

People Perception about Climate Change and Adaptation in the Arid Region of Pakistan

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Abstract:

The paper analyzes the people perception regarding climate change and adaptation in the arid region of Pakistan in terms of temperature and precipitation fluctuation, drought and desertification, food scarcity, impact on agriculture, river flow, as well as seasonal fluctuation.

According to Khan and Hasan (2012) the arid region of Pakistan shows 0.6 inches decrease in precipitation and 1.6 degree Celsius increase in temperature during 1960-2011. The flow of water sector in Pakistan shows a more vulnerable condition from 1937-2004 that will cause a drastic change in *Rabi* (Winter) as well as *Kharif* (Summer) cultivation and needs adaptation. The decline in flow of the water in Indus water system will affect the agriculture growth and production in the irrigated areas of the arid region in lower *Punjab* and *Sind* Provinces. The main purpose of the work is to know that what is the public opinion regarding climate change, its impacts and how to cope with the problem. Therefore, a questionnaire survey has been conducted in the lower *Punjab* and parts of *Sind*, *Balochistan*, and *Gilgit Baltistan* provinces to know the public opinion about the on going climate change and its impacts on social, economic, demographic, and agriculture sectors. The major questions in the questionnaire are about temperature and precipitation fluctuation, deforestation, overgrazing, drought, desertification, change in the earth geography, wars, change in pressure pattern, population increase, construction of water reservoirs, water resources, current government policies.

Key Words: Climate change, Adaptation, People perception, Rabi season, Kharif season, Water resources, Population growth.

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1. Introduction:

Climate is not a static phenomenon; it varies in space and time. According to Berret (1963), *“There are two scales of climate variations: for short-range variation, relatively minor in respect of temperature and precipitation, the preferred term is climatic fluctuation. In case, where the variation is much greater and of long duration, the preferred term is climatic change. Departure from normal or mean values within the normal range of weather at any location is simply referred to as climatic variability”*. These variations are of little importance in themselves, but they do serve to emphasize the fact that it is the nature of climate and weather, which varies from time to time and that the variations may be more or less extreme.

Climate change can be approached from perspectives of the time period involved, geographical area influenced, the causes or effects of the changes, or whether these changes are of long time duration or temporary. Climate change is a phenomenon for which older as well as new materials can be used for comparison purpose or for a retrospective study.

Numbers of climate variations were recorded after the earliest years of the meteorological instrument record (1650 to 1700AD) particularly in Europe and some parts of South Asia. Most recent climate change has occurred in the past 200 years, with a number of warm as well as cool years, recorded in various parts of the world (Lamb, 1966).

In recent years, Intergovernmental Panel on Climate Change (IPCC) has been conducting research on global climate change and its impact at macro level. So far it has published four reports intended to assess scientific, technical and socio-economic information concerning climate change, its potential impacts and option for adaptation and mitigation. The last report published in 2007, gives following observations regarding South Asia including Pakistan:

- *“Freshwater availability is projected to decrease by the 2050s, in South Asia, particularly in large river basins.*
- *Coastal areas, especially heavily populated mega delta regions in South Asia, will be at greatest risk due to increased flooding from the sea and, in some mega deltas, flooding from the rivers.*
- *Climate change is projected to compound the pressures on natural resources and the environment associated with rapid urbanization, industrialization and economic development.*
- *Endemic morbidity and mortality due to diarrheal disease primarily associated with floods and droughts are expected to rise in East, South and South-East Asia due to projected changes in the hydrological cycle.”*

Some of the impacts are very serious and can substantially affect the human well being in terms of food, energy, and health security. Pakistan is one of the countries in South Asia which is to be affected very seriously from the impacts of climate change. These changes will be more sever in the arid land and might affect the people lives in terms of physical, biological, and socio-economical environment. Besides, it may cause a shift in the boundaries of arid land and crop growing season towards north. Therefore, a research has been devised to study the public opinion about the climate change and to evaluate their

awareness regarding the climate change, causes, and adaptation in the arid region of Pakistan. The main purpose of the work is to know that what is the public opinion regarding climate change, its impacts and how to cope with the problem.

