INDICATORS FOR MEASURING THE PROGRESS IN ADAPTATION IN AGRICULTURE:

EXPERIENCES FROM THE GANGETIC BASIN

SVRK Prabhakar and S. Hayashi, IGES; R. Kotru, ICIMOD; S. S. Haider, BCAS; and D. Mohan, TERI

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INDICATORS FOR MEASURING THE PROGRESS IN ADAPTATION IN AGRICULTURE:

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METHODOLOGY, IGES

The study on adaptation effectiveness indicators has been carried out by the Institute for Global Environmental Strategies (IGES) in collaboration with national partners such as BCAS, ICIMOD and TERI in the Gangetic basin with the Strategic Environment Research fund of the Ministry of Environment, Government of Japan (S8). The study follows the approach of identifying local effectiveness indicators in a participatory manner which will be integrated into the Global Adaptation Index (GaIn) in order to arrive at Local Adaptation Index (LaIn). A broad set of effectiveness indicators were identified first by conducting literature review followed by a regional consultation workshop and these indicators were further vetted at national level expert consultation meetings where individual indicators were visited for their relevance to the country and study location specific circumstances. These indicators were transformed into structured questionnaires for consultations with local farming communities, district administration and non-governmental organizations that engage in implementing adaptation projects. The survey data has been statistically analyzed for identifying associations between adaptation practices and various socio-economic characteristics (Pearson chi-square test). The indicators are currently

PROCEEDINGS OF THE SESSSION AT THE 4TH INT. CONF. ON CC.

The session has revealed that the adaptation effectiveness indicators could significantly vary with the demographic background of the stakeholders participating in adaptation and hence indicated the difference of opinion on how effectiveness of a particular practice be quantified. This indicates the need for participatory to reflect the opinions of different stakeholders benefiting from adaptation.

been quantified for integration into a form of local adaptation index following the methodology set by the GaIn.

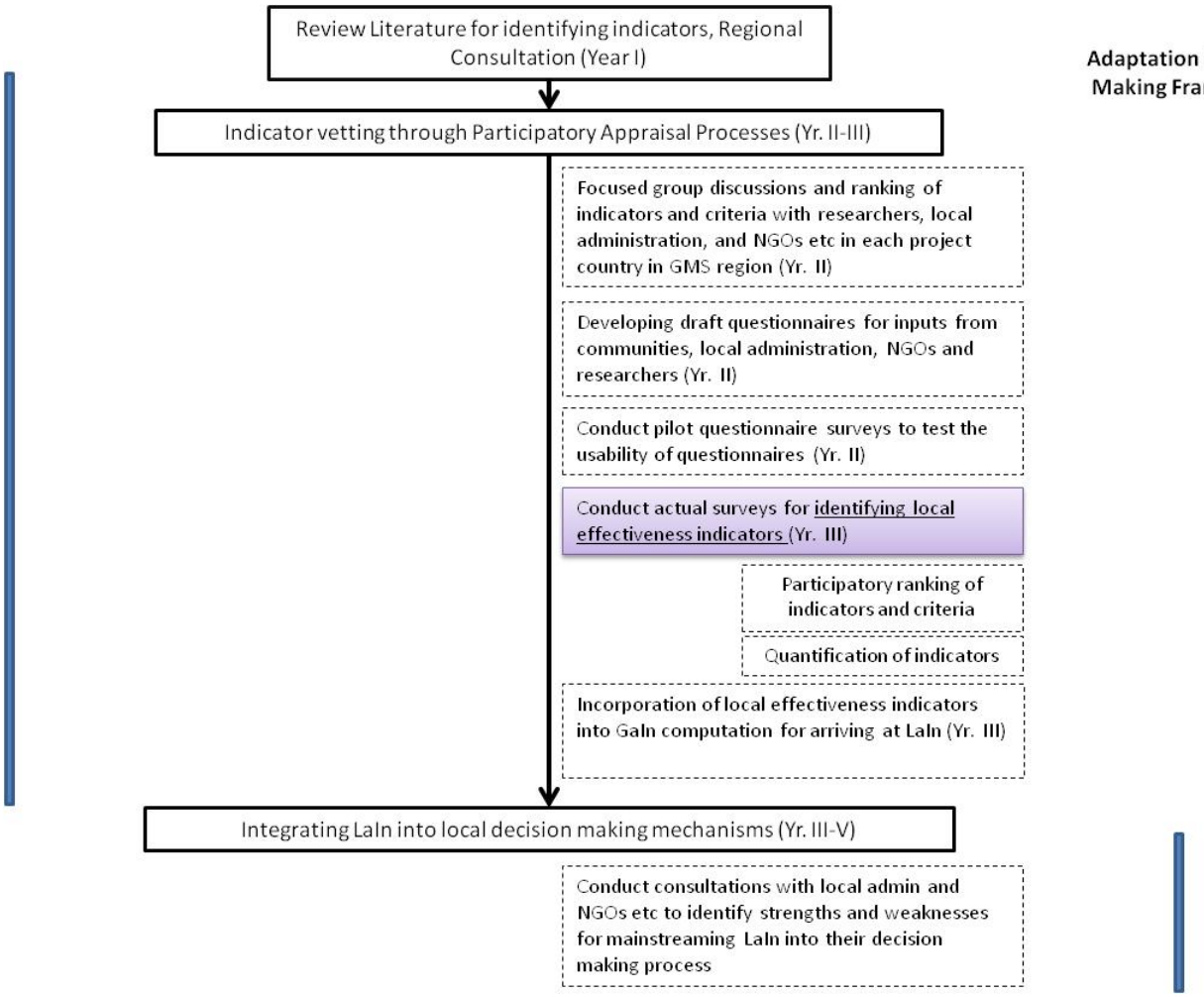


Figure 1. Flow diagram showing the overall study approach

BANGLADESH, BCAS

The surveys were conducted in the drought prone area of Chapai Nawabganj district. The repeated droughts in the district have manifested in the form of loss in crop production, increase in pest attack, and perennial water crisis. One of the prominent adaptation options in the region is to drill deep tube wells to supplement the rainfall deficit for crop and household purposes. However, this single intervention has failed to provide an effective remedy to the problem. The field surveys have indicated that options such as adoption of drought tolerant and short duration crop varieties followed by relay cropping are the need of the hour. Subsidies to farmers and farmer field schools were seen as an important policy options for adapting to climate change in this region. To evaluate the effectiveness of these options, the respondents have identified several effectiveness indicators which have shown statistically significant association with the demographic background of the respondents. Period of fresh water availability and calorie intake per person have shown significant association with the gender

among all the environmental and social indicators while none of the economic indicators have shown significant association with the socio-economic background.

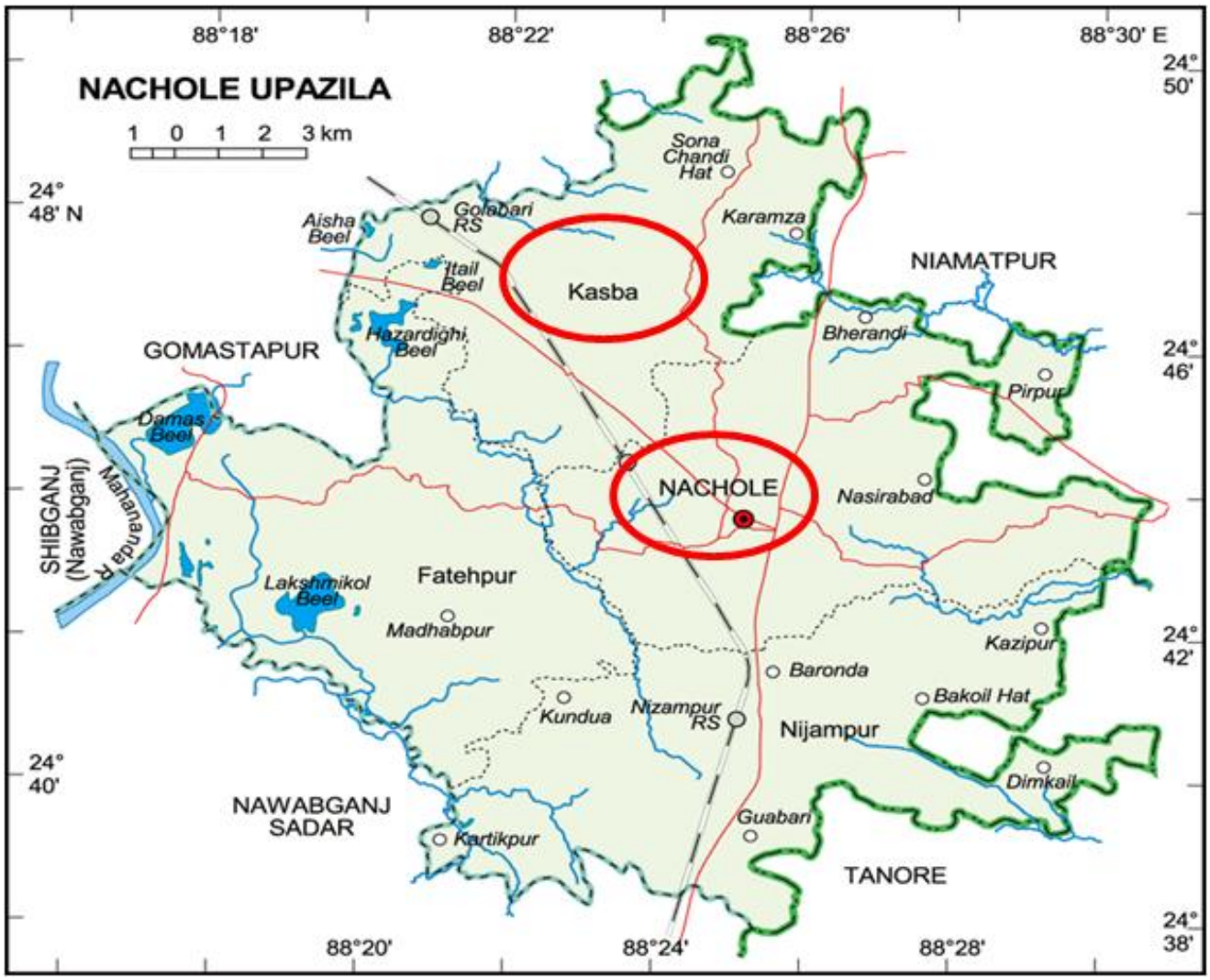


Figure 2. Study locations in Bangladesh part of the Gangetic Basin

INDIA, TERI

The study was carried out in the Kanpur Dehat District of Uttar Pradesh state in India where drought is a prominent climatic disaster. The prominent adaptation option in vogue in the area is construction of water harvesting structures such as contour bunding which is again a single intervention approach as seen in Bangladesh. The surveys have revealed that there is a need to introduce improved irrigation systems, improved soil management practices and improved drought forecasting to go hand in hand with the water harvesting being implemented in the study location. The respondents felt that the indicators such as increased water availability, duration of water stress, % of income used for health care, food self sufficiency, increased assets and total farm income will better reflect the effectiveness of the identified adaptation options. The statistical analysis has not revealed any significant association between practices, for all the top ranked indicators and socio-economic characteristics of the

respondents. However, the associations were significant for the other less significant indicators (those ranked 2 and below).

