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Factor Affecting Orchards Farmers Adaptation Strategies to Climate Change in District Swat

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ABSTRACT
This study examines how farmers in the villages of Dakorak and Gulibagh in Swat District are adapting to the impacts of climate change. Using purposive sampling, 310 households were selected, and primary data were collected through a structured and pre-tested questionnaire. Analysis through SPSS-based descriptive statistics showed that 27% of respondents had completed secondary education, and 25.1% cultivated land between 11–20 kanals. A substantial proportion (85.8%) observed significant changes in temperature, and 87.7% had implemented adaptation strategies.The most commonly adopted strategies included changes in irrigation timing (82.2%), mixed farming practices (61.6%), basic storage techniques (16.7%), the use of weather forecasting apps (53.8%), and application of chemical sprays (83.5%). Binary logistic regression analysis indicated that education level, farming experience, and farm size had statistically significant positive effects on adaptation behavior. The study concludes that a majority of respondents are aware of climate change and are taking proactive measures. It recommends focused awareness programs and policy support to enhance adaptation capacity at the grassroots level.

Keywords: *Climate Change Adaptation, Farmers' Perception, Agricultural Practices, Dakorak, Gulibagh, Swat District, Binary Logistic Regression, Indigenous Strategies, Farm-Level Resilience, Rural Livelihoods.*

Introduction

Climate change remains one of the most critical environmental threats facing humanity today. Its multidimensional impacts extend beyond environmental degradation to directly threaten food production, freshwater availability, human health, and ecological stability. Across the globe, the manifestations of climate change have become more tangible and frequent in the form of intensified storms, floods, droughts, and cyclones, with developing nations bearing the brunt of these changes. Pakistan, situated in a climate-sensitive tropical region, is particularly vulnerable to these disruptions (Mustafa, 2011). Scientific studies based on satellite data, climate modeling, and historical observations clearly indicate that significant atmospheric changes have been occurring since the pre-industrial era. According to the Intergovernmental Panel on Climate Change (IPCC, 2018), global temperatures are projected to rise between 1.4°C and 5.8°C by the end of this century. Such an unprecedented increase would severely affect sea levels, disrupt ecosystems, reduce water availability, and place enormous stress on agricultural productivity

especially in countries like Pakistan that lack the resilience mechanisms of wealthier nations (Mustafa, 2011).
The broader implications of climate change include widespread population displacement and severe socio-economic losses. The IPCC (2018) projects that climate-induced displacements could affect more than 150 million people globally by the century's end. Additionally, climate-related hazards such as floods, cyclones, and droughts now account for about 70% of natural disasters recorded in the last 50 years. These climate and water-related disasters are responsible for 56% of global disaster-related deaths and account for a staggering 75% of all economic losses in the same period (IFRC, 2020). These global figures reflect the magnitude of the crisis, but its effects are particularly stark in Pakistan. Ranked 12th in the Global Climate Risk Index from 1993 to 2012 and climbing to 5th in 2021, Pakistan's climate vulnerability is among the highest in the world (Ullah et al., 2018; Habib et al., 2022). The nation's agricultural sector, which is vital to its economy contributing 19.5% of GDP and employing more than 42% of the workforce is especially threatened. Changes in seasonal rainfall, frequent droughts, higher average temperatures, and floods have severely disrupted crop cycles, reduced productivity, and intensified rural poverty (Khan et al., 2021; Husain & Hassan, 2014).
The impacts of climate change in Pakistan are further complicated by the country's diverse geographical and ecological zones, ranging from dry mountainous regions and fertile plains to coastal belts. This variation means climate change affects different regions in distinct ways. In the northern areas, for instance, melting glaciers are altering river flows and increasing the risk of floods, while southern parts are experiencing severe droughts and desertification. Over recent years, increasingly erratic rainfall patterns and extreme temperature shifts have destabilized agricultural systems and rural livelihoods. The intensification of floods, droughts, and heatwaves has resulted not only in crop failures and livestock losses but also in displacement, infrastructure damage, and rising food insecurity (Husain & Hassan, 2014). Agricultural productivity is also declining due to a rise in pests and diseases, soil erosion, and a shortening of the growing season. Although modern agricultural innovations and climate-smart techniques offer some promise, these solutions are heavily dependent on stable water supply, timely access to resources, and robust institutional support. Without integrated adaptation strategies that are tailored to Pakistan's regional dynamics and socio-economic realities, the impact of climate change on food systems and rural livelihoods will continue to escalate. Technological intervention, public awareness, and targeted policy responses are urgently required to build long-term resilience (Rizwanullah & Liang, 2021; Faraz & Israr, 2016).

Objectives

1. To study the perception of farmers about CC and its impact on orchard growers in the study area.
2. To identify factors that influence farmers' choices of adaption in the study area.
3. To recommend and suggest some adaptive strategies in coping with the changing conditions of the climate in improvement of orchard production in the study area.

Hypothesis

H_0 Technology adaptation for climate change has no effect on orchard growers

Literature Review

Studies across the globe illustrate the diverse strategies farmers employ to adapt to climate change. In the Nile Basin, Deressa et al. (2009) identified key factors such as education, landholding size, and access to information as determinants in farmers' choice of adaptive methods like crop diversification, soil conservation, and irrigation. Similarly, Crane et al. (2010) emphasized that adaptation is a socially negotiated process, not just a technical response to environmental shifts. Fujisawa and Kobayashi (2011) explored how apple farmers in Japan responded to delayed fruit ripening due to climate change, demonstrating that sales channels shape adaptive behavior. Meanwhile, Lal et al. (2011) and Bhatti et al. (2012) emphasized how sustainable land and nutrient management, such as no-till farming and organic practices, can both mitigate and adapt to climate risks. These global findings underscore that successful adaptation blends social, economic, and environmental considerations.