Aridity prevails over 63 districts and covers total area of 676,400 square kilometers comprising of Gilgit-Baltistan province in the north, southern Punjab, Sind, central and southern Baluchistan, and parts of Chitral and Dera Ismail Khan Districts in Khyber-Pakhtunkhwa province (Map-1).

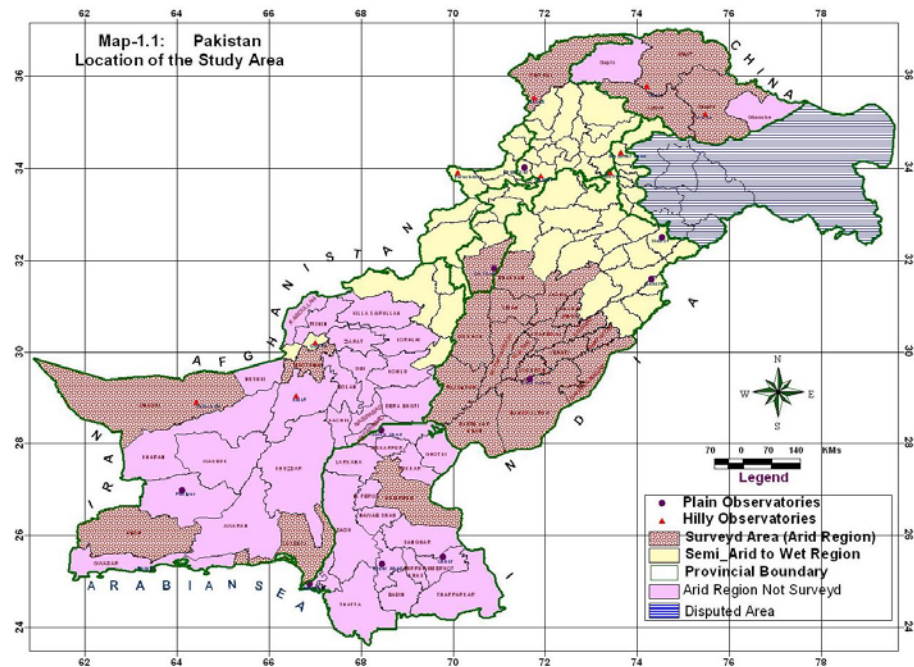
A number of researchers have studied the climate change, impacts and adaptation in Pakistan and

international level respectively. The well know among them are; Khan (1960), Khan S.A. and Khan M.L. (1961), Khan A N 2000, IPCC (2001 and 2007), Beig (2001), FAO (2002), Defra (2009), Saab and Tolba (2009), Hasan M and Khan S (2010), Never B (2012).

2. Methodology:

The main objective of the study is to know the public opinion and awareness about the climate change, causes, and adaptation in the arid region of Pakistan. The specific questions are: what is the public opinion regarding climate change, its impacts and how to cope with the problem? Are people of the arid region aware about this issue and willing to participate on the actions required?

The work is based on primary data collected from the field questionnaire survey and personal interviews. The major questions are about temperature and precipitation fluctuation, deforestation, overgrazing, drought, desertification, landuse change, wars, crop production, population growth, construction of water reservoirs, river flow, environment policies, and willingness to cope with the climate change issue. As the security situation is not good in the entire arid region. Therefore, a questionnaire survey was conducted in the arid region of the lower Punjab, parts of Balochistan, Sind, Gilgit-Baltistan, and Upper and lower Khyber Pukhtunkhwa provinces taking into account random sampling method. The sample areas covers about 25 districts having different kind of desert landforms like pure desert, piedmont plains, irrigated desert, sand dunes, steppe,



