

Local Perception of Climate Change, COVID-19 and their Impact on Birds in Jammu and Kashmir

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ABSTRACT

Weather is of major significance for the population dynamics of birds, but the implications of climate change have only recently begun to be addressed. There is already compelling support that birds have been affected by recent climate changes. The metabolic rate of birds is not only affected by weather (e.g. cold weather requiring increased energy expenditure for body maintenance) but also exerts other direct and indirect effects on bird behaviour. The extreme weather events, like prolonged frozen spells and droughts, can have catastrophic effects on bird populations, including long-term effects on whole cohorts. Birds are generally admired for their beauty, songs, and the beauty of their near miraculous ability to fly without recognizing their role direct or indirect to the Ecosystem Services. Birds are marvellous indicators of environmental health which offer humans pleasure, joy and spiritual motivation. The main reason to study climate change, COVID-19 and their impact on birds is to promote understanding of the ecosystems that support all life on earth, including human beings. In this study, a well designed and validated questionnaire was used to collect the information from a sample of 400 local people from Kashmir valley. The main aim of writing this paper was to find out the perception and approach of local people towards climate change, COVID-19 and their impact on birds. The data collected from the survey was analyzed

using standard statistical tools. The result of our study revealed from people perception that increase in temperature, unpredictable rainfall, increase in frequency of disaster and decrease in food production has direct impact on birds. Further, the study revealed that local people showed interest towards birds, nature and wildlife preservation. The respondents in majority reported the sudden increase in bird sightings during COVID-19 lockdown. Finally, to cope with climate change impact, it was suggested that education programmers be introduced among the people to increase awareness about the role played by bird in our lives, significance of wildlife conservation and management amidst changing climate. Further, to cope with COVID-19 threat, the research advised to follow WHO and health ministry guidelines.

Key Words: Climate change, COVID-19, Perception, Birds, Kashmir, Preservation, Statistics

1. INTRODUCTION

The climate of a place is defined as weather and it takes years to change while weather of a place can change in just a few hours. In literature (Igwe, 2003; Ezeudu, 2009; Nworgu, 2006 and Nzewi 2009) there exist a number of definitions of climate change and with the increased coverage by the electronic and printed media in recent years, the potential connection of climate

change and the frequency, intensity, and/or duration of natural disasters have become a topic of interest worldwide. A research study (Kovats *et al.*, 2005) reported that the impact of climate change has been seen in many aspects, e.g., human health, ecosystem health, biodiversity, food production, economic growth, tourism, and water resources. Recently, a study (Bilal *et al.*, 2018) discussed perception of people towards influence of climate change on human health and the environment. Another study (Bilal *et al.*, 2018) discussed awareness and attitude of college students towards climate change in Kashmir. The studies revealed that the respondents were aware of climate but lack adaptations, strategies to deal with the climate change. Every country in one way or the another is contributing to the phenomena of climate change which consists of industrialization, burning fossil fuels, deforestation, and unlimited use of resources and vigor contributing to GHG emissions. In the literature, we come across various studies which reported that due to climate change common transmissible diseases subtle and endemic to climate change are malaria and cholera, meningococcal meningitis, dengue, leptospirosis and rickettsia infections. Climate change is viewed as one of the global problems which affect directly or indirectly the structure of the environment (Costello *et al.*, 2009). The world is more concerned about the fact that the changes taking place today have been speeded up because of human activities worldwide (Okebukola & Akpan 2009; Uzochi 2009). It is astounding that the perception of the people regarding climate change and nature has been minimally researched worldwide.