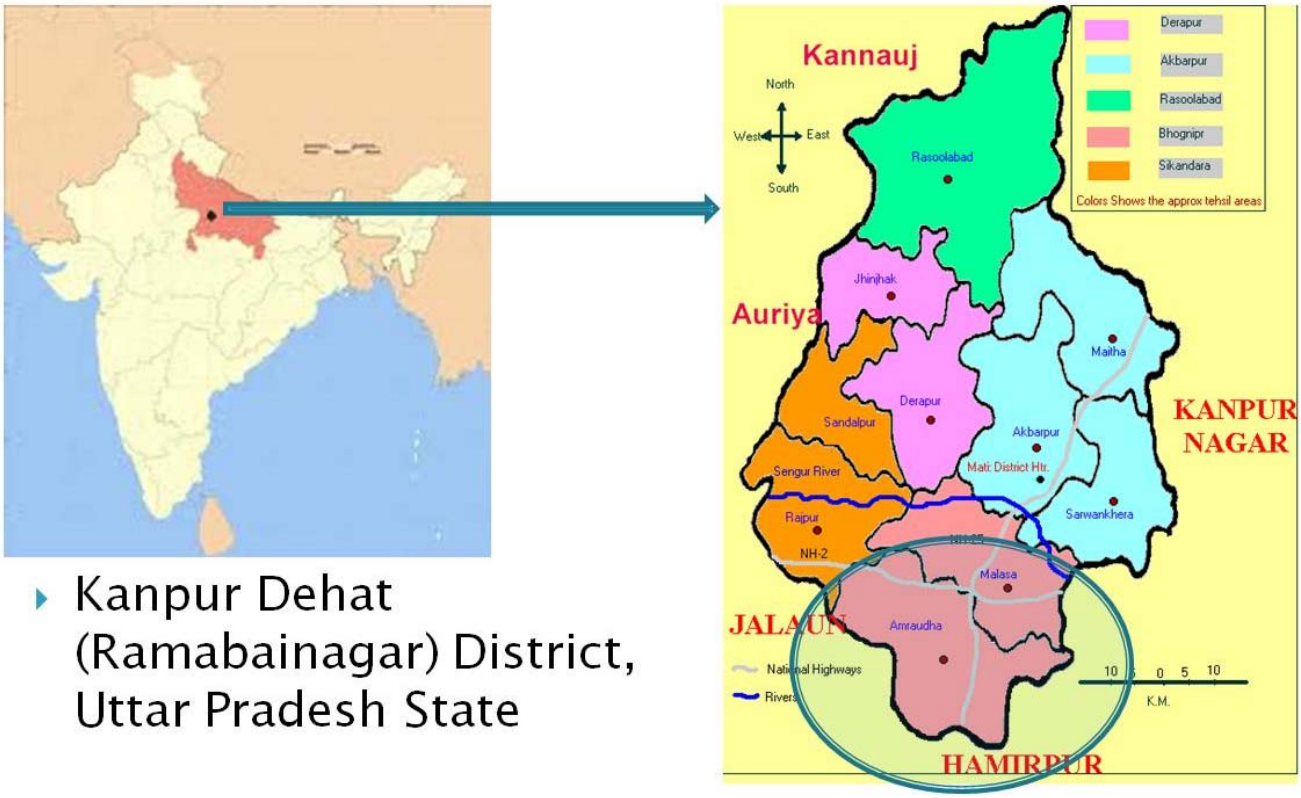


Figure 3. Study location in India part of the Gangetic Basin.

NEPAL, ICIMOD

The study was carried out in Bara and Parsa districts of Nepal where drought is a significant historical climatic stress that is affecting agriculture. The repeated droughts in the region have decreased crop yields, were responsible for increase in insect pests, and decreased availability of fresh water. The significant adaptation options identified in the study location were small irrigation systems, irrigation scheduling in the canal, irrigation rationing, and community based maintenance of irrigation canals. The top ranked indicators such as number of farmers with drought concerns, nutritional diversity, change in household income etc didn't show any association with the practices identified as well as the socio-economic background of the respondents. However, indicators such as soil organic carbon content and crop yield change differed significantly by the socio-economic status of the respondents.

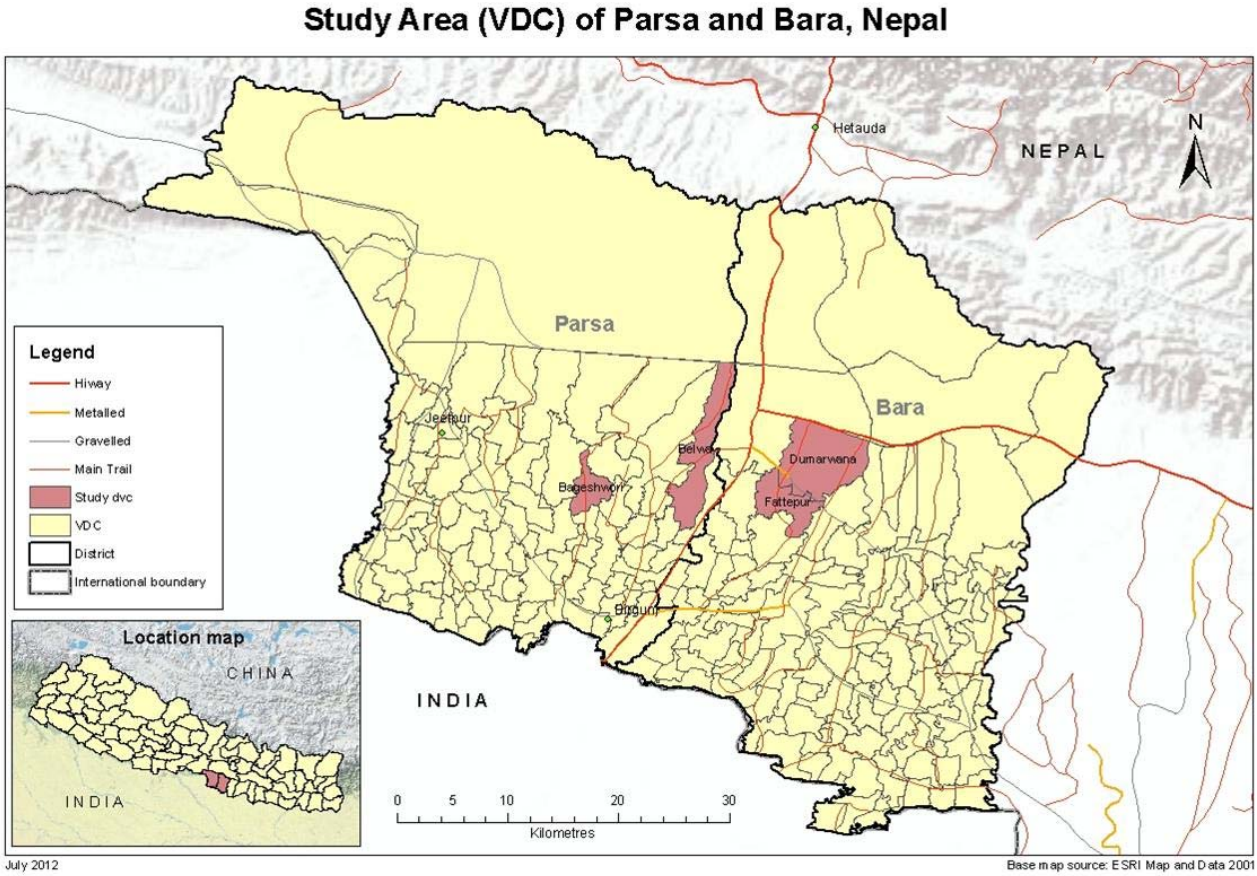


Figure 4. Study location of Nepal part of the Gangetic Basin.

COMPLETE PRESENTATIONS:

1. Assessing the Effectiveness of Local Adaptation Options through Local Indicators and Developing Local Adaptation Index (LaIn), IGES

2. Identification of Win-Win Adaptation Options through Adaptation Metrics and Integrated Adaptation Decision Making Frameworks, Nepal

3. Identification of Win-Win Adaptation Options through Adaptation Metrics and Integrated Adaptation Decision Making Frameworks, India

4. Identification of Win-Win Adaptation Options through Adaptation Metrics and Integrated Adaptation Decision Making Frameworks, Bangladesh

Assessing the Effectiveness of Local Adaptation Options through Local Indicators and Developing Local Adaptation Index (LaIn)

SVRK Prabhakar, IGES with

Project Team from IGES, BCAS, ICIMOD and TERI

Measuring the Effectiveness of Adaptation Options

- Adaptation costs are huge and available resources are insufficient.
- Planned adaptation is only possible by implementing adaptation options that are known to work with high degree of probability in a given climate.
- Risk of maladaptation is an important consideration.
- Synergies between various approaches of sustainable development, climate change adaptation and disaster risk reduction need to be harnessed for efficiency and effectiveness purposes.

Growing Emphasis for Adaptation Metrics: BAP on Adaptation (Section c, i-v)

- "Enhanced action on adaptation with consideration of …**prioritization of actions**…and support adaptation in a **coherent and integrated manner**"
- "**Positive incentives** for developing countries for **enhanced** mitigation and **adaptation actions**"

BAP, 2007

How to Prioritize and Incentivize Adaptation Actions?

- Developing and agreeing on a **measurement system** (adaptation metrics)
- Cannot be in isolation but work in a context:
  - In knowing where we want to reach: adaptation targets
  - Setting a base line of adaptation (to compare the progress and effectiveness)
  - Setting a time frame: Knowing how much 'adaptation' we want to achieve at each stage to meet the set target and

Some Suggested Adaptation Effectiveness Indicators in Agriculture

Metric/s	Reference	Description on availability and limitations (includes authors judgement)
Mean and variability of yield and production, income, aggregate of value added	Tubiello and Rosenzweig, 2008	Measured and computed metrics. Available at local, national, regional and international levels in many countries. The aggregate of value added may need to be computed at the local level as such statistics will not be readily available.
Nutrition index	Tubiello and Rosenzweig, 2008	Computed metric (sum of local production and net imports divided by total food demand). Can be computed at national and regional level.
Yield estimates (remotely sensed), yield variability, highest relative yield/yield percentile	Luers et al., 2003	Estimates could help in filling the gaps in the existing yield data, validating the measured yield data etc. Accuracy could be an issue when resolution of remote sensing is low.
Agricultural export, farm income, out-migration from farming, emergency payments	Venema, 2006	Agricultural exports and out-migration of farming are mostly applicable at the macro-economic level, while data on rest of the metrics (emergency payments) could be sparingly available.
Sources of income, livestock number, source of fertilizer	Brooks and Adger, 2005	It was not clear on how many sources of income is considered as optimal, and also the number of cattle. However, it is suggested that the higher the sources of income, with more diversification into non-farm sources, the higher the adaptive capacity.