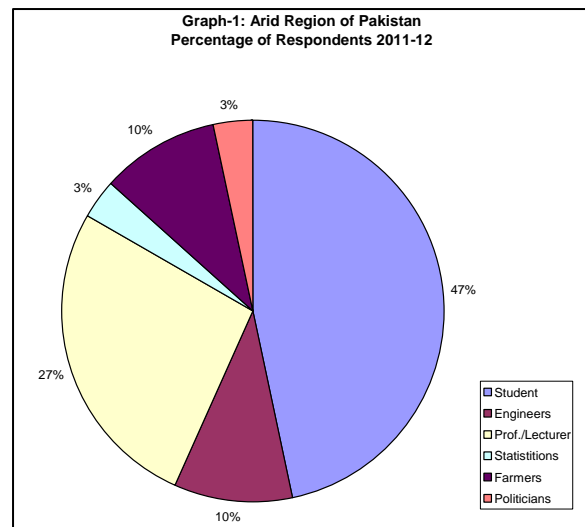
and barren mountains. It represents a clear picture of the entire arid region of Pakistan. The questionnaires were distributed among the students and teachers of the University of Bahawalpur, Peshawar, Karachi, and Quetta. The people who are surveyed and interviewed are including professors, lecturers, M.Sc and M.Phil students, farmers, lawyers, and statisticians. Total of 150 questionnaires were distributed in which 130 questionnaires were returned with complete answers (Graph-1) and used for the analysis. Generally, approximately 6 questionnaires were collected from each district. A master sheet has been prepared from the public opinion that classified into tables and charts for the purpose of analysis and conclusion.

3. Findings:

The work discussed the general opinion of the people about the on going climate change in term of impacts, adaptation and their willingness to participate in reducing the impacts of climate change in the entire arid region of Pakistan. The results of the questionnaire survey are stated as follow.

3.1. General Opinion:

The results of the survey show increasing awareness: 100% believe that the climate is changing. Generally, 40% of the participants believe that it has changed moderately, while 80% believe that it has severely changed with passage of time. About 73% of the people believe that climate of the arid region in lower Punjab is hot, while in some areas it is moderate and warm. Moreover, 55% of the people believe that climate of the arid region was warm before 2000 that changed into hot climate with passage of time. The people have noticed that climate of the arid region changed into hot climate with increasing temperature (80%) and decreasing precipitation (90%) during 1990 to 2011. This change in temperature and precipitation not only prevails in the arid region of the country but it has also affected the entire area of Pakistan (Graph-1).



3.2. Causes of climate change:

About, 57% of the participants believe that this change in the climate of the area is due to human activities like over population, over cropping, deforestation, over grazing, land degradation, wars, and atmospheric pollution. Most of the people believe that Government was not acting adequately to address the problems, while 84% believed climate change poses a serious challenge to the entire arid region. Over 94% believe that the exhaust gases are mostly added to atmosphere from vehicle emission, while some of them have opined that it is by industries. More than 90% pledged to participate in personal action to reduce their contribution to the problem.

3.3. Impacts and Adaptation:

The respondents were asked to choose sectors where climate change will have a major impact in the arid region of Pakistan, it was notable that not a single respondent said there would be no effect at all. The majority gave priority to health, drinking water, food, forest fires, economy, drought, desertification, crop production, and decline in the market values of different products. Most of the residents believe that they will feel the impacts of climate change within 5 to 10 years. Those surveyed were also asked to choose the three most important measures to mitigate the causes and to adapt to the effects of climate change. Changing consumption patterns, mainly reducing the agriculture production, was the main measure chosen, followed by education and awareness. For watertable, 44% of the respondents suggested to reduce the use of tube wells and to introduce most advanced agriculture and irrigation technologies. Most of them are inclined to take community based action for the reforestation on the barren land of the arid region. About, 90% of the people vote for decrease in the forests area of the arid region to be a major cause. They have opined that there have been severe cutting of forests for domestic use and recommended replantation of forests, provision of alternate energy sources, and alternate materials for the construction of houses.

