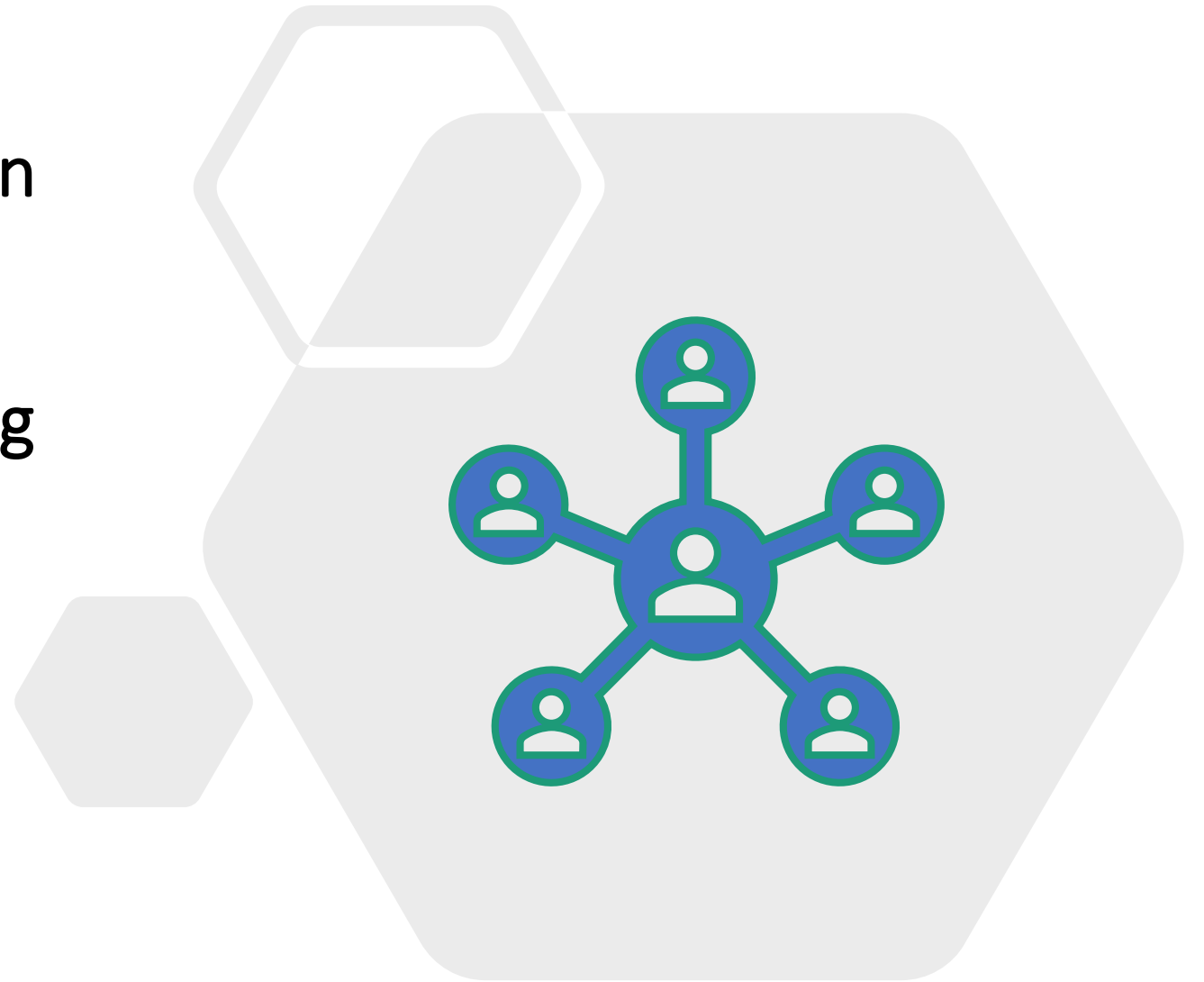


The role of social networks in accessing and utilizing weather and climate information and in improving extension services in upland farming communities

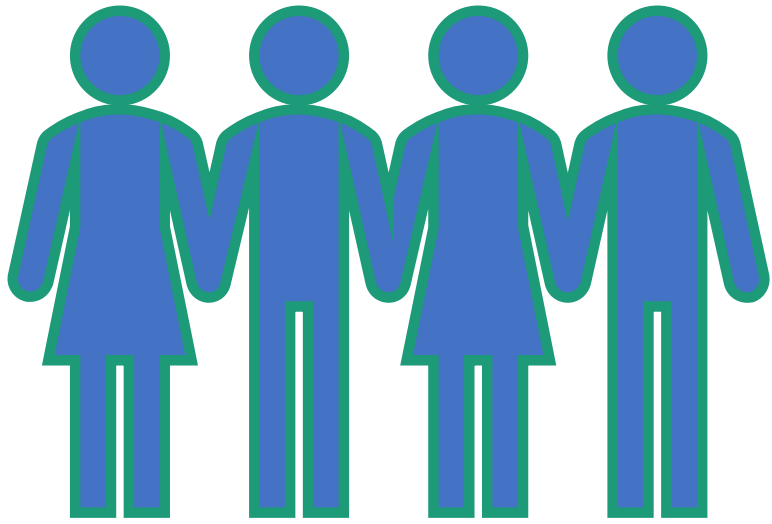
Aubrey D. Tabuga

PIDS, July 15, 2024



Rationale

- To contribute to the design of strategies for communication, IEC, and extension services by using existing norms/structures portrayed by social networks
 - Official communication strategies and IECs are often designed uniformly; less regard for heterogeneity in community circumstances (due to limited resources)
 - People in rural areas have limited means of accessing information via formal structures, in Atok, Benguet, there is very poor mobile phone signal – poor Internet connection
 - There are very few extension workers in Benguet, 134 serving tens of thousands farmers (for each extension worker - over 600 farmers in geographically constrained areas); They expressed their desire for better approaches for reaching farmers and for disseminating information



Why social networks
matter?

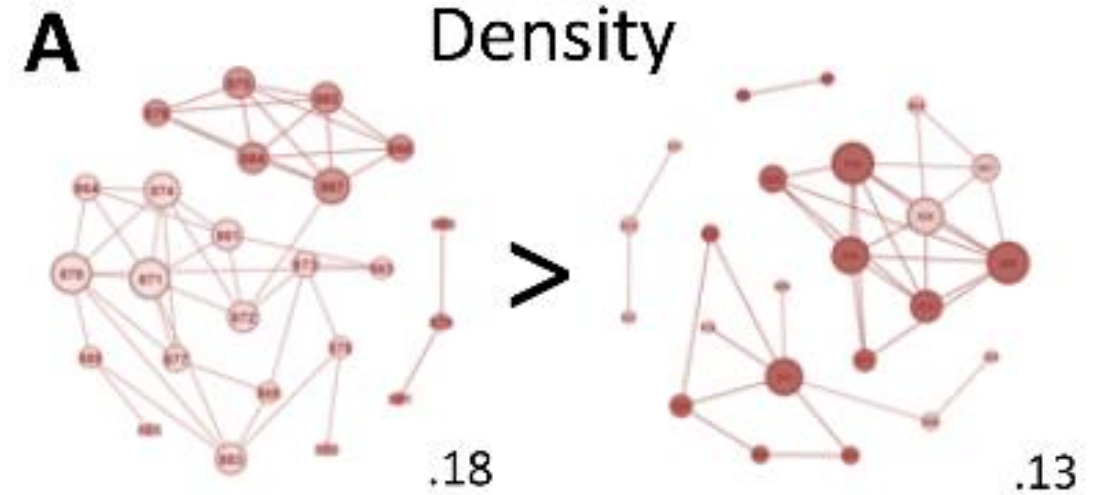
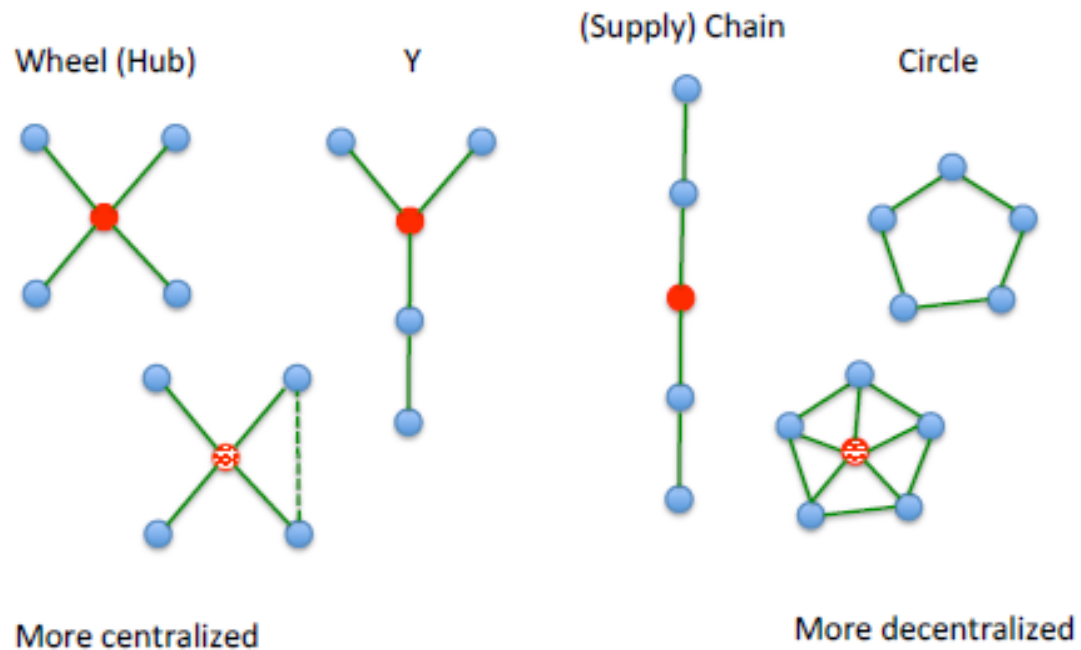
Contagion Models

- The rate of spread of a disease (or an innovation) is a function of the density of the community network (farmer network) which the disease has been injected into.
- The more cohesive (dispersed) network allows for faster (slower) rate of diffusion
- The more central the injection point(s) = faster rate of spread

Theory of social influence

- People engage in social comparison (sometimes without realizing it)—allows for social influencing
- Social influence can be direct (normative) or indirect (social reference)
- Information is the mechanism; the mere knowledge about one's activity/behavior and its benefits allows one to make a social comparison
- Social proximity → social influencing

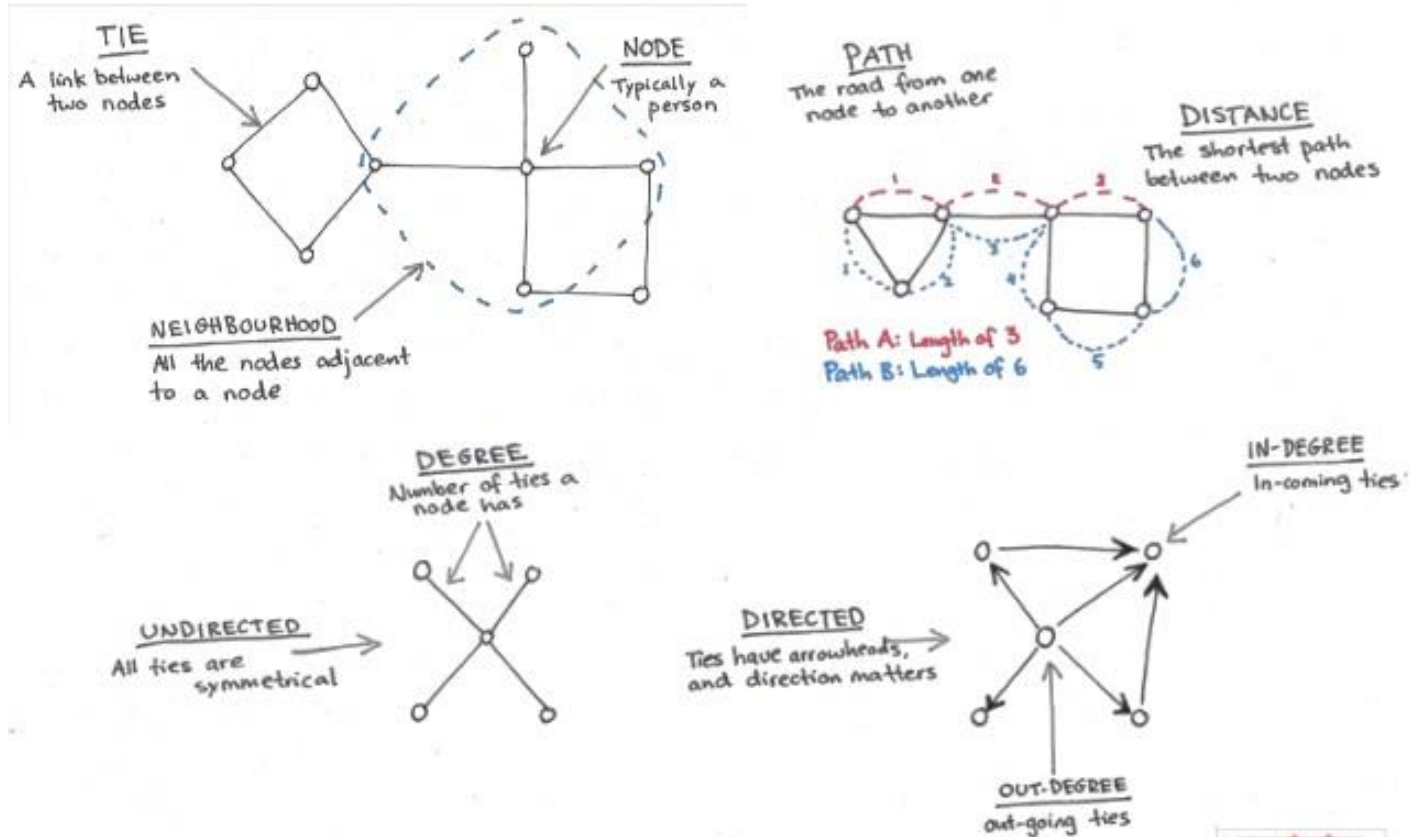
What do we mean by social structures or systems?



