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Socio-economic analysis of awareness and perception of climate change by the rice farmers in vulnerable regions of Odisha

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ABSTRACT

Public risk perception indicates the way people respond to the hazards including climate catastrophes. Public opinion largely shapes the policy formulations by the governments. The present study was conducted in Ganjam district of Odisha to gauze the awareness and perception of farmers regarding climate change which is already manifesting itself in the region. The study indicated that reasonably good percentage (65.17%) of farmers heard the term 'climate change'. However, they hardly understand the proper meaning of climate change. Around 41% of the farmers didn't have any idea about what causes climate change. However, farmers had unanimous feeling that the climate is changing. They perceived that intensities of day and night temperature, rainfall, humidity, cold and heat waves and frequency of cyclones has changed over the years. Majority of the farmers experienced that the cropping season and sowing time had been delayed because of late onset of monsoon. Farmers may be encouraged to rear livestock as a measure of occupation diversification to lessen the risk in times of climatic adversity. It is required to organize awareness camps for educating the farmers and general mass about the seriousness of threat level of climate change and the mitigation/adaptation options. Extension functionaries should impress upon the farmers to have more social participation.

Key words: *socio-economics, climate change, perception, rice farmer*

Agriculture is vulnerable to climate change to a greater extent. Research conducted over the last decade by the Intergovernmental Panel on Climate Change (IPCC) indicates an increase in the average global temperature by about 0.6^0C since the industrial revolution. It estimated that by 2100, average temperatures will increase by between 1.4 to 5.8°C mainly as a result of an increase in concentration of Green House Gases (GHGs) in the atmosphere (Hussain and Mudasser, 2007). Similarly, all India mean annual temperature has increased by 0.5 ^{0}C during 1901 – 2003 (Dash and Hunt, 2007). Populations in the developing world, which are already vulnerable and food insecure, are likely to be the most seriously affected due to this climate catastrophe. In developing countries, climate change may cause yield declines for most of the important crops. South Asia will be particularly hard hit as agriculture provides a source of employment for more than 60 percent of the population and contributes significantly to the gross domestic product. Research shows that India is among the most vulnerable countries in the world (Moss *et al.*, 2001; Brenkert and Malone, 2005) and Odisha is one of the most vulnerable states of India (Brenkert and Malone, 2005).

Agricultural production remains the main source of livelihoods for most rural communities in India and Odisha in particular. Climate change will have a greater negative impact on poorer farm households as they have the lowest adaptive capacity to changing climatic conditions. Social scientists have found that public risk perceptions strongly influence the way people respond to hazards. What the public perceives

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as a risk, why they perceive it that way, and how they will subsequently behave are thus vital questions for policy makers attempting to address global climate change, in which the effects are prolonged. Climate change are beyond the control of any one group, have inequitable distributions of costs and benefits. In this situation, public support for or opposition to proposed climate policies will be greatly influenced by the perceived risks of global warming (Bord *et al*, 1998). Public opinion is also critical because it is a key component of the socio-political context within which policy makers operate. According to Leiserowitz (2008) public opinion can fundamentally compel or constrain political, economic and social action to address particular risks. He further argued that, successful mitigation or adaptation to global warming will require changes in the behavior of billions of human beings, who each day make individual choices that collectively have enormous impacts on the Earth's climate. Such knowledge can allow policy makers to design mitigation and adaptation strategies for climate change. Very little information about public opinion or behavior regarding climate change is available. This paper summarizes rice farmers' perception, opinion and understanding of climate change/global warming in the Odisha, one of the most vulnerable states of India.

MATERIALS AND METHOD

The study was conducted in Ganjam district of Odisha. Both primary and secondary data were collected for the investigation. Stratified random sampling method was adopted to collect primary data. Initially two clusters in two different blocks having greater vulnerability towards extreme climate like submergence and flash flood were selected. Cluster I falls under Purusottampur block alone and cluster II covers part of Khallikote and part of Purusottampur block.

Subsequently, eight villages were selected randomly under these two clusters. Further, based on participatory rural appraisal, discussions with village committee members, NGOs and interest of the farmer for carrying out agricultural activities, 500 beneficiaries were selected for the project. Out of the selected beneficiaries, 101 farm families were surveyed and primary data were obtained by one to one interview with the farmers during 2011 (Table 1).

RESULTS AND DISCUSSION

Out of the total geographical area of 0.82 million hectare, the total area under cultivation in the district is 0.40 million hectare which is 47% of total area. Agriculture sector predominantly occupies the important place in Ganjam district as a major source of income and employment opportunity. The district is important producer of the crops like paddy, groundnut, black gram, pigeon pea, sugarcane, cotton and vegetables. Irrigation facility is available for 2.51 hectare in wet season and 0.45 lakh hectors in dry seasons. However, the agriculture is at the vagaries of Monsoon and dry-land farming technology is absent among farmers. Inputs like quality seeds, fertilizer and bio- fertilizer, pesticides, etc are not available in sufficient quantity and particularly at the time of need. The district has scope to achieve higher level of production and productivity with increase in irrigation facilities, diversification and improved technologies.