3.3.1. Drought and Desertification:

The arid region of lower Punjab has passed through a severe drought many times since 1960. About 36% believe that the severe drought of the area was recorded in 1971, while some of them vote for 2000, when the market value of the livestock dropped to almost half as compared to normal years. Among the participants, 28% have opined that these droughts were hydrological, while 62% believe that it was agriculture drought which effected the fauna, human lives, and agriculture (Winter and summer crops) in the rainfed areas of the lower Punjab. About, 70% of the participants believe that these droughts were the result of decrease in precipitation that declined the flow in the tributaries of the arid region and caused high damages to crops, human, and animal lives. The most affected areas during 1971 and 2000 droughts were Baluchistan, lower Khyber Pukhtunkhwa, Lower Punjab, and entire region of tribal areas. Besides, 50% of the people believe that the climate change in the entire arid region not only effected the human lives but also pushed the birds to migrate into the near by lands for breeding, shelter, and food. Moreover, 57% of the respondents mentioned that less than 25% residents of the lower Punjab migrated to near by cities in search of jobs, foods, shelters, and drinking water during drought years. This migration took place because of non-availability of timely government support to the residence of the arid region.

3.3.2. Agriculture sector:

Generally, 67% of the participants believe that the recent climate change in the entire region mostly affected the *rabbi* crops (October to May) in the region. Among the surveyed, 70% have opined that this change not only affected the production of crops but it also caused change in the planting and harvesting period of *rabbi* (winter) and *kharif* (summer) crops in the area. This change varies from 21-30 days and the farmers needed to sow and harvest different crops before the due time. The total of 59% of the people have opined that the crop

production in the arid region is going to decrease with passage of time and this change will cause food scarcity and shall distort the national economy. Furthermore, 62% of the respondents believe that the climate change going to cause shift in the boundaries of the agriculture zones towards north, while in some areas it is toward northwest during 1990-2011. All of the people stated that the per acre production of the *rabbi* (winter) as well as *kharif* (summer) crops is going to decline with passage of time that varies from 10 to 15 Kilograms.

3.3.3. Water resources:

Most of the respondents have the opinion that people are using tube well as water resource for agriculture (48%), whereas 36% are in irrigated arid plains and 15% into rainfed area. About 96% have mentioned that the flow in canals and rivers has decreased between 1980 and 1995. This decrease in the water flow has high impacts on the agriculture production, human lives, and national economy. This decrease in precipitation and flow of water is going to increase desertification in the area and shifted the boundaries of arid region towards north and northwest. The respondents believe that this happened because of decrease in precipitation (62%), while 24% have highlighted that it is the result of deforestation in the entire arid region. About 45% of the surveyed people have suggested deforestation, while 55% believe that well developed canal system is the main source to control desertification in the entire region.

3.3.4. Glaciers:

As glaciers are the main sources of surface water and it is necessary to know the public perception regarding the climate change impacts on glacier resource in the *Gilgit-Baltistan* province. The 67% of participants have opined that the glaciers in the northern arid region of Pakistan are going to decrease with passage of time. Whereas 50% of the surveyed people believe that the glacier resources of the country have retreated rapidly while the remaining has converse opinion. Most of the respondents believe that this is because of global warming, change in temperature and deforestation. Among the people, 38% believe that it could be controlled by the plantation of trees on mountains, while the remaining have suggested for the control of atmospheric pollution. Furthermore, 85% of the residence believes that the ongoing climate change is going to affect the coastal region by means of sea level rise, cyclones, and floods. This not only affects the human life on the coastal region but always causes damages to sea ports, crops, and decline the sea trade.

Discussion:

It is observed that the drought condition during 1995-2000 made aware the residence of arid region about climate change. They are agreed for their participation on the actions required and their willingness to personally contribute to climate change mitigation and adaptation measures. The respondents to the field survey revealed a clear desire for the Government to participate and cooperate proactively in order to reach a solution to the problem of climate change. The arid region inhabitants seem ready to accept and be part of concrete national and regional action to deal with climate change. The skeptical attitudes, which prevailed among some groups on the facts and causes of climate change, either denying it entirely or limiting it to natural causes, are

receding. Government inaction is no longer an option. Most of them suggested to encourage participation through groups, clubs, media, government, and individually.