Birds, biologically are Aves, warm blooded vertebrates, having average body temperature of 41-42^oC, bearing wings and feathers, having four chambered heart, sharpest vision, great power of singing and deep power of smell (especially in migratory birds who can smell even the environmental objects) are mystifying and a wonderful creation as small as male

humming birds (57 mm) or as large as ostrich (9-10 feet) weighing about 150 kg. For humans, birds have ecological, cultural, social and economic value as they play a vital role in the control of insect pests of agricultural crops, as predators of rodents, as scavengers and pollinating agents so they are considered an important component of the ecosystem. Birds are also ecologically essential in maintaining the balance of many ecosystems by sustaining various food chains and energy cycles. Human music has its start in bird song and it is observed that bird songs relax people physically and stimulates mentally, reducing stress and anxiety. They act as the natural purification agents of our environment, indicators of climatic conditions and are the good quality indicators of natural disasters and even small environmental disturbances. It is estimated that there are about 9,000-10,000 living species of birds on earth and around 13 percent are found in India. The valley of Kashmir is a home to around 262 species of birds together with resident and migratory birds (summer visitors and winter visitors) from Central Asia (Kazakhstan, Uzbekistan, Tajikistan, etc.), some countries of Eastern Europe (Russia, Poland, Hungary, Romania, Bulgaria, Serbia, etc.), Siberia, China, Japan, Philippines and other regions of the globe out of the total of 358 species recorded from Jammu and Kashmir. A study (Gichuki, 1999), revealed that local people who frequently interact with birds in their local environment may develop a broader knowledge of the life histories, behaviour (breeding period and habitat use), movement and seasonal changes in composition and abundance of those birds. In other study (Huntington, 2000), it was reported that the traditional knowledge is increasingly used by academics, agency scientists and policy-makers as a source for ideas on ecosystem management, restoration and conservation biology. In the literature Shah *et al.*,(2000), Choudhary (2002), Sharma (2003), Ahmed (2004), Kumar and Sahi (2005, 2006), Kumar (2006), Kotwal and Sahi (2007), Dar and Dar (2009), Bilal

et al., (2018), observe various faunistic surveys carried out in J&K. Researchers worldwide have reported that many bird species have the phenotypic plasticity to cope with climate change. It was reported that there is change in various aspects of breeding performance (including laying date and clutch size) and morphological traits (tarsus and wing length) of bird (Przybylo et al., 2000). (Harrington et al., 1999) reported that there is growing evidence that some species may find it difficult to adapt to climate change because, for example, the use of inappropriate environmental cues as phenological triggers, or because different parts of a food chain may respond differentially to climate change. The increase in temperature cause many problems for migratory and hibernating species. Further, there is strong evidence that long-distance migrants may suffer from the effects of phenological miscuing so long distance migrants may be vulnerable to the impacts of climate change. This is the case predominantly if they respond to endogenous rhythms or to environmental stimuli unrelated to temperature (Gwinner, 1996). The studies report that there is some indication that long-distance migrants have not responded as rapidly to climate change as short-distance migrants (Jenkins & Watson 2000; Penuelas et al., 2002).

The corona virus are a large family of viruses having ssRNA genome which may cause illness in animals or humans and the most recent discovered coronavirus causes coronavirus disease COVID-19. The world is facing an unprecedented threat from the COVID-19 pandemic caused by the SARS-CoV-2 virus which is affecting 211 countries and 2 international conveyances: the Diamond Princess cruise ship harbored in Yokohama, Japan, and the Holland America's MS Zaandam cruise ship (www.worldometers.info). The emergence of novel coronavirus (SARS-CoV-2) in Wuhan China has added new member to the human coronavirus family and sea food market in Wuhan has been treated as epicenter of this deadly disease (Chen et al.,

2020). The main symptoms of COVID-19 are fever, tiredness, dry cough and about 80% infected people recover from this disease without requiring special treatment. It is a matter of concern as some people become infected but don't develop symptoms or feel unwell. We can protect ourselves from this dangerous disease by staying aware of the latest information on the COVID-19 outbreak, following WHO guidelines and health ministry advisory. The planet earth heats up, animals big or small on land and in the sea, are headed to the poles to get out of the heat. The disturbance results in contact of animals with other animals they normally wouldn't, and that creates an opening for pathogens to get into new hosts. The root causes of climate change can increase the risk of pandemic such as deforestation. Deforestation is the main cause of habitat loss and the loss of habitat forces animals to migrate and potentially contact other animals or people and share germs worldwide. Similarly large livestock farms can also serve as a source for spillover of infections from animals to people as less demand for animal meat and more sustainable animal husbandry could decrease emerging infectious disease risk and lower greenhouse gas emissions. To improve our health and reducing risks for infectious disease, we have to follow steps to delay climate change. So far, we don't have direct evidence based on research that climate change is influencing the spread of COVID-19, but we do know that climate change alters how we relate to other species on Earth and that matters to our health and our risk for infections. In the light of the above discussion, the current study was carried out in Jammu and Kashmir with the aim to assess the local people's perception of Climate Change, COVID-19 and their Impact on Birds.