Source: Goetz (2016), adapted from Borgatti et al. (2009)

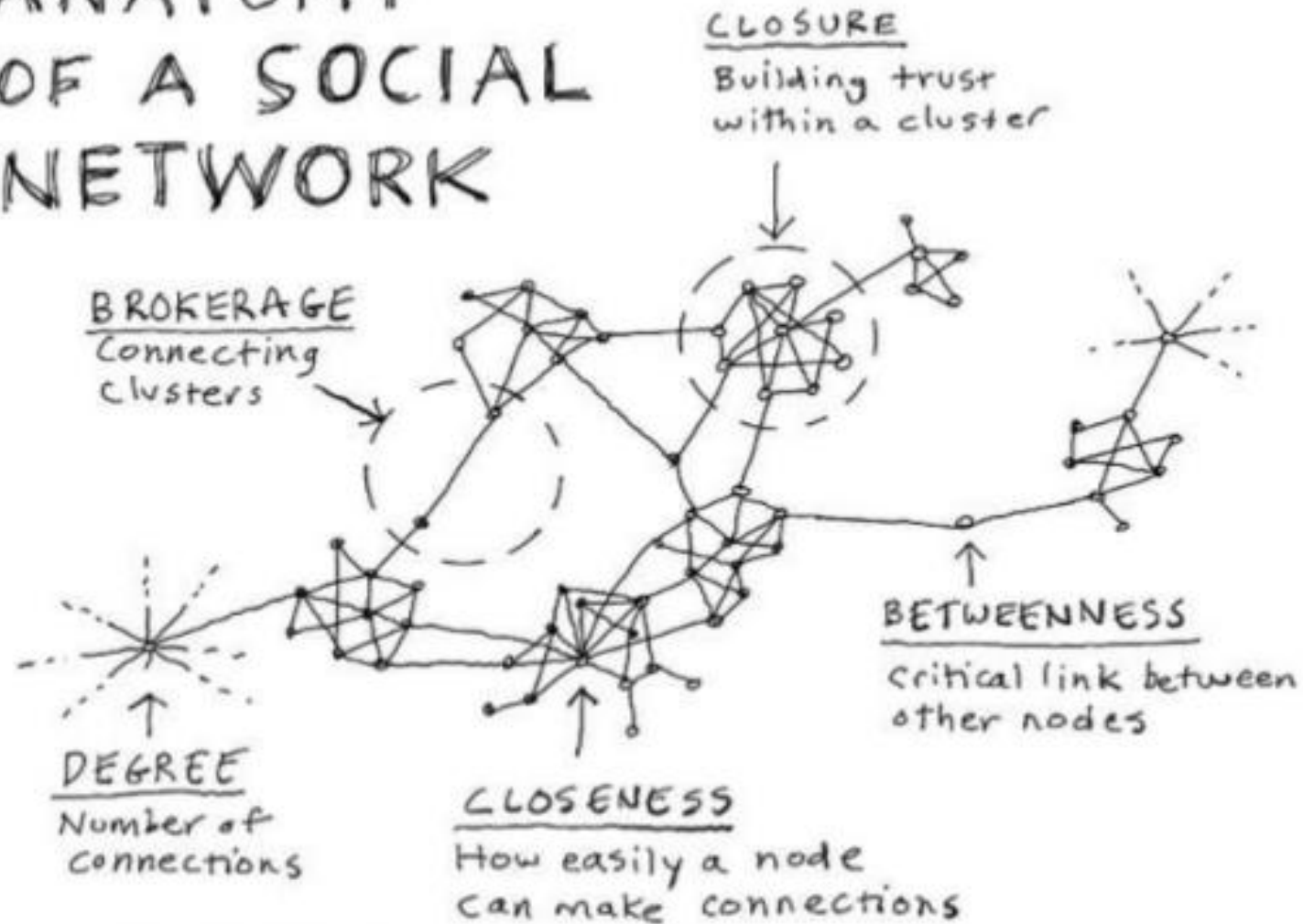
Some basic terms

SOCIAL NETWORK ANALYSIS - GRAPH THEORY BASICS



Network parameters

ANATOMY OF A SOCIAL NETWORK



Purposes of SNA

- By knowing the structure, we can speculate about the rate of diffusion of any property of interest (information, agricultural innovation or a cutting-edge technology, resources, diseases)
- We can also develop a strategy of information dissemination that is more efficient
- Because we get to know the peripheral actors, we can devise a strategy that may work for them
- From SNA, we can get parameters at the individual level that we can correlate with other variables of interest like access and utilization of WCI (regression analysis)

Purposes of SNA (cont'd.)

- Because we have more information, say, about an actor's interaction with agents of the government like extension workers → we can do overlay with the network structure, to gain extent of reach of the agent for:
 - For evaluation purposes (did past efforts work in terms of reaching farmers/households who are more central?)
 - For enhancing current efforts (where do we go from here? Where to allocate resources to improve the outcome of interest?)

Objectives

1. Examined social networks in the upland communities; determined the central and peripheral actors
2. Examined relationship between network centrality (being well-connected and access and utilization to WCI
3. Assessed extent of reach of extension workers

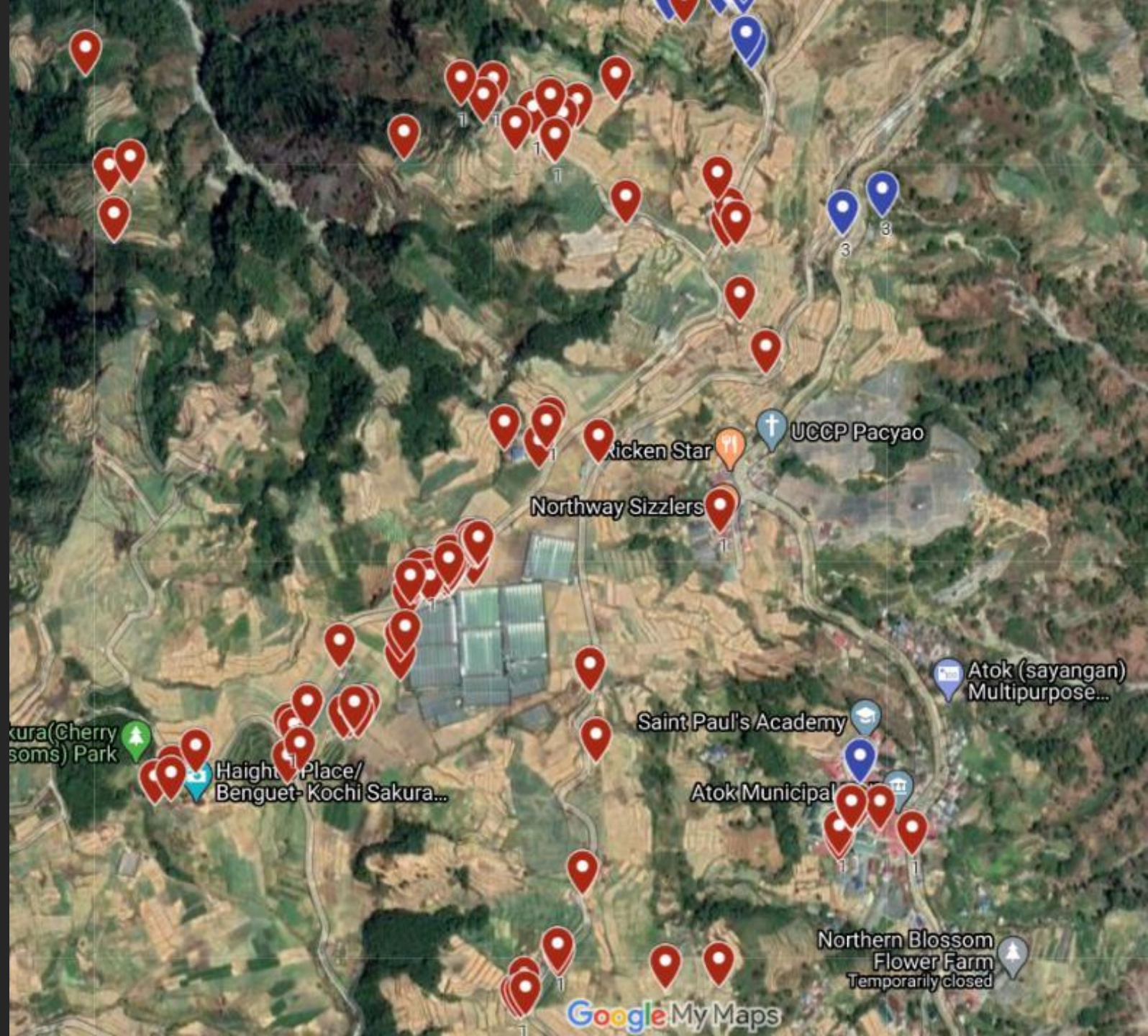
Study areas:
3 sitios in Atok
1. Proper Paoay
2. Tulodan
3. Macbas



