

# Adaptive Capacity and Adaptation to Climate Change and Variability of Farming Households of Dumangas, Iloilo, Philippines

by

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# Introduction

Farming households in developing countries like the Philippines are most vulnerable to climate change and variability because of their climate/weather-sensitive livelihood and lack of resources to finance adaptation measures.

Climate change/variability impacts can still be disproportionate across households due to differences in adaptive capacity.

In order to formulate appropriate programs and policies addressing farming households' vulnerability it is important to understand adaptive capacity at the household level, know the factors that contribute to the differences in levels of adaptive capacity and determine whether adaptive capacity translates to adaptation.

# Objectives

1. Determine the levels of adaptive capacity of farming households to climate change,
2. Identify the factors that cause the differences in adaptive capacity
3. Find out whether adaptive capacity translates to adaptation

# Methodology

- The study was conducted in Dumangas, a town in Iloilo Province , Central Philippines facing several weather-related risks (flooding and drought)
- Data were gathered through a household survey, and key informant interviews.
- The survey included 520 farming households selected through stratified random sampling.
- Key informant interviews with fifteen experts/key informants from the local government unit, local leaders, and experts on climate change and disaster risk reduction, agriculture, and soils.
  - to elicit key informant/ experts' ratings on the relative importance of indicators and sub-indicators of adaptive capacity.
  - provide information about farming, irrigation and the agromet station operation in the study site.

- Data were analyzed using a composite index that applied analytic hierarchy process, a multi-criteria decision making tool.

# Method of Analysis: Adaptive Capacity Index

- Adaptive Capacity is defined in this study as
  - the ability of the farming households to adjust to climate change and variability or
  - and/or the recover from their impacts.
- Adaptive capacity is influenced by
  - Livelihood diversity
  - Ownership and access to resources
    - physical
    - human
    - financial
  - Access to Information

- The adaptive capacity index in this study was based on the sustainable livelihoods framework as shown in the study of Eakin and Bojorquez-Tapia (2008)
- Adjustments were made to contextualize the index to Dumangas by excluding or changing the indicators that were not applicable to the study site.

# Indicators and Sub Indicators of Adaptive Capacity

Indicators	Sub Indicators	Description
Human Resources	Farming experience	The number of years that the respondent has been in farming
	Education attainment of household head	The number of years spent in school by the household head
	Percentage of adults with primary education	The number of adults in the household that had some elementary education expressed as percentage of the total number of adults in the household
	Percentage of adults in the household	The number of adults in the household expressed as percentage of the total number of household members



# Indicators and Sub Indicators of Adaptive Capacity

Indicators	Sub Indicators	Description
Physical Resources	Farm size	The farm size in hectares
	Irrigation	Source of irrigation
	Ownership of farm implements/machines	The number of useful farm machines owned by the farming household
	Farm ownership	Type of farm occupancy

# Indicators and Sub Indicators of Adaptive Capacity

Indicators	Sub Indicators	Description
Financial resources	Remittances from family members	The amount of remittances/regular monetary assistance received by the household
	Value of animal units	The estimated total value of animals owned and raised by the household
	Receives financial assistance/subsidy from the government	If the respondent has regularly availed of financial assistance or subsidy for farming from the government
	Has access to credit	Whether the respondent knows a possible source of credit (formal or informal) or if the respondent has availed of credit to finance farming from 2006-2010

# Indicators and Sub Indicators of Adaptive Capacity

Indicators	Sub Indicators	Description
Information	Type of trainings on farming	The type of training that the farmers undergone in the last 5 years from 2006-2010
	Receives technical assistance	If the farmer has been regularly visited by or has consulted an agricultural technician for assistance in farming from 2006-2010
	Participates in farm organization	If the respondent is a member of any farmers' organization
	Sources of climate information	The number of sources of climate information accessed by the farmer

# Indicators and Sub Indicators of Adaptive Capacity

Indicators	Sub Indicators	Description
Livelihood diversity	Number of livelihoods/sources of income	The number of all sources of income and employment of all household members
	Percentage of land not in crops	The percentage of land not devoted to crop production
	Number of crops planted	The number of crops planted per year

# Index Construction

1. Scoring of categorical data using Analytic Hierarchy Process (AHP) based on the ratings/judgements of key informant/experts.
2. Transformation of data into indicator values through normalization - turning the data into unitless values ( from zero to one) to be comparable.