Table 1. Details of the number of villages/population/ beneficiary/respondents in the study area.

Cluster/village	Total no. of families	No. of beneficiary families	No. of families surveyed
Cluster I	Purusottampur		
Pratapur	601	90	18
Hindolopalli	74	30	7
Mendhapalli	69	45	9
Gothiali	233	85	17
Belua & B. Badagaon	355	100	20
Cluster II	Khallikote & Purusottampur		
Balia	348	50	10
Badarampalli	631	50	10
Komoda	331	50	10
Total	2642	500	101

Area-wise Badarampalli is the largest and Hindolopalli is the smallest village among the lot. Though Mendhapalli has lowest net sown area, irrigated area as a percentage of net sown area is highest (about 96%) in this village. Balia and Komado have largest area under forestry and community land, respectively. The major cropping system of the cluster villages are Rice – Green gram and Rice – Black gram. Rice is being cultivated only in wet season, mostly direct seeded and

broadcasted in the month of June/July. The popular rice varieties in the area were Swarna, Pooja and Mashuri. Other varieties like Lalat, HMT Sona, Sonali, Shyama, Krishna, Patri Jagannath, Lal Jagannath, Pratiskhya and Samulia were also prevalent. The average applied dose of NPK was 38:19:9 kg ha^{-1}. The yield of different varieties varied from 2.35 to 3.04 t ha^{-1} with an average yield of 2.82 t ha^{-1}. However, in dry season farmers grew green gram/black gram as broadcasted / pyracropping without application of fertilizers. The yield achieved by the farmers was around 0.25 t ha^{-1}. The major horticultural crops grown by the farmers were chilli, brinjal and tomato. The farmers also grew potato, cabbage, cauliflower, cowpea and beans, however, the area under these vegetables were negligible.

Almost 90% of the selected households were from schedule caste and other backward caste categories. Analysis of age-wise and education-wise data of the respondents indicated that the average age of the household head was 48 years and the respondents had less than 5 years of schooling. About 43% of the respondents were from APL family and rests are from BPL family. The average family size of the households was about 6 constituting 4 adults and 2 children per family.

Table 2. Household characteristics of the study area

Particulars	Unit	Value
General caste	% of sample	10.11
Other backward caste	% of sample	44.94
Scheduled caste	% of sample	44.94
Average age of respondents	Years	48.11
Years of schooling	Years	4.62
Above poverty line	% of sample	42.70
Below poverty line	% of sample	57.30
Family size	Numbers	5.56

Farming was the primary occupation to about 99% households and pension /service was the only other primary occupation. Among the secondary occupational options, labour wage, business and service were the major ones (Table 3).

Land holding pattern analysis shows that the total cultivated area per household was about 3.5 acres (Table 4), one-third of which came from leased in land.

Table 3. Occupation pattern of members in the study area

Occupation	% of respective category
Primary	
Farming	98.88
Pension/Service	1.12
Secondary	
Farming	7.69
Fishery	7.69
Labourers	42.31
Priest	3.85
Business	26.92
Service	11.54

It also indicates that the leased-in area was almost half of their owned land. Most (80.6%) of the cultivated area was irrigated type and canal was the major source of irrigation.

Table 4. Land holding pattern (Ac) in the study area

Type of land	Irrigated/un-irrigated	Area (Ac)
Own land	Irrigated	1.77
	Un-irrigated	0.55
	Total	2.32
Leased-in land	Irrigated	1.04
	Un-irrigated	0.12
	Total	1.16
Leased-out land	Irrigated	0.02
	Un-irrigated	0
	Total	0.02
Operational holding	Irrigated	2.79
	Un-irrigated	0.67
	Total	3.46

Social participation among the farmers was poor. Only about 24% of the respondents were the members or office bearers of any social organizations (Table 5). About 67% of the participated respondents were members and/or office bearers of cooperative credit societies. Village society was the next preferred social organization. Though some of the villages have credit cooperative societies, fishery societies, village committees, other religious committees and pani panchayat very few people were associated with these societies.

