Research Article

Appraisal of Awareness Level of Farmers Regarding Biodiversity Conservation in District Sargodha, Punjab, Pakistan

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Abstract | Mother nature creates a delicate balance between living and non-living elements of the environment known as ecosystem and biodiversity. Any disruption in this balance may result catastrophic effect on the environment including impact on plant, animal and human life. Hence, efforts to maintain a healthy biodiversity through conservation are needed. Since the life is passing through the time of global warming and climate variation, new issues for farming community are on the rise. These issues are related to protection of natural environment and biodiversity which is one of the critical problems encounter by farmers of Pakistan. It is vitally important to take proactive measures to enact timely solutions to this issue, and avoid further losses in biodiversity. The present study was aimed to determine the awareness level of the respondents regarding biodiversity conservation. The results showed that farmers were relatively aware of regarding species diversity; however, they do not know the modern techniques to uphold crop and species diversity. Biodiversity concept of farmers is at very basic level and they know only limited conventional ways to maintain it. The statistical analysis showed weak significant association between factors responsible for biodiversity loss and two types of biodiversity since χ^2 (3) = 11.338, p = 0.010 and concluded that all factors are not equally responsible for loss in both types of biodiversity. Results showed that biodiversity conservation has its role in agricultural development. By conserving biodiversity, agricultural production can be increased. The results from Exploratory Factor analysis showed that by retaining three factors, the explained variation goes up to 54%.

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Introduction

Mother nature creates a delicate balance between living and non-living elements of the environment which known as ecosystem and biodiversity. Disruption in balance of biodiversity may leads to catastrophic effect on the environment including impact on plant, animal and human life. Natural resources are being exploited for a long time. Consequently, due to this indiscriminate exploitation of the natural resources, drastic changes have occurred in the environment.

Pakistan is enriched with assets of biological diversity. In Pakistan, presently the phenomenon of deforestation, loss of biological diversity, land

erosion, salinity and water logging etc. have already caused huge damage to environment and biodiversity, annihilation of plants and animal life, and eventually has a negative impact on human race itself. Maintaining a healthy level of biodiversity is critical for sustaining agriculture and the environment. Biological diversity indicates inconsistency among species, genes and ecosystem in recent years and is variability in organizational role and configuration at its every unit (Reyers et al., 2006).

Decrease in the biological diversity loss is increasing by day across the world. Globally, agricultural practices have many interrelated ecological footsteps (Scherr and McNeely, 2008) and resultantly, conservation of biological diversity is influenced by it. Land under human utilization (80-90% area) is also being used for food production. Agriculture has high potential for biodiversity, it is estimated that agricultural based population falls fewer than 25% biodiversified categorized areas of the world. Hence, agriculture and biodiversity conservation should be managed collectively. The well being and survival of mankind depends upon the biological diversity since it is an important source of food, and variability of biological assets needs to be disseminated equally for its broader advantages.

Intervention of Extension services is the only mechanism that different stakeholders of agriculture system make aware about conventional biodiversity conservation. Biodiversity conservation applications require paradigm shift in extension theory and models through education and outreach, creating awareness regarding biodiversity assets and climate change. Rural communities have a varietal of resources to support biodiversity with their biological diversity (Shackleton, 2007). According to Taylor and Smith (2007), agriculturalists need to take serious measures to conserve biodiversity in states where 50% of the population of rural areas is smallholders. Biodiversity conservation include increase in production, natural resources etc. and could be managed to get success (Abdu-Raheem and Worth, 2011). In another study, Allahyari (2009) reported that extension can provide best network for information dissemination and its role can never be over looked in applications of sustainable agriculture. In addition, biodiversity conservation conflicts among different stakeholders of agriculture system need to be tackle in support of sustainable agricultural production (Ahmad and Karami, 2007).

