Farmers Vulnerability to Flood and Adapted Mitigation Strategy: A Critical Analysis

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ABSTRACT

Disaster is a combination of hazard and vulnerability. Vulnerability is the inability of individuals or social groups to cope up with or adapt to disaster induced stresses placed on their livelihood and well-being. The study was conducted in Kurnool district of Andhra Pradesh. Considering various individual (attitude, knowledge and skills), and social (interconnectedness and cohesiveness) dimensions an index was developed to measure the vulnerability of sample respondents. Results showed that fifty per cent of respondents are moderately vulnerable, about thirty per cent are less vulnerable and about twenty per cent are highly vulnerable to floods. As majority of respondents are vulnerable, long term measures, capacity building and training of farmers should be emphasized for better preparedness and mitigation of floods.

Key Words: *Floods; Vulnerability; Mitigation strategy;*

A disaster is a result from the combination of hazard, vulnerability and insufficient capacity or measures to reduce the potential chances of risk. A disaster happens when a hazard impacts on the vulnerable population and causes damage, casualties and disruption. Any hazard - flood, earthquake or cyclone which is a triggering event along with greater vulnerability (inadequate access to resources, sick and old people, lack of awareness etc) would lead to disaster causing greater loss to life and property. For example; an earthquake in an uninhabited desert cannot be considered as a disaster, no matter how strong the intensities produced. An earthquake is disastrous only when it affects people, their properties and activities. Thus, disaster occurs only when hazards and vulnerability meet.

The term vulnerability has its origin in the natural hazards and food security literature. It is derived from a Latin word vulnerable (to be wounded) and describes the potential to be wounded physically and / or psychologically. However, the term is viewed beyond just getting injured or killed by a hazard, envisaging the livelihood pattern and impacts of hazards.

Blaikie (1994) describes vulnerability as the characteristics of a person or a group to anticipate, cope, resist and recover from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someone's life and livelihood is put at risk by a discrete or identifiable event in nature or in society. While for *Chambers (1989)*, vulnerability represents the ability or not to modify the impacts of disaster and the means to cushion risks. On a national level, vulnerability manifests itself in poorer countries due to lack of resources and capacity to respond. At the community level class, caste, gender, ethnicity, age, level of education and access to resources all determine vulnerability (*Blaike1994, IPCC 2001*). The Inter Governmental Panel on Climate Change (IPCC) Second Report mentioned that the vulnerability of a system increases as the adaptive capacity decreases, highlighting an inverse relationship with each other. Drawing from above relationship vulnerability assessment needs to include the indicators of adaptive capacity like technology, knowledge, wealth, and socio-economic attributes. The IPCC Working Group II, Third Assessment report defines adaptive capacity as a function of factors related to wealth, technology, education, information, skills, infrastructure, access to resources, and stability and management capabilities (*IPCC, 2001*). Many studies have considered the

determinants of adaptive capacity as indicators for vulnerability assessment. Combining all these variables, the study aimed to examine the farmers' vulnerability to floods and also to study the mitigation mechanisms adapted by the farmers to cope with floods.

METHODOLOGY

The study was conducted in Kurnool district of Andhra Pradesh with an objective to examine the farmers' vulnerability to floods and mitigation strategy adapted by them. Four flood affected mandals were selected randomly and two villages from each mandal were randomly selected. Ten farmers were chosen at random from each village thus constituting a total sample of eighty respondents. Data were collected through interview method with the help of a structured schedule.

For the purpose of the study, vulnerability was operationally defined as the inability of individuals or social groups to cope up with or adapt to disaster induced stresses placed on their livelihood and well-being.