2. MATERIALS AND METHOD

The present study carried out in Kashmir valley, was qualitative in nature (questionnaire survey, online focus group discussions and face to face interviews) and

aimed to assess the local people's perception on climate change, COVID-19 and their impacts on birds in the study area. A set of questionnaire was developed and a total of 400 respondents (200 rural and 200 urban) above age 35 years were interviewed (personally as well as online) in Kashmir valley during the survey period in 2019-20. Primary data was collected during survey and literature was reviewed to match secondary data. A structured questionnaire was prepared which contained the demographic profile and perception on climate change impact with bird security issues. Final questionnaire was prepared by utilizing the findings of pre-testing of questionnaire survey. Stratified random sampling technique has been applied as sampling procedure. The data collected was tabulated and analyzed statistically using SPSS software (version 21).

3. RESULTS AND DISCUSSION

The data presented in Table 1 reveals that majority of the respondents from rural as well as from urban areas showed interest towards birds. It was reported by 12.5% urban and 8.0 rural people understudy that they are seeing 1-3 birds around home daily, 48.5% urban and 16.5 rural people reported that they are seeing 4-6 birds around home daily and 39.0% urban and 74.5% rural people reported that they are seeing 7-10 birds around home daily. Statistically, it was been observed that there was significant association between location and number of birds present home ($p < 0.05$).

Table 1: Birds seen by the respondents understudy around their residential areas

Location	Different Birds seen by respondents around home		
	7-10 birds (%)	4-6 birds (%)	1-3 birds (%)
Urban	78 (39)	97 (48.5)	25 (12.5)
Rural	149 (74.5)	33 (16.5)	16 (8.0)
Chi-square = 55.68, p-value < 0.01			

The data presented in Table 2 reveals that in response to all statements regarding perception of climate change, COVID-19 and their impact on birds, except statement 1, i.e., there is drastic change in weather condition, majority of respondents from rural as well as from urban areas accept the statements. Statistically, there was non-significant difference in the opinion of rural and urban respondents ($p > 0.05$) as shown. The recent Satellite images show dramatic drops in air pollution in coronavirus hotspots around the world circulated widely on social media, offering a silver lining to an otherwise very dark story. The graphs are also reminder of the climate crisis that will continue when the COVID-19 pandemic passes. Our ears were gladdened on the first morning of the lockdown by the chirping of songbirds, hitherto drowned out by the noise of traffic. Worldwide news came of animals spotted in unusual locations: a nilgai wandering down an avenue in Noida, monkeys running amok in Thailand and wild goats strolling around a Welsh coastal town. Dr. Parmil Kumar, Department of Statistics, University of Jammu, J&K, an avid bird watcher has sighted nine unusual species for the first time in his locality Jammu. Dr. Bilal Ahmad, working as scientist in SKUAST-Kashmir, J&K observed sudden rise in bird sightings during COVID-19 lockdown in urban as well as in rural areas of Kashmir.