In spite of these circumstances, land utilization subsidies to biological diversity. Even though "sustainable agriculture" has been recognized for a long time through extension services, extension services are not playing an effective role in any applied form to guide growers those are involved in practices which are responsible for loss in biodiversity. Developing countries like Pakistan, proper attention has been largely absent to learn and educate about biodiversity conservation and protection of other related natural resources since farmer's belief on low-priced, low quality and unregistered chemical usage, and these practices have been illegal in many countries as they are harmful for human health and environment. This practice alone has proved to be a barrier in filling the gap between agricultural policy and applications to uphold the biodiversity conservation (Bechtold and Patterson, 2005).

Protection of natural environment and biodiversity is one of the critical areas of concern as increase threat of global warming and climate change bring new set of challenges for farming communities and environment. Time has come to take proactive and result oriented measures to reach timely conservation solutions to avoid further loss in biodiversity. This study proposes that agricultural extension system could revive its role and boost up awareness among farmers through teaching and training programs regarding protection of biodiversity for sustainable agricultural development. This effort will not only protect the environment but also increase in yields of crops and vegetables. This will lead to plentiful harvests that will help feed the growing population. The training and knowledge boost up the competency level of the farmers (Shurjeel et al., 2016). Attention need to be diverted towards cultivation of crops by protecting natural environment and biodiversity. However, contemporary global concerns about natural ecosystems management further pose challenges to agricultural extension practitioners whose primary goal is to promote agricultural development by providing information, training and education to end users. This study, therefore, creates a model that integrates objectives for achieving biodiversity conservation through farmers' awareness to save natural resources. This study further provides in depth understanding of the role that agricultural extension could play in conserving biological diversity, and proffer a

foundation for reviewing agricultural extension itself. This study is considered as a first step in which the role of extension services may be appraised to save biodiversity and environmental challenges and help to pave the way for its conservation in Pakistan.

Materials and Methods

The purpose of this study was to appraise the awareness level of farmers regarding biodiversity conservation in District Sargodha, Punjab-Pakistan.

Research Objectives

Following objectives were explored during this study.

1. To describe the demographic profiles of respondents in district Sargodha.
2. To identify awareness level of farmers regarding biodiversity.
3. To find out association among the factors responsible for loss of biodiversity and types of biodiversity.
4. To identify the role of biodiversity conservation in sustainable agricultural development as perceived by respondents.
5. To identify the role of agricultural extension in promoting biodiversity conservation as perceived by respondents.
6. To identify the perceptions of respondents for promoting biodiversity conservation.

Research design

A descriptive correlational survey research design was used in this study for determination of the extent to which different factors are related or have any type of association with promotion or loss of biodiversity. Statistical technique such as chi-square used to identify strength of association among factors.

Population and sample

The study was conducted in district Sargodha, Punjab Pakistan. The district has been divided into seven tehsils: Silanwali, Sahiwal, Sargodha, Shahpur, Bhera, Bhalwal and Kotmomin. The sample of size 480 respondents those have basic concepts of biodiversity in some way or the other was selected by multistage sampling technique. According to multistage sampling, 2 tehsils were randomly selected, from each tehsil, 4 union councils, and from each union council 4 villages were randomly selected, and from each village 15 respondents were randomly selected after compiling the list of potential farmers to be included in the study. Hence, the final workable sample included 480 respondents. The results of the study are generalize-able to geographical limits of Sargodha district exclusively.

Instrumentation

Interview schedule was used as an instrument for assessing the awareness level of farmers regarding biodiversity conservation. A five-point Likert type scale was used in order to record the responses. Instrument was pretested on a selected number of respondents before final data collection and the face and contents validity was also checked. The instrument was tested for reliability by calculating Cronbach's alpha =0.82 (for all 62-items measured on likert type scale) using the data from the pilot study.

Data collection and analysis

The respondents were interviewed face-to-face by the team of researchers for data collection. The instrument was administered to each of the respondents individually to ensure unbiased and uninfluenced response.

The collected data was coded and entered into the Microsoft excel sheet for further analysis. Statistical Package for Social Sciences (SPSS) was used for the data analysis. The descriptive statistics such as mean, standard deviation, frequency distribution, and percentages were used for general description of the data. The statistical techniques such as Factor analysis and Chi-square to check the association among different categorical variables were used to infer the results and to draw reasonable conclusions.