Many studies highlight the structural and policy barriers that hinder adaptation. Gupta (2010) discussed the shift in framing climate change from an environmental concern to a developmental one, stressing the inadequacy of current global commitments. Eshamand and Garforth (2013) found that Sri Lanka's agricultural sector suffers from fragmented adaptation planning. Similarly, Khanal (2014) showed that farmers in Nepal face challenges such as rising temperatures, water scarcity, and increased winds, while suggesting practical adaptations like drought-tolerant crops and water-efficient irrigation. Adenle and Azadi (2015) noted that insufficient R&D funding in developing countries restricts technology adoption, while Upadhyay and Bijalwan (2015) argued for the use of ICT in communicating climate risks. Rasul and Sharma (2016) introduced the nexus approach connecting energy, food, and water to better address adaptation needs, highlighting the urgent requirement for integrated solutions.

In Pakistan, similar issues emerge. Ali and Erenstein (2017) found that younger, better-educated farmers tend to use a broader range of adaptive practices. Abid et al. (2017, 2019) identified institutional weaknesses such as limited access to information, capital, and extension services, which constrain farmers' ability to adapt effectively. Ullah et al. (2017, 2018) emphasized water scarcity, socio-economic vulnerability, and the importance of institutional support like access to credit and quality inputs. Nawaz et al. (2019) showed how climate change threatens citrus production in Punjab by increasing pest infestations and water stress. Moreover, Subedi (2019) and Ali et al. (2020) confirmed that adverse weather conditions, limited market access, and low education levels reduce the capacity of fruit farmers in Khyber Pakhtunkhwa to implement adaptive techniques. These findings suggest a growing disconnect between scientific recommendations and local realities in Pakistan's agricultural system.

Collectively, the literature demonstrates that adaptation is not just about changing agricultural practices but also about addressing institutional, social, and economic barriers. Despite a growing awareness of climate risks, access to extension services, credit, market information, and climate-resilient technologies remains uneven across regions. While multiple studies offer rich insights into regional adaptations, there remains a gap in understanding localized responses particularly among orchard farmers in high-risk areas like Swat, Khyber Pakhtunkhwa. The existing research has yet to sufficiently explore farmers' willingness to invest in climate adaptation or identify the socio-economic factors influencing such decisions. This study, therefore, aims to bridge that gap by providing localized data on adaptation strategies and investment willingness, with a specific focus on fruit growers in Pakistan's vulnerable mountainous regions.

Research Methodology

This section explains the research methodology that will used in showing the research study. This contains universe of the study, sample size, sampling technique and tools of data collection and analysis.

Universe of the study

This study was conducted in Swat, district of Malakand Division Khyber Pakhtunkhwa province in Pakistan. District swat constitutes the universe of this study. The total population is 2,309, 570.out of which the rural population is 1,613,670 and urban is 695,900. Total number of households 274,620 (Pakistan Bureau of Statistics 2018**).** District Swat is the universe of the study, therefore only one tehsil Charbagh is selected and two villages Dakorak and Gulibagh are selected.

Population

The total household in Tehsil Charbagh is 15315.The total household in village Dakorak is 686 households in village Gulibagh whereas total 914 households. Both villages Dakorak and Gulibagh having total household are 1600. (Pakistan Bureau of Statistics 2018)

Sampling and sample size

A sample size of 310 was selected by using Uma Sekaran table, 2003. Both villages Dakorak and Gulibagh having total population are 1600 households. Further, proportional allocation technique was used to allocate the given sample among the study areas.

Table 1; Selection of the Sample Respondents in the Study Area

Tehsil	Villages	No of households	Sample size
Charbagh	**Dakorak**	686	133
	Gulibagh	914	177
Total	**All**	1600	310

Data Collection

Two villages were selected for data collection and analysis: Dakorak and Gulibagh in the tehsil Charbagh District of Swat. Data collection utilized a semi structured questionnaire, gathering information on household/farmer adaptation techniques currently employed to compensate for the changing climate change. The format evolved as the research determined necessary versus unnecessary information needed for the study.

Data Analysis

Data collected in the field via paper method was then transferred to a computer databank for analysis. Statistical Package for Social Sciences (SPSS) analyzed the collected data and represented the data through a binary logit model using a percentages and frequencies report.

Proportion Allocation Sample Technique

$$ni = \frac{Ni}{N} \times n \qquad 3.1$$

Where:

n_i= Number of sample households in each village

N_i = Total number of households in 1 village

N = Total number of households in focus area

n = Total sample size

Using the proportional sampling method, the sample size for each household was calculated as follows.

n_1= 686/1600 × 310 = 133 = Dakorak

n_2 = 914/1600 × 310 = 177 = Gulibagh

Analytical Framework

This study's analytical framework was comparable to that utilized by Abid, et al., (2015) Ahmed, et al., (2021) the same technique was also used by Ullah et al., (2018) Saguye, (2017) Binary logistic regression is a statistical technique that is utilized in research studies to examine the association between a dependent variable and one or multiple independent variables. A logistic regression model enables the selection of a predictive model for a dependent variable that is dichotomous, meaning it can take only two possible values. It defines the relationship between a dichotomous response variable and a set of explanatory variables (predictors) (Allison2012). The extraction information was exported into SPSS software for further analysis The model will be employed to identify the variables that clarify the adoption of technology. A logistic model was developed based on the binary response variable (one – Strategies Adaptation; zero – otherwise)

Variables used in the study

The study used a dependent variable of adaptation strategies, what techniques were used, whether any technique was used or none used, how techniques were developed or whether the techniques were discovered through literature, research, or trial and error. Dependent, independent and expected sign of the variable details are included in a table 3.2.