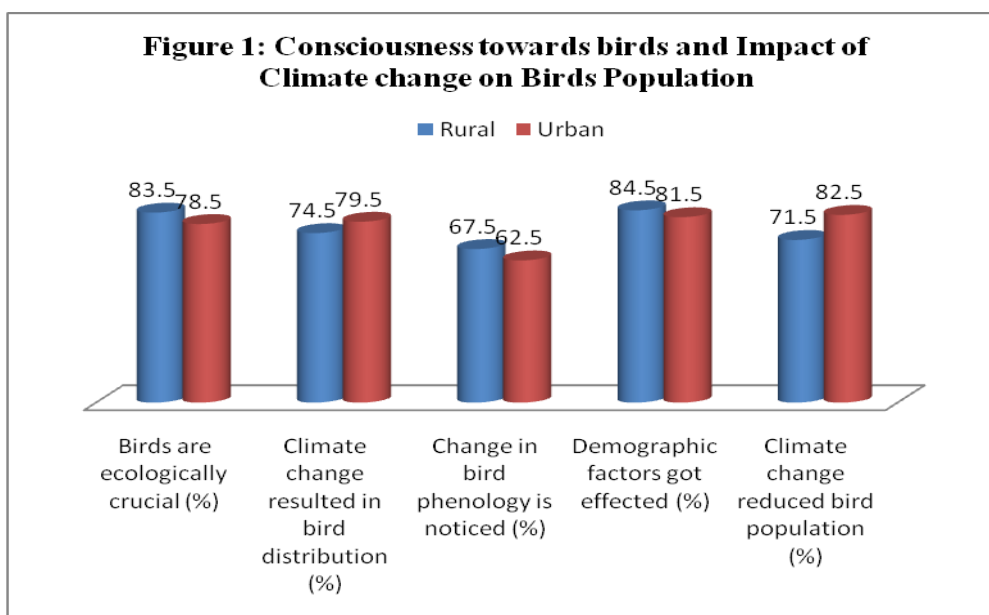
When the lockdowns are lifted and life returns to what it once was, so too will the pollution that clouds the skies and with it the greenhouse gases that fuel global warming. The (COVID-19) pandemic has revealed the vulnerabilities and strengths of every country and has taught us a series of lifelong lessons. It is important after COVID-19, we need to realize that a growing economy needs to respect the carrying capacity of nature.

Table 2: Perception of people towards climate change, COVID-19 and their impacts onbirds

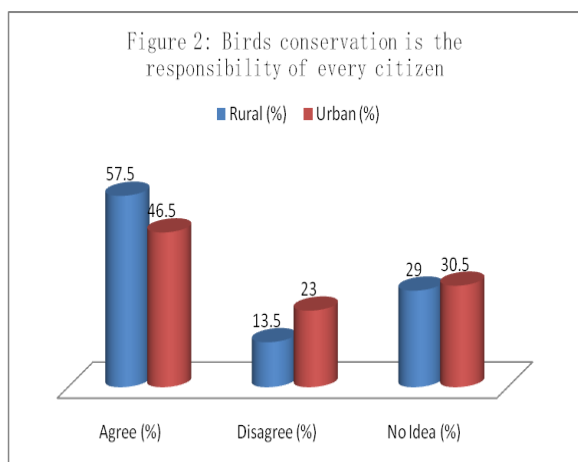
S.No.	Variable	Type	Mean ± S.D.	P-value
1.	Drastic change in weather condition	Urban	2.23 ± 0.71	<0.05
		Rural	2.17 ± 0.88	
2.	Poor survival of some bird species	Urban	4.08 ± 0.68	>0.05
		Rural	4.10 ± 0.71	
3.	Destruction of bird species resulting from heavy wind storm	Urban	3.67 ± 0.82	>0.05
		Rural	3.70 ± 0.79	
4.	Excessive sunshine	Urban	4.14 ± 0.52	>0.05
		Rural	4.16 ± 0.55	
5.	Increased incidence of flooding	Urban	4.31 ± 0.47	>0.05
		Rural	4.34 ± 0.50	
6.	Increased incidence of drought	Urban	4.26 ± 0.61	>0.05
		Rural	3.23 ± 0.59	
7.	High temperatures and heat waves	Urban	3.27 ± 0.62	>0.05
		Rural	3.25 ± 0.59	
8.	Increase quantity of some bird species	Urban	3.71 ± 0.55	>0.05
		Rural	3.77 ± 0.54	
9.	Decrease in bird population	Urban	3.74 ± 0.57	>0.05
		Rural	3.71 ± 0.51	
10.	Increased bird disease infestation	Urban	3.43 ± 0.64	>0.05
		Rural	3.63 ± 0.72	
11.	Food insecurity and hunger	Urban	3.78 ± 0.597	>0.05
		Rural	3.83 ± 0.53	
12.	The COVID-19 resulted in the increase of bird population	Urban	2.29 ± 0.41	>0.05
		Rural	2.46 ± 0.543	