Results and Discussion

Different factors such as demographic profiles of the respondents, respondents' ages and their practices, awareness level of the respondents, factors responsible for loss of biodiversity, types of biodiversity, biodiversity and sustainable agricultural development, role of Extension services in promoting biodiversity conservation and what farmers think regarding biodiversity conservation were studied. The results for these factors are discussed in the proceeding sections of the study.

Demographic profiles of the respondents

According to the results from Table 1, average age of the respondents was 48 years. Approximately 87.91% of the respondents were between the ages of 31 to 60 years. Only 11.26% of respondents were over the age

of 61 years and 0.83% of the respondents were up to 30 years. Of the 480 respondents, 31 master's degrees, 86 bachelors, 154 intermediate, 164 matric and 45 held primary school certificates in education. Results indicated that approximately 66% of the respondents had 20 years or less farming experience and 34% had 21 years or more experience. However, average experience was 15 years. Results further showed that 71% of the respondents had 20 acres or less cultivated land and 27% had land between 21 to 40 acres. Only 2% of the respondents had cultivated land between 41 to 60 acres. Average cultivated land was 16 acres. The results showed that 48.3% were doing crop rotation and 22.1 % were doing inter cropping practices. Almost 29.6% were using innovative practices in the study area.

Table 1: *Frequency distribution of the demographic characteristics of the respondents (N=480).*

Age	Frequency	Percent
Up to 30	4	0.83
31-40	88	18.33
41-50	214	44.58
51-60	120	25.00
61-70	53	11.04
71-80	1	0.22
Education level		
Primary	45	9.40
Matric	164	34.20
Intermediate	154	32.10
Bachelors	86	17.90
Masters	31	6.50
Experience		
1-10	90	18.75
11-20	227	47.29
21-30	113	23.54
31-40	50	10.41
Cultivable land		
1-10	140	29.17
11-20	203	42.29
21-30	89	18.54
31-40	42	8.75
41-50	4	0.83
51-60	2	0.45
Existing farming practices		
Inter cropping practices	106	22.10
Crop rotation	232	48.30
Use of innovative practices	142	29.60
Total	480	100.00

Table 2: *Age groups of farmers vs. existing farming practices*

Existing farming practices					
		Inter cropping	Crop rotation	Inno-vative	Total
Young farmers	Count	0	4	0	4
	Expected Count	.9	1.9	1.2	4.0
	%within Age groups of farmers	0.0%	100.0%	0.0%	100.0%
	%within existing farming practices	0.0%	1.7%	0.0%	0.8%
	% of Total	0.0%	0.8%	0.0%	0.8%
Mid-dle-age farmers	Count	68	139	95	302
	Expected Count	66.7	146.0	89.3	302.0
	%within Age groups of farmers	22.5%	46.0%	31.5%	100.0%
	%within existing farming practices	64.2%	59.9%	66.9%	62.9%
	% of Total	14.2%	29.0%	19.8%	62.9%
Old-age farmers	Count	38	89	47	174
	Expected Count	38.4	84.1	51.5	174.0
	%within Age groups of farmers	21.8%	51.1%	27.0%	100.0%
	%within existing farming practices	35.8%	38.4%	33.1%	36.2%
	% of Total	7.9%	18.5%	9.8%	36.2%
Count		106	232	142	480
Expected Count		106.0	232.0	142.0	480.0
%within Age groups of farmers		22.1%	48.3%	29.6%	100.0%
%within existing farming practices		100.0%	100.0%	100.0%	100.0%
% of Total		22.1%	48.3%	29.6%	100.0%

χ^2 **(4):** *5.672; p: 0.225*

Table 3: *Means, Standard Deviations, and Ranks of awareness level regarding biodiversity as perceived by the farmers.*

How much you know about	N	Mean*	SD	Rank
Crop diversity	480	1.30	0.51	3
Animal diversity	480	1.50	0.50	2
Ecosystem diversity	480	1.87	0.71	1