Prabhakar, 2008

Problems with Earlier Suggestions

- Mostly a compilation of indicators and doesn't often provide an overall picture of adaptation in a given sector
- Policy makers may often prefer single composite index representing the entire sector with a single number (not withstanding their intrinsic limitation) than a seemingly confusing set of several indicators.

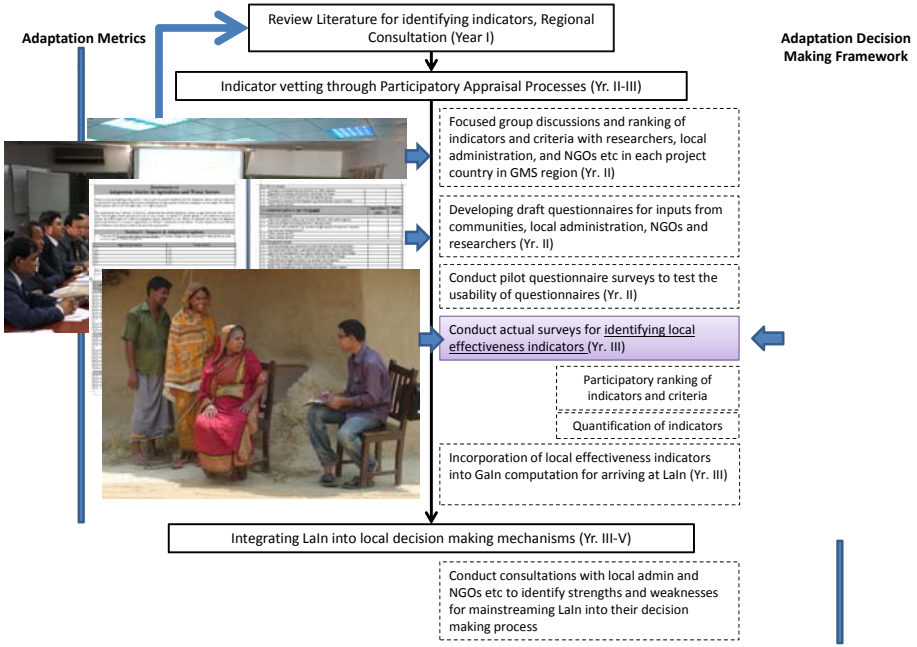
Strategic Research Project on Adaptation Metrics

- **Partners:** BCAS, Bangladesh; ICIMOD, Nepal; TERI, India
- **Funding:** Strategic Research Fund (S8), GOJ through Ibaraki University
- **Objectives:**
  - To identify and operationalize a set of indicators for measuring the effectiveness of adaptation actions at the local level **[Local Adaptation Index (LaIn)]**
  - To assess the current adaptation decision making mechanisms and to arrive at an integrated policy decision making framework **[Adaptation decision making frameworks]**
  - To test the methodologies in other regions (e.g. Mekong Basin)

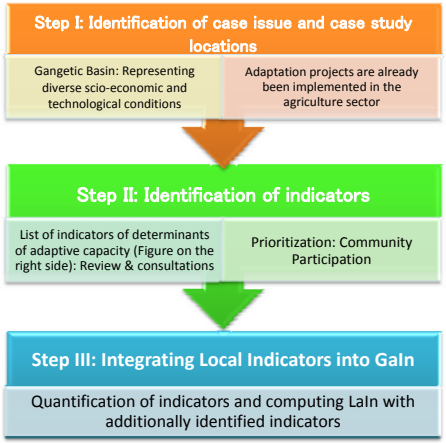
Local Adaptation Index (LaIn): Localizing GaIn

- **GaIn:** Comprehensive macro assessment of Vulnerability and Readiness of a country in a given year

- **LaIn: Ultimate objective:** Precise assessment of Vulnerability and Readiness at a given point of time (ex-ante and ex-post) at village level



Integrating Local Indicators into GaIn



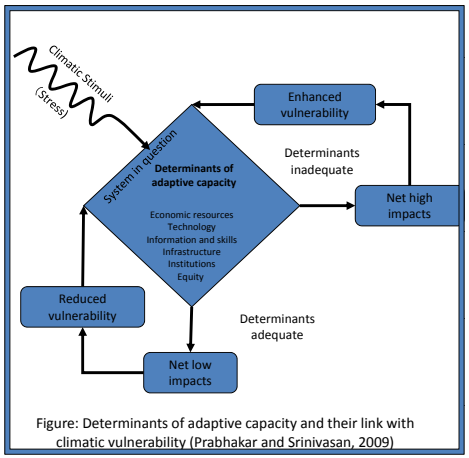
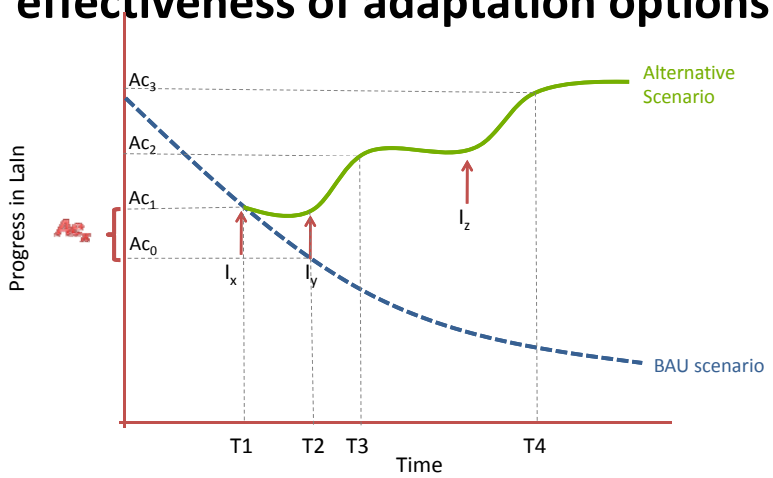


Figure: Determinants of adaptive capacity and their link with climatic vulnerability (Prabhakar and Srinivasan, 2009)

How LaIn can be used for evaluating effectiveness of adaptation options?



$$Ae_x = Ac_1 - Ac_0$$

Where:
Ae_x: Effectiveness of adaptation action x;
Ac_0, Ac_1: LaIn values at times T1 and T2
Ix, Iy, Iz: adaptation actions

Mock Exercise: LaIn

LaIn=

$$\left[\left(\sum_{i}^{Read.} \frac{Index_i - Mean_{all}(Index_i)}{Stdev_{all}(Index_i)} * Weight_{Index}\right) / Max(Score)_{all}\right]_{Read.} * 60 -$$

$$\left[\left(\sum_{i}^{Vuln.} \frac{Index_i - Mean_{all}(Index_i)}{Stdev_{all}(Index_i)} * Weight_{Index}\right) / Max(Score)_{all}\right]_{Vuln.} * 40$$

Country Presentations

Mock Exercise for LaIn: Vulnerability and Readiness Indicators
(Additional to GaIn Indicators)

	Indicators (Bangladesh, based on pilot survey)
Vulnerability	• % farms with soil degradation (exposure) • % soil cover (exposure) • Period of fresh water availability (exposure) • Area under high water use crops (sensitivity) • Area under arable farming (sensitivity) • Soil organic matter content (capacity) • Area under reduced tillage (capacity)
Readiness	• % of households having access to credit (economic) • % of households having access to markets (economic)

Mock Exercise: LaIn

Indicator values for BAU practice

	Indicators (Bangladesh, based on pilot survey)	Value	Range (Min Max)	Score	Weight
Vuln.	•% Soil degradation	20	5-30	0.67	0.14
	•% soil cover	40	10-70	0.57	0.14
	•Period of water availability (days)	120	50-200	0.60	0.14
	•Water int. crops (ha)	50	40-60	0.83	0.14
	•Arable farming (ha)	80	40-90	0.89	0.14
	•Soil OM content (%)	0.5	0.25-1	0.50	0.14
	•Reduced tillage (ha)	10	5-60	0.17	0.14
Read.	•Households credit access (%)	40	10-80	0.50	0.50
	•Farmers access to markets (%)	50	20-80	0.63	0.50

Note: Scores are calculated by linear normalization with thresholds

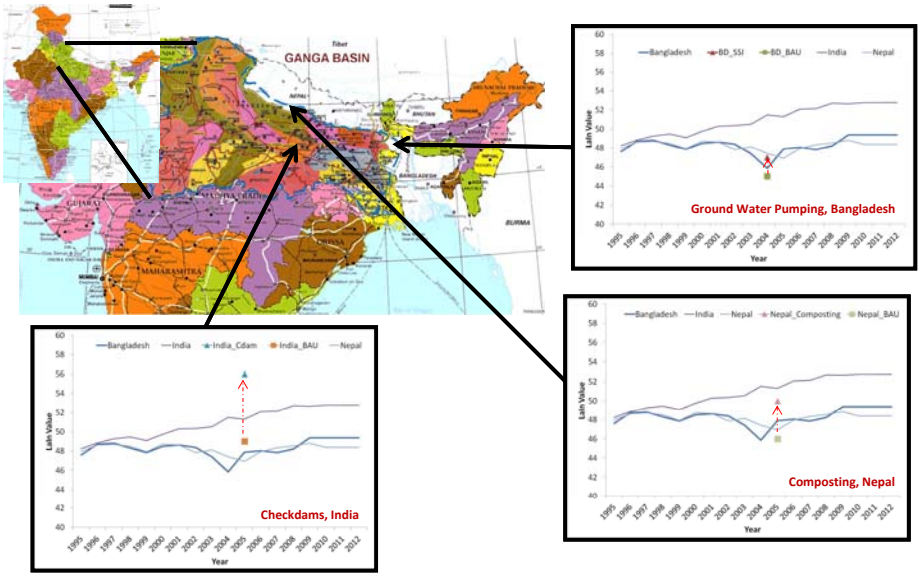
Mock Exercise: LaIn

Indicator values for ZT practice

	Indicators (Bangladesh, based on pilot survey)	Value	Range (Min Max)	Score	Weight
Vuln.	•% Soil degradation	5	5-30	0.17	0.14
	•% soil cover	70	10-70	1.00	0.14
	•Period of water availability (days)	180	50-200	0.90	0.14
	•Water int. crops (ha)	30	40-60	0.50	0.14
	•Arable farming (ha)	80	40-90	0.89	0.14
	•Soil OM content (%)	0.75	0.25-1	0.75	0.14
	•Reduced tillage (ha)	40	5-60	0.67	0.14
Read.	•Households credit access (%)	50	10-80	0.63	0.50
	•Farmers access to markets (%)	60	20-80	0.75	0.50

Note: Scores are calculated by linear normalization with thresholds

LaIn in the Gangetic Basin



Work in Progress

- Identify crucial set of indicators through sensitivity analysis by calculating LaIn with:
  - Gender associated indicators
  - Economic status associated indicators
  - Practices associated indicators etc.
- Identification of effective practices for a given drought severity level
- Feedback from stakeholders

THANK YOU!