Table 2: Description and expected signs of variables used in the model

Variable	Measurement	Expected sign
Dependent Variables **Use of adaptation strategies. (Irrigation time, mix farming, weather app, storage practices, chemical spray application, other)**	If using any adaptation strategies =1 or 0 if otherwise.	
Independent Variables		
Age of the household	Quantitative (in years)	+
Education of the household	Quantitative (in years)	+
Farm size of the household	Quantitative (in kanals)	+
Farming experience of the household	Quantitative (in years)	±
Monthly income of the Household	Quantitative (in PKR)	+

Model specification

The binary logit model to analyze the factors that influence farmers' decisions to implement adaptation measures for extreme weather events. The general equation of a binary logit model is represented as follows:

$$\log\left(\frac{p}{1-p}\right) = \beta_{\circ} + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 \text{ ....3.2}$$

Whereas,

P= probability of Y=1, 1-P = probability of Y =0

Y= Use of adaptation strategies (1 using at least one strategy, 0=No)

X_1= Age of household (years)

X_2= Education of household (years)

X_3= Farm size of household (kanals)

X_4= Farming experience (years)

X_5= Monthly income of household (PKR)

$\beta_{\circ}$= Constant
β_s= Coefficient of the variables

Results and Discussion

Post-analysis details, including a discussion and analysis of the study regions and variables affecting the regions, were addressed. Variables highlighted include: age, education level of the farmers and house, household size, farm and land size, experience, and access to available extension services, public and private and how these variables and techniques implemented affected production.

Descriptive Statistics

The following highlights the variables addressed of sample respondents including age, education level, household size and farming experience of the farmers, access to available extension services to the farmers, and land size of the farm. These features were incredibly instructive regarding the results and are described in detail below.

Age of the Respondents

Age is a key factor defining the awareness and willingness to implement new adaptation techniques to any innovation or plan was the age of the farmers The age and experience of the farmers has a directly correlates with experience, experience level has been proven to increase with age.

Table 3: Ages of the Sample Respondents in the Study Area

Study Area	**Age** (years)			**Total**
	21-30	**31-40**	**above to 40**	
Dakorak	24 (18)	19 (14.3)	90 (67.7)	133 (42.9)
Gulibagh	32 (18.1)	23 (13)	122 (68.9)	177 (57)
Total	56 (18)	42 (13.5)	212 (68.3)	310 (100)

Note: Figures in parentheses are percentages
Source: Field survey, 2022

Table 3 shows that the minimum age of the sampled respondents for the farming community was 21 to 30 years. While maximum age was above to 40 years. The age was categorized in to four classes which were up to 20 years 21-30, 31-40, above to 40 years Thus these findings are considered to be in line with Tazeze et al., (2012) who also reported that household age, i.e. experience, has a favorable and significant effect on adaptation to climate change. This is because as household age increases, the person is expected to have more experience with weather forecasting, increasing the likelihood of using different weather forecasting techniques. Climate change approaches for adaptation the majority of participants were in the age group of 40 years and older. in which 68.3% of the total sampled respondent belonged to Dakorak and Gulibagh.

Educational level of the Respondents

Education plays a pivotal role in enhancing an individual's comprehension and skills. It is vital in determining one's willingness to embrace innovative concepts, inventions, or strategies. It is a process of gaining knowledge, skills, beliefs, and values. In comparison to an uneducated farmer, a literate farmer can apply innovative methods to protect his production, profit from it, and take advantage of the current circumstances.

Table 4: Educational level of the sample respondents in the study Area

Study Area	Educational level (years)					Total
	Illiterate	Primary	Matric/inter	Bachelor	Master	
Dakorak	58 (43.6)	25 (18.8)	35 (26.3)	9 (6.8)	6 (4.5)	133 (42.9)
Gulibagh	76 (42.9)	31 (17.5)	49 (27.7)	11 (6.2)	10 (5.6)	177 (57)
Total	134 (43.2)	56 (18)	84 (27)	20 (6.4)	16 (5.1)	310 (100)

Source: Field survey, 2022

Based on the findings presented in Table 4, it was revealed that a significant portion of the surveyed respondents who had received an education belonged to Gulibagh which is 57% of the total sampled respondents about 43.2% of the total respondents were illiterate. Maximum of the sampled respondents of 26.3% were having 1-12 years of education. Only 5.1% of the respondents of the total had 16-18 years of education. The result are in line with Tazeze et al., (2012) who also stated that most of the respondents were literate showing that education increases the possibility of adapting to climate change. While 6.4% of the sampled respondents had 12-16 years of education level.

Household size of the Respondents

A household is a collection of people who share food and shelter and are dependent on one another, either directly or indirectly. This indicator demonstrates the participation of members of a household in labor intensive activities in the adoption of indigenous climate change strategies. The size of the household is classified into five categories.

Table 5: Household Ssize of the Sample Rrespondents in the study Area

Study Area	Household size (numbers)					Total
	1-5	**6-10**	**11-15**	**16-20**	**+21**	
Dakorak	29 (21.8)	57 (42.2)	38 (28.5)	7 (5.2)	2 (1.5)	133 (42.9)
Gulibagh	42 (23.7)	73 (41.2)	51 (28.8)	7 (4)	4 (2.3)	177 (57)
Total	71 (22.9)	130 (41.9)	89 (28.7)	14 (4.5)	6 (1.9)	310 (100)

Source: Field survey, 2022

Table 5 results show that most of the household's sizes were between 6-10 members in Dakorak and Gulibagh, while in Gulibagh most families with 11-15 members were found. Out of the total sampled respondents, households with below 5 members were 22.9% households, 41.9% had 6-10 members, and 4.5% were from household with 16-20 members while only 1.9% of the respondents of the total households had members more than 21. These findings are considered to be in line with the findings Deressa et al., (2009) who also reported that households with large family size are more likely to adapt to climate change.