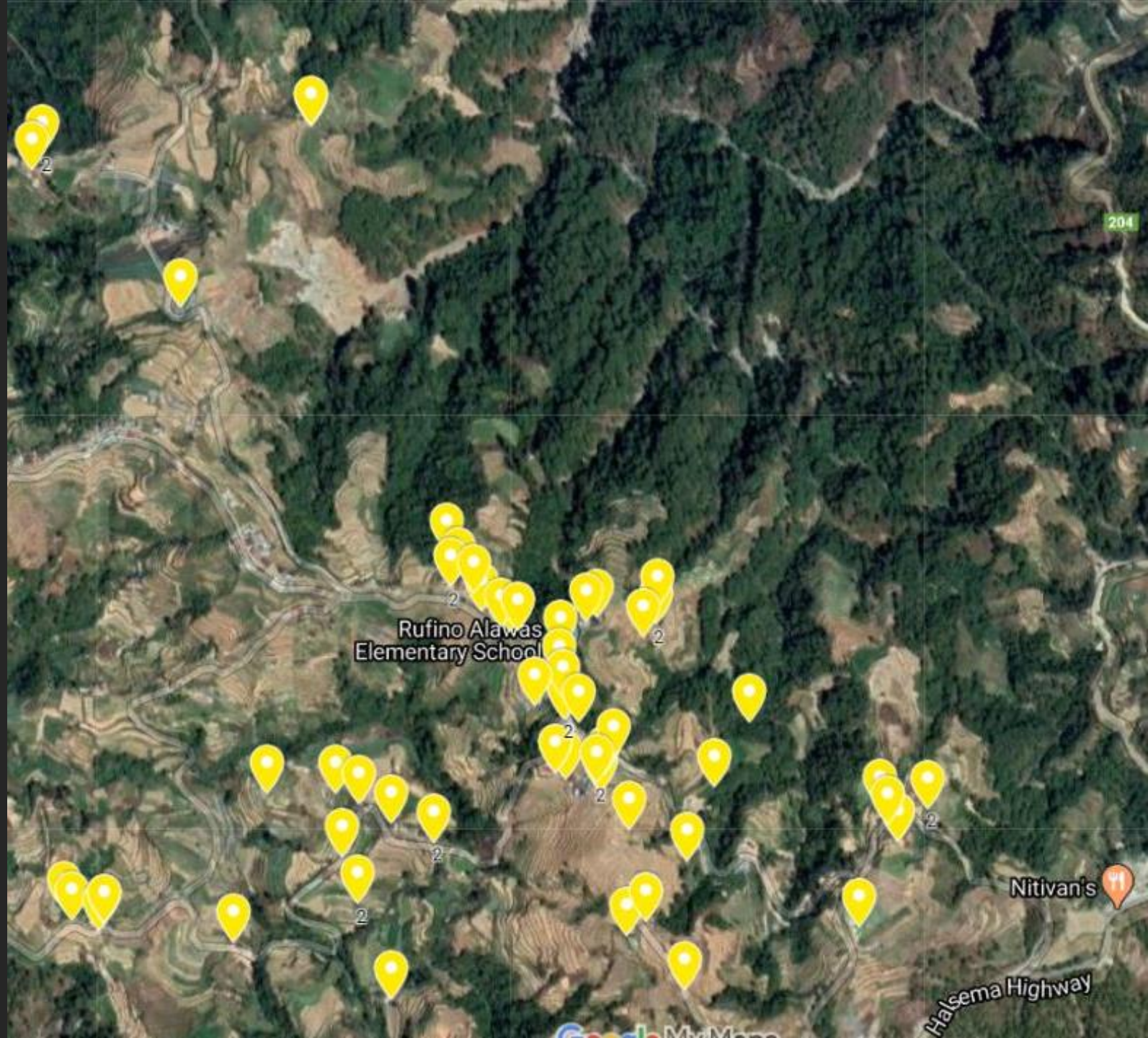
Barangay Cattubo



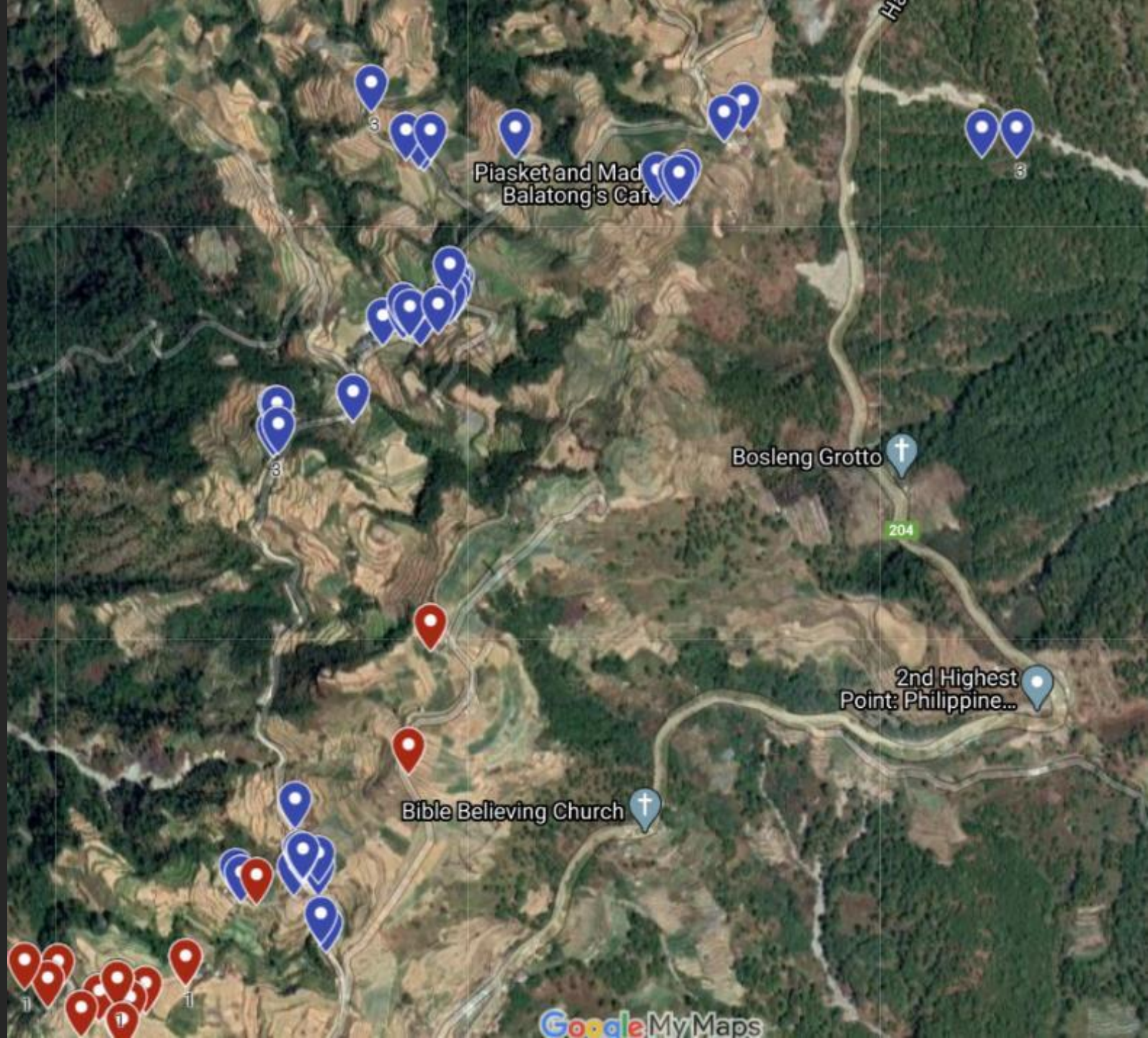
HH based on
geocodes –
Proper Paoay



HH based on
geocodes –
Tulodan



HH based on
geocodes –
Macbas



Site selection process

- Criteria
 - feasible to conduct full enumeration of households
 - at least 2 sites so comparison can be made
 - site be separated physically from the rest of the community by a mountain, river or major road, or that it can be identified as a distinct cluster either by some physical barrier or ethnicity, or **political boundary**, like a sitio
 - engaged in the production of cabbage, carrot or potato
- PIDS and BSU consulted with barangay officials and MAO to select the study sitios based on the project team's criteria. Moreover, they also provided a list of households living in the selected sitios.

Survey

- Benguet State University hired six field enumerators, 2 have prior experience in conducting household interviews
- Used paper and/or tablet questionnaire
- Survey is translated to Filipino, English and Ilocano
- Data collection: Oct – first week of Dec 2019 (approx. 8 weeks)
- Estimate length of survey is 1 hour, depending on the number of respondent's contacts
 - Project team prepared a list of household alters – for every respondent household, the list contains households in the same sitio that they share the same surname or middle name- to improve recall and reduce respondent fatigue

Challenges in conducting the survey

- Atok Mayor's Office and barangay office are informed of the survey
- Terrain in Atok and limited transportation moving inside the sitio
- Respondents are hesitant to provide names of their contacts (scam)
- Households have left the sitio or new households have moved in
- No time, busy schedule of the farmers
- Enumerators complete 1-2 interviews a day.
 - Small window to interview the respondents. They leave early morning and return in the afternoon.

SNA questionnaire

Instructions: The respondents in this section are **household head and spouse**. Network or contact refers to any person living outside the respondent's household who the person is related with, either by blood or marriage or friendship, or whom the respondent is associated with in terms of economic and farming activities, and **living within the sitio**. For example, cousin, neighbor, friend since birth, co-worker, "suplay," "taga-suplay," financier, employer/worker, trader, disposer, employer/worker, trader, ninong/ninang, etc. The maximum number of contacts that can be named is 50.

1	2	3	4	5	6	7	8	9	10	11	12	13
No.	Reference	Full name of the contact/network [Last name, First Name, Middle Name]	HCN	What is your exact relation? [MA] <i>Anya ti relasyon yo kenni ____</i>	What is the usual mode of communication? [MA] <i>Ili kadawyan, kasano kayu nga maki comcommunicate kanya na?</i> (see codes)	How frequent do you communicate with each other, regardless of mode? <i>Gaano kayo Mamin ano kayo nga agtungtung?</i> (see codes)	Do you obtain or give health-related advice on the following? (read codes) <i>Awawat kayo ba wenno mangit ited kayo ti advice maipanggep kadagiti sumaganad?</i> [MA, read codes]	Do you usually obtain advice from (or give advice to) the person when making certain farm-related decisions? <i>Awawat kayo ba wenno mangit ited kayo ti advice kenni __ no maipanggep iti panag garden?</i>	Do you usually share or borrow farm inputs or any other resources with the person in times of need? <i>Mangibing bingay wenno ag bulbulod kayo kadi ti inputs kenni __ no kasapulan?</i>	When in need, how likely that this person or his/her family will come to your aid when called upon? <i>Tumulong ngata isuna wenno ti pamilya na nu agkasapulan ka?</i> (see codes)	What type of W&C information do you usually get from the person [MA]? <i>Anya dagiti impormasyon maipanggep iti panawen ken klima ti maawawat yo magapo kanyana?</i> (MA, read codes)	What type of W&C information do you usually share to the person [MA]? <i>Anya nga impormasyon maipanggep iti panawen ken klima ti ibing bingay yo kanyana?</i> (MA, see codes)
1								1 Yes 0 No	1 Yes 0 No			
2								1 Yes 0 No	1 Yes 0 No			
3								1 Yes 0 No	1 Yes 0 No			

Social relations data

FRIENDS AND NEIGHBORS	WORK-RELATED	KIN	OTHER SOCIAL NETWORKS
Close friends	Employer	Parent-child	Weather and climate information
Childhood friends	Worker	Siblings	Peer advice (farm-related)
Neighbors	Co-worker, colleague	Children	Resource/inputs (farm-related)
Kailian (kababayan)	Hired labor	Aunts/uncles	Credit links
Churchmate	Supplier	Cousins	Health information/advice
	Creditor	Niece, nephew	
	Trader	Grandchildren	
	Disposer	In-laws	
	Trucker		
	Private technician		

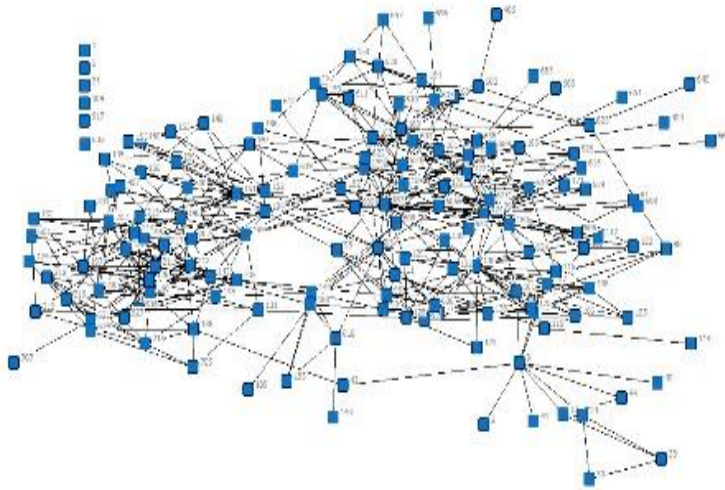
Characteristics of the study areas

	Brgy. Paoay	Brgy. Cattubo	
	Proper Paoay	Tulodan	Macbas
Completed interviews	119	74	46
Accessibility from highway	Accessible	Less accessible	Least accessible
Spread of dwellings	Relatively near each other	Clustered	Dispersed
Poverty rate, %	8.3	32.8	
Access to safe water, %	35	7	
Unemployment rate, %	0.2	1.9	

Characteristics of social networks



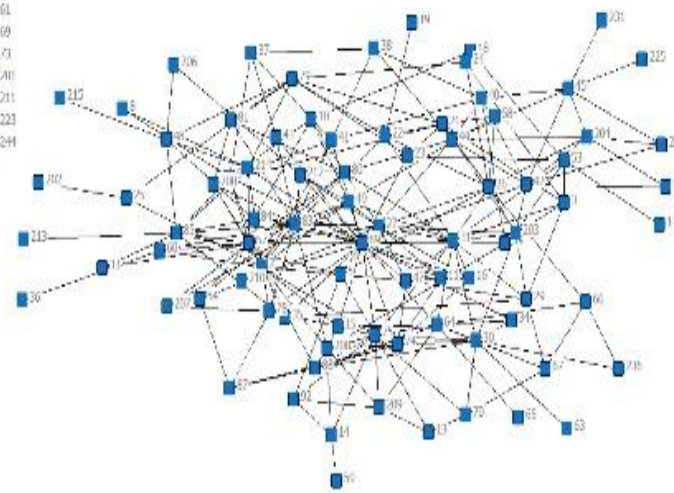
Bounded network of (inter-household) social relations



Proper Paoay (N=115)

Most accessible

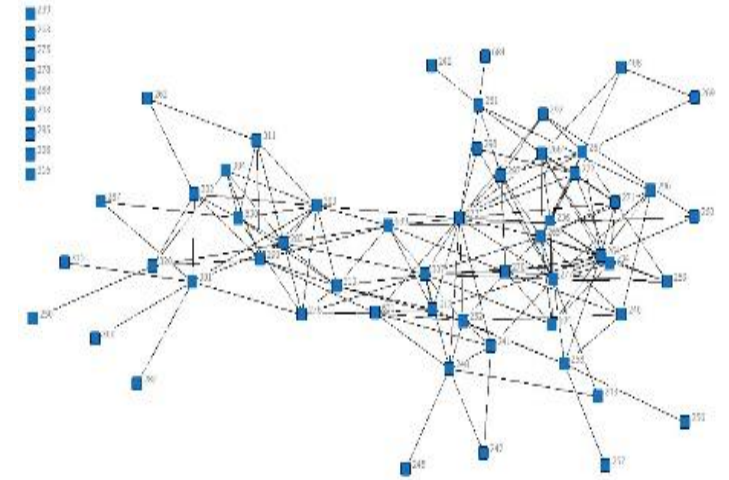
Density= 0.044



Tulodan (N=90)

