

## Perception of farmers regarding climate change: A comparative study

**Comentado [MDLAVH1]:** It is suggested to put the name of the region of the study site

### Abstract

**Comentado [MDLAVH2]:** In the materials and methods, they comment that the information will be analyzed with statistical data and in the summary there are no such results.

The term *climate* stands for general weather conditions prevailing over a period of many years, while *climate change* refers to significant variation in average weather conditions during a long time period that may be several decades or more. Agriculture is the major source of livelihood for almost 60 % of the India's total population. Its different regions are highly vulnerable to various natural disasters like avalanches, earthquakes, floods, drought etc. stressors of water resources" (IPCC, 2014). The present comparative study was conducted in the purposively selected Haryana state and Himachal Pradesh state. One district from each state i.e., Hisar from Haryana and Shimla from Himachal Pradesh were selected at random. A total sample of 240 farm families, 40 from each village (total six village, 1 village from each block) was selected purposively comprising of 120 farm families of Hisar district and 120 of Shimla district. Result showed that in both Haryana and Himachal Pradesh, maximum respondents were familiar about the term climate change but they were unaware about many related terms. Result also elucidated that increasing population and food and water scarcity were perceived most important threat in Haryana and economic situation and unemployment & poverty, food and water scarcity were most important threats perceived in Himachal Pradesh and in Haryana maximum changes were noticed in terms of extreme heat and cold and pattern of rainfall whereas, in Himachal Pradesh maximum changes were observed in pattern of rainfall and season shift. Result also observed that in Haryana most important problem caused by global warming included heat waves which ranked first followed by lesser rainfall and water shortage ranked second and third respectively while in Himachal Pradesh most important problems included lesser snow with ranked first followed by lesser rainfall (rank II) and reduced lake ice cover (rank III).

**Keywords:** climate change, rainfall, global warming, water shortage

### Introduction

**Comentado [MDLAVH3]:** Information is missing, it is a topic that has been relevant and has information that should be considered.

Climate change is among the biggest challenges in our times, as it has the potential to disrupt and even threaten the existence of human civilization. The term *climate* stands for general weather conditions prevailing over a period of many years, while *climate change* refers to significant variation in average weather conditions during a long time period that may be several decades or more. Hence the long-term trend relates to climate change which

differentiates it from the short-term i.e. natural weather variability. The concepts related to Climate change include high temperatures, precipitation changes, and high atmospheric CO<sub>2</sub> concentrations.

United Nations Framework Convention on Climate Change (UNFCCC) refers to climate change as “a change of climate which is attributed directly or indirectly to humans’ activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (Anonymous, 2005). India is among the most vulnerable countries when it comes to climate change. It has one of the highest population densities with high amount of economic activity, very large numbers of poor people who rely on the natural resource base for their livelihoods and agriculture with a high dependence on rainfall.

Agriculture is the major source of livelihood for almost 60 % of the India's total population. Its different regions are highly vulnerable to various natural disasters like avalanches, earthquakes, floods, drought etc. It is a known fact that producing and transporting food results in greenhouse gas emissions. Various studies show the overall loss in the crop production in various parts of the country in the last few years due to the anticipated rise in the temperature (Zhao *et al.*, 2017).

Frequent extreme temperature and precipitation events can disrupt crop production. Extreme events like floods and droughts can harm crops and reduce yields. Climate change lowers the “Farmer income between 15% to 18% on average, rising to anywhere between 20% to 25% in irrigated areas (Economic Survey, 2018-19).

A study claims that climate change is reducing the major crop yields in the state of Haryana, it is also reducing the agricultural productivity due to unpredictable moisture deficits during crop growth which are major constraints to productivity (Haryana State Action Plan on Climate Change, 2011) which posing a threat to long term food security. Similarly, in Himachal Pradesh, among the most reported incidents of climate change is increasing water scarcity. There is a strong evidence in favour of anthropogenic climate change as one of many stressors of water resource (IPCC, 2014).