Farm Size of the Respondents

The amount of land that can be used only for agricultural purposes is considered the farm size. According to the study area, agricultural lands were irrigated. Higher farm availability therefore means higher yields and opportunities to diversify crops and farming practices.

Table 6: Farm size of the sample Respondents in the study Area

Study Area	**Farm Size** (kanals)						**Total**
	1-10	**11-20**	**21-30**	**31-40**	**40-50**	**+50**	
Dakorak	16 (12.3)	32 (24)	33 (24.8)	15 (11.2)	16 (12)	21 (15.7)	133 (42.9)
Gulibagh	17 (12.7)	46 (25.9)	44 (24.9)	19 (10.7)	22 (12.4)	29 (16.4)	177 (57)
Total	33 (10.6)	78 (25.1)	77 (24.8)	34 (10.9)	38 (12.2)	50 (16.1)	310 (100)

Source Field survey, 2022

Table 6 shows different farm sizes in the study areas as below 1-10, 11-20, 21-30, 31-40, 41-50, and above 50 kanals.their farm percentages were10.6%, 25.1%, 24.8%, 10.9%, 12.2%, and 16.1%, respectively. Only 24.8% sampled respondents from Dakorak and 24.9% from Gulibagh 21-30 kanals of cultivable lands. On other hand, farm sizes below 1-10, and 11-20. 21-30 kanal were found common in Gulibagh. Thus, the results in line with the findings of Belay et al., (2017) who stated that the majority of the adaption strategies have a favorable and significant relationship with farm size. The size of farmland increases, the possibility of planting different fodder trees and contributing crop with livestock production increases. The table results displayed that maximum of the sampled respondents held farm sizes below 11-20 kanals.

Farming Experience of the Respondents

Agricultural practice describes the nature of farm practices carried out by farmers. Practice period comes. The more time you spend practicing, the more experience you will gain and the better you will perform on the field. Farmers know more about what strategies are right for the current climate.

Table 7: Farming Experience of the sample Respondents in the study Area

Study Area	**Farming experience** (years)					**Total**
	1-10	**11-20**	**21-30**	**31-40**	**+40**	
Dakorak	41 (30.8)	36 (27)	31 (23.3)	18 (13.5)	7 (5.2)	133 (42.9)
Gulibagh	53 (29.9)	50 (28.2)	49 (27.7)	18 (10.2)	7 (3.9)	177 (57)
Total	94 (30.3)	86 (27.7)	80 (25.8)	36 (11.6)	14 (4.5)	310 (100)

Source Field survey, 2022

According to the data presented in Table 7 it was observed that the majority of the sampled respondents, accounting for 27%, had farming experience ranging from 11 to 20 years. and 29.9% had 1-10 years of farming experience while only 3.9% of the respondents of the total farmers had experience more the 40 years. In Dakorak 29.9% of the respondents had 1-10 years of experience. In Gulibagh 28.2% had 11-20 years of experience. Thus, these findings align with previous research or findings that have been reported. Belay et al., (2017). who said that farming expertise has a favorable impact on some aspects of climate change Adaptation techniques supported in increasing reaction to the negative consequences of climate change. While 11.6% of the sampled respondents had farming experience of 31-40 year.

Total Monthly Income Level in PKR

Income refers to the earnings individuals receive from their mental or physical endeavors. The level of income plays a significant role as an economic factor among the respondents, providing insights into their economic conditions and their reliance on natural resources. A higher income level allows for a more enjoyable lifestyle, while individuals with lower income levels often face hardships and depend on external support for their standard of living.

Table 8: Total Monthly income of the sample Respondents

Study Area	10-20 Thousand	21-30 Thousand	31-40 Thousand	+40 Thousand	Total
Dakorak	24 (18)	50 (37.6)	39 (29.3)	20 (15)	133 (42.9)
Gulibagh	32 (18.1)	67 (37.9)	51 (28.8)	27 (15.3)	177 (57)
Total	56 (18)	117 (37.7)	90 (29)	47 (15.1)	310 (100)

Source Field survey, 2022

Table 8 indicates mostly income of respondents which is 37.7% of the respondents have 21-30 thousand PKR monthly income while 29% of respondents having monthly income level 31-40 thousand PKR. And 18% of the respondent’s monthly income 10-20 thousand PKR. Only15.1% of the respondent’s monthly income above 40 thousand PKR from the total sample respondent in the study area.

Access to Extension Services

Access to extension services means new and updated training as well as information on farm related ideas, innovations, strategies, and methods to tackle early-stage challenges. It plays a major role in supporting how farmers are coping with the current threats of climate change.

Table 9: Access to Extension services of the sample Respondents in the study Area

Study Area	Access to Extension services		Total
	No	**Yes**	
Dakorak	72 (54.5)	61 (45.8)	133 (42.9)
Gulibagh	94 (53.1)	83 (46.9)	177 (57)
Total	166 (53.4)	144 (46.4)	310 (100)

Source: Field survey, 2022

Table 9 The findings presented information on the sampled respondents' availability of extension services. only 46.4% sampled respondents were able to access the services of extension in the study area. Whereas the remaining 53.4% of the sampled respondents lacked access to such services. The results are in line with same like Abid et al., (2019) who also reported that Access to extension services improves the adoption of climate change adaption methods. Farmers who are in constant contact with extension workers to obtain information about farming technology, new varieties, pest and disease control, and other topics are more likely to adjust to climate change than farmers who have little or no access to extension services. The respondents who had limited access were from the area under investigation of Dakorak and Gulibagh was found far outside access to such services.