Contact: prabhakar@iges.or.jp

Identification of Win-Win Adaptation Options through Adaptation Metrics and Integrated Adaptation Decision Making Frameworks

IGES-BCAS-ICIMOD-TERI Project Partners

Rajan Kotru ,Bhaskar Karki, Navraj Pradhan ,Kamal Aryal, Anju Pandit

4th International Conference on Climate Change 13th July, 2012 at Seattle, USA

International Centre for Integrated Mountain Development

Kathmandu, Nepal

ICIMOD

FOR MOUNTAINS AND PEOPLE

ICIMOD

FOR MOUNTAINS AND PEOPLE

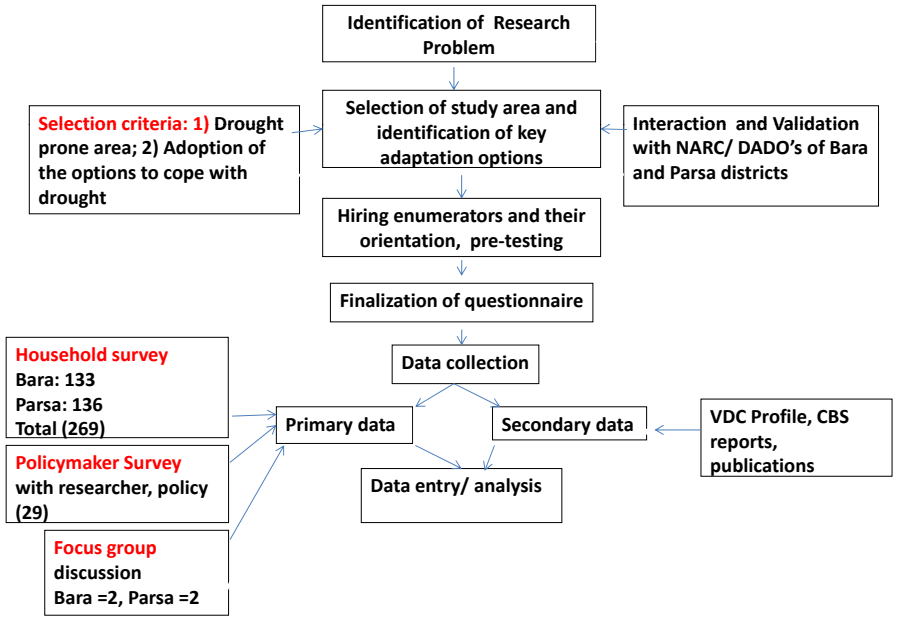
- Research Sites in Nepal
- First impressions on "adaptation"
- Sum-Up

History of Droughts in Nepal

Year	Districts	Impacts
1974	Sindhupalchowk	254 ha of maize in Chakubas, Taragaun, and Saping (VDCs)
1983	Ramechaap	*80% of paddy and maize crops were damaged*
1992	Bara, Dhanusha, Mahottari, Sindhuli, Sarlahi,Saptari Morang, Jhapa Sirhaha, Kailai, Kanchanpur, Banke, Surkhet, Dang, Bardiya, Dailekh, Nawalparasi	*The entire district was affected: about half the paddy and much of the maize was badly affected* About 50 – 60% of paddy fields couldn't be planted 4013 ha of paddy fields could not be planted
1994	Parsa, Bara and other 31 districts	*In Bara 71 VDC and Parsa – 41 VDC's were affected.*
2005	Dolakha, Chitawan, Taplejung, Jhapa, Sunsari, Siraha, Morang, Dandeldhura, Banke, Dang, Rupandehi, Gulmi, Syanja, Kasi	In 24 VDC's farmers could not plant millet or paddy. Maize could not be planted in 500 ha.
2006	Sarlahi, Rautahat, Ramechaap, Khotang, Bhojpur, Bajhang, Dailekh, Kalikot, Banke, Tanahu, Nawalparasi, Palpa	Few districts in Terai 8,394 ha of paddy was destroyed and 33,850 ha damaged.
2008 – 2009	Mid and Far Western Nepal districts	Deficient rainfall in 2008; Wheat and Barley production declined 14- 17 %

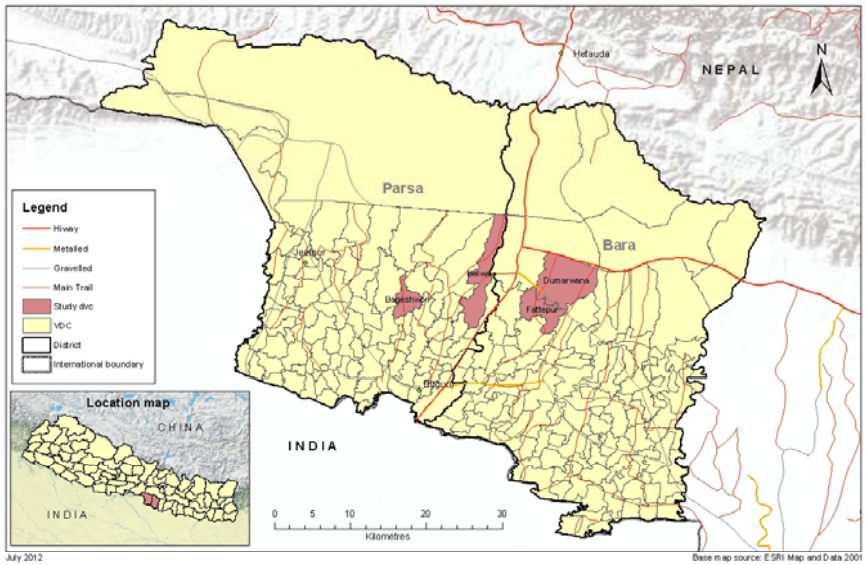
TSource: DesInventar; UNDP 2009

Methodological Process for Field survey



Study field site, Nepal

Study Area (VDC) of Parsa and Bara, Nepal

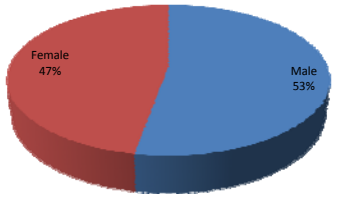


Field survey information, Nepal

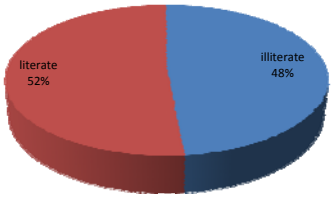
District	VDC	Total VDC Population	Survey - Ward/ Village Name	Total households surveyed
Parsa	**Fattepur**	1225; M – 51% F – 49 %	1 / Fattepur 3/ Jhogaditol 4/ Shantitol 8 / Khairwa 9 / Amadar	64
	Dumarwana	3503; M – 49% F – 51%	8 / Juralai 4/ Bhawanipur – Kata toll	69
Bara	**Bageshwori**	3080; M – 52% F – 48 %	1 / Bahauri 5 / Bageshwori 6 / Chainpur 7 / Tikuliya	66
	Belwa	1205; M- 52% F – 48%	1/ Parsauni 2 & 3 Belwa, Isampur, Parsuani	70
				Total - 269
Average rainfall: 1790.97mm (Simara)				

Respondent's profile

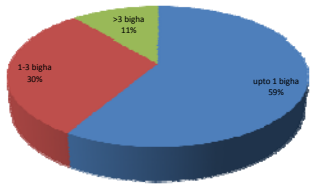
Gender representation



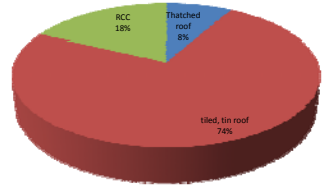
Education status of respondents



Categorization of respondents on the basis of land owned

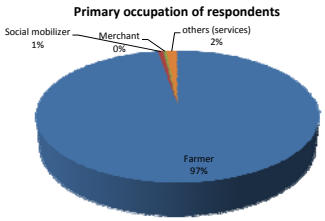


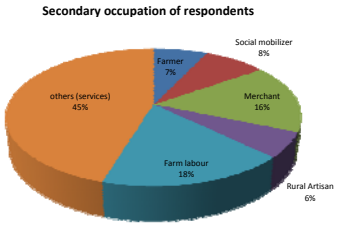
Categorization of respondents on basis of economic status

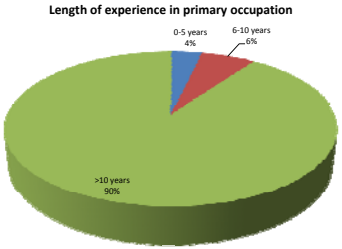


1 ha=1.5 Bigha

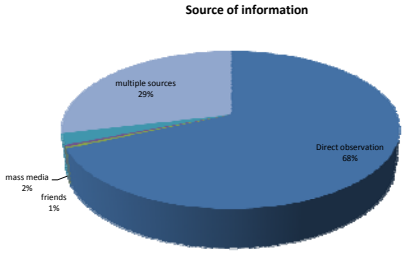
Respondents' profile

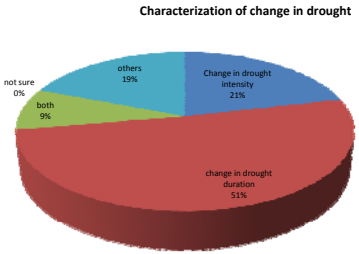




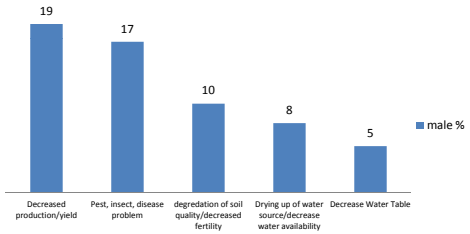


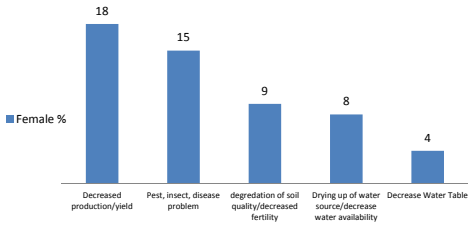
Responses on general understanding on climate change



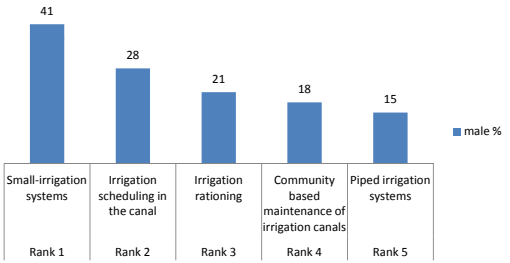


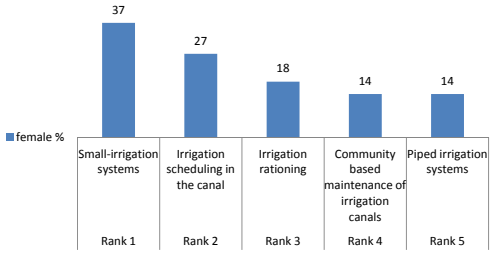
Impact of climate change on agriculture crop sector





Five Infrastructure related Adaptation options





Gender vs Indicators

- A ‘chi-square test of independence ‘ was performed to examine the relation between gender and indicators.