The present study attempt to ascertain perception among farmers regarding a very important public issue i.e., climate change. The study generates useful data on the perceived incidence of climate change.

#### **Material and methods**

Present comparative study was conducted in the purposively selected Haryana state and Himachal Pradesh state. One district from each state i.e., Hisar from Haryana and Shimla

**Comentado [MDLAVH4]:** Remove the hyphen. It is suggested that they follow the magazine format with a published example.

from Himachal Pradesh were selected at random. Further three block each from Hisar and Shimla were considered to draw the sample. From each block, one village were approached to draw the required sample. List of farm families engaged in farming and other allied activities of different age group were prepared. A total sample of 240 farm families, 40 from each village (total six village, 1 village from each block) was selected purposively comprising of 120 farm families of Hisar district and 120 of Shimla district. The sample represented both males and females. Two types of variables independent (family profile, land characteristics, household assets, household amenities and communication variables) and dependent (perception about climate change, impact of climate change and adaptation to climate change) were studied. For this work a well-reasoned scheme for interview was developed and the information was collected personally by the researcher. This data was quantified and interpreted using suitable statistical tools such as frequency, percentage, mean, standard deviation, weighted mean score, t value, z value, spearman's correlation and pearson's correlation coefficient.

## Results

### Perception of the farm families regarding climate change

Perception of farm families was measured in terms of their awareness regarding the issue and attitude towards saving climate.

### Awareness of respondents about climate change and related terms

Table 1 displays the awareness about climate change and related terms among respondents of Haryana and Himachal Pradesh. In Haryana, result show that a good percentage of the respondents were familiar with the term global warming (62.50 %) and land degradation (69.17 %), however, majority of respondents were not familiar with green-house gases (68.33 %), ozone layer depletion (94.17 %), acid rain (90.83 %), melting of glaciers (90.00 %) and forest fires (51.67 %). Similarly, in Himachal Pradesh, respondents were familiar with the term melting of glaciers (69.17 %), land degradation (91.67 %) and forest fire (83.33 %) but majority were not familiar with the terms greenhouse gas emission (75.00 %), global warming (67.50 %) and ozone layer depletion (92.50 %), acid rain (87.50 %).

It can be inferred from the table that in both Haryana and Himachal Pradesh, maximum respondents were familiar about the term climate change but they were unaware about many related terms. It was interesting to note that majority of Himachal Pradesh respondents were not familiar about global warming, while majority in Haryana did not know about melting of glaciers and forest fire, perhaps because they had no experience of these calamities

**Comentado [MDLAVH5]:** The statistical data indicated in the methodology are not shown in the results. only shows Spearman's rank correlation

**Comentado [MDLAVH6]:** remove the hyphen

**Comentado [MDLAVH7]:** In this part of results and discussion. Although it is a comparative topic of two regions, it is possible to relate it to other authors where they have identified some aspects of the topic.

**Table 1: Awareness of respondents about climate change and related terms**

n-240

| S. no. | Familiarity with climate related terms | Category     | Haryana<br>n1-120<br>F (%) | Himachal Pradesh<br>n2-120<br>F (%) |
|--------|--|--------------|----------------------------|-------------------------------------|
| 1.     | Climate change                         | Familiar     | 77(64.17)                  | 85(70.83)                           |
|        |  | Not familiar | 43(35.83)                  | 35(29.17)                           |
| 2.     | Global warming                         | Familiar     | 75(62.50)                  | 39(32.50)                           |
|        |  | Not familiar | 45(37.50)                  | 81(67.50)                           |
| 3.     | Greenhouse gas emission                | Familiar     | 38(31.67)                  | 30(25.00)                           |
|        |  | Not familiar | 82(68.33)                  | 90(75.00)                           |
| 4.     | Ozone layer depletion                  | Familiar     | 07(5.83)                   | 09(7.50)                            |
|        |  | Not familiar | 113(94.17)                 | 111(92.50)                          |
| 5.     | Acid rain                              | Familiar     | 11(9.17)                   | 15(12.50)                           |
|        |  | Not familiar | 109(90.83)                 | 105(87.50)                          |
| 6.     | Melting of glaciers                    | Familiar     | 12(10.00)                  | 83(69.17)                           |
|        |  | Not familiar | 108(90.00)                 | 37 (30.83)                          |
| 7.     | Land degradation                       | Familiar     | 83(69.17)                  | 110(91.67)                          |
|        |  | Not familiar | 37(30.83)                  | 10(8.33)                            |
| 8.     | Forest fire                            | Familiar     | 58(48.33)                  | 100(83.33)                          |
|        |  | Not familiar | 62(51.67)                  | 20(16.67)                           |