Strategies Adaptation

Adaptation strategies are the indigenous approaches adapted by the farming community to cope with climate exposures in the study area. Irrigation time, Mix Farming, Storage practices, Weather App, Chemical spray application are the adaptation strategies detected in the study area.

Table 10: Strategies adaptation to climate change adapted by the sample Respondents in the study Area

Study Area	**Strategies Adaptation**											
	Strategies adaptation		**Irrigation time**		**Mix farming**		**Storage practices**		**Weather App**		**Chemical spray application**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Dakorak	119 (89.5)	14 (10.5)	114 (85.7)	19 (14.2)	85 (63.9)	48 (36)	21 (15.7)	112 (84.2)	72 (54.1)	61 (45.8%)	112 (84.2)	21 (15.7)
Gulibagh	153 (86.4)	24 (13.6)	141 (79.6)	36 (20.3)	106 (59.8)	71 (40.1)	31 (17.5)	146 (82.4)	95 (53.6)	82 (46.3%)	147 (83)	30 (16.9)
Total	272 (87.7)	38 (12.2)	255 (82.2)	55 (17.7)	191 (61.6)	119 (38.3)	52 (16.7)	258 (83.2)	167 (53.8)	143 (46.1%)	259 (83.5)	51 (16.4)

Source: Field survey, 2022

The values assumed in table 10 The findings reveal that among the respondents surveyed on climate change adaptation, 12.2% reported not having made any adaptations. On the other hand, the majority of the respondents approximately 87.7% reported having implemented adaptation measures in the study area. This indicates that a significant proportion of the respondents have actively engaged in adapting to climate change. maximum adapted strategy for climate change adaptation. Farmers' responses to changes in irrigation time found that about most of the farmers increased the number of irrigations in the study area in response to climate change. change irrigation time experienced by 82.2% of the total sampled respondents. Mix farming is a promising approach to climate change adaptation that can provide a range of benefits to farmers and the environment mix farming practices was 61.6% of the total sampled respondents. Storage practices play a critical role in climate change adaptation, particularly in the context of agriculture and food security. A storage practice was 16.7% of the total sampled respondents. farmers can use weather apps to manage their farms more effectively in the face of climate change. A weather App practice was 53.8% of the total sampled respondents. Chemical spray is one of the techniques used in agriculture to adopt climate change impact. Chemical spray practices were 83.5% of the total sampled respondents Consequently, this adaptation plan was discarded from the study.

Change in Temperature

The farmers perception in the study area on last couple of years change in temperature trends. Farmer's perception annual and seasonal temperature in district swat and Khyber Pakhtunkhwa increased for the last couple of years and the winter and spring days become warmer and summer and fall days getting hotter.

Table 11 : Change in Temperature of the Sample Respondents in the Study Area

Study area	Change in temperature		Total
	Increased	Decreased	
Dakrak	112 (84.2)	21 (15.7)	133 (42.9)
Gulibagh	154 (87.8)	23 (12.9)	177 (57)
Total	266 (85.8)	44 14.1)	310 (100)

Source: Field survey, 2022

Table 11 showed that farmers perception was last couple of years temperature was changed that Dakorak and Gulibagh 85.8% of the farmers perceived for increased in temperature out of the total sampled respondents. While 14.1% perceived decreased in temperature these findings are considered to be in line with the findings Ajibefun and Fatuase, (2011) who also reported that due to changes in temperature farmers adapt different adaptive strategies to limit the risk of climate change conditions.

Orchards Grown

Orchard grown has shown a positive association with the adoption of different sets of climate change practices. Evidence recommended that if farmers have a larger land cultivated area it intensifies to invest more in the use of climate change measures.

Table 12: Orchards grown of the sample Respondents in the study Area

Study Area	Orchards Grown					Total
	Apricot	Plum	Peach	Persimmon	Any others	
Dakorak	28 (21)	30 (22.5)	59 (44.3)	12 (9)	4 (3)	133 (42.9)
Gulibagh	38 (21.4)	42 (23.7)	67 (37.8)	22 (12.4)	8 (4.5)	177 (57)
Total	66 (21.2)	72 (23.2)	126 (40.6)	34 (10.9)	12 (3.8)	310 (100)

Source: Field survey, 2022

Table 12 showed result about orchards grown of sampled respondents Dakorak and Gulibagh most of the farmers orchards grow of Peach 40.6% of the total sampled respondents. Apricot is 21% in Dakorak 21.4% in Gulibagh 21.2% of the total sampled respondents. In Dakorak and Gulibagh Orchard grow of Plum was 23.2% of the total sampled respondents. While persimmon was 10.9% of the total sampled respondents.3.8% of any others orchard grow of the total sampled respondents in the study area.

Table 13: Results of Binary Logistic Regression

Independent variable	*β*	S.E.	Wald.	Sig.	Exp (B)
Age of the respondents	-734	.252	8.469	.004	.480
Education of the respondents	624	.179	12.202	.000	1.866
Farming experience	849	.237	12.824	.000	2.336
Farm size	459	.140	10.712	.001	1.582
Monthly income	-377	.202	3.465	.063	.686
Constant	999	1.167	.732	.392	2.714
Number of observations= 310 *Log likelihood=164.151* *Model Chi=66.511* *Prob.> chi2=0.000*					

In the study area the age of the respondents found with positive sign and statistically insignificant at .004 the result was like to Saguye, (2017) Basnet et al., (2021) stated that age is significantly and negatively related to perception of climate change. Age affects how farmers understand climate factors. Older farmers tend to have a better understanding compared to younger farmers. This shows that age is important because it is connected to the farming experience and the use of traditional knowledge by farmers.