(Here we use 5 point likert scale, Disagree=1, Strongly disagree=2, Neutral=3, Agree=4, Strongly disagree=5)

The data presented in Figure 1, reveals that 83.5% rural and 78.5% urban respondents agree that birds are ecologically crucial, 74.5% rural and 79.5% urban respondents agree that climate change resulted in bird distribution, 67.5% rural and 62.5% urban respondents agree that there is change in bird phonology, 84.5% rural and 81.5% urban respondents agree that demographic factors of birds got effected due to climate change, 71.5% rural and 82.5% urban respondents agree that climate change reduced bird population. The results of our study are in agreement with the other studies conducted in various parts of the globe.



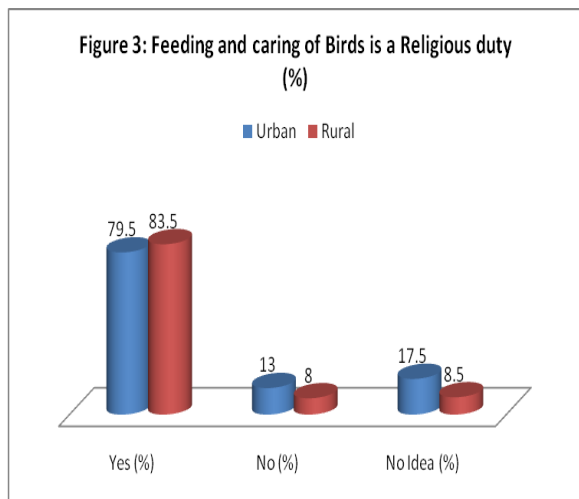
The data presented in Figure 2, showed that majority of respondents understudy (57.5% rural and 46.5% urban) agreed that birds conservation is the responsibility of every citizen. It is observed that many people derive great pleasure, fulfillment and inspiration from watching birds and listening to them worldwide. The benefits birds pass us aren't just cultural but they play a significant role in the functioning of the world's ecosystems, in a way that directly impacts human health, economy and food production as well as millions of other species. Birds are very useful as they control pests, pollinate plants, serve as nature's clean-up crew, spread seeds, transform entire landscapes, keep coral reefs alive, inspire science etc. The Ecosystems such as forests and the marine environment provide us with food, medicines and important raw materials. Birds play an important role to keep the climate stable, oxygenate air and transform pollutants into nutrients. They are high up in the food chain and good indicators of the general state of our biodiversity. Birds when start disappearing, it means that something is wrong with our environment and that we need to take action. There is increased recognition of the need for the protection of birds in any area as well as migratory birds throughout their flyways.



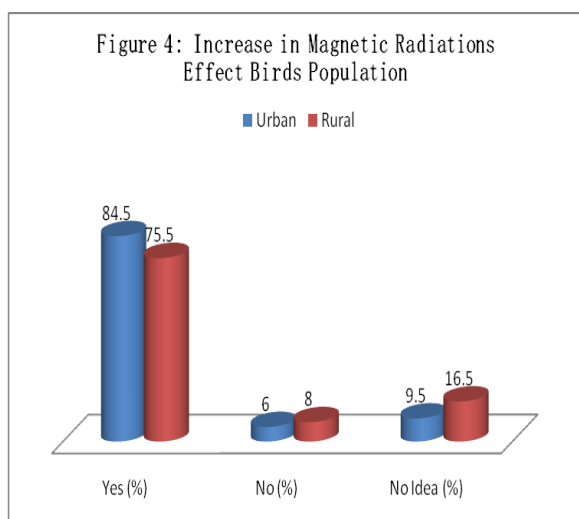
The data presented in Figure 3, showed that majority of respondents understudy (83.5% rural and 79.5% urban)