Normalization method: the min-max approach

$$\text{Normalized value of the sub - indicators} = \frac{(\text{actual value} - \text{minimum value})}{(\text{maximum value} - \text{minimum value})}$$

3. Attaching weights to the indicators and sub-indicators using AHP.
  - To determine the relative importance of each indicator and sub-indicator using AHP.
  - Pairwise comparisons were performed by key informants /experts on two hierarchic levels (indicator and sub-indicator levels)
  - Calculation of priorities / weights as well as determination of consistency of judgements were done using the softwares, Super Decisions 2.0.8 and Expert Choice (trial version).

# Index Construction

## 4. Aggregation

- all indicators with their corresponding weights were combined to come up with one single index value for adaptive capacity.

## 5. Classification

- Since there is no general rule for classifying adaptive capacity levels the classifications and cut points were based on previous studies (for example Eakin *et al.*, 2008 and Gbetibouo, 2010)
- Adaptive capacity was classified into low, moderate, and high.
- The cut-off point for each level was based on the dispersion of data by setting three intervals that contain low, moderate, and high adaptive capacity.

# Results

## Description of the Study Site

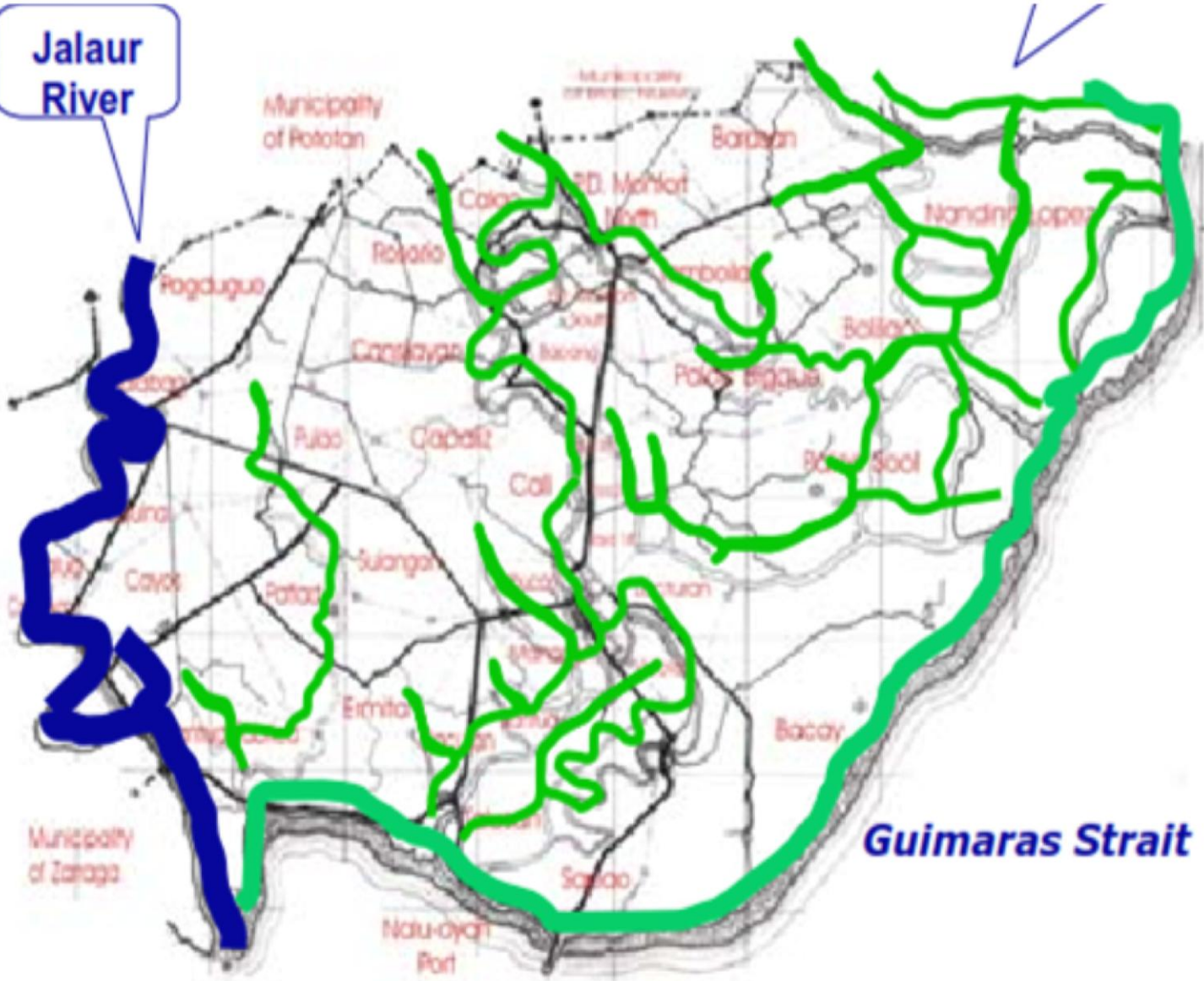
- Total land area is 12,870.8 hectares.
- Agriculture - 56% of the total land area and aquaculture – 35%
- As of the 2000 census, population is 56,291 persons (12,443 households )
- Population density is 500 persons per square kilometer.
- The main economic driver is agriculture.
- Rice is the major crop, with 6,145 out of 6,820 hectares of farmlands devoted to its production.
- The average production per hectare is 3.6 metric tons.
- Produces about 6 % total rice production in Iloilo Province.
- A coastal town, hence threatened by sea level rise and coastal erosion
- 80 % of the municipality is flood-prone during the rainy season due to low elevation and the extensive river network in its territory.
- Majority of these farms are at risk from drought during prolonged dry spells because the town is located at the tailend of the irrigation source