Education of the respondents found positive and statistically highly significant at .000 which define that one unit increase in education of the respondents corresponds to .624 times increase in the log odds of tthese results are consistent with previous findings regarding the level of adaptation. Sarker et al., (2013) who revealed that there exists a positive correlation between levels of education and the adoption of improved technologies. Farmers with higher levels of schooling are anticipated to exhibit greater adaptability to climatic changes. Maddison (2006) stated that farmers with higher levels of education are more likely to adapt better to change climate events.

The result obtained shows that farming experience in the study area was statistically highly significant with a positive sign which define that one unit increase in farming experience of the respondents corresponds to .849 times increase in the log odds of the level of adaptation tthese results are supported by the finding of Ullah et al., (2018) who obtained similar results. The coefficient of farmer age had a positive relationship with strategy adoption, and the estimated marginal effect indicates that the likelihood of adopting the methods is growing.

Farm size was also found positive and statistically significant .001 which defines that one-unit increase use of farm size corresponds to .459 times increase in the log odds of the farm size adaptation the result can be compared with the outcomes of Mohammad et al., (2020) stated that the use of improved crop types, greater fertilizer application, organic manure and mulching/use of cover crops all had a significant and favourable effect on farm size.

In the study area monthly income was found statistically insignificant .063 the result was like to Paudel et al., (2019) who obtained similar results the majority of farmers had poor socioeconomic standing, and even when they concentrated on farming, their output levels were insufficient this made climate change a greater threat to their way of life.

Conclusion

This study was conducted to examination bases of farmers adaptation to climate change in selected villages of district swat and two village i.e., Dakorak and Gulibagh. In a total of 310 sample size 133 were taken from Dakorak 177 sample size were selected from Gulibagh After gathering information, a semi-structured questionnaire was utilized as the primary method of data collection. the investigation was done by using statistical package for social sciences SPSS through percentages, frequencies, and Binary logit model.

The data were analysed by using descriptive statistics. Displayed that the age of about 68.3% of the sampled respondents in the study area having above 40 years age. About 41.9% from the total sampled respondents had 6-10 members.

The sampled respondents' average education level was 1-12 years of education (27%) while about 43.2% of them were illiterate. The farming experience was found habitually among 11-20 and 1-10 years for 27.7% and 30.3% of the sampled respondent, individually. The Result also reveals that 46.4% of the respondents having access to extension services while 53.4% having no access to extension services. According to the data, the majority of the sampled respondents possessed a farm size 11-20 kanal 25.1% and total monthly income 21-30 thousand 37.7%. The results indicate that most of the participants i.e., 87.7% of the respondents adapted to climate change whereas 12.2% respondents stated that they did not adopt in response to climate change.

Moreover, it is stated that many adaptation strategies were brought in use to throw on going climate change that occur with rapid change. Starting from Mix farming majority of the respondents i.e., 38.3% did not practices Mix farming while 61.6% practiced Mix farming. The result displays that 53.8% respondents were use Weather App whereas only 46.1% did not use Weather App. Whereas the findings reveal that 16.7% of the respondents were practices storage practices majority of the respondents i.e., 83.2% did not practice storage practices.

The result also reveals that 82.2% of the sampled respondents were performs irrigation time whereas only 17.7% did not practice irrigation time. Majority of the farmers in the field area were reported to be using chemical spray application while only 16.5% of them did not use of chemical spray application.Temperature changes noticed over the last few years. The data in the table pointed that 85.8% respondents reported a temperature change and state that the temperature has increased. and 14.1% of the respondents pointed that the temperature decreased during last couple of years. The data also pointed that 40.6% of the respondents growing peach orchards It was also reported by 23.2% % of the sampled respondents that they are growing Plum 21.2% of the respondents that they are growing Apricot 10.9% of the respondents they are growing Persimmon whereas only 3.8% of the sample respondents growing any others orchards.

According to the findings, climate change is affecting farmer communities either directly or indirectly. Farmers have been aware of climate change, its effects, and perceived changes in temperature and rainfall over the last decade. Peach, plum, apricot, and persimmon were among the crops grown in the area. The causes of climate change are overpopulation and pollution. Deforestation and industrialization, coupled with the changes in weather conditions, the study concludes that the farming community adopted many indigenous strategies in response to climate change vulnerabilities in the study area. These strategies include change in irrigation timing, mix farming, use of weather app, storage practices, and the use of chemical spray application.

Various causes of climate change mitigation and adaptation strategies have important and positive role. Irrigation time is the factor that has the greatest impact on the adoption of coping strategies for climate change is irrigation timing, and it is considered to be very significant. While education, farming experience, and farm size related that significant effect on adaptation strategies. Most of the farmers in the area were not informed about the available extension services, and the government has not yet met their needs. This lack of information has resulted in their limited understanding of the issues related to climate change.

Recommendations

i. The following recommendations are given based on the findings:
ii. One way to address the limited knowledge of climate change adaptation strategies among farmers in the area is to engage all stakeholders in the development of comprehensive and feasible strategies that are suitable for the local government. This approach can help to enhance the farmers' understanding of climate change and enable them to adopt effective coping strategies.
iii. The lack of weather information and forecasts prevents farmers from effectively adapting to climate change. So providing timely information is the way to overcome this situation.
iv. To tackle the issue of climate change, which is largely caused by human activities such as population growth, it is essential to create awareness and implement proper planning measures by the government and other relevant organizations. This approach is necessary to address the problem of increasing population and its impact on climate change.
v. Trees are critical in adaption to the changing climate; analytical recommendation is to increase planting trees to stabilize the environmental changes.
vi. Societies across the nations should be able to assess the risks and vulnerabilities the changing climate has on their livelihoods. By participating in these assessments, formulating realistic planning, and taking a proactive role, both on the individual level as well as collaboratively with each other, the nations will be able to make the necessary adaptations and mitigation to overcome the predictable obstacles presented by climate change.
vii. The study suggests that the government should invest more money to help farmers acquire specific knowledge that will benefit orchards.