Table 5. Social participation of households (%) in the study area

Particulars	Participation
Overall participation	23.60
Category of participation	
Gram panchayat	4.76
Credit cooperative society	66.67
Fishery society	4.76
Village society	19.05
Religious committee	4.76

The investigation revealed that each and every farm households had their own residential house. A majority of farm households possessed ploughs (59.6%), sickle (84.2%), spade (83%) and khurpi (47.2%) where as only few households possessed sprayer, duster (Table 6). Tractor was also very rare, only a little more than 3% households owned it. About 73% of the households had bicycles but two wheelers were limited to 13% of the households. Among the household gadgets mobile was the most common possession which was available with 51% of households. Penetration of colour television was moderate, only 27% of household had colour TVs. Other gadgets like refrigerators, coolers, pressure cooker etc. were negligible. As far as livestock is concerned on an average each household possessed 0.55 dairy cattle, 0.08 buffalo, 0.08 goat and 0.35 poultry. Therefore the analysis indicates that the possession of livestock was very low in an agriculturally predominant economy of Ganjam district of Odisha. Extension functionaries should impress upon the farmers to rear livestock as a measure of diversification to lessen the risk in times of climatic adversity.

Table 6. Agricultural asset possessions of the households in the study area

Asset	No. per household	% of the household possessed
Plough	0.78	59.55
Harrow	0.06	5.62
Leveller	0.01	15.73
Sprayer	0.04	4.49
Duster	0.07	1.12
Sickle	2.24	84.27
Khurpi	0.76	47.19
Spade	1.49	83.15
Tractor	0.01	3.37
Two wheller	0.15	13.50
Cycle	0.85	73.00
Colour TV	0.28	27.00
B&W TV	0.08	07.87
Fridge	0.03	3.37
Cooler	0.01	1.12
Sewing machine	0.01	1.12
Cooker	0.09	7.87
Mobile phone	0.56	51.68
LPG connection	0.07	6.74
Dairy cattle	0.55	29.21
Buffalo	0.08	4.49
Goat	0.08	1.12
Poultry	0.35	5.62

Farmers were asked to put each statement in any of the five degrees of agreement. After that the percentage analysis was done (Table 8).

The risk orientation analysis revealed that most of the households (88%) agreed that farmers should practice mixed cropping instead of mono cropping to avoid risks among them 47% strongly agreed to this.

Table 7. Risk orientation analysis of the households in the study area

Statement	SA	A	UD	DA	SD
Farmer should grow more crops to avoid greater risks involved in growing one to two crops	47.2	40.4	11.2	1.1	0.0
A farmer should rather take more of a chance in making a big profit than to be content with a smaller but less risky profit	40.4	38.2	13.5	7.9	0.0
A farmer who is willing to take greater risks than the average farmer usually does better financially	40.4	32.6	25.8	1.1	0.0
It is good for a farmer to take risks when he knows the chance of success is fairly high	42.7	34.8	21.3	1.1	0.0
It is better for a farmer not to try new farming methods unless most others have used them success	22.5	27.0	44.9	4.5	1.1
Trying an entirely new method in farming by a farmer involves risk but it is worth	44.9	21.3	16.9	16.9	0.0

SA: Strongly agree, A: Agree, UD: Undecided, DA: Disagree, SD: Sometimes Disagree

Table 8. Perception of climate change by respondents in the study area

Statement	% of the respondents
No idea	55.06
Delay in monsoon	6.74
Change in temperature, rainfall	1.12
Increase in temperature	1.12
Season change	1.12
Sun is coming down	1.12
Pollution, destruction of forest	1.12
Increasing heat	3.37
More sunshine	31.46

Majority of the respondents felt that farmer who takes risks improves economically. The analysis further reveals that the farmers were generally risk takers when the chances of success is high. Further, farmers might consider adoption of entirely new method of farming if chances of success are high. Therefore, as an adaptation strategy against climate change risk, if farmers are given the new and innovative technologies their chances of adoption would be high.

Climate change risk perception by general public is critical because it is a key component of the socio-political context within which policy makers operate. Public risk perceptions strongly influence the way people respond to hazards. How public perceive and will subsequently behave are thus vital questions for policy makers attempting to address global climate change. In this situation, public support for or opposition to proposed climate policies will be greatly influenced by the perceived risks. In the present study it was found that reasonably good percentage (65.17%) of people heard the term 'climate change'. However, the understanding of climate change is not proper.

Majority of the farmers (65.1%) heard about the climate change but do not understand the proper meaning of climate change. A study (Leiserowitz, 2008) also found similar findings where it has been reported that around 60% of Indian heard about global warming. However, only hearing the name is not enough, it is necessary to understand the proper meaning. But about as 55% farmers did not have any idea about the proper meaning of climate change. Major chunk of farmers also thought that (31%) climate change means more sunshine.