1. Environmental Indicators

- Significant statistical difference could not be established

2. Social Indicators

- Significant statistical difference could not be established

Gender Vs Indicators

3. Economic Indicators

- Ranking of the indicator “Inter-annual variability” does not differ significantly by gender for small irrigation. But it ***differs significantly in Inter cropping practice.*** So in inter cropping practice there is association between indicators and gender.

Educational status Vs Indicators

- A ‘chi-square test of independence ‘ was performed to examine the relation between gender and indicators.

1. Environmental Indicators

- Significant statistical difference could not be established

2. Social Indicators

- Significant statistical difference could not be established

3. Economic Indicators

- Significant statistical difference could not be established

Economic status Vs Indicators

- A ‘chi-square test of independence ‘ was performed to examine the relation between gender and indicators.

1. Environmental Indicators

- Ranking of the indicator **“Organic matter content in the soil”** differs significantly by economic status (roof top type based) for practice 2: inter cropping.
- Rest of the indicators do not differ significantly by economic status

Economic status Vs Indicators

2. Social Indicators

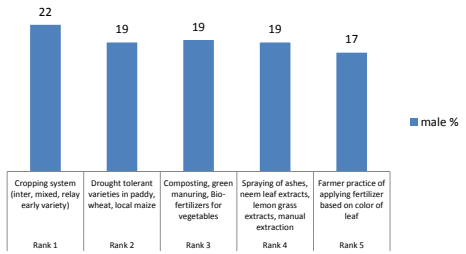
- Ranking of the indicators: No of farmers with concerns related drought; Quality of food Nutritional diversity; Access/ Availability (number of months of food sufficiency; Work load on women; % of households having access to market" do not differ significantly by economic status.

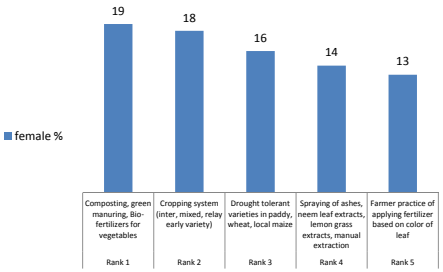
3. Economic Indicators

- Ranking of the indicators: change in household income saving assets; % of households having access to credit ; % of households income from non-agriculture practice; Inter-annual variability; do not differs significantly by economic status

- Ranking of the indicator "crop yield change (economic terms)" differs significantly by economic status (land holding size based) for practice 1: irrigation practice

Five Management related Adaptation options





Practice Vs Indicators

- A 'chi-square test of independence ' was performed to examine the relation between gender and indicators.

1. Environmental Indicators

- Ranking of the indicator " % of area that have concerns related to drought" differ significantly by practices.
- Ranking of the indicator " number of droughts" differs significantly by practices.
- Ranking of the indicator " Net Primary productivity" do not differ significantly by Practices.
- Ranking of the indicator "Organic matter content in the soil" differ significantly by practices.
- Ranking of the indicator " Biodiversity (change in species)" differ significantly by practices.

Practice Vs Indicators

2. Social Indicators

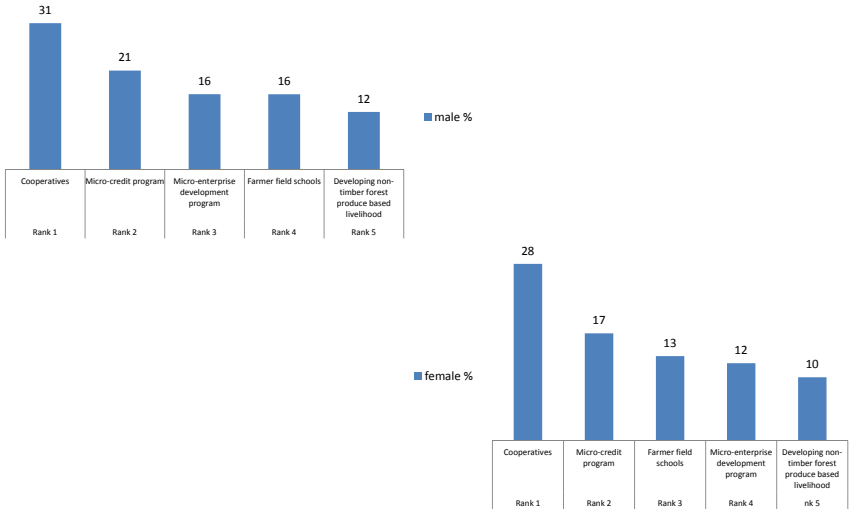
- Ranking of the indicator " No. of farmers with concerns related drought" differs significantly by practices.
- Ranking of the indicator "Quality of food Nutritional diversity" differs significantly by practices.
- Ranking of the indicator "Access/Availability (number of months of food sufficiency" differs significantly by practices.
- Ranking of the indicator "Work load on women" differs significantly by practices.
- Ranking of the indicator "% of households having access to market" differs significantly by practices.

Practice Vs Indicators

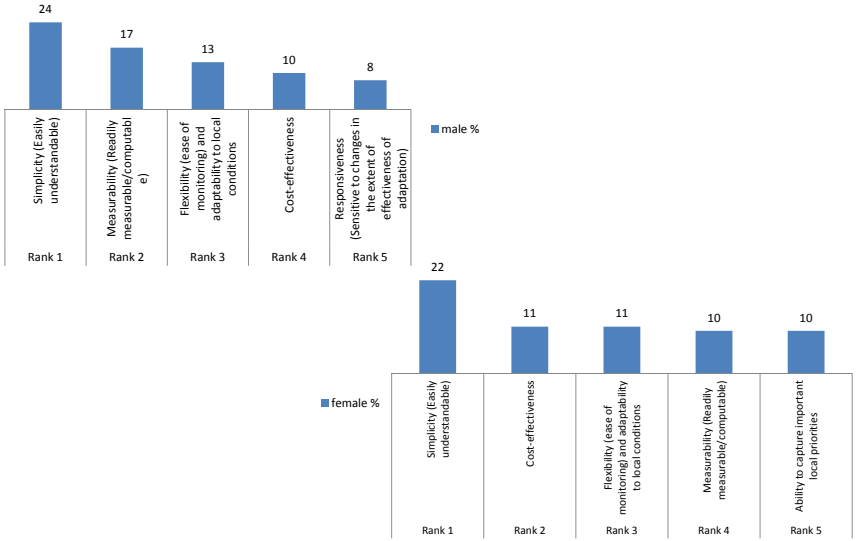
3. Economic Indicators

- Ranking of the indicator "change in household income saving assets" does not differs significantly by practices.
- Ranking of the indicator "crop yield change (economic terms)" does not differs significantly by practices.
- Ranking of the indicator "% of households having access to credit" differs significantly by practices.
- Ranking of the indicator "% of households income from non-agriculture practice" differs significantly by practices.
- Ranking of the indicator "Inter-annual variability" does not differs significantly by practices.

Five Policy related Adaptation options



Five important criteria: based on which indicators have been identified



Sum UP

- Climate Change as common denominator
- Perceptions Men and Women matches *-decreased yield vs small irrigation as adaptation strategy*
- Management related adaptation options bring *male-female difference* of perception
- Barring *"intercropping Practice"* no statistical significance between gender and indicators
- *Options and indicators in Nepal are limited* due to poor technology transfer, poor extension service, lack of adaptation to climate change interventions, small scale agriculture practices
- A more *comprehensive data analysis* of the field survey needs to be pursued

Identification of win-win Adaptation Options through Adaptation Metrics and Integrated Adaptation Decision Making Frameworks

IGES-BCAS-ICIMOD-TERI Project Partners

Divya Mohan, Associate Fellow, TERI
Himani Upadhyay, Associate Fellow, TERI
Suruchi Bhadwal, Associate Director, TERI

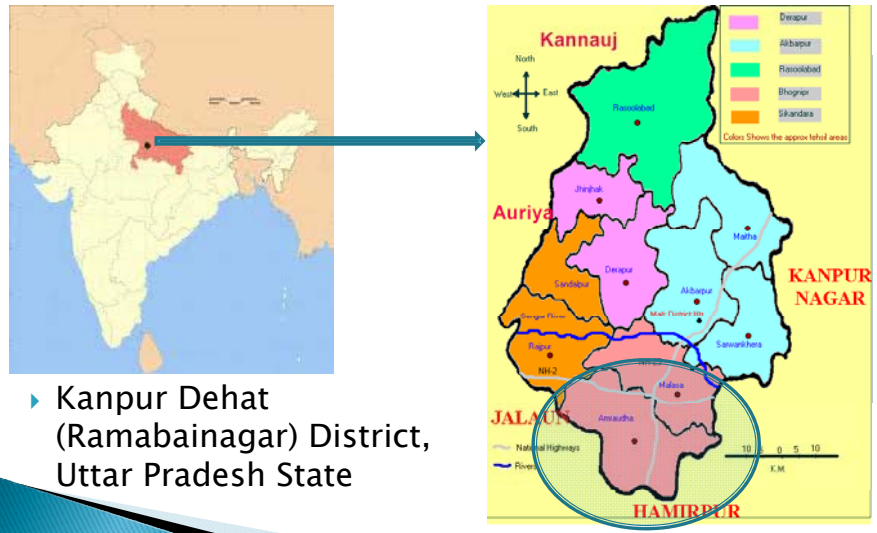
Outline

- Background
- Study Area
- Context
- Adaptation Intervention
- Survey Findings
- Statistical Analysis
- Study Implications

Background

- Ganga Basin:
  - Food basket of India
  - Supports livelihoods of millions
- Huge dependence on water
- Monsoon rainfall key determining factor for agricultural output
- Many areas drought prone in this area

Study Area



- Kanpur Dehat (Ramabainagar) District, Uttar Pradesh State

Context

- Ravine area with undulating terrain
- Difficult to implement irrigation options
- Essentially rain dependent area
- Excessive soil erosion due to runoff
- Less recharge of groundwater
- Winter crops affected badly as less moisture retained in upper terrain
- Region very sensitive to less rainfall and droughts
- Impact on overall crop productivity and livelihoods of people

Intervention

- Bunding (depending on slope of the terrian)
  - Contour Bunding
  - Peripheral Bunding
  - Contour wall and check dam
- Uttar Pradesh Land Development Authority
- Supported by local NGO
- Objective:
  - To check water runoff during monsoon
  - To check soil erosion and nutrient runoff
  - To improve water recharge and moisture retention

Contour and Peripheral Bunding

Check Dam

Benefits of Bunding

- Improved crop production in winter
- Better income, improved livelihoods
- Lesser migration