# The Study Area





**Jalaur River**



# Results

## Socio-Economic Profile of Respondents:

Male - 352 or 68%, Female – 168 or 32%

Mean age is 54 years old

Literacy rate – 99.6% , Average years of formal education – 9 years

Married respondents – 79%, Average household size – 4

Average household monthly income – PHP 14,804 or USD 361\*

Average farm size – 1.65 hectares

Average farm experience – 26 years; Rice farmers – 99%

\*Exchange rate: USD 1 = PHP 41

# Physical Resources

- More than half (52%) of the farmers are owners of the fields they till.
- The most common source of irrigation is shallow tube well (34%)
- More than half (54%) of the respondents have farm equipment, commonly thresher, blower, and power tiller.
- Average farm size is only 1.65 hectares.
- 90% of the farming households are smallholder farmers cultivating only three hectares or less.
- Farming households generally have few physical resources.
- Majority of them own small farms and nearly half do not have farm equipment.
- Also, about 62% of them do not have access to NIA irrigation and depend only on the reliable irrigation (river, rain and shallow tube well).

# Physical Resources

INDICATORS AND SUB-INDICATORS OF ADAPTIVE CAPACITY	NUMBER	PERCENT	AHP SCORE
Physical Resource			
Farm ownership			
Owner	273	52.0	1.000
Leaseholder	185	36.0	0.199
Shareworker	62	12.0	0.152
Total	520	100.0	
Source of Irrigation			
NIA irrigation only	145	28.0	1.000
NIA Irrigation and shallow tube well	46	9.0	0.693
Shallow tube well only	176	34.0	0.125
River and shallow tube well	2	0.4	0.422
River only	50	9.6	0.117
Rainfed only	101	19.0	0.062
Total	520	100.0	
Number of farm machines owned			
0	239	46.0	
1 - 2	185	36.0	
3 - 4	74	14.0	
5 - 6	20	3.8	
7 - 10	2	0.4	
Total	520	100.0	
Farm Size			
1 hectare and below	297	57.0	
1.01 - 3	173	33.0	
3.01 - 5	32	6.0	
5.01 - 10	13	3.0	
10.01 and above	5	1.0	
Total	520	100.0	
Average Farm Size: 1.65 hectares			

# Human Resources

- Farmers are generally literate, 518 (99.6%) out of 520 had formal education.
- The average number of years spent in school is nine.
- Most households consist 75%-100% adults
- 442 (82%) have 76-100% of their adult family members with elementary education.
- 81% of the respondents had farming experience of more than 10 years, average farming experience is 26 years.