Considering the various dimensions of individual (attitudinal, knowledge and skills), social (interconnectedness and cohesiveness), availability of physical resources and other livelihood support systems; an attempt was made to develop an index to measure vulnerability of sample respondents. Drawing from the approaches of *TERI (2003)* and *UNDP (2002)*, a composite vulnerability index was worked out and respondents were grouped under the categories of highly vulnerable, moderately vulnerable and less-vulnerable. For each component of vulnerability (awareness about disaster management, attitude towards disasters and their management, possession of knowledge and skills about mitigation mechanisms, social cohesiveness, and value orientation like fatalism and egalitarianism, sub-indices were worked out. The values of each indicator were normalized to the range of values in the data set by applying the following formula

$$\text{Index value} = \frac{\text{Actual value - Mini. value}}{\text{Max. value - Mini.value}}$$

For the indicator with negative connotation, index value was reversed (1 - index value). The overall index was formed from weighted average of the sub-indices, with weights derived from theoretical understanding. The aggregated figure ranged from 0 to 1, where 0 signified highest level of vulnerability. The respective weights for sub-indices were drawn from literature and experts' opinion. The overall equation for the model employed for the study was:

$$VI = \sum_{i-1}^{n} \left(I_i * W_i \right)$$

where, Ii = Sub-index

Wi = Weights of the sub-index and

n= No.of parameters =7 (Awareness, Attitude, Fatalism Egalitarianism, Knowledge, Skills and Social cohesiveness)

VI= I_1* 17.6 + I_2*8.45 + I_3*7.75 + I_4* 6.34+ I_5* 23.94 + I_6* 23.24+ I_7*12.67

I_1: Awareness

I_2: Attitude

I_3: Fatalism

I_4: Egalitarianism

I_5: Knowledge of mitigation mechanisms

I_6: Skills in adaptation practices

I_7: Social cohesiveness

RESULTS AND DISCUSSION

Attitude towards disasters and their management: Ninety per cent of the respondents expressed agreement with the statement that it was the duty of government to take steps for preventing or handling any disaster, while about only one-third (36.25%) showed agreement with the statement that the community had a larger role than Government in taking initiatives for effective management of disasters. However, their agreement with the statement that we should not run after gains at the cost of nature, rather should strive to restore its damaged majesty, with a mean score of 3.71, gives some ray of hope among the people to mend their ways for ecological redressal. Agreement by nearly 67 per cent of the respondents with the statement that there was nothing that I can do personally for preventing or managing disasters, reflects the helplessness orientation among people of the area.

The findings reveal that predisposition of the respondents are mixed. Because of belief system and personality orientation they showed attitude of dependency on external source for management of problem. Attitude for self-initiated adoption behaviour could not be deduced from the result. Hence, it is imperative to provide motivational, attitudinal and infrastructural support to the people in order to develop their capabilities for village-centric adaptive mechanisms and measures.

Value orientation:

Fatalism **:** Fatalism refers to belief in fate. Generally due lack of education people believe in fatalism, thereby

Table 1. Distribution of respondents according to their attitude towards disasters and their management *(N=80)*

S.No	Statement	SA	A	UD	D	SD	Mean
1.	The environmental crisis is an outward manifestation of the crisis of mind and spirit.	5 (6.25)	49 (61.25)	3 (3.75)	23 (28.75)	0 -	3.45
2.	We should not run after gains at the cost of nature, rather should strive to restore its damaged majesty.	9 (11.25)	55 (68.75)	0 -	16 (20.00)	0 -	3.71
3.	The community has a larger role than Government in taking initiatives for effective management of disasters	7 (8.75)	22 (27.5)	0 -	48 (60.00)	3 (3.75)	2.77
4.	All farmers should deploy sustainable practices for maintaining ecological balance.	18 (22.5)	48 (60)	0 -	14 (17.50)	0 0	3.87
5.	Occurrence of floods is erratic and is beyond control hence there is little scope for human intervention.	22 (27.5)	45 (56.25)	0 -	13 (16.25)	0 -	3.95
6.	The environment is a low priority for me as compared to livelihood and other things in my life.	3 (3.75)	41 (51.25)	0 -	36 (45.00)	0 -	3.14
7.	There is nothing that I can do personally for preventing or managing disasters.	22 (27.5)	32 (40.00)	0 -	19 (23.75)	7 (8.75)	3.54
8.	It is the duty of the Government to take steps for preventing or handling any disaster.	32 (40.00)	40 (50.00)	0 0	8 (10.00)	0 -	4.2

