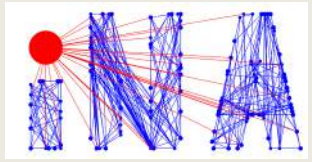


- Degree centrality – number of links
- Closeness centrality – measure of how readily other nodes can be reached
- Betweenness centrality – importance as a bridge between other nodes
- Centrality of neighbors – importance in terms of importance of neighbors

Impact network analysis (INA)

- Impact **OF** research products such as information/training, disease resistance, and disease-free seed production technologies
- Impact **ON** spatial ecological processes, such as crop productivity, pest invasions or ecosystem services more broadly
- Impact **THROUGH** communication and decision-making networks, and linked biophysical networks

Impact network analysis



Information or technology

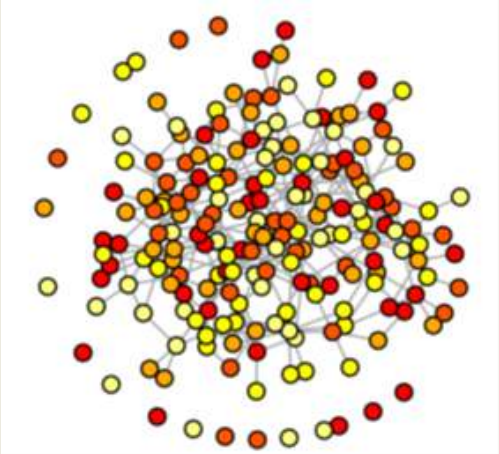
Socioeconomic network

Integration of socioeconomic and biophysical components
Heterogeneity
Phenotypes
Constraints

Outcome: yield, profit, ES, etc.

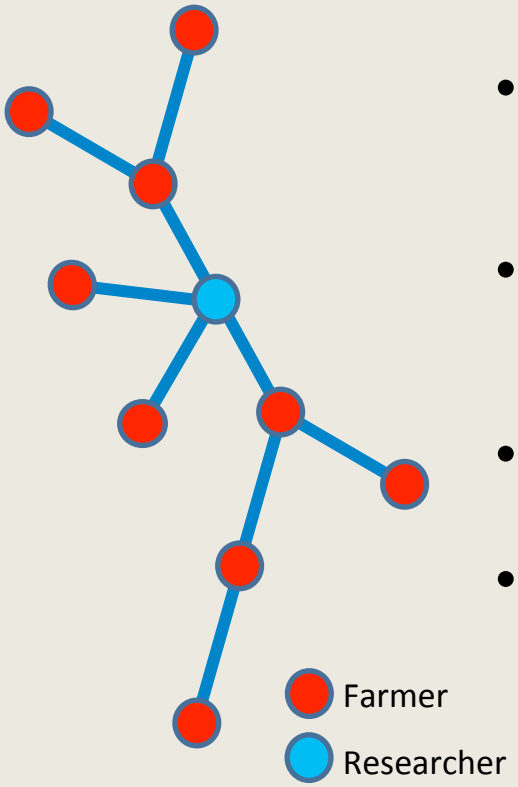
Biophysical network

Garrett, in review



"Impact network analysis" as a framework for improving systems such as participatory research

Links indicating utility of engagement



- For Farmer and Researcher: utility is a function of the increase in success due to link (benefits minus costs)
- Success defined by farmer and researcher may be more or less strongly related to success for society
- Over time, links will be dropped if both parties don't perceive them to have utility
- In the development context, targeted subsidies may adjust utility to improve network structure

Some general hypotheses for optimizing participatory research - I

- Particularly interesting question: what model outcomes go beyond common sense?

- Formulating efficient information messages can move information through otherwise very low utility links
- Identification of key participants will make participatory research more successful… and key traits in communication networks go beyond having high degree centrality

Some general hypotheses for optimizing participatory research - II

- Selecting key participants may also need attention to sampling environmental heterogeneity, and identifying networks within each environmental type
- Targeting extremely resource-poor farmers may be enhanced by including farmers with a range of resource status, depending on network structures

Some general hypotheses for optimizing participatory research - III

- Understanding temporal and spatial variability in impact networks will allow estimation of the needed time for effectiveness of research projects
- Some technologies (such as cell phone apps) may make the costs of engagement much lower... but their contribution will depend on personal recommendations

Some general hypotheses for optimizing participatory research - IV

- Understanding utility links provides predictions of expansion of impact networks resulting from participatory research
- Even when there is high uncertainty about the structure of communication and epidemic networks, using approximations will still provide benefits when selecting participants and locations