# Human Resources

INDICATORS AND SUB-INDICATORS OF ADAPTIVE CAPACITY	NUMBER	PERCENT	AHP SCORE
Human Resource			
Formal education of household head			
None (0)	2	0.4	
Elementary level (1-5 years)	53	10.0	
Elementary graduate (6 years)	100	19.0	
High school level (7-9 years)	66	12.6	
High school graduate (10 years)	124	24.0	
College level/vocational (11-13 years)	103	20.0	
College graduate and post graduate (14 years and above)	72	14.0	
Total	520	100.0	

INDICATORS AND SUB-INDICATORS OF ADAPTIVE CAPACITY	NUMBER	PERCENT	AHP SCORE
Percentage of adults in household			
0% - 25%	6	1	
26% - 50%	95	18	
51% - 75%	114	22	
76% - 100%	305	59	
Total	520	100	
Percentage of adults with primary education			
0% - 25%	6	1	
26% - 50%	37	7	
51% - 75%	43	8	
76% - 100%	434	84	
Total	520	100	
Farming experience (years)			
10 and less	98	19	
11 - 20	120	23	
21 - 30	137	26	
31 - 40	93	18	
41 - 50	44	8	
51 - 60	25	5	
61 - 70	3	1	
Total	520	100	
Sources of farming knowledge (multiple responses)			
Own experience	341	66	
Family member	327	63	
Other farmers	107	21	
Training	67	13	
Technical assistance	23	4	
Organizations	7	1	

# Financial Resources

- Few (less than 20%) respondents receive remittances from their family members.
- Average remittance received was PHP 8,830 per month or USD 215.
- Majority (73%) raise animals either for consumption, for commercial purposes, or for ploughing the field.
- Only 16% avail of government subsidy for farmers.
- 61% had access to credit



# Financial Resources

INDICATORS AND SUB-INDICATORS OF ADAPTIVE CAPACITY	NUMBER	PERCENT	AHP SCORE
<b>Financial Resources</b>			
<b>Amount of monthly remittances received from family members</b>			
None	425	82	
5,000 and below	49	9	
5,001 – 10,000	18	3	
10,001 – 20,000	18	3	
20,000 – 50,000	8	1	
Above 50,000	2	0.4	
<b>Total</b>	<b>520</b>	<b>100</b>	
<b>Value of animal units owned by respondents</b>			
0	142	27	
1,000 and below	98	19	
1,001 – 5,000	135	26	
5,001 – 10,000	37	7	
10,001 – 20,000	41	8	
20,001 – 50,000	39	8	
50,001 – 100,000	18	3	
Above 100,000	10	2	
<b>Total</b>	<b>520</b>	<b>100</b>	
<b>Access to credit</b>			
No	204	39	
Yes	316	61	
<b>Total</b>	<b>520</b>	<b>100</b>	
<b>Receives government financial assistance</b>			
No	435	84	
Yes	85	16	

# Information Resources

- 180 (34.6%) respondents attended some form of training on farming from 2006 to 2010.
- Only 35 (6.7% ) farmers attended Climate Field School.
- 100 out of 520 farmers in the span of five years (2006-2010) were able to avail of technical assistance from the municipal agricultural office (MAO)
- Very few (92 or 18%) are members of a farmers' organization
- Many respondents (483 or 93%) have at least one source of weather/climate information.