SA: Strongly Agree, A: Agree, UD: Undecided, D: Disagree and SD: Strongly Disagree.
Figures in parentheses indicate percentage

attributing the process and outcome of an yevent to fate. Fatalism was measured on a five-point continuum and subjects were asked to express their agreement and disagreement with a set of five statements drawn from the modified scale of (*Leiserowitz, 2006*).

For about 59 per cent of the respondents, the future is too uncertain for a person to make serious plans and about 58 per cent believed that there is no use worrying about public affairs and they could not do anything about them anyway (Table 2). For about 54 per cent of the respondents it didn't make much difference if people elect one or another political candidate, for nothing would change. 50 per cent of them agreed that they had very little control over their life. About 48 per cent felt that life is like a lottery. 35 per cent of the respondents felt that they are better off if they do not trust anyone.

Affirmation with these statements by a majority reveals prevalence of value of fatalism among the

Table 2. Distribution of respondents according to value of fatalism N=80)

S.No	Statement	SA	A	UD	D	SD	Mean
1	The future is too uncertain for a person to make serious plans.	18 (22.5)	29 (36.25)	4 (5)	21 (26.25)	8 (10)	3.35
2	It doesn't make much difference if people elect one or another political candidate, for nothing will change.	11 (13.75)	32 (40)	0 0	28 (35)	9 (11.25)	3.1
3	I feel that life is like a lottery.	15 (18.75)	23 (28.75)	3 (3.75)	31 (38.75)	8 (10)	3.07
4	A person is better off if he or she does not trust anyone.	7 (8.75)	21 (26.25)	6 (7.5)	21 (26.25)	25 (31.25)	2.55
5	I have very little control over my life.	3 (3.75)	37 (46.25)	0 -	30 (37.5)	10 (12.5)	2.91
6	It is no use worrying about public affairs; I cannot do anything about them anyway.	18 (22.5)	28 (35)	2 (2.5)	24 (30)	8 (10)	3.3

SA: Strongly Agree, A: Agree, UD: Undecided, D: Disagree and SD: Strongly Disagree.
Figures in parentheses indicate percentage

Table 3. Distribution of respondents according to their value of egalitarianism (N=80)

S.No	Statement	SA	A	UD	D	SD	Mean
1.	What this world needs is a more equal distribution of wealth.	19 (23.75)	58 (72.5)	0 -	3 (3.75)	0 -	4.16
2.	I support govt's effort to get rid of poverty.	14 (17.5)	46 (57.5)	0 -	19 (23.75)	1 (1.25)	3.66
3.	I support affirmative action.	24 (30.0)	52 (65.0)	4 (5.0)	0 -	0 -	4.25
4.	Firms and Institutions should be so organized that everybody can influence important decisions.	18 (22.5)	59 (73.75)	0 -	3 (3.75)	0 -	4.15
5.	If people were treated more equally we would have fewer problems.	19 (23.75)	58 (72.5)	0 -	3 (3.75)	0 -	4.16
6.	The world would be a more peaceful place if its wealth were divided more equally among nations.	28 (35.0)	48 (60.0)	0 -	4 (5.00)	0 -	4.25
7.	We have gone too far in pushing equal rights.	0 -	25 (31.25)	0 -	52 (65.0)	3 (3.75)	2.59

SA: Strongly Agree, A: Agree, UD: Undecided, D: Disagree and SD: Strongly Disagree
Figures in parentheses indicate percentage

people. Such values only retard the development process. Hence, it is essential to bring about change in value orientation of people in order to pave the way for progressiveness. People should be motivated and trained to take initiatives and have control over the processes and outcomes.

