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## The adverse effect of climate change on magpie in Ladakh - A review based on climate crises

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### Abstract

**Background:** Climate Change is identified as a great challenge in the world, as it adversely impacts the flora and fauna directly. Climate change has an impact on all kinds of biota like vegetation, animals, and birds. Similarly, the impact is seen in the case of magpies in Ladakh, like the birds, its number is declining at a very alarming rate in Ladakh. As traditionally said magpie is a bird that likes a clean environment. Also, it's said that magpies keep many diseases not from spreading, and their decline in number reveals a change in the climate.

### Objectives and Method

1. This paper systematically reviews the physical impact of climate change on Magpie such as changes in its natural habitats, as well as their biological consequences.
2. To find out the causes for declining in the population of Magpie.
3. To find out the items of human use taken by Magpie when found it in open.
4. To find out the period magpie-built nest and go for breeding.

Our focused reviews suggest that, need for identifying areas of commonality. It focuses on the multiple impacts of climate change on Magpie.

**Findings:** The review suggested that climate change has been recognized as a crucial factor affecting the Magpie population. So, to revive its number, we should utilize environmentally friendly fuels, instead of fuels causing greenhouse gases. Also, we find nests of magpies more commonly. But due to the change in climate this community of birds facing challenges to survive. This also reveals the level of pollution in Ladakh than past. This change in climate and its temperature change affect the survival of the magpie bird community. In our model, we suggest that climate does so by causing environmental degradation, which is affected bidirectionally and leads to issues of biodiversity.

**Conclusion:** A focused review on mechanisms via which climate change operates to affect the natural habitat of Magpie deserves our attention, for research and policy-making for the safeguard we got to consider multi-dimensional mechanisms via which climate change affects the natural habitats of Magpie with a focus on important mediating factors such as environmental degradation its direct impact on Magpie.

**Keywords:** Climate change, Magpie bird, pollution

### Introduction

Climate Change is identified as a great challenge in the world, as it adversely impacts the flora and fauna directly. Climate change happens in two ways, first; falling global temperature and second, increase in global temperature. But in contemporary issue is related to an increase in temperature, which is called global warming. This change occurs due to greenhouse gasses, which tend to absorb heat, and ultimately it makes the earth's environment warmer. This Climate change led to disturbance in the incoming and outgoing radiation which result in a change in environmental conditions. Fauna and environment are closely associated with each other for sustaining their existence. Climate change has an impact on all kinds of living things like vegetation, animals, and birds. It is now clear that climate change is the major rather new threat that will confront biodiversity this century, and that if greenhouse gas emissions run unchecked until 2050 or beyond, the long-term consequences for biodiversity will be disastrous" (Lovejoy and Hannah, 2005b) <sup>[14]</sup>. Similarly, the impact is seen in the case of the magpie, as its number is declining at a very alarming rate in Ladakh. Observation and key informant methods were used to analyze the issue in the study area. As traditionally said magpie is a bird that likes a clean environment and is one of the most intelligent birds. Of the seventeen kinds of magpies considered here as probably valid the greatest number, ten, have the main parts or all of their ranges in Asia (Linsdale 1937) <sup>[13]</sup> Magpie lives in cold areas, and in Ladakh, these species were more common between 9000 and 13000 feet. The impact of climate is a very serious issue in the whole trans-Himalayan region because with this most of the glaciers melt and transform the