# Information Resources

INDICATORS AND SUB-INDICATORS OF ADAPTIVE CAPACITY	NUMBER	PERCENT	AHP SCORE
<b>Information Resources</b>			
<b>Type of training</b>			
Climate Field School	35	7	1.000
Municipal Agricultural Office's training	89	17	0.290
Chemical companies' training	56	11	0.113
None	340	65	0.000
<b>Total</b>	<b>520</b>	<b>100</b>	
<b>Receives technical assistance</b>			
Yes	100	19	
No	420	81	
<b>Total</b>	<b>520</b>	<b>100</b>	
<b>Participates in farmers' organization</b>			
Yes	92	18	
No	428	82	
<b>Total</b>	<b>520</b>	<b>100</b>	
<b>Number of sources of climate/weather information</b>			
0	37	7	
1	334	64	
2	149	29	
<b>Total</b>	<b>520</b>	<b>100</b>	

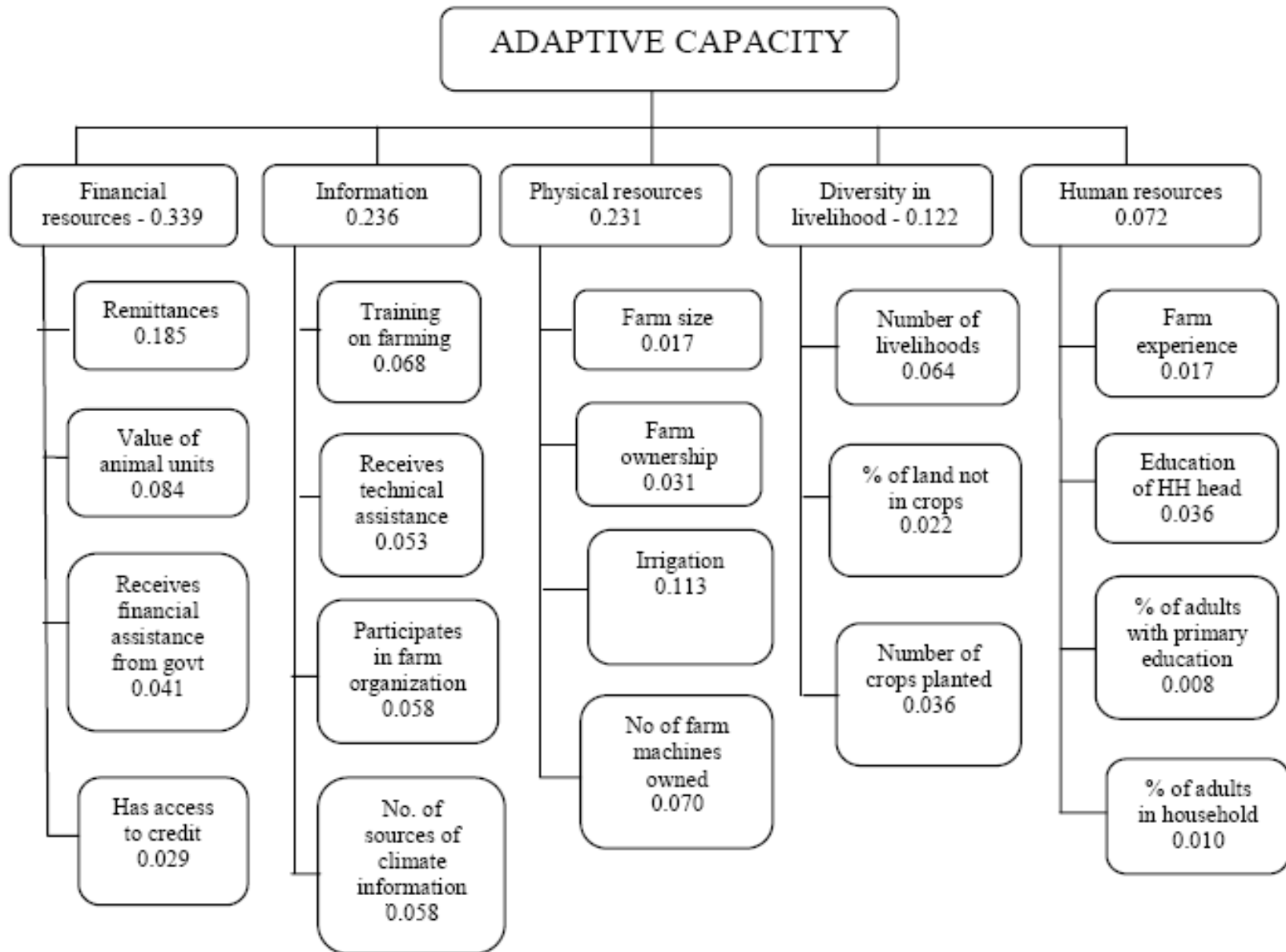
# Livelihood Diversity

- Households have a limited number of livelihoods, at most two sources of income -farming and one or two other additional sources.