The people have opined that to cope with the scarcity of running water, caused by climate change, it is needed to construct additional water reservoirs that will overcome the shortage of water resources in different parts of the arid region of Pakistan. To make evergreen the arid land of *Baluchistan*, they have suggested to construct water reservoir at *Rajanpur/Dera Ghazi Khan* districts and channelize the extra water of the *Indus river* into any dry torrent of *Baluchistan* by constructing tunnel in the *Suleman-Khirthar* mountains and with the help of a link/divert canal. This will not only help to turn the arid land of *Baluchistan* into a live and evergreen but will also play a vital role in the national economy and the recharging of watertable. The diversion canal will also save the residential areas of lower *Punjab* and *Sind* from flood disaster.

4. Conclusion:

The public opinion regarding climate change adaptation and mitigation in the arid region of Pakistan is;

- To control deforestation, population growth, and over grazing.
- To control atmospheric pollution, addition of chlorofluorocarbons, wars in the entire region, nuclear conflicts, and vehicle emissions.
- To introduce early warning system for floods and drought.
- To prefer construction of new dams and barrages for the storage of flood water.
- To take action for the depletion of underground water.
- To aware the public regarding the impact of climate change using mass media and to include climate change concept in the curriculum at school level.
- To reserve funds for reforestation on mountains and to control deforestation in the entire region.
- To convince people for individual struggle and to preserve the national resources.
- To decrease the multiple cropping on agriculture land in the arid region.
- To introduce modern machinery for the cultivation of crops in the arid region.
- To encourage usage of natural gas or solar energy instead of petroleum, coal, and forests.
- To increase literacy ratio and community based programs for the awareness of people regarding climate change.
- To revise environmental policy and to make sure Implementation of environmental laws on national level.

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7. QUESTIONNAIRE

The following questionnaire is prepared to study the “Climate Change and its Impact on the Agriculture in Arid Land of Pakistan (1961-2000) at Ph.D level in the Department of Geography University of Peshawar, Khyber-Pakhtoonkhwa. Your response will help us with our ongoing study of Climate Change in Pakistan. All questions are optional to answer, chose/encircle multiple options where required. Your responses will be anonymous during course of study.

Name.....Profession/Class.....Designation.....
 Education.....Sex: Male/Female District.....
 Contact No (Mobile/Fixed Line).....Province/University.....

1. Pakistan climate is changing.
 a. Agree b. Disagree c. Strongly Agree
2. How serious is climate change in your area?
 a. Weak b. Moderate c. Severe
3. How is the climate of your native place?
 a. Hot b. Warm c. Moderate d. Cool e. Cold
4. How was climate of your area before 2000?
 a. Hot b. Warm c. Cool d. Cold.
5. Is there any change in temperature of your area?
 a. Yes b. No
6. If yes then, the change has made temperature;
 a. Warmer b. Colder c. Moderate
7. For how many years have you observed this change.
 a. 10 b.20 c.30 d. 40 e. 50
8. Is there any change in the rainfall of your area?
 a. Yes b. No
9. If yes, then has it;
 a. Decreased b. Increased c. No Change
10. Since how many years have you noted this change;
 a. 10 b.20 c.30 d. 40 e. >50
11. What part of Pakistan has been most effected by climate change?
 a. Baluchistan b. Sind c. Punjab d. KPK e. Northern Areas f. FATA
 g. Azad Jammu and Kashmir h. All of 'a' to 'g'
12. What you think is Climate change a result of;
 a. Human activities b. Natural Processes c. Carbon emission
 d. Deforestation e. Land Degradation f. all of "a" to "e"
 g. Any other.....
13. What are the main activities of humans that effected climate?
 a. Deforestation b. Over Population c. Mining d. Wars
 e. Carbon emission f. All 'a' to 'e' g. Any other.....
14. What do you suggest to control these activities?