Egalitarianism: Egalitarianism refers to value orientation to equality. Measured on five-point continuum with modified scale of (*Leiserowitz, 2006*) the obtained mean values of more than 4 for most of the statements amply indicate the affirmation of the majority of the respondents about egalitarianism. Similarly for the statement with negative connotation with respect to egalitarianism- "We have gone too far in pushing equal rights the mean score was 2.59 indicating that a majority showed disagreement with it.

Hence, it is deduced that a large majority of the respondents held value of equality. Such positive value in a society is highly appreciating as it facilitates equal accessibility and distribution of common goods among people. In times of crisis such value orientation will embolden the efforts and approach of people in making adaptation and mitigation of adversities related to disasters.

Social cohesiveness : Social cohesiveness among the individuals was studied with information related to inhabitancy pattern, kinship ties pattern and interdependence pattern.

A majority of them (58.75%) were original inhabitants and 32.5 per cent were old time immigrants, which demonstrate strong linkage with the region (Table 4). Similarly kinship ties for majority of them (82.5%) were local, which further strengthened the bonding in the household networks. Healthy interdependence was observed in the village as reflected by reciprocity in labour exchange and leasing of land. Cohesiveness among the respondents and system is reflected from the findings.

Table 4. Distribution of respondents according to their cohesiveness (N=80)

Factors	Nature of association	No.	%
Link with the region	Original inhabitant	47	58.75
	Old time immigrant	26	32.5
	Recent immigrant	7	8.75
Kinship ties in the region	Mostly local	66	82.5
	Distant	14	17.5
Interdependence in the village	Labour exchange	36	45.0
	Food exchange	8	10.0
	Service provision	15	18.75
	Leasing of land	21	26.25
	Cooperative farming	0	0

However, for promoting collective and participatory interventions for mitigation it is essential to strengthen their networks and develop groups and associations in the area. Such collectives provide stability in the community and helps in better adjustment and adaptation in times of crisis.

Level of dependence : The nature and extent of dependence of the respondents on natural and social capital was studied (Table 5). It was observed that generally there was dependence to a greater extent on the resources for livelihood as drawn from the mean

Table 5. Distribution of respondents on the basis of level of dependence (N=80)

Resources	Level of dependence Fully dependent	To a greater extent	To a lesser extent	Not dependent	Mean
Cultivable land	38 (47.5)	26 (32.50)	16 (20)	0	3.27
Community land	0	3 (3.75)	11 (13.75)	66 (82.50)	1.21
Forest	0	0	0	0	0
River/ Canal	19 (23.75)	37 (46.25)	24 (30.00)	0	2.94
Neighbourhood	0	29 (36.25)	51 (63.75)	0	2.36
Village institutions	0	31 (38.75)	49 (61.25)	0	2.39

scores above 2. A majority of respondents (47.5%) were fully dependent and 32.5 per cent were dependent on a larger extent upon land for livelihood. About 24 per cent of the respondents were fully dependent and about 46 per cent were dependent to a greater extent on river or canal for irrigation. All respondents had dependence upon neighborhood and village institutions. Hence, people need to be educated towards judicious use of natural resources for sustainability. Also they need to be sensitized for building up social capital with networking, reciprocity and linkage for better cohesiveness and collective action for collective preparedness and adaptation to crises emerging from disasters.

Table 6. Distribution of respondents according to their knowledge about mitigation mechanisms (N=80)

S. No.	Mitigation mechanism	Possessed No.	%
1	Shifting to safe places	50	62.5
2	Receiving temporary relief materials (food, water, clothes etc)	57	71.25
3	Health and sanitation measures	43	53.75
4	Disposal of carcass	33	41.25
5	Saving the seed	34	42.5
6	Storing the food grains and fuel	37	46.25
7	Input, seed supply	38	47.5
8	Mixed farming	13	16.25
9	Adjusting cropping pattern	39	48.75
10	Crop insurance	31	38.75
11	Shifting the cattle to safe places	35	43.75
12	Storing fodder	24	30
13	Cattle insurance	23	28.75
14	Building insurance	17	21.25
15	Monetary compensation	73	91.25
16	Soil reclamation and desilting of fields	31	38.75
17	Forming check bunds and rock dams	16	20
18	Planting trees on bunds	13	16.25
19	Construction of infiltration conduits	3	3.75
	Mean	32.1	40.13