- Most (68%) farmers plant only one crop, about 31 percent plant two and only about 2 percent plant three to five crops.
- Almost all farmers specialize in rice farming (99%).
- Almost all farmers (95%) devote 100 percent of their land to crop production.

# Livelihood Diversity

INDICATORS AND SUB-INDICATORS OF ADAPTIVE CAPACITY	NUMBER	PERCENT	AHP SCORE
Diversity in livelihood			
Number of sources of household income Including farming			
1	197	38	
2 - 3	301	58	
4 - 5	22	4	
Total	520	100	
Other sources of household income			
Non-farm employment	122	23	
Off farm employment	8	2	
Animals	129	25	
Aquaculture	13	2	
Business	52	10	
Rental	13	2	
Remittances	95	18	

# Weights of Indicators and Sub indicators



# Levels of Adaptive Capacity

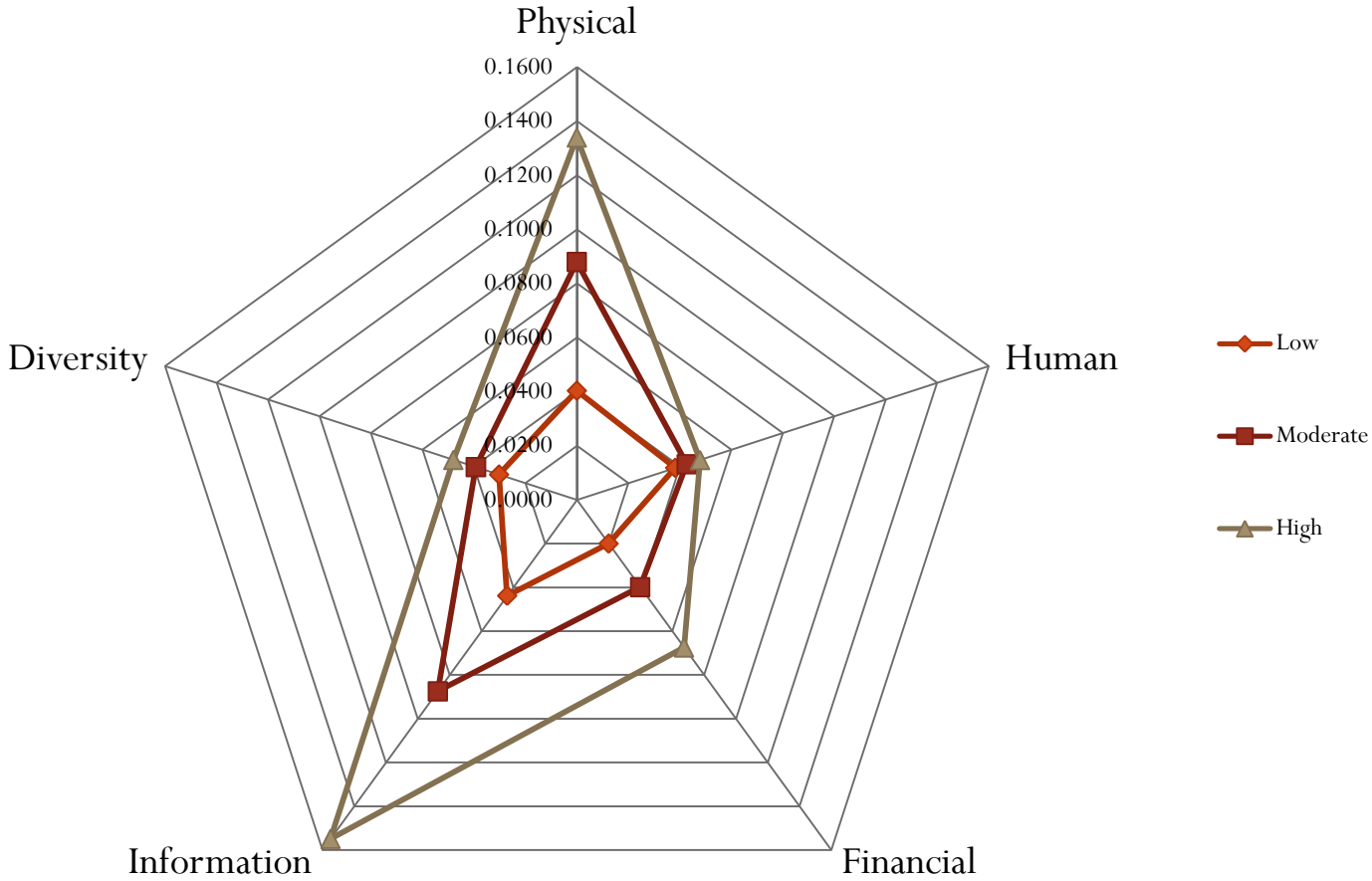
Classification	Number of Respondents	%	Average Adaptive Capacity Scores
Low	312	60	0.173
Moderate	185	36	0.297
High	23	4	0.452
Total	520	100	