15. Which natural processes do you think has changed the climate of Pakistan?
 a, Floods b, Forest fires c, Tectonic moment
 d, Deforestation e. Global warming f. Degradation of soil
 g. Temperature fluctuation h. Precipitation Fluctuation

- i. All 'a' to 'l' j. Any other.....
16. Is there any solution to control it, if yes then give your opinion?
.....
.....
17. What are the main sources of Carbon emission in Pakistan?
a. Vehicles b. Industry c. Volcanic eruption e. Air crafts
f. All "a" to "e" g. Any other.....
18. What are the impacts of the climate change in your area?
a. Water Scarcity b. Forests fires c. Decline Economic growth d. Caused drought and desertification e. Reduced crops production
f. Decrease in market value g. Any other.....
19. We will feel the impacts of climate change?
a. With in five years b. 5-10 years c. 11-20 years
d. >20 years
20. What change have you observed in the Underground/Drinking water in the last 40 years?
a. Decrease b. Increase
21. For how many years have you observed this change in the underground/drinking water.
a. 10 b. 20 c. 30 d. 40 e. 50 and above
22. What are the main causes of decline in watertable?
a. Decrease in rainfall b. Deforestation
c. Population growth d. Tubewells e. All of the above
f. Any other.....
23. What are you suggesting for the stability of the watertable/underground water?
a. Decrease use of tubewells b. Afforestation c. Decrease in population
d. Any other.....
24. What changes have you observed in the forests of your area since 1960?
a. Decrease b. Increase c. Any other.....
25. What are the main causes of deforestation in your area?
a. Sever cutting b, Domestic use c, Forest fires d. Any other.....
26. What do you suggest for the stability of forests?
a. Plantation b. Decrease in domestic use c. Provision of alternate energy
d. all "a" to "c" e. Any other.....
27. How much times your area has passed from drought condition since 1960?
a. One b. Two c. Three d. Four e. Above five
28. When was the last time there was severe drought in your area?
a. 1961 b. 1971 c. 1981 d. 1991 e. 2000
f. Any other.....
29. What type of drought it was?
a. Hydrological b. Meteorological c. Agriculture
30. What are the main causes of drought in your area?
a. Decrease in rainfall b. Decrease in river flow
c. Cutting of forests d. Any other.....
31. Has it affected the human lives?
a. Yes b. No
32. If yes, is it in terms of ;
a. Caused diseases b. Damage to human lives c. Damage to agriculture
d. Decrease in drinking water e. Food Scarcity
f. Damage to livestock g. All "a" to "e"
h. Any other.....
33. What part of Pakistan has most effected by the drought condition?
a. Baluchistan b. Sind c. Punjab d. NWFP e. Northern Areas
f. FATA g. Azad Jammu and Kashmir h. All of 'a' to 'g'
34. What kind of support was provided by Govt of Pakistan to the drought effectives?
a. Financial b. shelters c. Drinking water d. food

- b. e. Medicine f. All "a" to "e" f. Any other.....
35. Has the drought affected the animal life in your area?
a. Yes b. No
36. Reference question no 35, What kind of affects you observed on animal lives?
a. Deaths b. Decrease in Market price c. Increase in animal diseases d. Change in animals lay before time e. All "a" to "e"
f. Any other.....
37. What was the market value of the following animals at the time of drought and before drought (Mentioned price in PKR)?
- | Name | before Drought | Drought Period |
|-------------|----------------|----------------|
| a) Goat | | |
| b) Sheep | | |
| c) Ox | | |
| d) Cow | | |
| e) Asses | | |
| f) Donkeys | | |
| g) Buffalos | | |
| h) Moll | | |
| i) Cattle | | |
38. Have there been any impacts of drought on the lives of Aves (Birds)?
a. Yes b. No
39. What are the main impacts of drought on birds? Please tick mark.
a. Increase in Diseases b. Shelter c. Increase in death
d. Increase in migration e. Any other.....
40. How many people have migrated from your village/town during drought period?
a. Less than 25% b. 25-50% c. 51-75% d. Above 75%
41. What was the impact of drought on agriculture/crops?
a. Mostly damaged b. Low production c. Low Market price d. Any other.....
42. What crops were mostly effected by drought?
a. Rabbi b. Kharif
43. What are the dates of sawn and harvesting of Kharif and Rabbi crops in your area?
- | Crop Name | Swan Month/Date | Harvest Month/Date |
|-----------|-----------------|--------------------|
| a) Rabbi | | |
| b) Kharif | | |
44. Is there any change in the sawing and harvesting of Rabbi or Kharif crops since last 40 years?
a. Yes b. No
45. If yes, what is the range of change?
a. 5-10 days b. 11-20 day c. 21-30 days d. More than 30 days
46. Has this change led to sawn or harvest the Rabi and Kharif crops?
a. Before due time b. After due time
47. Reference question 46, has the production of crops going to;
a. Increased b. Decreased c. Remain stable d. Any other.....
48. Is there any change in the agriculture zones because of climate change?
a. Yes b. No
49. If yes, is the agriculture zones boundaries shifted towards;
a. North b. South c. East d. West e. No change
50. When you have observed this shift in the agriculture zones? Please mentioned the approximate date/Year.....
51. Is there any change in the crops yield per acres in your area?
a. Yes b. No
52. If yes, what is the range of decline in crops yield per acre?
a. 0-5KG b. 5-10KG c. 10-15 KG d. Any other.....
53. Is this decline related to;
a. Kharif crops b. Rabi crops c. Any other