**Most important threat to the society as perceived by respondents**

A list of important issues that are creating a threat to the society including climate change was prepared and respondents were asked to indicate the importance of the threats. Data of table 2 displays that as per Haryana respondents, most important threat to the society was perceived as increasing population (92.50 %) followed by poverty, food and water scarcity (75.83 %), economic situation and unemployment (60.83 %), global warming and climate change (48.33 %) and spread of infectious diseases (41.67 %). Terrorism was perceived as important threat to the society by 65.00 per cent respondents in Haryana while proliferation of nuclear weapons and extinction of species were not perceived as important threat by majority of respondents i.e., 86.67 per cent.

In Himachal Pradesh, most important threat to the society perceived by majority of respondents included economic situation and unemployment (66.67 %) followed by poverty, food and water scarcity (62.50 %), global warming and climate change as well as increasing population (51.67% each) and spread of infectious diseases (47.50 %).

**Table 2: Most important threat to the society as perceived by respondents**

**n=240**

**Comentado [MDLAVH8]:** The table can be enhanced so that it can be viewed vertically, just like the other tables.

| S. No. | Threats                                    | Haryana<br>n-120<br>F (%) |           |               |                           | Himachal Pradesh<br>n-120<br>F (%) |           |               |                           |
|--------|--|---------------------------|-----------|---------------|---------------------------|------------------------------------|-----------|---------------|---------------------------|
|        |  | Most Important            | Important | Not Important | Mean weighted score(Rank) | Most important                     | Important | Not important | Mean weighted score(Rank) |
| 1.     | Poverty, food and water scarcity           | 91(75.83)                 | 29(24.17) | 0(0.00)       | <b>2.76(II)</b>           | 75(62.50)                          | 45(37.50) | 0(0.00)       | <b>2.63(II)</b>           |
| 2.     | Economic situation and unemployment        | 73(60.83)                 | 47(39.17) | 0(0.00)       | <b>2.61 (III)</b>         | 80(66.67)                          | 40(33.33) | 0(0.00)       | <b>2.67(I)</b>            |
| 3.     | Global warming and climate change          | 58(48.33)                 | 42(35.00) | 20(16.67)     | <b>2.32(IV)</b>           | 62(51.67)                          | 53(44.16) | 05(4.16)      | <b>2.48(III)</b>          |
| 4.     | Extinction of species                      | 0(0.00)                   | 30(25.00) | 90 (75.00)    | <b>1.25(VII)</b>          | 51(42.50)                          | 54(45.00) | 15(12.50)     | <b>2.30(VI)</b>           |
| 5.     | Increasing population                      | 111(92.50)                | 09(7.50)  | 0(0.00)       | <b>2.93(I)</b>            | 62(51.67)                          | 53(44.16) | 05(4.16)      | <b>2.48(IV)</b>           |
| 6.     | Spread of infectious diseases              | 50(41.67)                 | 41(34.16) | 29(24.17)     | <b>2.18(V)</b>            | 57(47.50)                          | 53(44.17) | 10 (8.33)     | <b>2.39(V)</b>            |
| 7.     | Proliferation of nuclear weapons/conflicts | 0(0.00)                   | 16(13.33) | 104(86.67)    | <b>1.13(VIII)</b>         | 0(0.00)                            | 15(12.50) | 105(87.50)    | <b>1.13 (VIII)</b>        |
| 8.     | Terrorism                                  | 29(24.17)                 | 78(65.00) | 13(10.83)     | <b>2.13(VI)</b>           | 34(28.33)                          | 69(57.50) | 17(14.17)     | <b>2.14(VII)</b>          |

Important threats perceived as most of the respondents were terrorism (57.50 %) and extinction of species (45.00 %), while proliferation of nuclear weapons was not considered as important threat to the society by majority of the respondents.