Methodology

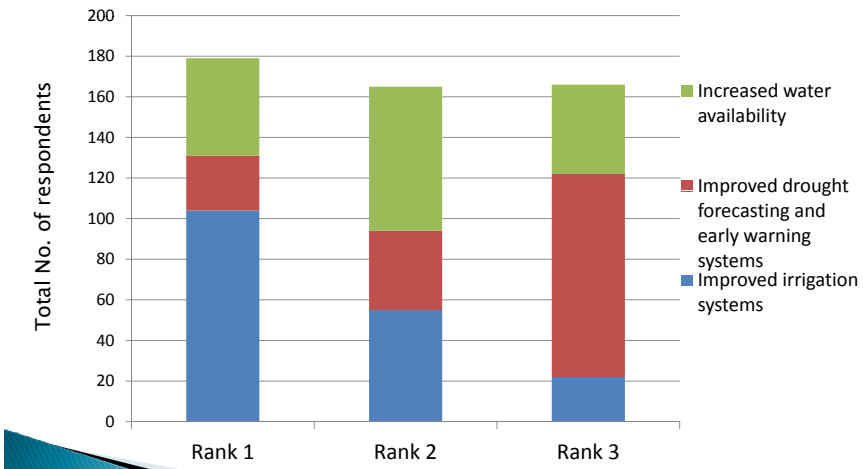
Pilot Survey
- To understand the context
- To understand people's perspective

Main Survey
- Questionnaire Survey
- FGDs

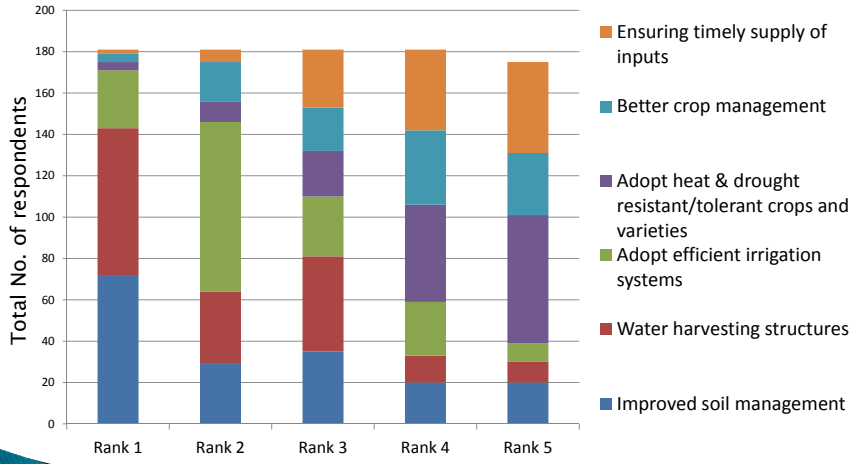
Survey Findings – Impacts

- Most of the respondents have observed changes in the climate
- Changes observed in rainfall pattern (more erratic) and drought (duration and intensity)
- Impact on water resources (last 10-15 years)
  - Decline in groundwater level
  - Drying up of surface water sources like ponds
- Impact on agriculture
  - Reduction in crop productivity
  - Increased pest infestation in some cases

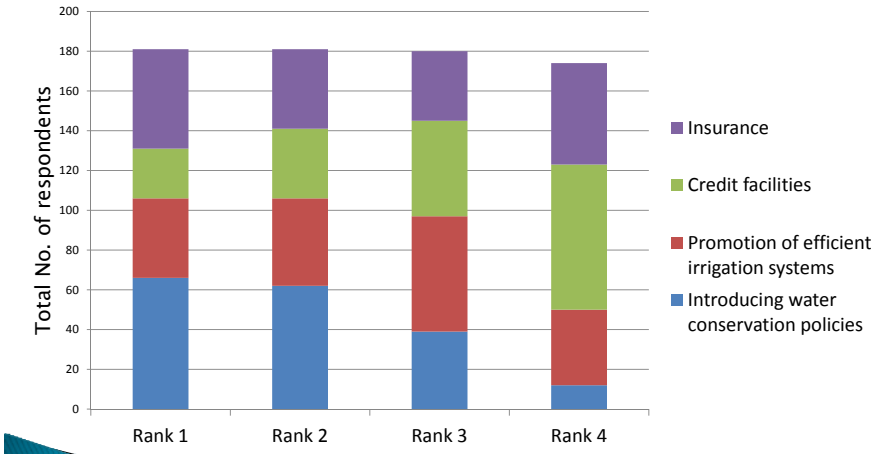
Top Infrastructure related adaptation options



Top Ranked Management related adaptation options



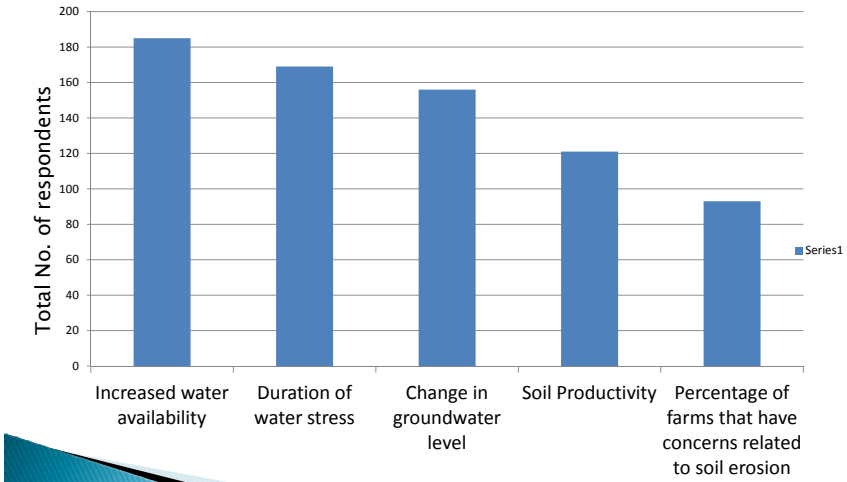
Top Ranked Policy related adaptation options



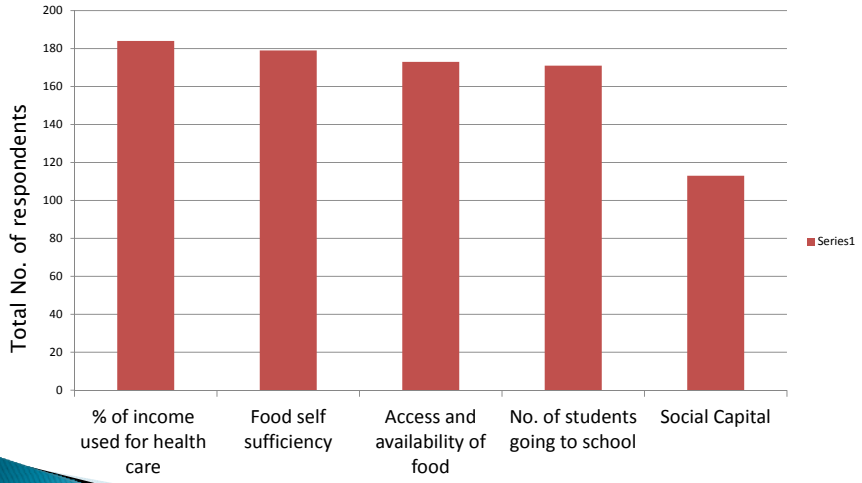
Most important adaptation options

- Infrastructure:
  - Improved irrigation system
- Management
  - Improved soil management
- Policy
  - Introducing water conservation policies

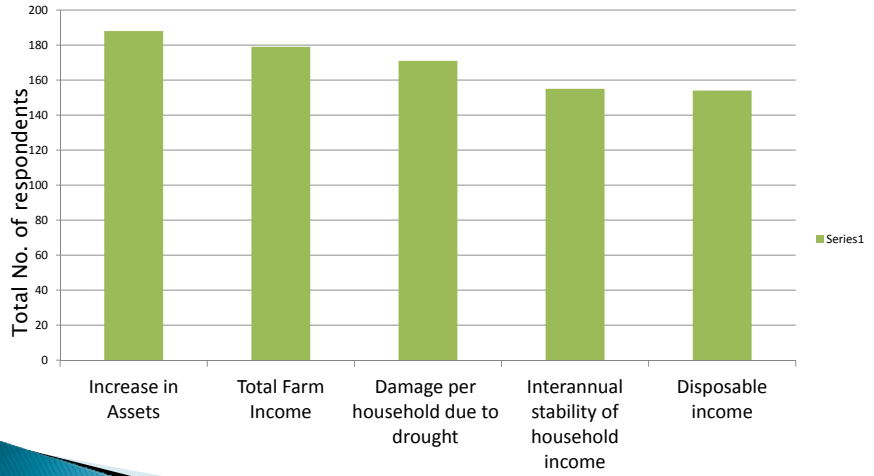
Top Ranked Indicators to monitor Environmental effectiveness



Top Ranked Indicators to monitor Social effectiveness



Top Ranked Indicators to monitor Economic effectiveness



Statistical analysis

- Comparative Analysis to understand trends in prioritization of indicators.
- Pearson chi-square test of independence used for statistical analysis.
- Comparisons:
  - Gender vs indicators
  - Economic Status vs. indicators
  - Practice group vs. indicators

Statistical Analysis– Gender vs Top Ranked Indicators

	Gender vs. Top Indicator of Environmental effectiveness (Increased water availability)	Gender vs. Top Indicator of Social effectiveness (Percentage of income used in healthcare)	Gender vs. Indicators of Economic effectiveness (Increase in assets
Pearson Chi-Square	4.477	4.115	8.275
df	7	6	5
P – value	0.723	0.661	0.142
N value	197	196	196

Statistical Analysis- Gender vs indicators

- Comparative analysis of top ranked indicator in each of the three categories of effectiveness and gender shows that gender and indicators are independent.
- There is no association of gender and indicators ranked.
- Similar trend observed in the top 5 ranked indicators of all three categories.

Statistical Analysis – Economic Status vs Top Ranked Indicators

	Economic Status vs. Indicators of Environmental effectiveness (Increased water availability	Economic Status vs. Indicators of Social effectiveness (Percentage of inome spent on health care (Increase in assets)	Economic Status vs. Indicators of Economic effectiveness)
Pearson chi-square	16.839	15.276	9.033
df	14	12	10
P value	0.265	0.227	0.529
N value	195	196	195

Statistical Analysis – Economic Status vs Top Ranked Indicators

- Economic status vs. indicators of environmental effectiveness
  - Top ranked indicators show no association with economic status and these are independent.
  - 2nd and 3rd ranked indicators shows association. So the ranking is linked or dependent on eco status. This includes indicator of food self-sufficiency and access to food
- Economic status vs. indicators of social effectiveness
  - All top 5 ranked indicators independent so no association
- Economic Status vs. indicators of economic effectiveness
  - All top 5 ranked independent so no association

Statistical Analysis – Practice group vs top ranked indicators

	Practice vs. Indicators of Environmental effectiveness (Increased water availability	Practice vs. Indicators of Social effectiveness (Percentage of income spent on health care (Increase in assets)	Practice vs. Indicators of Economic effectiveness)
Pearson chi-square	12.030	2.747	0.864
df	7	6	5
P value	.100	0.840	0.973
N Value	193	194	193

All values significant so no association found between practice group and ranking of indicators

Identification of Win-Win Adaptation Options through Adaptation Metrics and Integrated Adaptation Decision Making Frameworks

IGES-BCAS-ICIMOD-TERI Project Partners

Golam Rabbani, Research Fellow and
Syeda Sajeda Haider, Senior Research Officer
Bangladesh Centre for Advanced Studies (BCAS)

IGES Project Team Members:

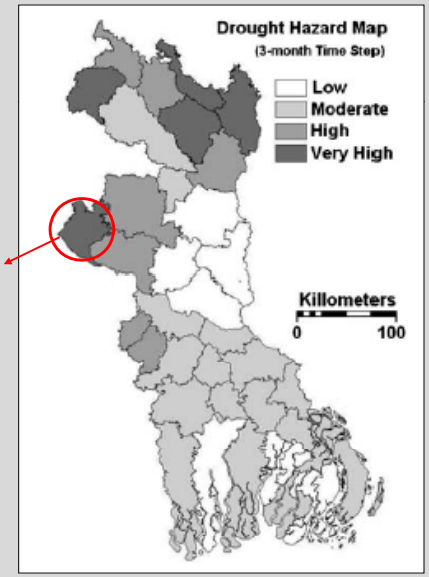
Golam Rabbani, Research Fellow
Syeda Sajeda Haider, Senior Research Officer
Tajul Islam, Senior Research Officer
Mahmud Hasan Tuhin, Research Officer
Ariful Islam, (Statistical Analyst)

Special thanks to **SVRK Prabhakar,** IGES for constant support and input!