# Average Scores Per Indicator

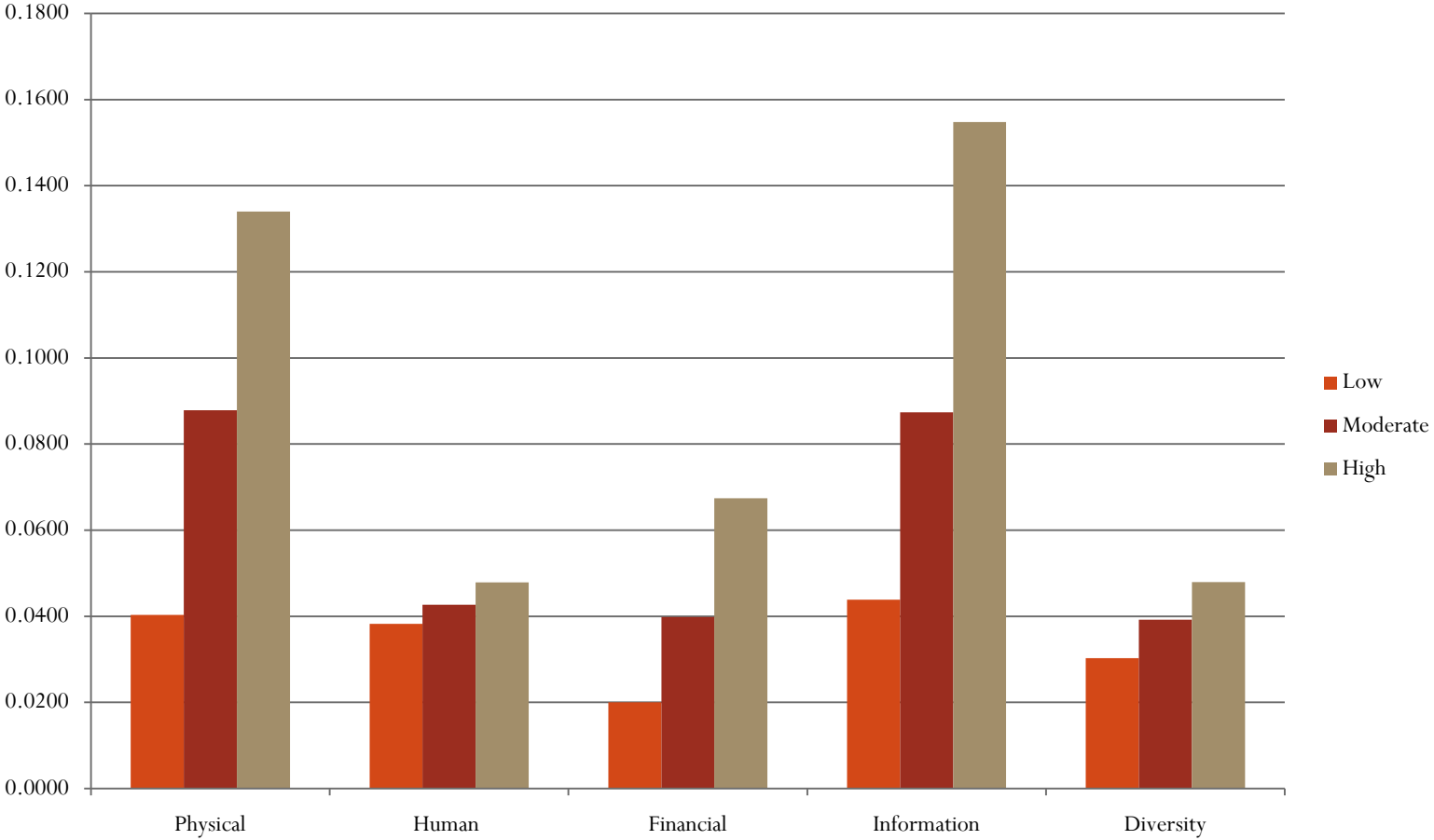
Level of Adaptive Capacity	Physical	Human	Financial	Information	Diversity
Low	0.0404	0.0382	0.0200	0.0439	0.0303
Moderate	0.0879	0.0427	0.0399	0.0874	0.0392
High	0.1340	0.0479	0.0674	0.1548	0.0480
Average	0.0874	0.0429	0.0424	0.0954	0.0392