It can be concluded from the data that increasing population and food and water scarcity were perceived most important threat in Haryana and economic situation and unemployment & poverty, food and water scarcity were most important threats perceived in Himachal Pradesh. However, global warming and climate change was placed at fourth place in Haryana and third place in Himachal Pradesh.

#### **Changes noticed by the respondents in climate during last 10 years**

Table 3 displays the changes noticed by the respondents in climate during last 10 years. Data explains that in Haryana majority of respondents notices great extent of changes with respect in extreme heat and cold (79.17 %) and pattern of rainfall (63.33 %). Maximum respondents reported somewhat changes with respect to lower sea/water level (75.00 %) and season shift (55.83 %). However, majority of respondents in Haryana did not observed changes in landslides (70.00 %) and frequent flood/drought (47.50 %). Result also observed that rank wise extreme heat and cold ranked first followed by pattern of rainfall, lower sea/water level, season shift, frequent flood/drought and landslides i.e., second, third, fourth, fifth and sixth rank respectively.

In Himachal Pradesh, data shows that more than half of respondents reported changes to the great extent in terms of season shift (57.50 %) followed by pattern of rainfall (56.67 %), landslides (53.33 %) and frequent flood/drought (50.83 %). Somewhat change was perceived in terms of extreme heat and cold (65.00 %), while no changes were noticed in lower sea/ water level (65.00 %). Result also observed that in ranking pattern of rainfall ranked first followed by season shift, frequent flood/drought, landslides, extreme heat and cold and lower sea/ water level at second, third, fourth, fifth and sixth place respectively.

It can be concluded from the data that in Haryana maximum changes were noticed in terms of extreme heat and cold and pattern of rainfall whereas, in Himachal Pradesh maximum changes were observed in pattern of rainfall and season shift.

**Table 3: Changes noticed in the climate during last 10 years****n-240**

| S. no | Changes                | Haryana<br>n-120<br>F (%) |                 |           | Weighted mean score | Himachal Pradesh<br>n-120<br>F (%) |                 |           | Weighted mean score |
|-------|------------------------|---------------------------|-----------------|-----------|---------------------|------------------------------------|-----------------|-----------|---------------------|
|       |                        | Great extent              | Somewhat extent | No change |                     | Great extent                       | Somewhat extent | No change |                     |
| 1     | Pattern of rainfall    | 76(63.33)                 | 18(15.00)       | 26(21.67) | <b>2.42(II)</b>     | 68(56.67)                          | 45(37.50)       | 07(5.83)  | <b>2.51(I)</b>      |
| 2     | Extreme heat and cold  | 95(79.17)                 | 16(13.33)       | 09(7.50)  | <b>2.72(I)</b>      | 30(25.00)                          | 78(65.00)       | 12(10.00) | <b>2.15(V)</b>      |
| 3     | Lower sea /water level | 16(13.33)                 | 90(75.00)       | 14(11.67) | <b>2.02(III)</b>    | 09(7.50)                           | 33(27.50)       | 78(65.00) | <b>1.43(VI)</b>     |
| 4     | Season shift           | 19(15.83)                 | 67(55.83)       | 34(28.33) | <b>1.88(IV)</b>     | 69(57.50)                          | 33(29.50)       | 18(15.00) | <b>2.43(II)</b>     |
| 5     | Frequent flood/drought | 21(17.50)                 | 42(35.00)       | 57(47.50) | <b>1.70(V)</b>      | 61(50.83)                          | 21(17.50)       | 38(31.67) | <b>2.19(III)</b>    |
| 6     | Landslides             | 19(15.83)                 | 17(14.17)       | 84(70.00) | <b>1.46(VI)</b>     | 64(53.33)                          | 14(11.67)       | 42(35.00) | <b>2.18(IV)</b>     |