***Mean:** *1: Not at all aware; 2: Somewhat aware; 3: Moderately aware; 4: Highly aware; 5: Extremely aware.*

Chi-square test of independence was applied for checking association among farmers of different age groups and existing farming practices. Following null hypothesis was formulated:

Table 4: *Type of biodiversity * factors effecting biodiversity.*

			Factors effecting biodiversity				Total
			Exploitation of natural resources	Climate change	Extinction of plant and animal species	Population growth and urbanization	
Type of biodiversity	Crop diversity	Count	31	63	98	64	256
		Expected Count	41.6	56.5	87.5	70.4	256.0
		% within type of biodiversity	12.1%	24.6%	38.3%	25.0%	100.0%
		% within factors effecting biodiversity	39.7%	59.4%	59.8%	48.5%	53.3%
		% of Total	6.5%	13.1%	20.4%	13.3%	53.3%
	Animal diversity	Count	47	43	66	68	224
		Expected Count	36.4	49.5	76.5	61.6	224.0
		% within type of biodiversity	21.0%	19.2%	29.5%	30.4%	100.0%
		% within factors effecting biodiversity	60.3%	40.6%	40.2%	51.5%	46.7%
		% of Total	9.8%	9.0%	13.8%	14.2%	46.7%
Total		Count	78	106	164	132	480
		Expected Count	78.0	106.0	164.0	132.0	480.0
		% within type of biodiversity	16.2%	22.1%	34.2%	27.5%	100.0%
		% within factors effecting biodiversity	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	16.2%	22.1%	34.2%	27.5%	100.0%

χ^2 (3): 11.338; p: 0.010

H_0: Farmers of different age groups and existing farming practices are independent

Results from Table 2 shows no statistically significant association between farmers of different age groups and existing farming practices since χ^2 (4) = 5.672, p = 0.225 and concluded that all three farming practices are equally being practiced by all age groups. Moreover, Phi and Cramer's V both used to test strength of association and noticed weak association (Phi=0.109 and Cramer's V = 0.077) between different age groups of farmers and existing farming practices.

Respondents described their awareness level in each selected element of biodiversity such as animal diversity, crop diversity and ecosystem diversity on five-point likert type scale. The results from Table 3 showed that highest mean score was 1.87 for "Ecosystem system" Lowest mean score was 1.30 for the concept of "crop diversity". The "animal diversity" has mean score of 1.50. Farmers had little awareness regarding ecosystem diversity. Lowest mean of crop diversity shows that respondents had no information at all regarding this type of diversity. The results revealed that farmers were relatively aware regarding animal diversity. However, they do not know modern techniques to uphold crop and animal diversity. In addition, they perceive the concept of diversity in conventional ways.

The chi-square test of independence was used to determine the association among different factors responsible for loss of biodiversity and types of biodiversity with the null hypothesis.

H_0: Factors responsible for loss of biodiversity and types of biodiversity are independent

Results from Table 4 showed weak statistically significant association among factors responsible for biodiversity loss and types of biodiversity since χ^2 (3) = 11.338, p = 0.010 and concluded that all four factors are not equally responsible for loss in both types of biodiversity. Moreover, Phi and Cramer's V both used to test the strength of association, it was noticed that Phi=0.154 and Cramer's V = 0.154 indicated weak association among factors responsible for biodiversity loss and types of biodiversity.

Table 5: *Means, standard deviations and ranks of role of biodiversity conservation in sustainable agricultural development as perceived by farmers.*