54. What are the main sources of irrigation in the surrounding of your native village/towns?
a. Karez b. Tubewells c. Canal system d. Rainfed
55. Is there any change in the flow of water in canals and rivers of your area?
a. Yes b. No
56. Since when, have you observed this change in flow of water. Please mention the year.....
57. Which are the main rivers passing closer to your native village/town, please highlight the names.....
58. Is there any change in the flow of these rivers?
a. Yes b. No
59. If yes, since when you have observed it. Please mentioned the year.....
60. Has this decreased in flow of water effected?
a. Agriculture b. Economy c. Human lives d. all "a" to "c"
d. Any other.....
61. What type of soil you have in your native town/village?
a. Loess b. Gravels c. sandy d. Loamy e. Any other.....
62. What caused desertification in your area?
a. Decrease in rainfall b. Decrease in rivers flow c. Deforestation
d. Any other.....
63. Has your area change into pure desert with passage of time?
a. Yes b. No
64. What type of desert it is;
a. Rocky b. Stony c. Badlands d. Sandy e. Mountain f. Any other.....
65. What is the maximum height of trees in your area?
a. 1-2` b. 3-4` c. 5-6` d. above 6`
66. How to control desertification in your area.
a. Afforestation b. Well canal system c. Any other.....
67. Are there any glaciers in your area? **(If no then go to Question no 72)**
a. Yes b. No
68. If yes, then what kind of change have you observed in the last 40 years in the Glaciers?
a. Increase in glaciers b. Decrease In glaciers c. Sever Melting
d. Any other.....
69. Are these glaciers melting more rapidly?
a. Yes b. No
70. What are the main causes of melting of Glaciers?
a. Increase in temperature b. Atmospheric pollution
c. Cutting of Forests d. Global warming e. Any other.....
71. What are you suggestions to control high melting of glaciers?
a. Planting of tress b. Control of atmospheric pollution c. Control of global warming
d. Any other.....
72. Has the on going climate change effected coastal region in Pakistan?
a. Yes b. No
73. If yes, then is the sea level;
a. Rising b. Declining c. No change d. Any other.....
74. What are the main impacts of rise on the coastal region in Pakistan?
a. Damages to crops b. Damages to ships c. Decrease in sea trade
d. Damages to sea forts e. Damages to human
f. Any other.....
75. The way to control climate change is;
a. We all need to take action b. Govt should take step for this
c. Ministries should make proper policy d. all of the above
e. Any other.....

76. What action would you encourage to take action on climate change?
a. Clubs b. Organization c. Govt
d. Each Individual of the country e. Any other.....
77. What do we need to do for the reduction of carbon emission to atmosphere?
b. Control on Vehicles b. control emission of CFCs from Industries c.
Control on wars d. Control on Nuclear weapons
e. Any other.....
79. What action do you think is required to reduce the impact of climate change on the economy of Pakistan? Please highlight your suggestions/Comments that have not been mention in the questions stated above (Attached an extra sheet if necessary).



Thank you for your valuable response.

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