References

Abid, M., Ngaruiya, G., Scheffran, J., & Zulfiqar, F. (2017). The role of social networks in agricultural adaptation to climate change: implications for sustainable agriculture in Pakistan. Climate, 5(4), 85.

Abid, M., Scheffran, J., Schneider, U. A., & Ashfaq, M. J. E. S. D. (2015). Farmers' perceptions of and adaptation strategies to climate change and their determinants: the case of Punjab province, Pakistan. Earth System Dynamics, 6(1), 225-243.

Abid, M., Scheffran, J., Schneider, U. A., & Elahi, E. (2019). Farmer perceptions of climate change, observed trends and adaptation of agriculture in Pakistan. Environmental management, 63(1), 110-123.

Adenle, A. A., Azadi, H., & Arbiol, J. (2015). Global assessment of technological innovation for climate change adaptation and mitigation in developing world. Journal of environmental management, 161, 261-275.

Ahmed, Z., Guha, G. S., Shew, A. M., & Alam, G. M. (2021). Climate change risk perceptions and agricultural adaptation strategies in vulnerable riverine char islands of Bangladesh. Land use policy, 103, 105295.

Ali, A., & Erenstein, O. (2017). Assessing farmer use of climate change adaptation practices and impacts on food security and poverty in Pakistan. Climate Risk Management, 16, 183-194.

Ali, U., Wang, J., Ullah, A., Tan, Y., Nurgazina, Z., & Khan, Z. A. (2020). Determinants of farmers' choice adaptation strategies to climate change: Evidence from Khyber Pakhtunkhwa Pakistan. Pakistan Journal of Agricultural Sciences, 57(3).

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Ajibefun, A., & Fatuase, A. (2011). Analysis of perception and adaptation to climate change among arable crop farmers in Ikogosi Warm Spring Communities of Ekiti State, Nigeria.

Arnell, N. W., Livermore, M. J., Kovats, S., Levy, P. E., Nicholls, R., Parry, M. L., & Gaffin, S. R. (2004). Climate and socio-economic scenarios for global-scale climate change impacts assessments: characterising the SRES storylines. Global Environmental Change, 14(1), 3-20.

Abdur Rashid Sarker, M., Alam, K., & Gow, J. (2013). Assessing the determinants of rice farmers' adaptation strategies to climate change in Bangladesh. International Journal of climate change strategies and Management, 5(4), 382-403.

Abou-Hadid, A. F. (2006). Assessment of impacts, adaptation, and vulnerability to climate change in North Africa: food production and water resources. A Final Report Submitted to Assessments of Impacts and Adaptations to Climate Change (AIACC).

Bacha, M. S., Muhammad, M., Kılıç, Z., & Nafees, M. (2021). The Dynamics of Public Perceptions and Climate Change in Swat Valley, Khyber Pakhtunkhwa, Pakistan. Sustainability, 13(8), 4464.

Belay, A., Recha, J. W., Woldeamanuel, T., & Morton, J. F. (2017). Smallholder farmers' adaptation to climate change and determinants of their adaptation decisions in the Central Rift Valley of Ethiopia. Agriculture & Food Security, 6(1), 1-13.

Bhatta, G. D., Ojha, H. R., Aggarwal, P. K., Sulaiman, V. R., Sultana, P., Thapa, D., ... & Ghimire, L. (2017). Agricultural innovation and adaptation to climate change: empirical evidence from diverse agro-ecologies in South Asia. Environment, Development and Sustainability, 19(2), 497-525.

Baig, A., and Amjad, S. 2014 Impact of climate change on major crops of Pakistan; a Forecast for 2020. Pak. Busi. Rev. 600.

Bhatti, A. U., & Khan, M. M. (2012). Soil management in mitigating the adverse effects of climate change. Soil & Environment, 31(1).

Basnet, B. R., & Adhikari, G. M. Climate Change Adaptation Strategies and Capabilities of Small-scale Farmers in Nepal: Signifiers from Manohara River Basin.

Chaudhry, Q. U. Z. (2017). Climate change profile of Pakistan. Asian development bank Chen, W. Y., Seiner, J., Suzuki, T., & Lackner, M. (Eds.). (2012). Handbook of climate change mitigation. New York: Springer US

Chouksey, R., Singh, K. C., Singh, C., & Birle, Y. (2021). Adaptation of farmers regarding climate resilient technologies in Rewa block of Rewa District in Madhya Pradesh. Indian Journal of Extension Education, 57(1), 26-31.

Crane, T. A., Roncoli, C., & Hoogenboom, G. (2010). Adaptation to climate change and climate. NJAS: Wageningen Journal of Life Sciences. doi: 10.1016/j. njas.2010.11.002