Role of biodiversity conservation in sustainable agricultural development	N	Mean*	SD	Rank
Biodiversity conservation has primary role in sustainable agricultural development	480	4.04	0.90	1
Biodiversity conservation has significant role in increasing food production (perishable commodities)	480	3.75	1.05	4
Biodiversity conservation plays significant role in providing shelter for humans, animals, and plants	480	3.38	1.05	24
Biodiversity conservation is playing its role in medicinal flora and fauna	480	3.31	0.95	27
Biodiversity conservation has significant role in increasing production of energy fauna	480	3.21	1.05	30
Biodiversity conservation has great role in frequent supply of agricultural raw material	480	3.33	1.06	26
Biodiversity conservation has significant role in increasing ecotourism	480	3.26	1.03	28
Biodiversity conservation is playing its role in positively effecting environmental threats	480	3.35	1.04	25
Biodiversity conservation plays its role in biological activities	480	3.16	1.03	32
Biodiversity conservation has significant role in increasing biological cycle	480	3.22	1.12	29
Biodiversity conservation has significant role in regulating the climatic conditions	480	3.52	0.93	19
Biodiversity conservation has significant role in protecting soil fauna	480	3.51	1.13	20
Biodiversity conservation has significant role in protecting field from outbreak of pests	480	3.49	0.97	22
Biodiversity conservation has significant role in enhancing the quality and quantity of food.	480	3.69	1.00	8
Biodiversity conservation has significant role in protecting field from outbreaks of diseases.	480	3.60	1.06	15
Biodiversity conservation playing its role in increasing food preferences.	480	3.95	0.79	2
Biodiversity conservation is playing its role in increasing the cash income.	480	3.70	0.95	7
Biodiversity conservation is playing its role in genetic enhancement and crop breading.	480	3.53	0.94	18
Biodiversity conservation has significant role in increasing the agricultural yield on sustainable basis.	480	3.74	0.96	5
Biodiversity conservation plays its role in increasing nutrient uptake of plants.	480	3.81	0.83	3
Biodiversity conservation has its role in increasing soil stabilization.	480	3.65	0.91	9
Biodiversity conservation has its role in increasing disease resistance in the environment.	480	3.71	0.89	6
Biodiversity conservation has its role in enhancing water cycle.	480	3.45	1.13	23
Biodiversity conservation has significant role in enhancing ecosystem productivity.	480	3.62	0.97	12
Biodiversity conservation has significant role in enhancing micro climate of animals	480	3.56	0.95	17
Biodiversity conservation has significant role in enhancing macro climate (carbon cycle etc)	480	3.64	0.94	10
Biodiversity conservation has significant role in protecting natural resources of the country.	480	3.57	1.02	15
Biodiversity conservation has significant role in protecting nutritional and cultural values of wild plants.	480	3.53	1.05	18
Biodiversity conservation has significant role in enhancing fuel and fodder production of below ground plant biodiversity.	480	3.64	1.05	10
Biodiversity conservation has significant role in effective cloning and expression in plant to achieve traits such as stress tolerance pest resistance	480	3.62	1.05	12
Biodiversity conservation has significant role in horticultural crops physical and physiological parameters of the plants which are contributing in high yield	480	3.62	1.03	12
Biodiversity conservation has significant role in enhancing pharmaceutical production in the country.	480	3.51	1.07	20

***Mean:** *1: Very low; 2: Low; 3: Moderate; 4: High; 5: Very high.*

Table 6: *Means, standard deviations, and ranks for crop and animal diversity.*

Crop and animal diversity	N	Mean*	SD	Rank
Animal diversity conservation has significant role in increasing domestic animal's production at household level.	480	3.59	1.01	6
Crop diversity conservation has significant role in enhancing environmental sustainability	480	3.77	0.93	1
Wild plant diversity conservation has significant role in increasing food production	480	3.58	1.06	7
Wild animal diversity conservation has significant role in environmental regulation.	480	3.67	1.00	4
Biodiversity conservation has significant role in increasing sea food production.	480	3.75	0.96	2
Wild plant diversity conservation has significant role in environmental regulation.	480	3.67	1.02	4
Biodiversity conservation of pollinators (bees, butterflies) is beneficial for humans.	480	3.69	1.02	3

***Mean:** *1: Very low; 2: Low; 3: Moderate; 4: High; 5: Very high.*

Table 7: *Means, standard deviations and ranks of role of agricultural extension in promoting biodiversity conservation.*