Less accessible

Density=0.061



Macbas (N=63)

Least accessible

Density=0.086

Whole network parameters

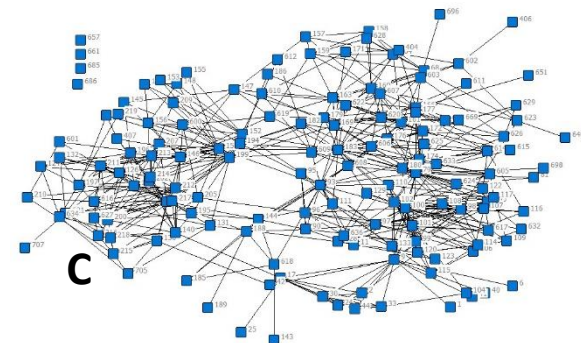
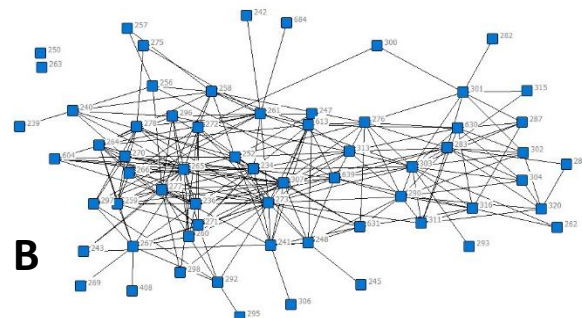
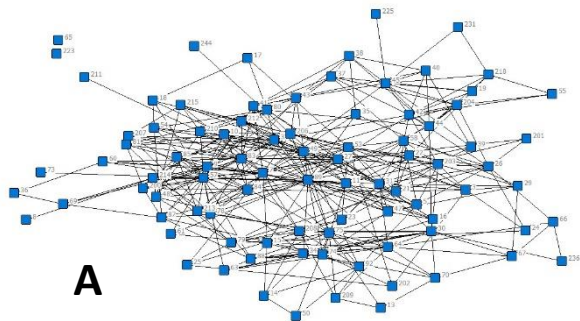
Parameter	Proper Paoay	Tulodan	Macbas
Density	0.044	0.061	0.086
Average degree	6.800	5.400	5.302
Diameter	7.000	6.000	6.000
Average geodesic distance	3.322	2.858	2.779
No. of nodes	155	90	63
No. of ties	1054	486	334

Tulodan

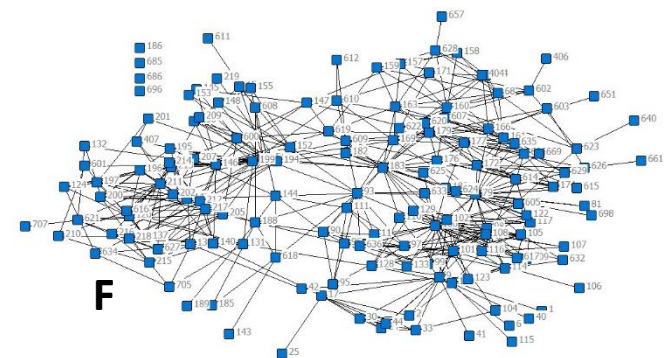
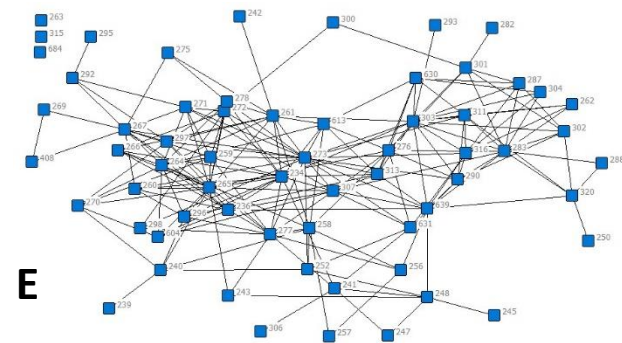
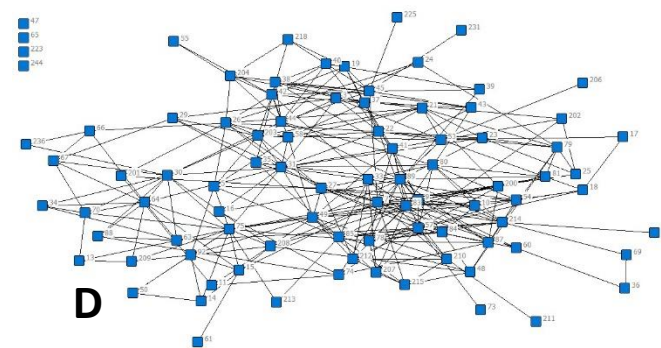
Macbas

Proper Paoay

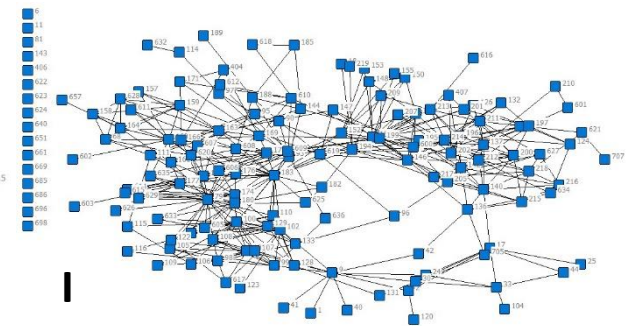
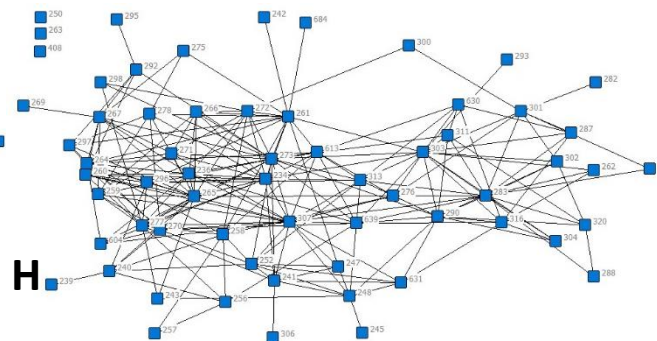
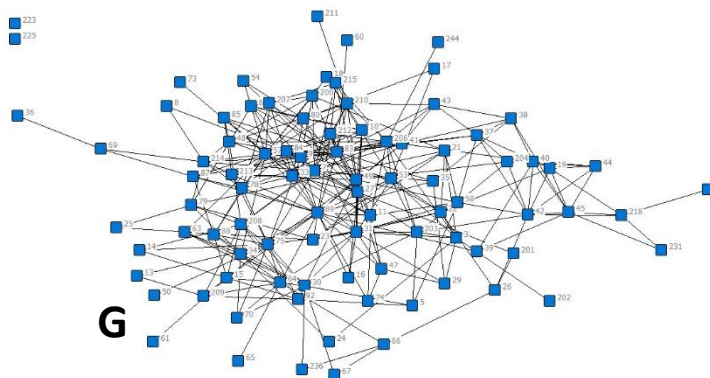
WCI



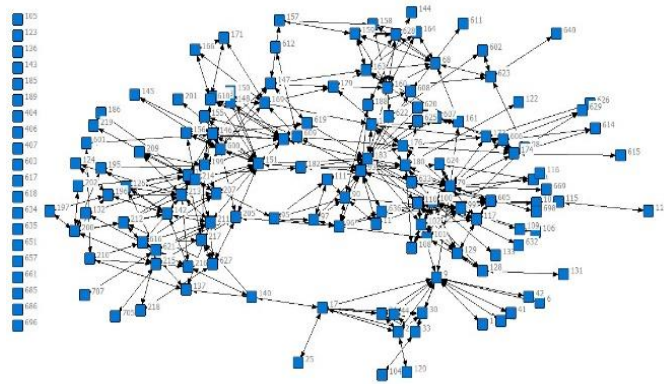
Peer advice
and resource



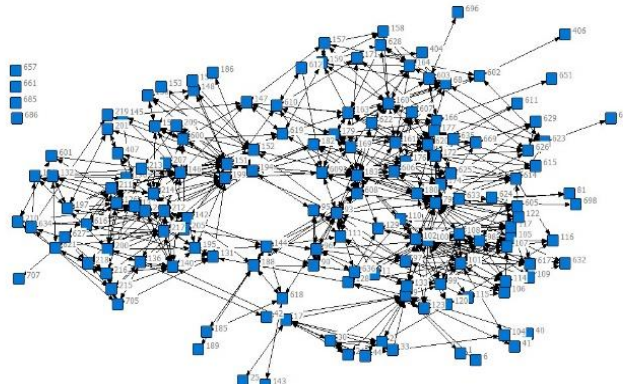
Health
information



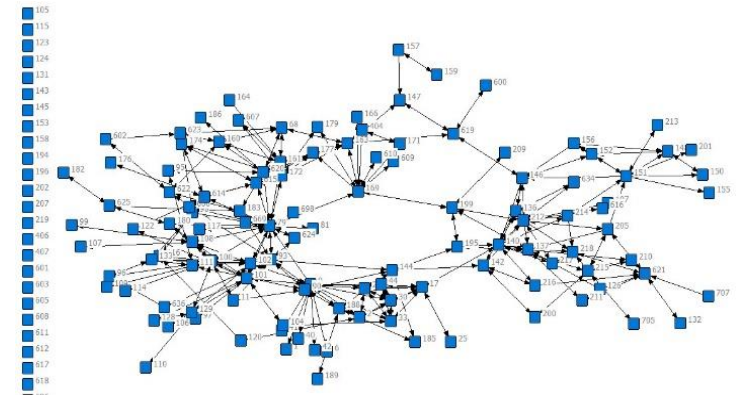
Networks by Type (Weather and Climate Information) – Proper Paoay