Around 41% of the farmers didn't have any idea about what causes climate change. Almost half of the farmers thought that deforestation is the cause of climate change (Table 9). According to them, increased CO_2, NO_2 and CFC, urbanization, industrialization, high population, pollution were the other causes of climate change. Even farmers felt that hands of God were responsible for climate change. Thus, accurate understanding of the causes of climate change remains quite limited in the study area.

Table 9. Perception of reasons of climate change by the respondents in the study area

Reason	% of respondents quoted
Deforestation	47.19
No idea	41.57
Increased CO_2, Nitrous Oxide ,CFC	1.12
Urbanization	1.12
Industrialization	2.25
High population	2.25
Religious	3.37
Pollution	3.37

Table 10. Perception of threat by the respondents in the study area

Threat level	% of respondents quoted
Very serious	07.17
Serious	11.59
Threat but not serious	51.16
Not a threat	30.08

Awareness of the problem is a necessary, but not sufficient condition to motivate an individual or collective response. Hence, it was further studied their threat perception level.

Only a handful (7%) of respondents thought that threat of climate change is very serious whereas 30% of them thought that is not a threat at all (Table 10). Little more than half of the respondents reported that climate change is a threat but not serious. In contrast, large majorities of Americans believe climate change is real and consider it a serious problem (Leiserowitz, 2006). Hence there is a need to organize awareness camp regarding the threat level of climate change.

Farmers had unanimous feeling that the climate is changing and about 68% and 35% farmers perceived that average day and night temperature, respectively has increased to some extent (Table 11). About 43% farmers observed that in rainfall and humidity there is substantial changes. According to 15% farmers, frequency of cyclones has increased

Table 11. Perception of climatic change over the past decade by the respondents

Parameter	Degree		Direction
	Substantial change	To some extent change	
Intensity of day temp.	10.11	68.54	Increased
Intensity of night temp.	10.11	34.83	Increased
Rainfall	42.70	48.31	Decreased and change in distribution pattern
Humidity	42.70	28.09	Increased
Frequency of cyclone	6.74	14.61	Increased
Intensity of cold waves	52.81	7.87	Increased
Duration of cold waves	10.11	12.36	Decreased
Intensity of heat waves	73.03	13.48	Increased
Duration of heat waves	16.85	12.36	Increased

to some extent. Besides, considerable proportion of farmers felt that they were also experiencing change in intensity of cold and heat weaves. They realized that duration of cold waves has decreased but that of heat waves has increased. As a result of change in weather parameters farmers had to adopt some changes in the cropping calendar. About 87% of the farmers stated that the cropping season, and sowing/ planting has been delayed because of late onset of monsoon (Table 12).

As a result of delayed sowing, harvesting also gets delayed to 87% of farmers. Although till date there has not been any change in the cropping pattern, however, they felt they have to change in the near future due to weather aberrations and depletion of ground water. Around 66% of farmers reported that ground water has got depleted because of low rainfall and unsustainable extraction.

Table 12. Awareness of respondents with regard to changes in cropping pattern and environment

Area of change	Kind of change	% of respondents
Change in cropping season	Delayed	87.6
	No change	12.4
Change in sowing time	Delayed	87.6
	No change	12.4
Change in harvesting time	Delayed	87.6
	No change	12.4
Change in cropping pattern	No change	96.64
	Changed	3.36
Change in salinity of soil	No idea	100
Change in quality of drinking water	Improved	5.6
	Deteriorated	11.24
	No change	83.15
Change in level of groundwater	Decreased	66.3
	No change	33.7
Loss of biodiversity	Yes decrease	10.1
	No idea	89.9

The study conducted elsewhere also reported changes in ecology. Climate Himalaya Initiative (2011) reported from north West Bengal and Nepal that there was a widespread feeling among population that weather was getting warmer, the water sources were drying up, the onset of summer and monsoon had advanced during last 10 years, there was less snow on mountains than before, emergence of new agricultural pests and weeds and appearance of more mosquitoes.

The paper brought out the awareness and perception level of rice farmers of Ganjam district of Odisha regarding climate change. It showed that the perception of climate change among the farmers of Odisha was not proper. Accurate understanding of the causes of climate change remains quite limited in the study area. This lack of basic awareness of the problem has a wide range of implications. For exerting political pressure on local and national governments to act, threat perception is necessary. Lack of correct perception may make them potentially vulnerable as individuals and communities. Decisions regarding rural area development, agricultural and subsistence practices, water management, etc. may not be proper in absence of correct perception (Leiserowitz, 2008). Farmers may be encouraged to have more social

participation. The analysis indicates that the possession of livestock was very low among the farmers of the district. Extension functionaries should impress upon the farmers to rear livestock as a measure of diversification to lessen the risk in times of climatic adversity. There is a need to organize awareness camp for educating the farmers about the seriousness of threat level of climate change.

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