were of the opinion that feeding and caring of birds is a religious duty of every individual. The primary religions of the world consider humans to be superior to animals and generally prohibit abusing of animals. Unfortunately most have historically overlooked cruel practices used to provide food, fur and service to humans. Animals in some religions e.g., Hinduism are viewed as sacred because of the beneficial role they play in life. The human-animal bond is a universal phenomenon, however, it is perceived differently in varying cultural and religious landscapes across the globe. In various traditions seeing a crow or a raven is considered as a bad omen, a creature bringing bad luck or bad news. There are different theories as to why it's viewed negatively, it could be because it's the creature in the Quran associated with death and mankind's first murder. According to Quran, "And his soul permitted to him the murder of his brother, so he killed him and became among the losers". Then Allah sent a crow searching in the ground to show him how to hide the disgrace of his brother. He said, "O woe to me! Have I failed to be like this crow and hide the body of my brother?" And he became of the regretful. (Quran 5:30-31). When the son of Prophet Adam (A.S), the first man on Earth, committed murder, Qabeel (Cain) killed his brother Habeel (Abel), Allah sent him a crow to teach him what to do with the dead body. It's said that the crow dug a hole in the Earth using its claws, dragged a dead crow into the hole and then covered it completely with dirt. The son of Adam (A.S), Qabeel imitated the bird and buried his brother, feeling great remorse over his sin of killing. To the present day, Muslims all over the world bury their dead, and there are different rituals and traditions that have been adopted over the centuries as they lay our dead to rest. In fact, the animals or birds anywhere whether in the sea or sky are seen as blessed and their lives and stories are examples for mankind to observe, learn from and

appreciate. The Prophet of Islam guides Muslims to treat animals with sympathy. He says, “A good deed done to an animal is as meritorious as a good deed done to a human being, while an act of cruelty to an animal is as bad as an act of cruelty to a human being.”

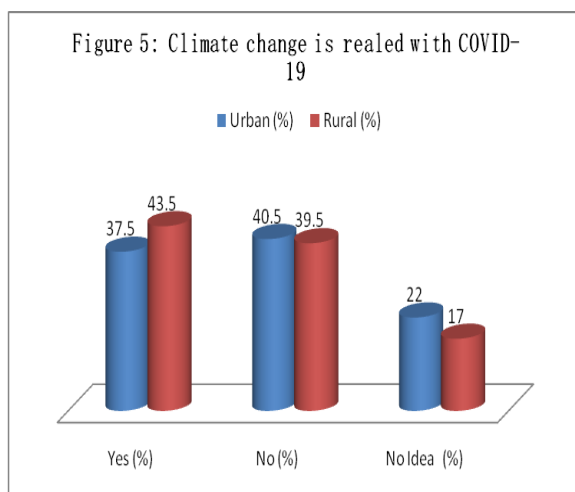


The data presented in Figure 4, showed that majority of respondents understudy (84.5% rural and 75.5% urban) were of the opinion that increase in magnetic radiations especially increase in number of mobile towers effected the birds population.



The data presented in Figure 5, reveals that 43.5% respondents from rural area believe that climate change are COVID-19 are related. However, majority (40.5%) of the respondents from urban areas

do not believe that climate change and COVID-19 are related. It is noticed that there is no effect of COVID-19 on avian fauna diversity. Birds have their defined territories and foraging points, the only thing COVID-19 has added is the time to we busy human beings to spot these beautiful creatures in our neighborhood. The pollution level, no doubt has decreased but its effect on birds cannot be instant as it is a gradual process and its effect will be visible after a long time if it stays static which unfortunately will not. Let us pray that this COVID-19 be over and we more explorer to see the beautiful things Almighty has created on earth.



4. CONCLUSION

The aim of this study was to investigate local people’s perception towards birds and impact of climate change on birds in Kashmir. The results indicated that the majority of people interviewed had not good knowledge of local birds, although they were aware about the importance of birds in our lives. The results of our study indicate that on interacting with the respondents, they know a little about the natural resource management and conservation. The beautiful days are gone when there were countless numbers of birds in existence and it was hard to believe life without birds. At present, it unusual for us to hear the beautiful and fascinating sounds of birds which at one time fill the air. Walter R. Lawrence (1895) more than 100 years