**Problems caused by global warming as perceived by respondents**

Data observes from table 4 that in Haryana, most important problem caused by global warming was heat waves which ranked first followed by lesser rainfall and water shortage which ranked second and third respectively. Weed and pest disease ranked fourth followed by drought which ranked fifth, increase fire threats ranked sixth and lesser snow ranked seventh, storms/tsunami/hurricanes ranked eighth, reduced lake ice cover ranked ninth and melting of glaciers ranked tenth whereas, in Himachal Pradesh lesser snow and lesser rainfall ranked first and second respectively followed by reduced ice cover ranked third, water shortage ranked fourth, storms/tsunami/hurricanes ranked fifth and melting of glaciers ranked sixth. The problem insects/pest/diseases ranked seventh, fire threats ranked eighth, heat waves ranked ninth and drought ranked tenth.

It can be concluded from the table 4 that in Haryana most important problem caused by global warming included heat waves which ranked first followed by lesser rainfall and water shortage ranked second and third respectively while in Himachal Pradesh most important problems included lesser snow

with ranked first followed by lesser rainfall (rank II) and reduced lake ice cover (rank III). Data also shows that significant rank order correlation i.e., 0.34\* was found which concluded that there was significant difference between the ranks of Haryana and Himachal Pradesh respondents.

**Comentado [MDLAVH9]:** The text cannot be horizontal.

UNDER PEER REVIEW

**Table 4: Rank wise problems caused by global warming as perceived by respondents****n-240**

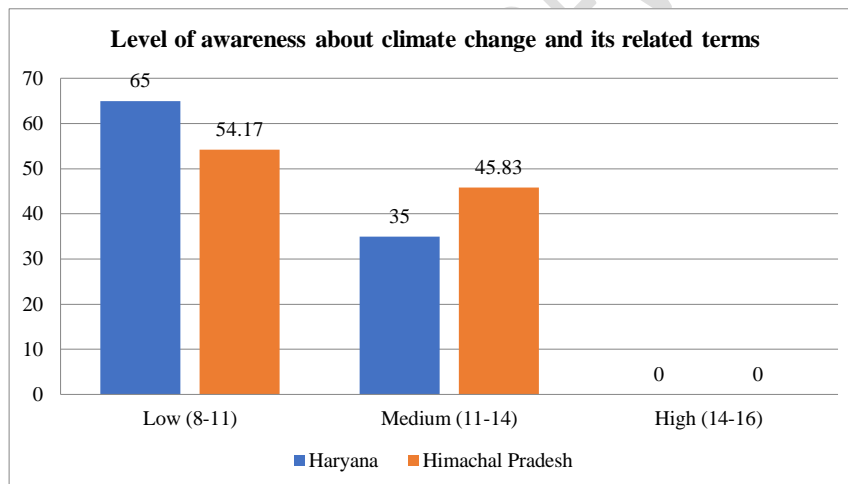
| S. No | Problems                  | Haryana<br>n-120<br>F (%) | Himachal Pradesh<br>n-120<br>F (%) | Spearman's rank correlation |
|-------|---------------------------|---------------------------|------------------------------------|-----------------------------|
| 1.    | Lesser rainfall           | II                        | II                                 | 0.34*                       |
| 2.    | Lesser snow               | VII                       | I                                  |                             |
| 3.    | Droughts                  | V                         | X                                  |                             |
| 4.    | Heat waves                | I                         | IX                                 |                             |
| 5.    | Storms/tsunami/hurricanes | VIII                      | V                                  |                             |
| 6.    | Reduced lake ice cover    | IX                        | III                                |                             |
| 7.    | Melting of glaciers       | X                         | VI                                 |                             |
| 8.    | Water shortage            | III                       | IV                                 |                             |
| 9.    | Fire threats              | VI                        | VIII                               |                             |
| 10.   | Insect/ pest/ diseases    | IV                        | VII                                |                             |

### Level of awareness about climate change and its related terms

Data of table 5 observed the awareness level of respondents about climate change and its related terms and revealed that both Haryana and Himachal Pradesh respondents had low level of awareness i.e., 65.00 per cent and 54.17 per cent respectively followed by medium level of awareness i.e., 35.00 per cent and 45.83 per cent respectively. None of the respondents had high level of awareness regarding climate change.