Outline:

- Project area
- Background of the project area
- Drought impacts
- Adaptation options
- Indicators vs Gender
- Indicators vs Economic status
- Indicators vs Practice
- Way forward

Project site in Bangladesh



Chapai Nawabganj District

Picture: District level drought hazard maps at 3 months time steps

Source: Shahid et al. 2008

Detail about the site

District/Zila: Chapai Nawabganj
Sub-district/Upazila: Nachole
Unions: 1) Nachole, 2) Kasba
Villages: Shibpur, 2) Maktapur
3) Shabdalpur, 4) Shonaichondi

Total agricultural land: 28368 ha.
Permanent fallow land: 1202 ha.
Temporary fallow land: 10 ha
Crop intensity: 212.67%
Number of deep tubewell: 545
Number of shallow tubewell: 70
Number of power pump: 612

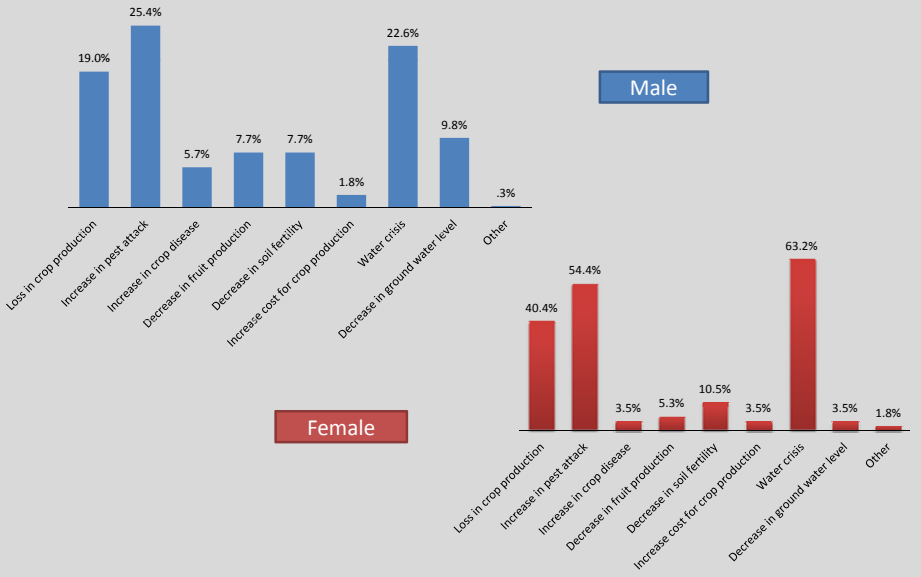
Background of Nachole Upazila

- There are 4 unions (lowest administrative level) in Nachole upazila with 197 villages. Population is 1,32,308 and density of population is 534.
- 80% of the population is farmer. Main cultivated crop rice. Other then rice wheat, maze, Sugarcane, mango etc. are also cultivated.
- Average rainfall is approx 2,044 mm. The rainfall is also very much seasonal, almost 77% of rainfall occurs during monsoon.
- According to the community, drought characteristics have been changed over time (e.g. Temperature has been increased, rainfall has been decreased, winter has become intense)
- Most of the water-bodies dry up during the dry season making people completely dependent on groundwater. This lead to an increase in abstraction rate of groundwater. According to community, in last 6 years the groundwater level has decreased about 15ft.

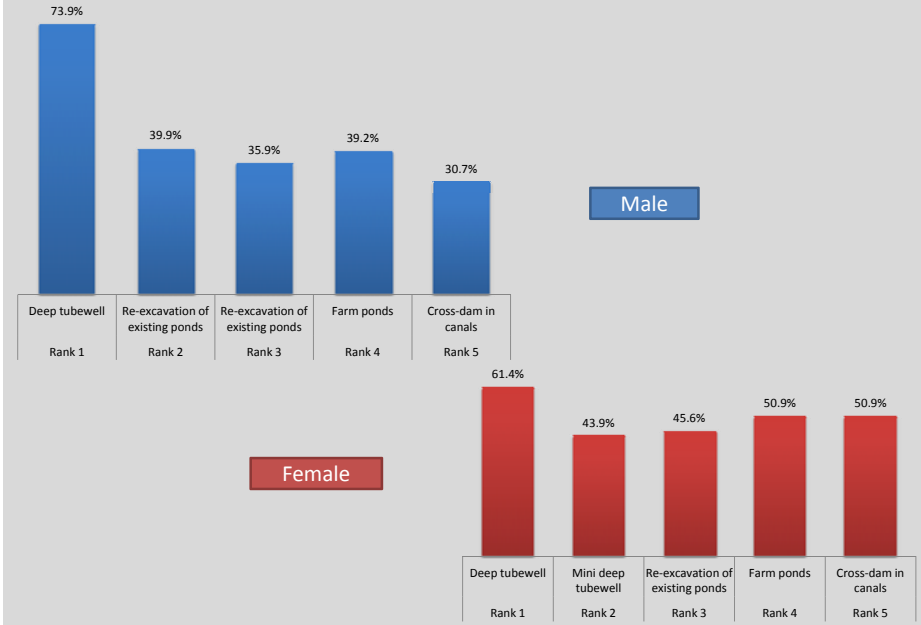
Survey Findings

- Adaptation Impacts & Options
- Comparison of Indicators with Gender, Economic status and Practice

Impact of climate change on crop agriculture sector



Five Infrastructure related Adaptation Options



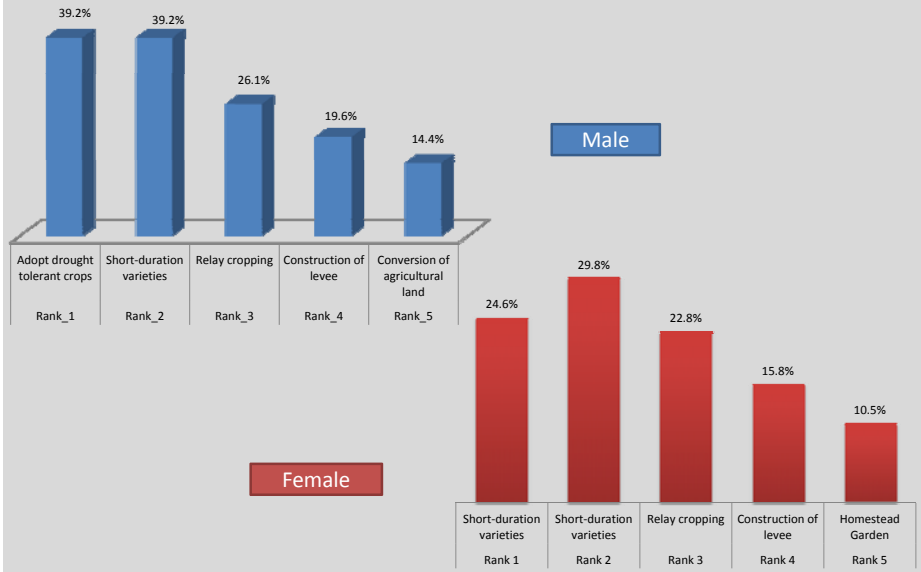
Dried up pond bed

Dried up mini pond

Cross dam

Deep tubewell

Five Management related Adaptation Options



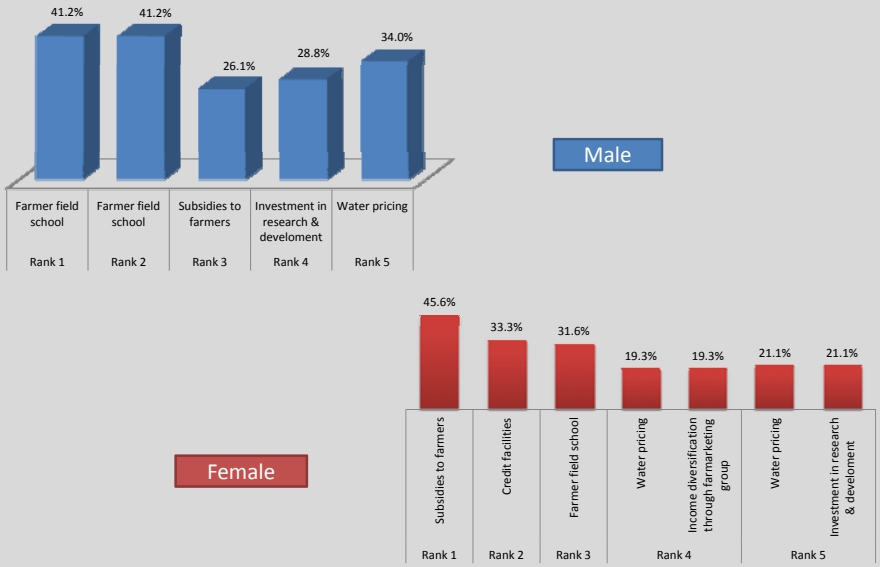
Stress tolerant rice cultivation

Construction of levee

Agro-forestry

Conversion of agri land to mango garden

Five Policy related Adaptation Options



Card for deep tubewell water (Water pricing)

Farmer field school

Recommendations (from the community)

- Cultivate drought tolerant, short term and less water demanding crop varieties.
- Re-excavation of existing government ponds, construction of new big pond and ensure their open excess to public.
- Installment of more deep tubewells by Govt.
- Construction of canal from adjacent rivers like Mohanandra for irrigation.
- Cross dam in canals.
- Improved weather forecast and early warning.
- Irrigation management.
- More research on drought hazard, drought monitoring etc.
- Access to Credit/Agricultural subsidies/Crop Insurance.
- Removal of middlemen domination in the market and ensure direct excess of farmers to the market.
- Timely and unbiased agricultural marketing information for a fair price.
- Govt. control over the price of agricultural input.