Role of agricultural extension in promoting biodiversity conservation	N	Mean*	SD	Rank
Extension Department is playing its role in natural resource management	480	2.00	0.63	9
Role of any supportive extension activities to increase farmers representation	480	2.40	0.49	5
Role of any input resources given by extension department to maintain biodiversity conservation	480	1.80	0.75	14
Extension Department encompasses protection measures for biodiversity conservation	480	2.10	1.04	8
Role played by different programs running by the Extension Department for biodiversity conservation	480	2.00	0.00	10
Role of available infrastructure for your assistance	480	2.70	0.64	1
Role of research programs on biodiversity by the Extension Department	480	2.50	1.02	2
Role of agricultural biodiversity assessment and monitoring done by Extension Dept	480	1.80	0.75	13
Role of Subject matter specialists from Agricultural Extension Department in promoting biodiversity conservation	480	1.70	0.46	15
Role of any training programs designed by the Extension Department for creating awareness regarding biodiversity conservation	480	2.50	0.67	3
Role of environmentally friendly chemicals encouraged by Extension Department	480	2.40	0.80	4
Role played by print media for dissemination of information regarding biodiversity conservation	480	1.90	0.83	12
Role played by electronic media for dissemination of information regarding biodiversity conservation	480	2.00	0.77	11
Role of Extension Department in conserving rights of wild biodiversity in Pakistan	480	2.20	0.60	7
Role of Extension Department in conservation of natural fauna of the country	480	2.30	0.78	6

*__Mean:__ *1: very low; 2: low; 3: moderate; 4: high; 5: very high.*

Table 8: *Means, standard deviations, and ranks of perceptions of farmers for biodiversity conservation.*

Perceptions of farmers for promoting biodiversity conservation	N	Mean*	SD	Rank
Innovative agricultural practices are helpful in promoting biodiversity conservation.	480	4.02	0.83	1
Climate friendly activities protect biodiversity from degradation.	480	3.73	0.92	4
Natural lifestyle of inhabitants would help to conserve biodiversity.	480	3.81	1.01	3
Biodiversity conservation is the need of the present era.	480	4.00	0.94	2
Agricultural practices of farmers must be compatible with biodiversity conservation	480	3.46	1.01	5

**Mean: 1: Strongly disagree; 2: Disagree; 3: No opinion; 4: Agree; 5: strongly agree.*

The role of biodiversity conservation in sustainable agricultural development was also appraised. According to the results from Table 5, the highest mean score (4.04) was for "primary role of biodiversity conservation for sustainable agricultural development" and lowest (3.16) was for "biodiversity conservation plays its role in biological activities". The results depicted that biodiversity conservation has its role in agricultural development by conserving biodiversity agricultural production can be increased which may lead to sustainable agricultural development.

The role of animal biodiversity conservation in sustainable agricultural development was evaluated. The results from Table 6 described that highest mean score (3.77) was for "Crop diversity conservation has significant role in enhancing environmental sustainability" and the lowest mean score (3.58) was for "Wild plant diversity conservation has significant role in increasing food production". The results revealed that crop and animal diversity conservation has its role in agricultural development by conserving crop and animal diversity.

The role of agricultural extension in promoting biodiversity conservation was another factor which was evaluated during the study. The results from Table 7 showed that lowest mean score (1.70) was for "Role of subject matter specialists from Agricultural Extension Department in promoting biodiversity conservation" and highest (2.70) was for "Role of available infrastructure for your assistance". The results revealed that Extension department is not playing its formal role in biodiversity conservation with mean score (2.00). The role played by print media for dissemination of information regarding biodiversity conservation was very low with mean score (1.90). The perceptions of farmers for promoting biodiversity conservation had significant role to explore during

the study. The results from Table 8 show that people agreed that innovative agricultural practices are helpful in promoting biodiversity conservation and in order to that the agricultural practices must be compatible with biodiversity conservation. The respondents also think that biodiversity conservation is the dire need of present era for environment friendly activities, hence must be promoted to save natural resources and flora and fauna of the country.