ago recorded in his famous book “The Valley of Kashmir” that Kashmir valley is rich in ornithological diversity and the Kashmiri people though with little know how about birds were tagged as bird lovers. In Kashmir many birds like Blue Heron, Breg which were common during Dogra regime have gone either rare or extinct. It is believed bird species that are unable to respond to climate change maybe most vulnerable to climate change and the increase in temperature, unpredictable rainfall, increase in frequency of disaster and decrease in food production has direct impact of birds worldwide. The results of our study showed that local people showed interest towards birds, nature and wildlife preservation. The majority of respondents understudy (57.5% rural and 46.5% urban) agreed that birds conservation is the responsibility of every citizen. The benefits birds pass us aren't just cultural but they play a significant role in the functioning of the world's ecosystems. Birds are very useful as they control pests, pollinate plants, serve as nature's clean-up crew, spread seeds, transform entire landscapes, keep coral reefs alive, inspire science etc. Birds play an important role to keep the climate stable, oxygenate air and transform pollutants into nutrients. Further, our study revealed that 83.5% rural and 78.5% urban respondents agree that birds are ecologically crucial, 74.5% rural and 79.5% urban respondents agree that climate change resulted in bird distribution, 67.5% rural and 62.5% urban respondents agree that there is change in bird phonology, 84.5% rural and 81.5% urban respondents agree that demographic factors of birds got effected due to climate change, 71.5% rural and 82.5% urban respondents agree that climate change reduced bird population. The respondents in majority reported the sudden increase in bird sightings during COVID-19 lockdown. Finally, to cope with climate change impact, it was suggested that education programmers be introduced among the people to increase awareness about the role played by bird in our lives,

significance of wildlife conservation and management amidst changing climate. Further, to cope with COVID-19 threat, the research advised to follow WHO and health ministry guidelines. It is concluded, to battle with climate change and COVID-19, we have to considerably decrease our greenhouse gas emissions from fossil fuels such as coal, oil and natural gas. We should encourage generating electricity from low-carbon energy sources such as wind and solar decreases harmful air pollutants like nitrogen oxides, sulfur dioxide, and carbon dioxide that lead to more heart attacks and stroke as well as obesity, diabetes, and premature deaths that put further strains on the whole system of our health care. The reduction in air pollution can keep our lungs healthy, which can protect us from respiratory infections like coronavirus infection. It is important when COVID-19 threat eases and COVID-19 lockdown is lifted, we restart our economy in proper way, make our workforce healthier by investing more in low-carbon technologies which are more climate-resilient. The climate change and global health policy are mostly treated as separate issues by the public and media. In fact, health entirely depends on the climate and the other organisms we share the planet with. We need to bring these communities together, although some progress has been made in addressing the risk of pathogen spillover from animals into people but largely we still view the environment, and life on earth, as separate. We can and must do better if we want to prevent the world from the next infectious pandemic. That means we must combat climate change and do far more to safeguard the diversity of life on earth, which is being lost at a rate not seen since the dinosaurs and more than half of life on earth went extinct 65 million years ago.