Knowledge of mitigation mechanisms possessed by the respondents : Mitigation mechanism is the ability of an individual to cope up with the disaster situation to reduce their effects. Under the circumstances of increased frequency and intensity of floods, farmers need to possess knowledge about mitigation mechanisms for better preparedness and adaptation. It was observed that majority of farmers knew about immediate measures taken during occurrence of floods like, shifting to safer places, temporary relief, monetary compensation etc (Table 6). However, a majority of them lacked the knowledge of preparedness activities to cope with or mitigate the adverse effects of floods like crop insurance, mixed farming, forming check bunds, construction of infiltration conduits, soil reclamation etc. Hence, it is imperative to devise suitable interventions like awareness campaigns, training etc., for updating their knowledge base on preparedness activities to facilitate better mitigation.

Areas of skill or training needed : The training needs of the respondents were assessed on three point continuum of most needed, somewhat needed and not needed with the respective weightage of 3, 2 and 1. Most of the training need areas identified obtained a mean score above 2, signifying that the training needs in the identified areas were most needed by majority of the respondents (Table 7). Based upon the mean training need score, it can be observed in the table that soil reclamation measures, organic farming, Integrated Nutrient Management (INM), and Integrated Pest Management (IPM), were identified as the most important areas of training for enhancing mitigation knowledge and skills. Training areas which cover soil conservation practices, organic farming, INM appear to be appropriate for enhancing the adaptive capacity of the respondents who are primarily the farmers.

Table 7. Distribution of respondents according to their training need (N=80)

Areas of training need	Most Needed	Somewhat Needed	Not Needed	Mean
IPM	45(56.25)	24(30.00)	11(13.75)	2.42
INM	49(61.25)	28(35.00)	3(3.75)	2.57
Entrepreneurship	32(40.00)	7(8.75)	41(51.25)	1.89
Minor irrigation	41(51.25)	30(37.50)	9(11.25)	2.4
Post harvest technology	34(42.50)	21(26.25)	25(31.25)	2.11
Sustainable farm management	27(33.75)	18(22.5)	35(43.75)	1.9
Soil reclamation measures	57(71.25)	17(21.25)	6(7.50)	2.64
Community disaster management	21(26.25)	30(37.50)	29(36.25)	1.9
Organic farming	52(65.00)	26(32.50)	2(2.50)	2.62

Table 8. Distribution of the farmers according to their level of vulnerability (N=80)

Vulnerability Index Intervals	No.	%
Highly Vulnerable (<0.49)	17	21.25
Moderately Vulnerable (0.49-0.61)	40	50
Less Vulnerable (>0.61)	23	28.75

Vulnerability: It is evident from the Table 8 that a majority of the respondents (50 %) were in moderately vulnerable group followed by about 21 per cent in highly vulnerable group, while about 29 per cent were in less vulnerable group. Lack of awareness, knowledge and skill about mitigation measures and having very high training needs in various areas of mitigation could be the factors for their vulnerability. Adequate training programmes in areas of preparedness and mitigation need to be organized besides launch of social protection measures to empower them for better preparedness and adaptation to floods.

CONCLUSION

Majority of the farmers in the area are vulnerable to floods. Vulnerability may be due to lack of awareness, knowledge and skill in coping mechanisms. Hence for developing mitigation strategy the emphasis must be laid upon socio-psychological empowerment of farmers through motivational, attitudinal and infrastructural support in order to develop their capabilities for better and community-centric adaptive mechanisms besides developing competencies in acquiring knowledge and skills related to mitigation practices.

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