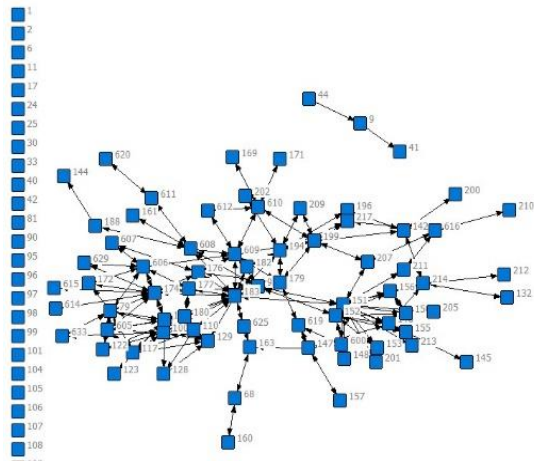
Heavy rainfall warning



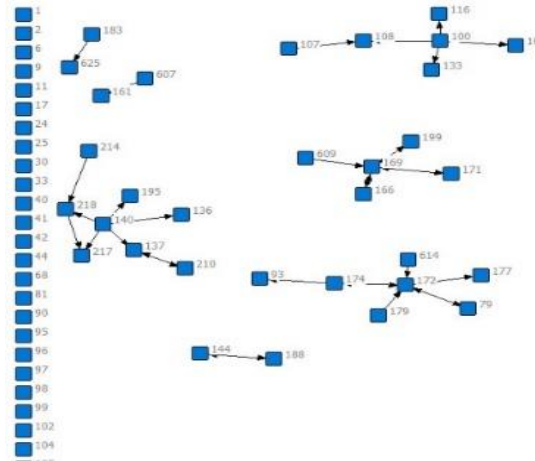
Tropical cyclone warning



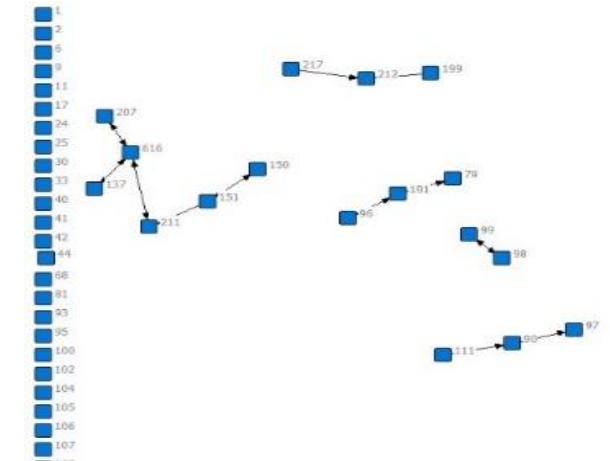
Daily weather forecast



El Niño

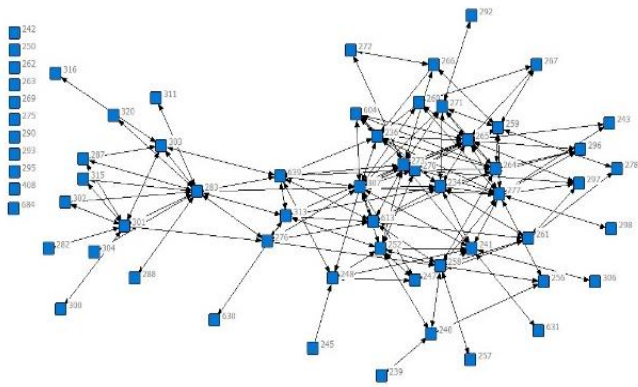


Narratives

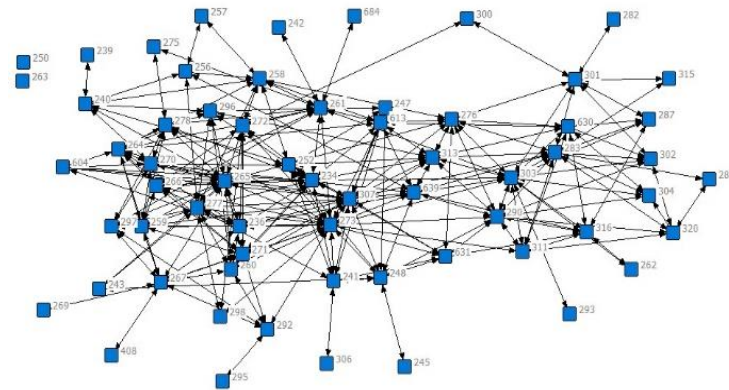


Non-PAGASA

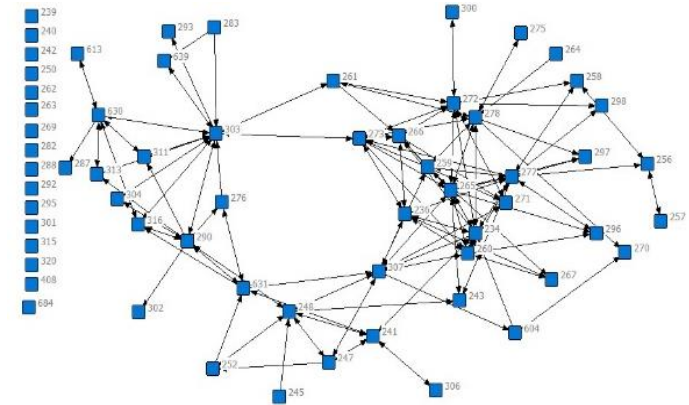
Networks by Type (Weather and Climate Information) – Macbas



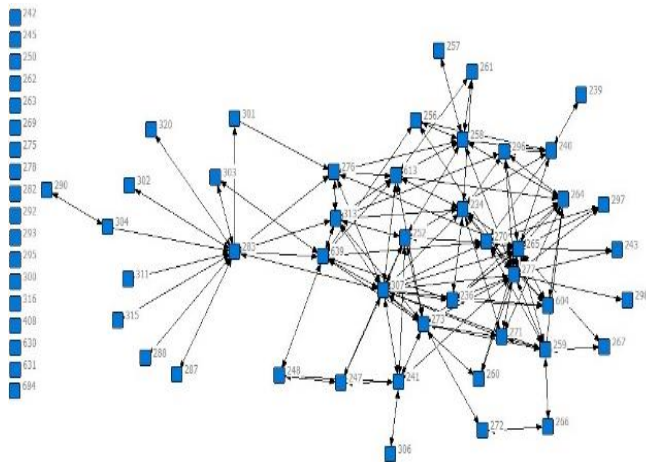
Heavy rainfall warning



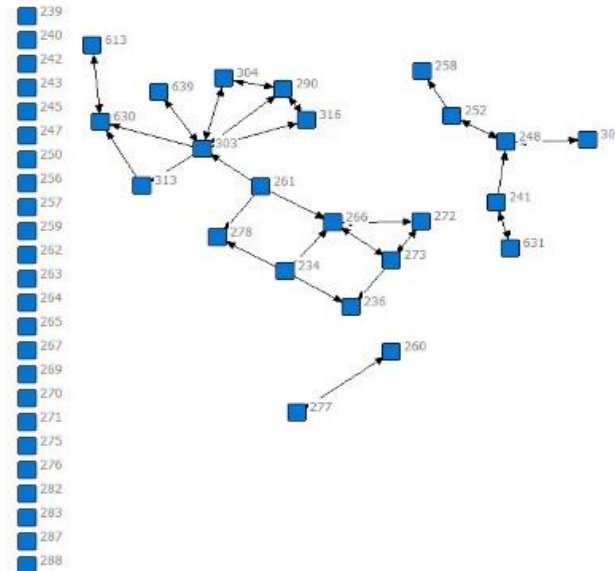
Tropical cyclone warning



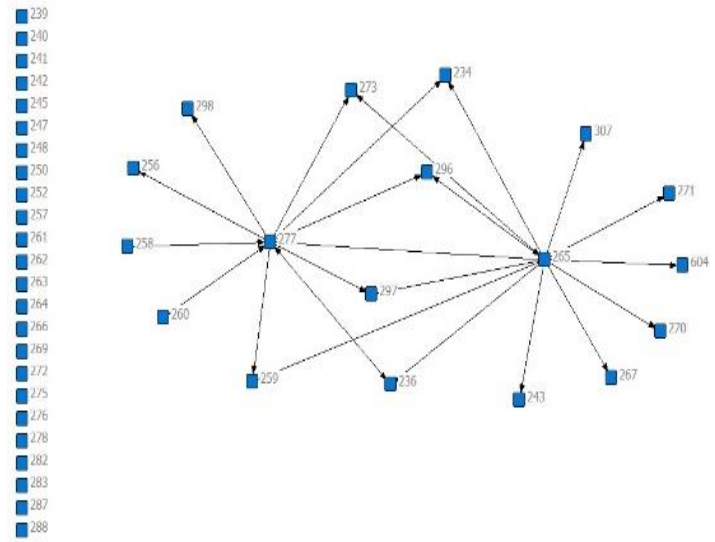
Daily weather forecast



El Niño



Narratives



Non-PAGASA

Correlates of network centrality



Definition of centrality

- Degree – total number of direct links of a node (e.g. bigger clans)
- 2-step reach centrality – the number of actors one can reach in 2 or less steps; total number of friends plus friends-of-friends
- Closeness - measures its average farness (inverse distance) to all other nodes; nodes with a high closeness score have the shortest distances to all other nodes, are able to spread information very efficiently through a graph
- Eigenvector centrality - a measure of the influence a node has on a network. If a node is pointed to by many nodes (which also have high eigenvector centrality) then that node will have high eigenvector centrality (Google's PageRank is a variant of eigenvector centrality)
- Betweenness - measures the extent to which a vertex lies on paths between other vertices; have considerable influence within a network by virtue of their control over information passing between others; their removal will disrupt lines of communication

Who hold central/core positions?/Correlates of centrality

Variable	Degree	2-Step reach	Closeness	Connectivity index
<i>Individual characteristics</i>				
Age of head	0.0045*	0.0150*	0.0042*	0.1606*
Age of head, squared	0.0000	-0.0001*	0.0000	-0.0013
Years of education of head	-0.0014	0.0025	0.0004	0.0106
Being Kankanaey	0.0101	0.0517	0.0198	0.2574
Years in farming by head	-0.0006	-0.0018	-0.0007	-0.0190
<i>Household characteristics</i>				
No. of household members	0.0032	0.0102	0.0036	0.0898
Vehicles owned	0.0175**	0.0588***	0.0203***	0.6744***
House ownership	0.0271*	0.0526	0.0230	0.4183
Size of farm operated	0.0000	0.0001	0.0000	0.0014
Ever availed credit	0.0001	0.0392	0.0110	0.0174
Asset index	-0.0107**	-0.0505***	-0.0156***	-0.4061**
Distance to place frequented (km)	-0.0006*	-0.0022*	-0.0008**	-0.0242*
Constant	-0.0447	-0.0815	0.2256***	-5.1012**
R2	0.2300	0.2758	0.2904	2084
N	224	224	224	224
legend: * p<.05; ** p<.01; *** p<.001				

Analyzing access and utilization of WCI

Variable	Obs	Mean	Std. Dev.	Min	Max
Individual characteristics					
Searched for and utilized all four major types of WCI	388	0.33	0.47	0.00	1.00
Age	388	42.22	14.02	14.49	84.02
Age, squared	388	1978.36	1295.42	210.00	7059.22
Years of education	378	8.65	3.43	0.00	16.00
Years in farming	384	15.85	13.05	0.00	57.00
Household characteristics					
No. of household members	388	4.0902	2.2641	1	20
Ever availed credit	375	0.5013	0.5007	0	1
No. of smartphones	388	1.25	1.2563	0	8
Asset index	381	0.0282	1.3154	-1.6128	4.4973
No. of vehicles owned	388	0.4923	0.8848	0	5
Distance to place frequented by respondent (km)	388	3.7586	12.5776	0	120
Log of size of farm operated	388	0.1825	1.9974	-3.912	6.6846
Degree	381	0.0991	0.0694	0.006	0.426
2-Step reach	381	0.4589	0.2071	0.039	0.933
Closeness	381	0.3874	0.0688	0.225	0.598
Connectivity index	381	0.164	2.3966	-4.6117	8.8381

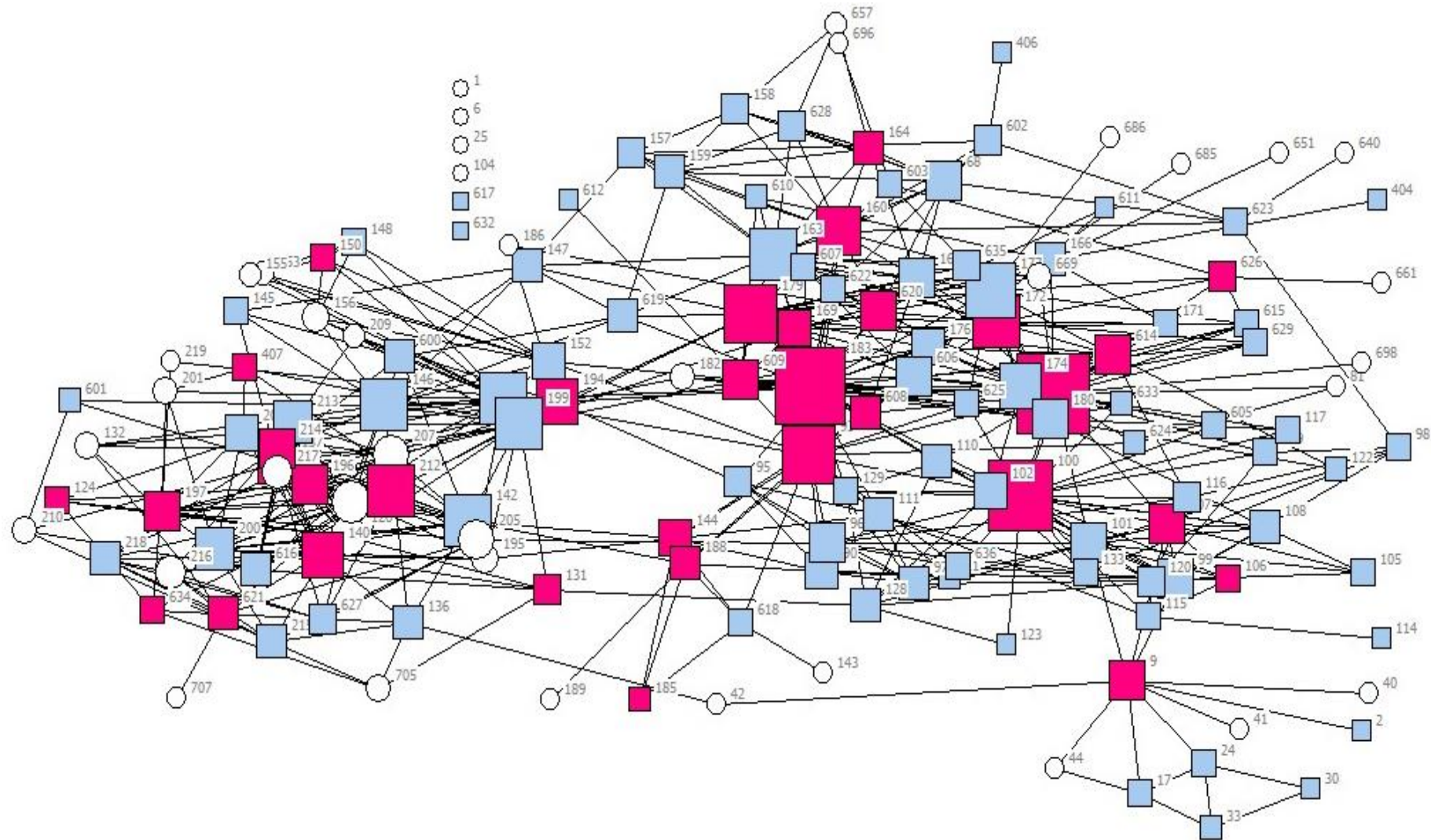
Analyzing access and utilization of WCI

Variable	Basic	Degree	2-Step reach	Closeness	Connectivity index
Individual characteristics					
Age of head	0.2765***	0.2694***	0.26***	0.2621***	0.2696***
Age of head, squared	-0.0035***	-0.0035***	-0.0034***	-0.0035***	-0.0036***
Years of education	0.0235	0.0276	0.0155	0.0175	0.0206
Years in farming	0.0636***	0.0674***	0.0646***	0.0662***	0.0684***
Household characteristics					
No. of household members	0.0208	0.0104	0.0009	-0.0009	0.0097
Ever availed credit	0.585*	0.5348*	0.4556	0.439	0.5555*
No. of smartphones	0.1741	0.1643	0.2024	0.1963	0.1841
Asset index	-0.3033*	-0.255	-0.2222	-0.2162	-0.2453
No. of vehicles owned	0.0138	-0.0819	-0.0985	-0.1257	-0.112
Distance to place frequented (km)	0.0103	0.0134	0.0142	0.0151	0.0151
Log of size of farm operated	-0.0315	-0.0399	-0.0574	-0.0557	-0.057
Degree		4.6046*			
2-Step reach			1.9924**		
Closeness				6.7316***	
Connectivity index					0.1811**
Constant	-7.2939***	-7.4458***	-7.5623***	-9.2658***	-6.9497***
Pseudo-R2	0.121	0.1336	0.1405	0.1454	0.1433
N	369	369	369	369	369