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REFERENCES

1. Ahmed A (2004). Diversity and Community structure of the birds of Tehsil Doda, Jammu. M. Phil. Dissertation. University of Jammu, Jammu (J&K), India.
2. Bhat Bilal A. et al., A Study on Impact of COVID-19 Lockdown on Psychological Health, Economy and Social Life of People in Kashmir, IJSHR, 2020, Vol. 5(2); 36-46.
3. Bhat Bilal A. et al., (2018): A Study On Students Perception and Approach Towards Birds and Their Conservation, North Asian International Research Journal of Social Science & Humanities, Vol. 4, Issue-9, pp. 82-97.
4. Bhat Bilal A, Shazia Manzoor, S. Dwivedi and Syed Sabahat Ashraf (2018): A Study on Participants' Perception Towards influence of Climate Change on Human Health and the Environment. *Agro Economist - An International Journal*, 5(2): 01-09.
5. Bhat Bilal A. (2018): Awareness and Attitude Among College students Towards Climate Change in Kashmir. *IJWM*, Vol 2(1), pp. 4-9.
6. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*. 2020; 395: 507-13.
7. Choudhary V (2002). *Studies on Avian Diversity of Jammu District of J&K State*. Ph. D. Thesis .University of Jammu, Jammu.
8. Cos tello A, Abbas M, Allen A, Ball S, Bell S, Bellamy R, Patterson C. Managing the health effects of climate change. *Lancet*. 2009;373:1693-733.
[http://dx.doi.org/10.1016/S0140-6736\(09\)60935-1](http://dx.doi.org/10.1016/S0140-6736(09)60935-1).
9. Dar IA, Dar MA (2009). Seasonal Variation of Avifauna of Shallabug Wetland, Kashmir. *J. Wetland Ecol.*, 2:20-34.
10. Gichuki FN. 1999. Threats and opportunities for mountain area development in Kenya. *AMBIO*. 28(5):430–435.
11. Ezeudu, F. O. (2009). Using concept map to teach ozone layer depletion and green house effects to senior secondary school chemistry students. *STAN. Environmental Educational Series* No 13 pp 78-87.
12. Gwinner, E. 1996. Circannual clocks in avian reproduction and migration. *Ibis* 138: 47–63.
13. Harrington, R., Woiwod, I.P. & Sparks, T.H. 1999. Climate change and trophic interactions. *Trends Ecol. Evol.* 14: 146–150.
14. <https://www.worldometers.info/>
15. Huntington HP. 2000. Using traditional ecological knowledge in science: methods and applications. *Ecol Appl.* 10(5):1270–1274.
16. Igwe, I. O. (2003) *Impact of climate changes on environment*. London: Cambridge University Press.
17. Jenkins, D. & Watson, A. 2000. Dates of first arrival and song of birds during 1974–99 in mid-Deeside, Scotland. *Bird Study* 47: 249–251.
18. Kovats, R. S., Edwards, S. J., Charron, D., Cowden, J., D'Souza, R. M., Ebi, K. L., ...& Pezzi, G. H.(2005). Climate variability and campylobacter infection: an international study. *International Journal of Biometeorology*, 49(4), 207-214.
19. Kotwal D, Sahi DN (2007). Diversity, Status and Abundance of avifauna of lakeMansar, Jammu and Kashmir. *J. The Bioscan*, 2(4):323-327.
20. Kumar S (2006). *Diversity of avifauna of District Kathua, J&K*. Ph.D. Thesis. University of Jammu, Jammu.
21. Kumar S, Sahi DN (2005). Avian fauna of Sewa River catchment area, District, Kathua (J&K). *Nat. J. Life Sciences*, 2 (Supp):83-89.
22. Kumar S, Sahi DN (2006). Diversity of Avifauna of Jasrota Wildlife Sanctuary, Kathua (J&K State). *J. Himalayan. Ecol. Sustain. Dev.* (1):95-104.
23. Shah GM, Qadri MY, Jan U (2000). Species Composition and Population Dynamics of Birds of Hokarsar Wetland, Kashmir. Environment, Biodiversity and Conservation. APH Publishing Corporation, New Delhi.
24. Sharma B (2003). *Faunal diversity of Ramnagar Wildlife Sanctuary, Jammu*. M. Phil. Dissertation, University of Jammu, Jammu.
25. Nworgu, B. G. (2006). *Educational research: basic issues & methodology*. Ibadan: Wisdom Publishers Ltd.
26. Nzewi, U. (2009). Climate change and the biosphere. *STAN. Environmental Educational Series* No 13 pp 37-54.

27. Okebukola, P. & Akpan, B. B. (2009). Recent developments in climate change. *STAN. Environmental Educational Series* No 13 pp 1-22.
28. Penuelas, J., Filella, I. & Comas, P. 2002. Changed plant and animal life cycles from 1952 to 2000 in the Mediterranean region. *Global Change Biol.* 8: 531–544.
29. Przybylo, R., Sheldon, B.C. & Merila, J. 2000. Climatic effects on breeding and morphology: evidence for phenotypic plasticity. *J. Anim. Ecol.* 69: 395–403.
30. Uzoehi, B. C. (2009). Human impact on the global environment. *STAN. Environmental Educational, Series* No 13 pp 23-36.

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