Indicators vs Gender

A 'chi-square test of independence' was performed to examine the relation between indicators and gender.

(1) Environmental Indicators

Gender sensitive:

Ranking of the indicators:
- Period of fresh water availability and
- Net primary production

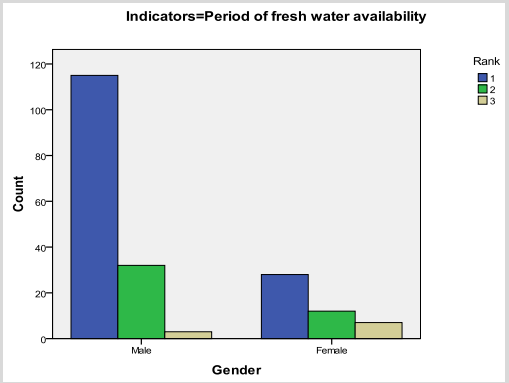
differs significantly by gender.

Gender not sensitive:

Ranking of rest of the three indicators:
- Change in ground water level,
- % of farms that have concerns related to soil erosion, and
- Nutrient balance in soil and water system

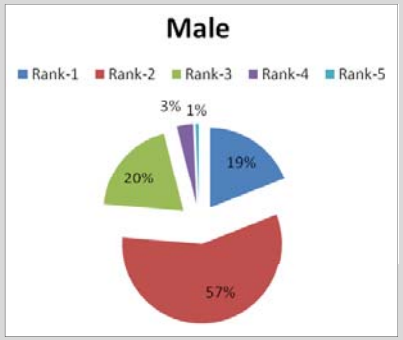
do not differ significantly by gender.

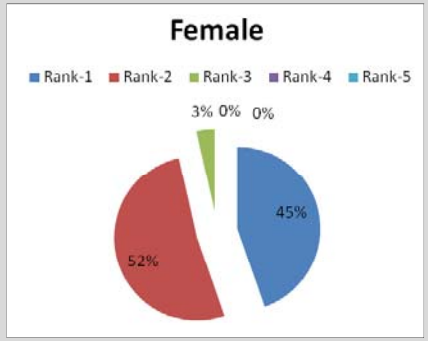
Example 1: Gender differentiated ranking



Period of fresh water availability differs significantly by gender (n=197, p= 0.0012, chi-sq= 13.44, df=2)

Example 2: Gender differentiated ranking





Net primary production (n=208, p= 0.0006, chi-sq=19.68, df=4) differs significantly by gender

(2) Social Indicators

Gender sensitive:

Ranking of the indicators:
- **Calorie intake per person**
- **% of households having access to safe drinking water**, and
- **Asset ownership among women and men or Gender equity**

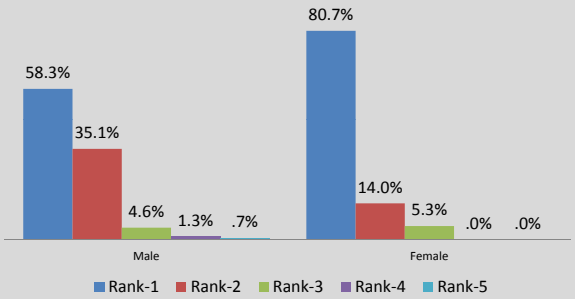
differs significantly by gender.

Gender not sensitive:

Ranking of rest of the three indicators:
- **Employment rate,**
- **Social capital,** and
- **% of households having access to markets**

do not differ significantly by gender.

Example:

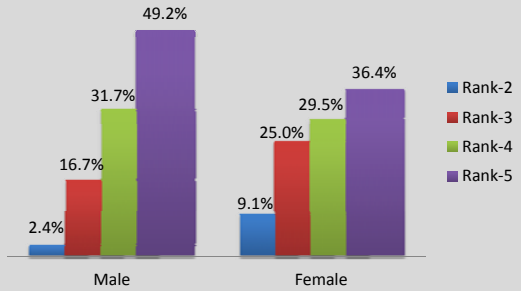


Gender sensitive:

Calorie intake per person (n=208, p=0.031, chi-sq=10.657, df=4) differs significantly by gender

Gender not sensitive:

Social capital does not differ significantly by gender



(3) Economic Indicators

Ranking of none of the economic indicators:

- Crop yield and yield variability,
- Market price of commodities,
- Market price of agro inputs,
- Damage per household/farms due to extreme events,
- Number of jobs created

differ significantly by gender.

Indicators vs Economic status

(2) Social Indicators

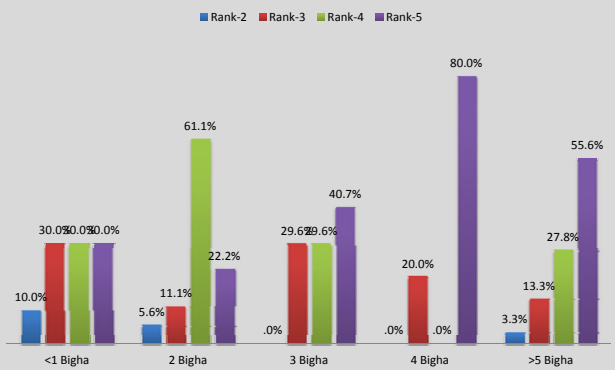
Social capital (n=170, p=0.021, chi-sq=23.948, df=12) differ significantly by economic status.

(3) Economic indicators

Number of jobs created (n=204, p=0.018, chi-sq=30.004, df=16) differ significantly by economic status.

Differentiated by economic status:

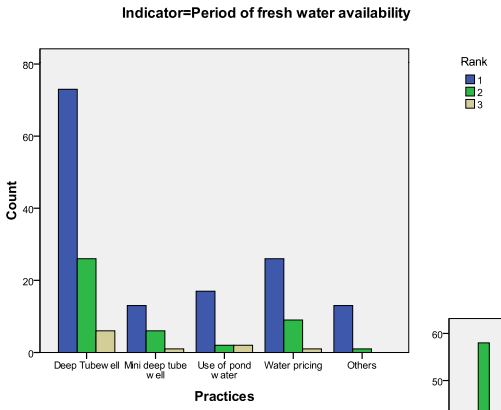
Social capital (n=170, p=0.021, chi-sq=23.948, df=12) differs significantly by economic status



Indicators vs Practices

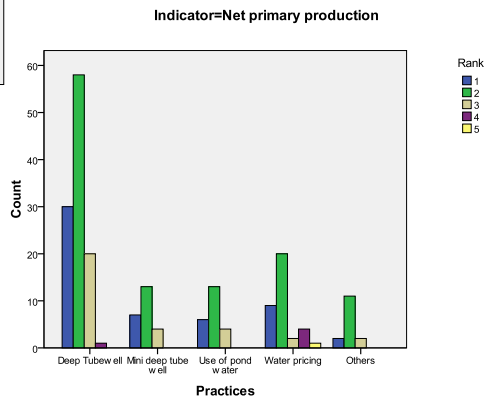
(1) Environmental Indicators

Ranking of all the environmental indicators except Period of fresh water availability, and Net primary production differ significantly by practice.



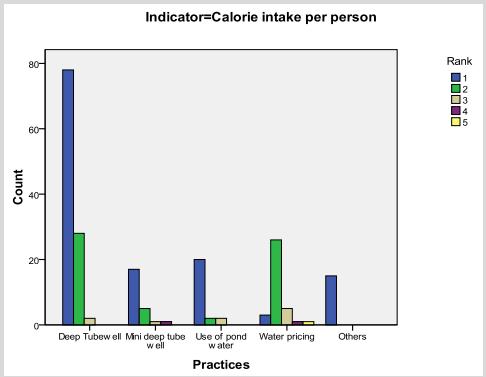
Example: Practice not sensitive

Ranking of the indicators:
Period of fresh water availability, and
Net primary production
does not differ significantly by practice.



(2) Social Indicators: Ranking of all the five social indicators differ significantly by practice.

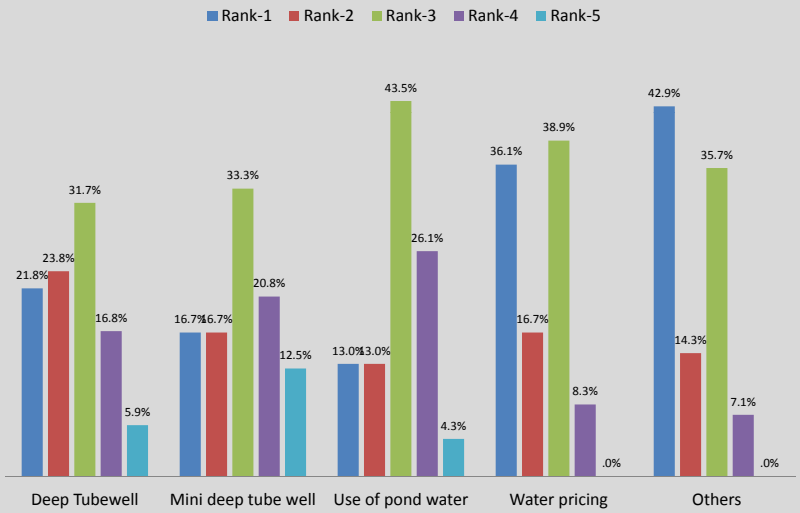
Example: Practice differentiated indicator



Calorie intake per person (n=207, p=0.00, chi-sq=73.940, df=16) differs significantly by practice

(3) Economic Indicators

Except Market price of agro inputs (n=198, p=0.319, chi-sq=18.092, df=16) ranking of all the economic indicators (Crop yield and yield variability, Market price of commodities, Damage per household/farms due to extreme events, and Number of jobs created) differ significantly by practice.



Market price of agro inputs does not differ significantly by practice type

Study Implications

- **Association between indicators and gender, practices, economic status:**
  - The practitioners need to consider these factors while prioritizing practices and identifying indicators for M&E.
- **Quantifying indicators:**
  - Presence of several indicators could pose resource burden on project managers. There is a need to further narrow down these indicators?
  - Availability of published data, time intervals in which these data are available etc could pose difficulty in quantifying effectiveness.

Way Forward: Moving from here

- **What we plan to do:**
  - **Quantifying indicators and integrating them into Local Adaptation Index (In progress).**
  - **Sharing and validation by community:** conduct a feedback session with local farmers and agriculture workers to inform them about the project outcomes.
- **What more can be done:**
  - **Institutional support:** Can the current institutional system effectively use these indicators for M&E?
  - **Demonstration/pilot projects?** to validate prioritized practices in other areas.

Pictures of Focus Group Discussions (FGDs)

Pictures of questionnaire survey


Thank You !

Study Implications

- No association found between gender and practice group with ranking of indicators for effectiveness of adaptation options
- In some cases, association found between economic status and ranking of indicators so this might be considered while prioritizing practices and indicators.

Data Collection for LaIn

- Need to have lesser number of indicators avoiding overlapping ones
- Getting data from different types of sources might bring difficulty in quantifying indicators
- Indicators should be simple and not complicated

Way Forward

- In depth data analysis
- Calculation of LaIn values
- Feedback session

Thank You