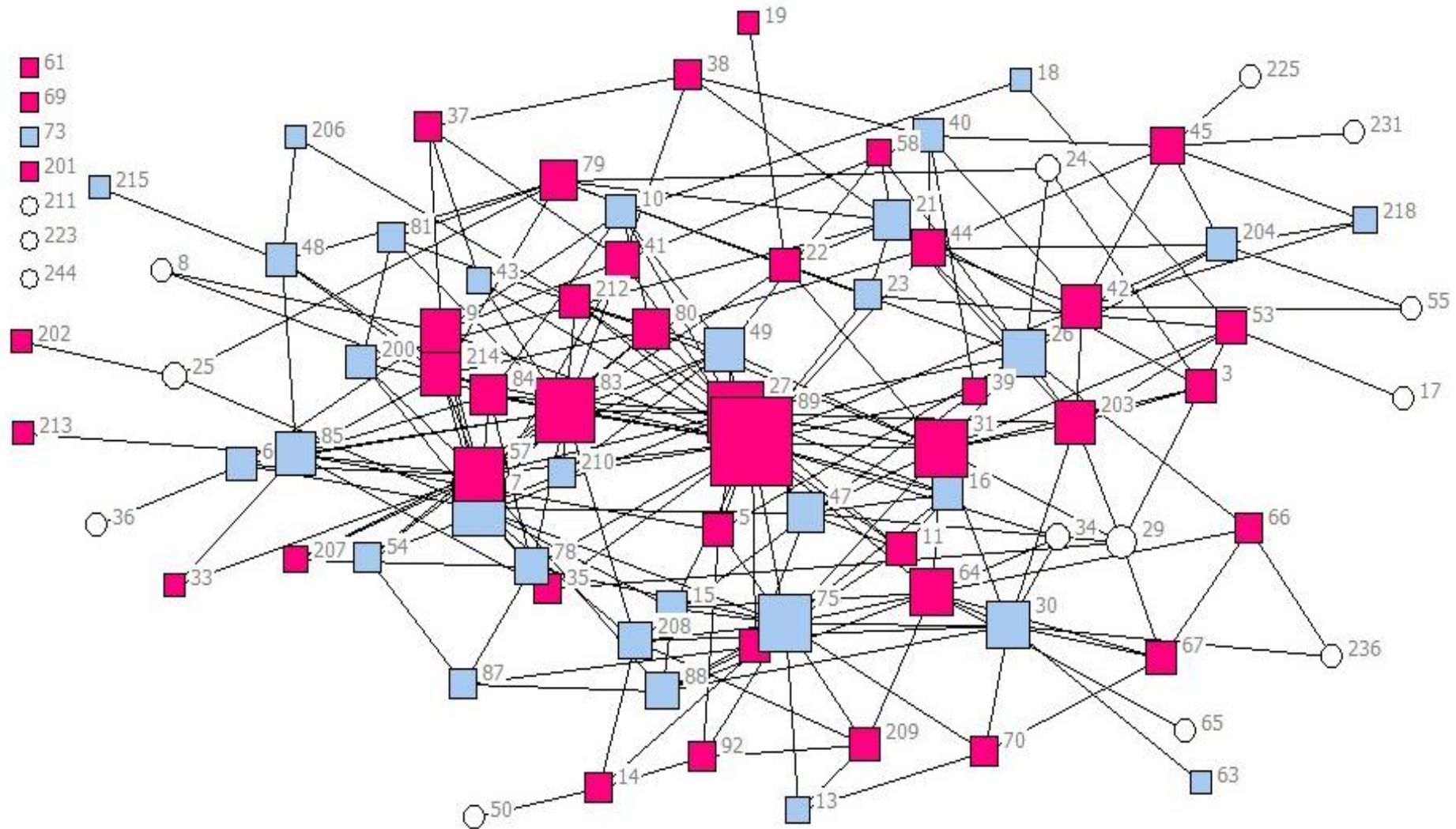
Extent of reach of AEWs



Extent of reach of AEWs in Atok based on social network in Proper Paoay (node size by degree)



Extent of reach of AEWs in Atok based on social network in Tulodan (node size by degree)



Mean centrality scores by type and group, all sitios

Variable		Obs	Degree	Closeness	2-Step reach	Centrality index
Interact with AEW	Yes	130	0.0941	0.3211	0.3665	0.4986
	No	231	0.0779	0.3057	0.3151	-0.1279
T-test (P-value)			0.0109	0.0038	0.0043	0.0032
Attend LGU meetings	Yes	157	0.0857	0.3087	0.3377	0.1836
	No	234	0.0784	0.3069	0.3177	-0.1232
T-test (P-value)			0.2246	0.7453	0.2529	0.1324
Attend farm field school	Yes	96	0.0986	0.3277	0.4015	0.7512
	No	286	0.0778	0.3045	0.3086	-0.1587
T-test (P-value)			0.0023	0.0001	0.0000	0.0001

Variable		Obs	Degree	Closeness	2-Step reach	Centrality index
<u>Proper Paoay</u>						
Interact with AEW	Yes	43	0.0965	0.3181	0.3243	0.3463
	No	132	0.0628	0.2960	0.2578	-0.6635
T-test (P-value)			0.0000	0.0046	0.0030	0.0003
Attend LGU meetings	Yes	46	0.0850	0.3122	0.3047	0.0840
	No	137	0.0649	0.2971	0.2608	-0.6215
T-test (P-value)			0.0108	0.0457	0.0446	0.0099
Attend farm field school	Yes	24	0.0835	0.3181	0.3245	0.1325
	No	159	0.0679	0.2983	0.2639	-0.5312
T-test (P-value)			0.1256	0.0409	0.0306	0.0600
<u>Macbas</u>						
Interact with AEW	Yes	20	0.1331	0.3195	0.4468	1.3118
	No	42	0.1299	0.3091	0.4260	1.0789
T-test (P-value)			0.8681	0.3929	0.6293	0.6869
Attend LGU meetings	Yes	40	0.0895	0.2787	0.3182	-0.1551
	No	39	0.1353	0.3106	0.4385	1.2014
T-test (P-value)			0.0064	0.0204	0.0056	0.0113
Attend farm field school	Yes	20	0.1258	0.3210	0.4565	1.1563
	No	50	0.1249	0.3024	0.4030	0.8847
T-test (P-value)			0.9639	0.1491	0.2287	0.6386
<u>Tulodan</u>						
Interact with AEW	Yes	67	0.0809	0.3236	0.3696	0.3537
	No	57	0.0744	0.3255	0.3662	0.2234
T-test (P-value)			0.5130	0.8419	0.9176	0.7248
Attend LGU meetings	Yes	71	0.0840	0.3233	0.3700	0.4390
	No	58	0.0719	0.3275	0.3709	0.1632
T-test (P-value)			0.2156	0.6580	0.9756	0.4444
Attend farm field school	Yes	52	0.0950	0.3348	0.4159	0.8809
	No	77	0.0674	0.3187	0.3397	-0.0672
T-test (P-value)			0.0050	0.0909	0.0175	0.0087

Conclusion

- We found varying extent of social cohesion possibly based on physical context
- Consistent with expectation, remote communities are relatively more socially cohesive (based on density, average geodesic distance)
- Density is not a perfect measure of cohesion – pay attention to isolated nodes especially in upland areas
- Contrary to expectation that there would be clusters, even communities near CBD can be connected (albeit, low density) – suggesting opportunities for social influencing and more fluid information dissemination

Conclusion

- Physical proximity and mobility are likely to be the key determinants of centrality within the community network in context of significant geographic constraints
- Central actors are those living near venues of interaction and those with greater means of transport
- Peripheral ones are those who live far from these venues or those who travel far distances to market their goods and do not own have means for transport
- The most affluent families are not necessarily the most central actors; in fact, these households appear to be on the periphery (they may find less need for social support or too preoccupied for social interaction)

Conclusion

- Centrality is a significant factor in access and utilization of WCI, *ceteris paribus*; enhancing social interactions and information sharing is a relevant strategy for improving access and utilization of WCI
- We found differentiated reach of AEWs depending on the communities
- Efforts in PP (least rural) appear promising; but not quite in Macbas and Tulodan (more rural)

Recommendations

- There may be a need for crafting different IEC approaches for different social and physical contexts
- Need to promote more direct links (promote interaction) between central actors and the LGU and other information sources and producers
- Take advantage of areas that are visited frequently by residents as these are good candidates for convening people for information campaigns
- Promote activities that facilitate greater and more meaningful interactions among farmers – to stimulate social learning and influencing
- Strengthen women's organizations; men are normally detained in the farm, while women may have more time to interact and collaborate
- Improve access to information through enhancing ICT infrastructure in the area – Atok has very poor mobile phone signal, some can be reached only through SMS
- It is necessary to improve communication capabilities and invest on mobility/transport of AEWs working in extremely challenging contexts



Thank you!
Dios ti agngina!

Recommendations

Area	More immediate concern	Next steps
Areas near population centers	Incentivize initial contacts in the community to echo/disseminate within their networks	Coordinate closely with central actors to reach peripheral actors more directly
Areas far from population centers	Identify central actors	Once central actors are identified, incentivize them to echo/disseminate, AEW to make direct interaction with officials and central actors and, when feasible, with farmers in periphery



Philippine Institute for
Development Studies

Analyzing Resilience of Farming Households in Atok, Benguet

*Dr. Aubrey Tabuga, Rita Vargas,
and Madeleine Baiño*

OBJECTIVES OF THE STUDY

- ❑ This study aims to assess the resilience of households in Atok, Benguet
- ❑ Specifically, it explores and analyzes farming households' resilience against various crises using the 2019 survey dataset collected for the ACIAR study involving 239 households from Atok, Benguet
- ❑ Employing the conceptual framework by Schipper and Langston (2015), this study intends to explore and develop indicators of farming household resilience, and examine correlates of resilience

METHODOLOGICAL FRAMEWORK

- Schipper and Langston (2015) identified key dimensions of resilience → learning, options, and flexibility
→ useful and flexible enough for use in various contexts

Name of framework
Rockefeller Foundation's Asian Cities Climate Change Resilience (ACCCRN)
Assessments of Impacts and Adaptations of Climate Change (AIACC) Sustainable livelihood approach
Action Research for Community Based Adaptation (ARCAB)
ARUP's City Resilience Framework (ARUP)
UK Department for International Development Building Resilience and Adaptation to Climate Extremes and Disasters framework (BRACED)
UNDP Community-Based Resilience Analysis (CoBRA) Framework
Constas and Barrett's Principles of Resilience Measurement for Food Insecurity (Constas and Barrett)
Mayunga's Capital-Based Approach to Community Disaster Resilience (Mayunga)
Feinstein International Center's Livelihood and Resilience Framework (Feinstein)
International Institute for Sustainable Development's Climate Resilience and Food Security (IISD)
UN Food and Agriculture Organisation's (FAO) Self-evaluation and Holistic Assessment of Climate Resilience of farmers and pastoralists framework (SHARP)
International Institute for Environment and Development's Tracking Adaptation and Monitoring Development (TAMD)
Technical Assistance to NGO's (TANGO) Livelihood Framework
Characteristics of a Disaster Resilient Community (Twigg, 2009) (Twigg)
UN/ISDR Disaster Resilience Scorecard for Cities (UN/ISDR)
USAID Measurement for Community Resilience (USAID 2013)
USAID Coastal Resilience (Indian Ocean Tsunami Warning System Program) (USAID 2007)