Del Pozo, A., Brunel-Saldias, N., Engler, A., Ortega-Farias, S., Acevedo-Opazo, C., Lobos, G. A., & Molina-Montenegro, M. A. (2019). Climate change impacts and adaptation strategies of agriculture in Mediterranean-climate regions (MCRs). Sustainability, 11(10), 2769.
Deressa, T. T., Hassan, R. M., Ringler, C., Alemu, T., & Yesuf, M. (2009). Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. Global environmental change, 19(2), 248-255.
Esham, M., & Garforth, C. (2013). Climate change and agricultural adaptation in Sri Lanka: a review. Climate and Development, 5(1), 66-76.
Epstein, D., Partnerships, E., Griffiths, E., John Handley, C. U. R. E., Darryn McEvoy, I. C. I. S., Thompson, D., & England, N. (2007). Shaw, R., Colley, M., and Connell, R. (2007) Climate change adaptation by design: a guide for sustainable communities. TCPA, London.
Fraga, H., Moriondo, M., Leolini, L., & Santos, J. A. (2020). Mediterranean olive orchards under climate change: A review of future impacts and adaptation strategies. Agronomy, 11(1), 56.
Fujisawa, M., & Kobayashi, K. (2011). Climate change adaptation practices of apple growers in Nagano, Japan. Mitigation and Adaptation Strategies for Global Change, 16, 865-877.
Faraz, M. (2016). Small scale farmer's perceptions about climate change in Swabi district of Khyber Pakhtunkhwa (doctoral dissertation, university of agriculture Peshawar).
Gitea, M. A., Gitea, D., Tit, D. M., Purza, L., Samuel, A. D., Bungău, S., ... & Aleya, L. (2019). Orchard management under the effects of climate change: Implications for apple, plum, and almond growing. Environmental Science and Pollution Research, 26(10), 9908-9915
Gupta, J. (2010). A history of international climate change policy. Wiley Interdisciplinary Reviews: Climate Change, 1(5), 636-653.
Gedefaw, M., Girma, A., Denghua, Y., Hao, W., & Agitew, G. (2018). Farmer's perceptions and adaptation strategies to climate change, its determinants and impacts in ethiopia: evidence from Qwara district.
Husain, S. B., & hassan, S. (2014). Farmers' perception about climate change and. Researchgate. doi:10.13140/RG.2.1.2599.4963
Habib, N., Alauddin, M., & Cramb, R. (2022). What defines livelihood vulnerability to climate change in rain-fed, rural regions? A qualitative study of men's and women's vulnerability to climate change in Pakistan's Punjab. Cogent Social Sciences, 8(1), 2054152.
Khan, I. a., Rafiq, M., saqib, S. b., ullah, R., & Atiq, M. (2021). Adaptation to Climate Change among Farmers in. Research square. doi:10.21203/rs.3.rs-809046/v1
Khanal, U. (2014). Perception and adaptation of the producers to the impacts of climate change in apple production: an assessment of Mustang district of Nepal. Journal of Agriculture and Environment, 15, 11-17.
Lal, R., Delgado, J. A., Groffman, P. M., Millar, N., Dell, C., & Rotz, A. (2011). Management to mitigate and adapt to. Journal of soil and water conservation, 66. doi:10.2489/jswc.66.4.276
Lybbert, T. J., & Sumer, D. A. (2011). Agricultural technologies for climate change in developing countries:. Elsevier/
Mustafa, Z. (2011). Climate change and its impact with special focus in Pakistan. In Pakistan Engineering Congress, Symposium (Vol. 33, p. 290). Lahore
Morton, J.F. (2007). Climate change and food security special feature: the impact of climate change on smallholder and subsistence agriculture. Proceedings of the national academy of sciences, 104 (59), 19680-19685.

Maddison, D. (2007). The perception of and adaptation to climate change in Africa (Vol. 4308). World Bank Publications.
Nawaz, R., Abbasi, N. A., Hafiz, I. A., Khalid, A., Ahmad, T., & Aftab, M. (2019). Impact of climate change on kinnow fruit industry of Pakistan. Agrotechnology, 8(186), 2.
Nhemachena, C., & Hassan, R 2007. Micro level analysis of farmers adaption to climate change in southern Africa. Intl. Food. Policy. Res. Inst.
Paudel, B., Zhang, Y., Yan, J., Rai, R., Li, L., Wu, X., ... & Khanal, N. R. (2020). Farmers' understanding of climate change in Nepal Himalayas: important determinants and implications for developing adaptation strategies. Climatic Change, 158, 485-502.
Rasul, G., & Sharma, B. (2016). The nexus approach to water–energy–food security: an option for adaptation to climate change. Climate Policy, 16(6), 682-702.
Rizwanullah, M., & Liang, L. (2021, February). Investigation of Farmer (Orchard) Willingness to Pay for Climate Change. A Case Study of KP Pakistan. In 2021 International Conference on Public Management and Intelligent Society (PMIS) (pp. 203-207). IEEE.
Reilly, J. M., & Fuglie, K. O. (1998). Future yield growth in field crops: what evidence exists? Soil and Tillage Research, 47(3-4), 275-290.
Subedi, S. (2019). Climate change effects of Nepalese fruit production. Adv. Plants Agric. Res, 9(1), 141-145.
Saguye, T. S. (2017). Assessment of Farmers' Perception of Climate Change and Variability and It's Implication for Implementation of Climate-Smart Agricultural Practices: The Case of Geze Gofa District, Southern Ethiopia. Assessment, 30, 1-15.
Tazeze, A., Haji, J., & Ketema, M. (2012). Climate change adaptation strategies of smallholder farmers: the case of Babilie District, East Harerghe Zone of Oromia Regional State of Ethiopia. Journal of Economics and Sustainable Development, 3(14), 1-12.
Ullah, W., Nihei, T., Nafees, M., Zaman, R., & Ali, M. (2017). Understanding climate change vulnerability, adaptation and risk perceptions at household level in Khyber Pakhtunkhwa, Pakistan. International Journal of Climate Change Strategies and Management.
Ullah, A., Khan, D., Zheng, S., & Ali, U. (2018). Factors influencing the adoption of improved cultivars: a case of peach farmers in Pakistan. Ciência Rural, 48.
Upadhyay, A. P., & Bijalwan, A. (2015). Climate change adaptation: services and role of information communication technology (ICT) in India. American Journal of Environmental Protection, 4(1), 70-74.