Finally, Exploratory Factor analysis was used to understand the role of different factors in promotion and conservation of biodiversity. Results presented in Table 9 indicated that the first factor alone explained about 20% of the variation, whereas first two factors cumulatively explained 39% and by adding the third factor, the explained variation goes up to 54%. Therefore, three factors retained to achieve minimum variation in the dataset.

Table 9: *Total variance explained.*

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Var	Cum.%	Total	% of Var	Cum. %
1	1.412	20.173	20.173	1.397	19.952	19.952
2	1.356	19.376	39.549	1.343	19.184	39.136
3	1.020	14.577	54.126	1.049	14.990	54.126
4	0.967	13.817	67.943			
5	0.901	12.866	80.809			
6	0.731	10.445	91.254			
7	0.612	8.746	100.000			

Extraction Method: Principal Component Analysis.

The notion of retaining three factors is further emphasized by the following scree plot mentioned as Figure 1 and the slope of the curve approximately levels out after three factors.

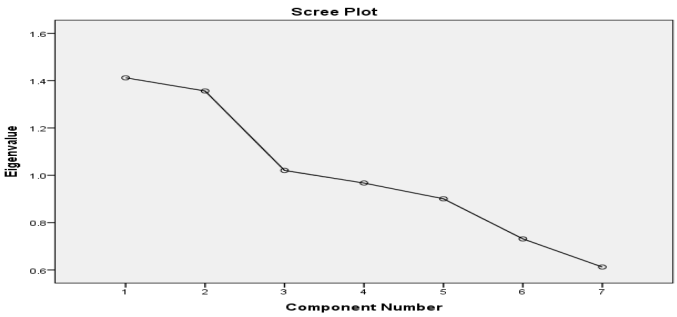

Figure 1: *Scree plot shows retention of three factors.*

In addition, Varimax with Kaiser Normalization factor rotating technique was applied to clearly differentiate the variables of interest. Table 10 describes the first component explained by three variables; biodiversity and sustainable agricultural development, crop and animal species diversity, and farmers' perceptions and biodiversity with maximum loadings of 0.683, 0.782, and 0.504 respectively and can be called as "farmers perceptions for crop and animal biodiversity for sustainable agricultural development". Second principal component is called as "demographics of the farmers" since age and experiences are highly correlated variables having maximum loadings of 0.794 for age and 0.802 for experience. Third component was only explained by Agricultural Extension and biodiversity with coefficient of 0.897 and called as "role of Agricultural Extension in promoting and conserving biodiversity".

Table 10: *Rotated component matrix.*

Factors	Component		
	1	2	3
Age	0.032	0.794	0.096
Experience	-0.063	0.802	-0.002
Awareness	-0.209	-0.222	-0.410
Biodiversity and sustainable agri. Development	0.683	-0.105	0.226
Crop and Animal species biodiversity	0.782	-0.032	-0.130
Agri. Extension and biodiversity	-0.128	-0.062	0 .897
Farmers' perceptions and biodiversity	0.504	0.072	0.004

Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization; Rotation converged in 4 iterations.

Conclusions and Recommendations

According to the results of the study, it is concluded that farmers' age, experience in farming, and awareness level of the respondents dramatically contribute toward conservation of biodiversity and environment friendly agricultural practices. Farmers have their own conventional concepts for maintaining biodiversity. However, in present era of climate variation and increasing world population; upholding biodiversity conservation is a huge challenge for agriculture based economies of the world. It is, therefore, recommended that research based knowledge sharing and transfer to the growers could play significant role in biodiversity conservation in agricultural system. Furthermore, Extension services intervention is highly important in transferring of research based knowledge to end users and makes them aware of benefits of upholding

biodiversity and disadvantages of violating the concepts of biodiversity conservation in the field.

Author's Contribution

Ejaz Ashraf conceived the idea, supervised the study, analyzed the data and prepared the final document. Hafiz Khurram Shurjeel helped in preparation of the instrument for the survey, data analysis and final write up of the document. Nosheen Fatima helped in implementation of the survey and data entry. Raheel Babar and Ikramul Haq helped in revision of the manuscript in the light of the comments of the reviewers. Finally, all authors approved the document.

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