METHODOLOGICAL FRAMEWORK

- Using empirical data collected on upland farming households, this study intends to EXPLORE and DEVELOP indicators that can be used to characterize various dimensions of resilience

Resilience Dimension	Description
Learning	Learning is the process of gaining greater knowledge and awareness of risk or threats faced including the ability to apply lessons in both preparedness and recovery
Options	This refers to diversity of options that allows people to reduce their vulnerability and cope and even do well in the event of crisis - behavior modification like ability to find other income sources, switch crops, and change physical location which all require wealth, entitlements, knowledge, and access to resources; also encompasses having altruistic support networks
Flexibility	The ability to withstand disruption without complete collapse, and to return to a functioning state; also includes the ability to recover without significant costs in time and resources; and a large degree of self-regulation

Variables

The 2019 Atok dataset includes the respondents' demographic and economic characteristics, their farming activities/employment characteristics, and social network

Domain	Expected variable	Actual variables
Learning	Highest educational attainment of household head	HH head or spouse is at least high school graduate
	Active Search for Weather-related Information	
	Use Any of The Weather-Related Information in Farming Activities	
	Access to the internet	HH head or spouse has internet access
	Presence of Varied Sources of Information	
	Being Able to Access Information if needed (Typhoon & Rainfall)	
	Attendance in Farm Field School/Workshop	
	Engagement with Extension Worker	
	Member/Beneficiary of agriculture development programs and organization	
	Likelihood in Adopting New Technology	HH is highly likely to adopt New technology
Options	Other sources of income aside from farming	HH has other income source
	Availment of credit – proxy for access to credit	HH has availed credit ever
	Financing other farms	
Flexibility	House floor area in sqm - proxy for assets	
	Proportion of durable assets, number of durable assets	No. of vehicles owned by the HH
	Diversity in agricultural activities/Varied farming activities	No. of farm activities engaged by the HH
	Main source of water	
	List of channel used for marketing	
	Adopting technology or being open to adopting technology	
	Network position (measured by degree, closeness and betweenness)	

SECTION TWO



WHAT IS RESILIENCE?

- COMES FROM THE LATIN VERB RESILIRE MEANING TO REBOUND OR RECOIL (CONCISE OXFORD DICTIONARY, 10TH EDITION)
- ECOLOGICAL SENSE: “measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables” (Holling, 1973)
- Resilience is the condition of being able to survive during an adverse situation (such as domestic abuse or an earthquake) and/or to refer to the ability to recover from such an event (Schipper & Langston, 2015)

MEASURING RESILIENCE

- Cabell and Oelofse (2012)
 - Developed an index of behavior-based indicators of resilience in the agroecosystem
 - Indicators: Socially self-organized, ecologically self-regulated, appropriately connected, Functional and response diversity, optimally redundant, spatial and temporal heterogeneity, exposed to disturbance, coupled with local natural capital, Reflective and shared learning, globally autonomous and locally interdependent, Honors legacy, Builds human capital, reasonably profitable.
- Meuwissen et al. (2019)
 - Developed a comprehensive resilience enabling framework for farming systems building on the concept of adaptive cycles.
 - Five phases:
 - Resilience of *what*?
 - Resilience to *what*?
 - Resilience *for what purpose*?
 - *What resilience capacities*?
 - *What enhances resilience*?

MEASURING RESILIENCE

- Asmamaw et al. (2019)
 - used the *Climate Resilience Index (CRI)* to assess the households' resilience to climate change-induced shocks in Dinki watershed, northcentral highlands of Ethiopia.
 - Employed Principal Component Analysis (PCA) and multiple regression analysis to identify the determinant factors and indicators to household resilience.
 - Results: **access to and use of livelihood resources are identified to influence households' resilience to climate change-induced shocks**
- Jayadas and Ambujam (2021)
 - Assessed Farmer Resilience Index (FRI) using variables under four dimensions namely economic, social, technical, and physical to assess the resilience of farmers in two rural villages, at the household level, in Cuddalore, India.
 - Used PCA for the variables under each dimension.
 - Results:
 - below-average physical resilience of farmers from both communities.
 - **Farmers with lesser exposure to climate extremes have fewer disaster experiences and take a longer time to improve their resilience.**

MEASURING RESILIENCE – Application in the Philippines

➤ Defiesta and Rapera (2014)

- Measured levels of adaptive capacity of farming households in Dumangas, Philippines to climate change using a *composite index of adaptive capacity*
- The index included five indicators namely (1) human resources, (2) physical resources, (3) financial resources, (4) information, and (5) diversity
- Results:
 - Majority of respondents adapt to climate change
 - More than half of the farming households have low adaptive capacity and only a meager 4 percent have high adaptive capacity
 - **Differences in adaptive capacity were caused by large disparities in information, physical and financial resources**

Social Capital

- “the features of social organizations, such as networks, norms, and trust, that facilitate action and cooperation for mutual benefit” (Putnam, 2003).
- A significant factor in various types of household and community resilience to environmental shocks (Lyons et al., 1998; Adger, 2003).
- It serves as a resource that frequently complements the efforts of local, regional, and national governments in times of disaster and during the recovery phase.

3 types of social capital (Aldrich and Meyer, 2014):

1. **Bonding** - connections among individuals who are emotionally close, such as friends or family, and result in tight bonds to a particular group
2. **Bridging** - connections between people who are not closely affiliated with each other but have links across different social groups based on factors like race or class.
3. **Linking** - connections between everyday individuals and those in positions of authority.

Resilience and Social Capital

- Anuradha, Fujimura, Inaoka, and Sakai (2019)
 - Investigated the effects of social and human capital on household resilience in an agricultural village community in Sri Lanka that faces environmental stresses.
 - Findings:
 - **bonding and bridging social capital, as well as economic activeness of human capital, were the key predictors of household resilience**
 - information sharing among neighbors, a manifestation of bonding social capital, played a crucial protective role against the environmental constraints faced by residents
 - Maintaining bridging social capital was identified as especially important for enhancing household resilience in the face of environmental stresses.
- Patel and Gleason (2017)
 - improve social cohesion and resilience simultaneously in urban communities
 - Findings:
 - There is a **strong association between social cohesion and community resilience**, indicating that social cohesion is a critical predictor of community resilience, regardless of demographic differences.
 - a **non-linear relationship between social cohesion and resilience**, suggesting that social cohesion has the most substantial impact on improving resilience at the community level in urban slums.

Resilience and Social Capital

➤ Carrico et al. (2019)

- Investigated the impact of individual-level measures of cognitive and structural social capital on livelihood outcomes for smallholding rice farmers across six rice-farming communities in Sri Lanka
- Findings:
 - the **connection between social capital and resilience varies for different members of the community**, and some members may have to make a difficult tradeoff between agricultural productivity and maintaining social relationships
 - **social capital did not have the positive effects on agricultural and economic outcomes**

SECTION THREE



PROFILE OF THE FARMING HOUSEHOLD

Indicator	Number	%share
Household size, mean	3.94	
Sex of household head		
Female	29	12.13
Male	210	87.87
Household Tenure Status		
Own or owner-like possession of house and lot	174	72.8
Rent house/room including lot	3	1.26
Own house, rent lot	2	0.84
Own house, rent-free lot with consent of owner	11	4.6
Own house, rent-free lot without consent of owner	3	1.26
Rent-free house and lot with consent of owner	46	19.25
Asset Ownership		
Radio	202	84.52
Basic phone	181	75.73
Smart phone	166	69.46
Computer	16	6.69
Motor	37	15.48
Vehicle	76	31.80
Tractor	63	26.36
Waterpump	93	38.91
Green house	30	12.55

PROFILE OF THE HOUSEHOLD HEAD

Indicator	Number	%share
Age, mean	43.64	
Civil status		
Single	46	19.33
Married	166	69.75
Divorced or separated	5	2.10
Common law/Live-in	8	3.36
Widowed	13	5.46
Highest Educational Attainment		
No grade completed	6	2.51
Preschool	2	0.84
Elementary undergraduate	39	16.32
Elementary graduate	55	23.01
High School undergraduate	24	10.04
High School graduate	61	25.52
Post secondary	4	1.67
College undergraduate	21	8.79
College graduate	23	9.62
Postgraduate	1	0.42
No Answer	3	1.26
Primary occupation		
disposer	1	0.42
farmer (includes livestock and fishing)	186	78.15
hired farm worker	29	12.18
others	22	9.24

Disaster/shocks experienced by the household in the past two years

Disaster/Shock	HH that experienced the disaster/shock	% to total
Typhoon	228	95.4
Frost	159	66.5
Hailstorm/Damage	139	58.2
Pest Infestation	44	18.4
Earthquake	43	18.0
Landslide	35	14.6
Increase In Food Prices	33	13.8
Increase In Fuel Prices	27	11.3
Financial Crisis	19	7.9
Drought	11	4.6
Flood	7	2.9
Erosion	7	2.9
Death Of Family Member	5	2.1
Political Instability	3	1.3

SECTION FOUR

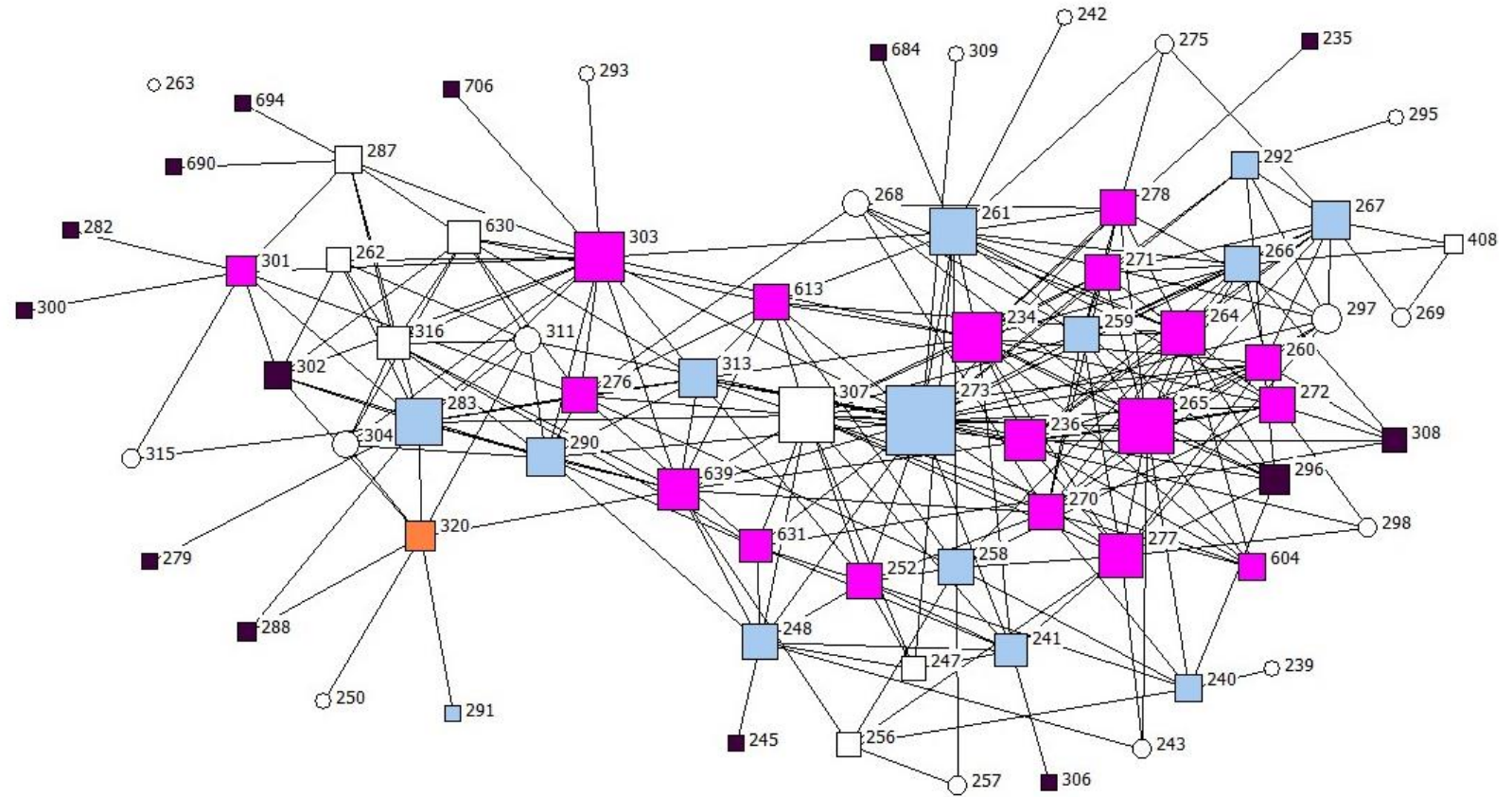


SITIO MACBAS

It is not easy to associate centrality with resilience (measured by full recovery from disaster(s) experienced = due to missing data