**Table 5: Level of awareness about climate change and its related terms**

| S. no. | Category       | Haryana<br>n1-120<br>F (%) | Himachal Pradesh<br>n2-120<br>F (%) |
|--------|----------------|----------------------------|-------------------------------------|
| 1.     | Low (22-33)    | 78(65.00)                  | 65(54.17)                           |
| 2.     | Medium (34-45) | 42(35.00)                  | 55(45.83)                           |
| 3.     | High (46-58)   | 0(0.00)                    | 0(0.00)                             |



**Fig 1-** Level of awareness about climate change and its related terms

### Conclusion

Study showed that in both Haryana and Himachal Pradesh, maximum respondents were familiar about the term climate change but they were unaware about many related terms. Majority of Himachal Pradesh respondents were not familiar about global warming, while majority in Haryana did not know about melting of glaciers and forest fire.

In Haryana, increasing population and food and water scarcity were most important threat while in Himachal Pradesh economic situation and unemployment & poverty, food and

**Comentado [MDLAVH10]:** remove the hyphen

**Comentado [MDLAVH11]:** There is no explanation of figure 1.

**Comentado [MDLAVH12]:** Put in the plural. Conclusions can be improved with the statistics that they propose to analyze.

water scarcity were most important threats perceived. Global warming and climate change was placed at fourth place in Haryana and third place in Himachal Pradesh.

In Haryana, maximum changes were noticed in terms of extreme heat and cold and pattern of rainfall whereas, in Himachal Pradesh maximum changes were observed in pattern of rainfall and season shift.

In both the states, majority of farmers had moderately favorable attitude towards saving climate.

Significant difference in perception of farmers regarding most important problem caused by global warming was found. Heat waves which ranked first in Haryana while in Himachal Pradesh lesser snow got top rank.

### References-

- Anonymous. 2005. Impact, vulnerabilities and adaptation in developed countries. United Nation Framework Convention on Climate Change. <http://unfccc.int/3582.php>*
- Intergovernmental Panel on Climate Change (IPCC). 2017. Climate change impact, adaptation and vulnerability. *Cambridge University Press. <http://www.ipcc.ch>.*
- Mishra, S. R., Bhandari, P.M., Issa, R, Neupane, D., Gurung, S. and Khnal, V. 2015. Climate change and adverse health events: community perceptions from the Tanahu district of Nepal. *Environmental Research*, 10(3):561-568.
- Zhao, C.,Liu,B., Piao,S., Wang,X, David,B. L., Huang,Y., Huang,Y., Yao,Y., Bassu, Ciais,P., Durand,J., Elliott,J., Ewert,F., Ivan,A., Janssens, Li,T.,Lin,E., Liu, Q.,Martre,P., Müller,C., Peng, S., Peñuelas,J., Alex,C., Ruane, Wallach, D.,Wang,T., Wu,D., Liu, Z.,Zhu, Y.,Zhu,Z. and Asseng,S. 2017 Temperature increase reduces global yields of major crops in four independent estimates.*Proceedings of the National Academy of Sciences*. 114 (35):9326-9331.
- Economic Survey. 2018-19. Press Information Bureau, Government of India, Ministry of Finance. <https://pib.gov.in/newsite/PrintRelease.aspx?relid=191213>.
- Anonymous. 2005. Impact, vulnerabilities and adaptation in developed countries. United Nation Framework Convention on Climate Change. <http://unfccc.int/3582.php>*

**Comentado [MDLAVH13]:** Find more information from other authors regarding the topic of the last five years. Because information is missing. As I mentioned in the introduction.