# Average Score Per Indicator



# Average Scores Per Indicator



# Sources of Differences in Adaptive Capacity

- Information
- Physical Resources
- Financial Resources

# Adaptation Strategies

The most commonly used adaptation methods of farmers:

- Additional irrigation
- Change in fertilizer
- Adjustment in planting schedule,
- Change in seed variety/crop rotation
- Maintenance of farm structure
- Increased pesticide application
- Change in planting method.

- 324 (62%) respondents employed adaptation measures.
- 196 (38%) respondents did not report any adaptation measure.

# Adaptive Capacity and Adaptation

	Low	%	Moderate	%	High	%
Employed adaptation Strategies	189	61	119	64	16	70
Did not employ adaptation strategies	123	39	66	36	7	30
	312	100	185	100	23	100

Number of Adaptation Strategies Employed	Low	%	Moderate	%	High	%
0	123	39.4	66	35.7	7	30.4
1	132	42.3	59	31.9	5	21.7
2	50	16.0	41	22.2	9	39.1
3	7	2.2	18	9.7	2	8.7
4	0	0.0	1	0.5	0	0.0
5	0	0.0	0	0.0	0	0.0
	312	100.0	185	100.0	23	100.0

# Key Findings

- On the average, farming households scored highest in information resources and lowest in diversity.
- Differences in adaptive capacity of farming households were caused by large disparities in information, physical and financial resources
- These were the most important indicators based on expert judgement.
- Most farmers adapt to climate change despite levels of adaptive capacity
- But higher adaptive capacity translates to more adaptive strategies.
- The percentage of farmers that adapted to climate change increased with level of adaptive capacity.
- Likewise the number of adaptation strategies employed also tend to increase with level of adaptive capacity.

# Recommendations

1. The adaptive capacity of households must be increased in order for them to employ more adaptation measures by increasing the provision of information, financial, and physical resources by:
  - (b) conducting educational campaign and training on climate change and farming adaptation techniques;
  - (c) supporting farm organizations in the municipality;
  - (d) making accessible to all farmers the climate and weather information generated by the local agromet station;
  - (e) encouraging farmers to avail of the existing subsidies (on seed and fertilizer) provided by the government;
  - (f) making credit more accessible to small farmers through small-denominated loans
  - (g) developing/encouraging effective crop insurance for small-scale farmers.
2. Further studies on the uses, methodology, and validity of adaptive capacity indices at the household level should be pursued.



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Thank you for your attention!