- Completely recovered from disaster(s)
- Partially recovered at best
- Did not recover at all
- Did not experience difficulty despite disaster
- Missing disaster-related data
- Did not experience any disaster

Social Network (kinship, friendship & economic)
(Node size proportional to degree centrality)
Sitio Macbas, Brgy. Cattubo, Atok

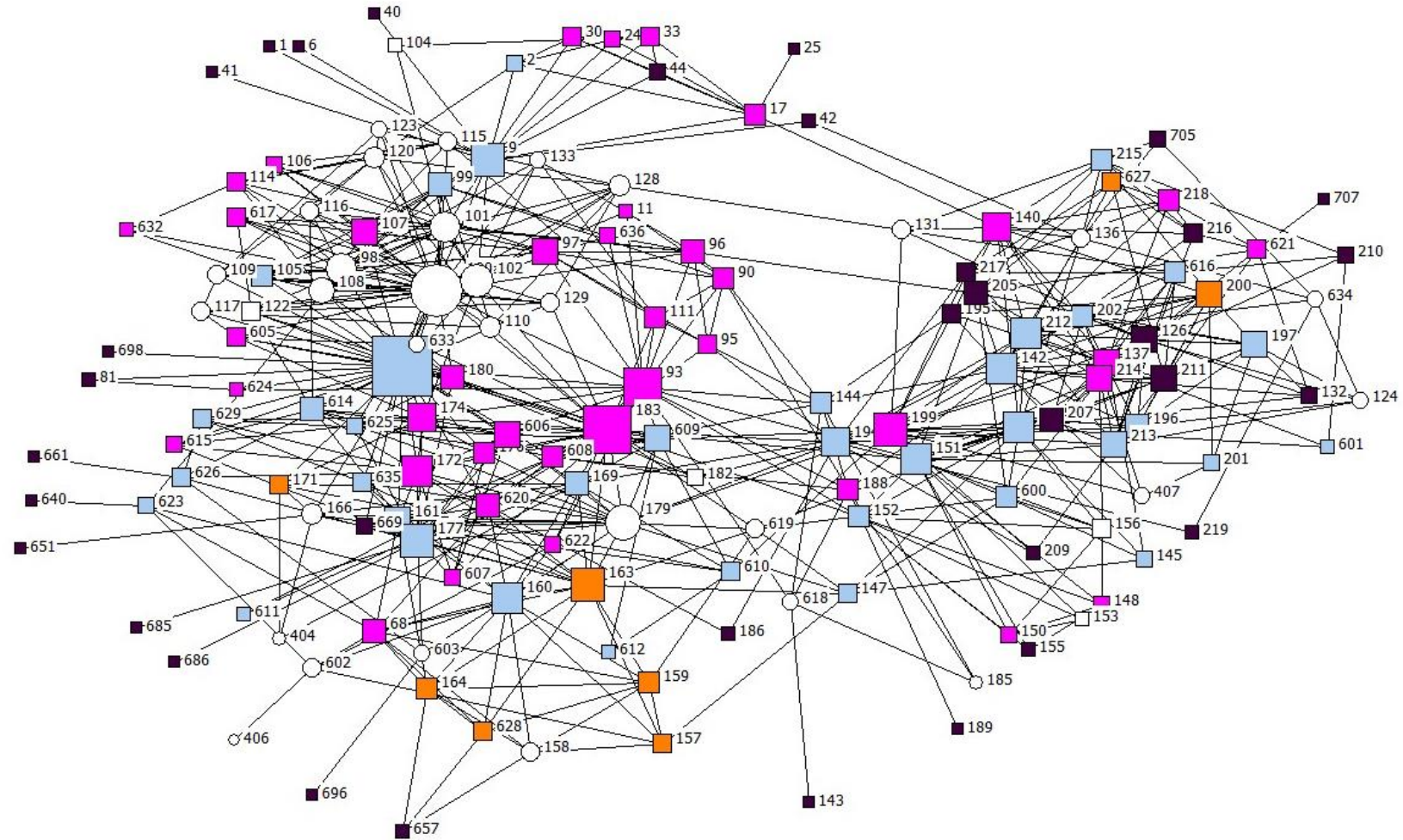


PROPER PAOAY

The few households who did not recover at all held non-central positions within the social network

Social Network (kinship, friendship & economic)
(Node size proportional to **degree** centrality)
Sitio Proper Paoay, Brgy. Paoay, Atok

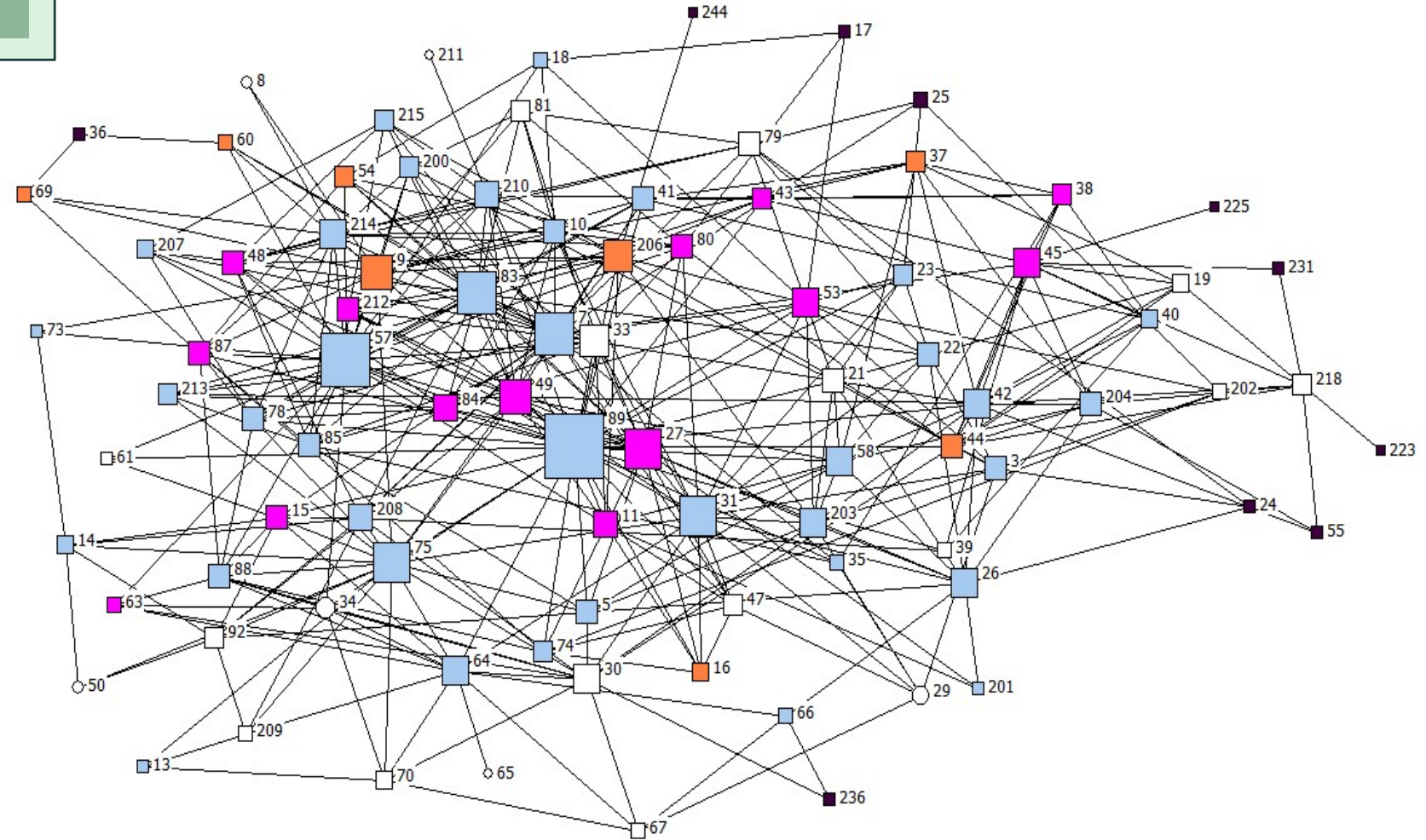
- Completely recovered from disaster(s)
- Partially recovered at best
- Did not recover at all
- Did not experience difficulty despite disaster
- Missing disaster-related data
- Did not experience any disaster



SITIO TOLUDAN

Social Network (kinship, friendship & economic)
(Node size proportional to **degree** centrality)
Sitio Toludan, Brgy. Cattubo, Atok

- █ Completely recovered from disaster(s)
- █ Partially recovered at best
- █ Did not recover at all
- Did not experience difficulty despite disaster
- █ Missing disaster-related data
- Did not experience any disaster



Developing a measure for learning dimension

- Principal components analysis (PCA) - was used to come up with an indicator for "learning" (PC1 was used) and options/flexibility

Learning:

- Education (head or spouse is at least high school graduate)
- Access to internet (head or spouse have access to the internet)
- Receptiveness to advice (being open to adoption of new technology)

Options/Flexibility

- Presence of other sources of income for the household
- Access to credit
- Diverse crops (head or spouse are growers of more than 1 type of crop)
- Vehicle ownership

Determinants of learning dimension of resilience

Variables	Model 1	Model 2	Model 3
Asset Ownership index	0.9542***	0.9447***	0.9480***
Network Index	0.0675***	0.0783***	0.0731***
Years engaged in farming	0.0081**	0.0078**	0.0046
HH availment of credit (ever)	-0.0880	-0.0597	0.0047
Total area of owned farm (hectare)	0.0004	0.0004	0.0003
No. of vehicles owned	0.2258***	0.2366***	0.2266***
Attendance in LGU seminars/events	-0.0808	-0.0580	-0.0250
Log of distance from usual venue of gathering	-0.0050	-0.0022	
Paoay dummy	-0.1232		
Observations	219	219	230
Adjusted R2	0.7852	0.7851	0.7814

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Determinants of options/flexibility dimension of resilience

Variables	Model 1	Model 2	Model 3
Years of schooling	0.0350	0.0256	0.0250
Asset Index for options	0.4167***	0.4739***	0.4182***
Paoay dummy	-0.3580*	-0.3586*	-0.3597*
Network Index	0.0033	0.0062	0.0027
Total area operated in the last cropping season (hectare)	-0.0058	0.0007	
Years engaged in farming	0.0102		
Observations	146	147	230
Adjusted R2	0.1213	0.1147	0.7814

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Ordered logit regression of HH recovery status

Variables	Model 1	Model 2	Model 3
Learning index	-0.3368***	-0.3435***	-0.3655***
Option/Flexibility Index	0.3380**	0.2968*	0.3083*
Network Index	0.1217*	0.0946	0.1126
Total area operated in the last cropping season (hectare)	0.0022*	0.0024*	
Years engaged in farming	-0.02256		
Observations	126	126	126
Pseudo R2	0.0761	0.0664	0.0506

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Logit regression of HH that experienced difficulty

Variables	Model 1	Model 2	Model 3
Learning index	-0.1907	-0.1462	-0.1529
Option/Flexibility Index	-0.2444	-0.2190	-0.1975
Network Index	0.2181*	0.2391**	0.2406**
Total area operated in the last cropping season (hectare)	0.0019	0.0017	
Years engaged in farming	0.0299		
Observations	150	151	151
Pseudo R2	0.0818	0.0709	0.0655

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

SECTION FIVE



Summary and recommendations

- Resilience is multifaceted and it helps that we slice it into pieces that can be examined in a much deeper way. So, we examined 1) learning and 2) options/flexibility
- We conducted network analysis and correlational analyses
- The network analysis failed to effectively establish the correlation between resilience (narrowly defined as having fully recovered from the disaster) and network centrality
- But in the regression analysis, we found significant correlation between connectedness and learning dimension

Summary & Insights

- Learning is also positively associated with wealth/assets, and having the means for movement or transportation (represented by vehicle ownership)
- Therefore, households who may need interventions in terms of the learning dimension of resilience are:
 - Those in the bottom income groups,
 - Peripheral social network actors and
 - Those without their own means of transport.

In the previous paper, peripheral households are characterized as those who are living at the outskirts (far from common areas of social gathering), those without means of transport, HH who are recent migrants in the area

Summary & Insights

- The dimension option/flexibility is also significantly correlated with wealth which means that those with greater assets are also those with access to resources like credit, other income sources, those with diverse crops
- Contrary to expectations:
 - Being in Proper Paoay is associated to lower score in options/flexibility
 - Having a lower learning index is associated to higher probability of recovery from a disaster (maybe because the variables we used are limited, they don't represent the dimension adequately)
 - Being well-connected is correlated to experiencing difficulties from a disaster

Summary & Insights

- For future research, it is essential to...
 - Identify in the study some important aspects:
 - Resilience in what? - nature of disaster matters (typhoon vs. hailstorm vs. pest infestation)
 - Need to clarify concepts of recovery (nuances)
 - Factors that contribute to HH resilience beyond HH characteristics/control (we did not control for these)
 - Other factors that manifest HH ability for self-regulation
- Implement a survey instrument that is designed for the purpose!

Thank You!



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