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whole ecology of Trans-Himalayan topography. Climate change is identified as a serious issue as it bears a chain reaction with it. However, there is growing evidence that some species may find it difficult to adapt to climate change because, for example, of the use of inappropriate environmental cues as phenological triggers, or because different parts of a food chain may respond differentially to climate change (Harrington *et al.*, 1999) [10]. Climate change raises temperatures, shifting seasons, changing precipitation, etc. are disturbing the behavior of our feathered friends and the ecosystems that support them. Similarly, impact bears on the flora and fauna in the study area also. The uniqueness of the study area lies in its location, that is, on the border between the Palaearctic and the Indo-Malayan zoogeographic zones and it harbors characteristic avifauna of both the regions. In another way, we can say study area located in between the Karakoram mountain range in the north and the Himalayan range to the south. Based on the time of occurrence, four bird groups have been identified in Ladakh. They are Resident birds, summer visiting birds, Wintering birds, Migrant birds, The study was undertaken over magpie which is mostly found in many parts of Ladakh. this species of birds in Ladakh facing the biggest challenge of climate change, and its resultant ecological modifications in Ladakh which reveals from its decline in the number of magpie birds and other feathered creatures. It's all happening due to modernization which results in the introduction of modern means of communication like the installation of mobile towers etc. This tower emits radiation which affects birds and animals. According to the ministry of environment and forests expert committee says that EMR is largely responsible for the bird's declining numbers.

### Literature review

Chandan Abbas and Gautam (2018). In their article entitled 'Field guide birds of Ladakh'. The excessive grazing near the wetlands is leading to the degradation of the vital breeding grounds of the rare and endangered migratory. They have found that the unregulated tourism activities near the wetlands are becoming a major threat to the breeding birds. This is causing more damage as the peak period of biological activity in Ladakh coincides with the peak tourism season.

Crick (2004) [6] in his article on "The impact of climate change on birds" Weather is of major importance for the population dynamics of birds, but the implications of climate change have only recently begun to be addressed. This review suggests that although there is a substantial body of evidence for changes in the phenology of birds, particularly of the timing of migration and of nesting, the consequences of these responses for a species' population dynamics is still an area requiring in-depth research.

Wormworth and Mallon (2017) in their report on "Bird species and climate change" More is known about birds' response to climate change to date than for any other animal group, mostly as a result of many species- and location-specific analyses. This review seeks to provide a global survey of the climate threat to birds by compiling hundreds of individual studies to resolve the larger picture of the impact.

Linsdale (1937) [13] in his paper on "The Natural History of Magpies" The magpies are peculiarly suitable for an intensive study because they comprise a group that possesses many distinctive features of behavior and

structure. Many races have developed, and this inhabits extensive areas in the northern hemisphere.

Tak *et al.* (2008) [25] in their article on 'Birds of Ladakh and analysis of their status' dealt with the species of Ladakh, Ladakh hosts typical bird species from the Palaearctic and the Indo-Malayan zoogeographic regions. They found that the Tibetan birds extend their home ranges well into eastern Ladakh. There is an immediate need to develop a strategy and action plan for the conservation and management of Ladakh's natural heritage, especially the high-altitude wetlands and lakes throughout

PFISTER (2001) [18] in his paper on "Birds recorded during visits to Ladakh, India" from 1994 to 1997, had found that small breeding population of Black-necked Crane *Grus nigricollis*. A total of 168 species was recorded, including eight new for Ladakh: Pallid. He also found in his research that the breeding of Hume's Groundpecker *Pseudopodoces humilis* was confirmed for Ladakh. He also observed that about 42 other species of interest are detailed and a complete list of species recorded, including information on abundance, status, location, and period is appended.

### Objectives

1. This paper systematically reviews the physical impact of climate change on Magpie such as changes in its natural habitats, as well as their biological consequences.
2. To find out the causes for declining in the population of Magpie.
3. To find out the items of human use taken by Magpie when found it in open.
4. To find out the period magpie-built nest and go for breeding.

Our focused review suggests a need for identifying areas of commonality. It focuses on multiple impacts of climate change on Magpie

### Methodology

This paper systematically reviews the physical impact of climate change on Magpie such as changes in its natural habitats, its declining number, as well as their biological consequences. Methodologies used in this study are observation, interviews with key informants. The interview consisted of questions related to their experience of the local dwellers regarding magpie. Data were collected series of in-depth interviews with participants who have been experienced with the Magpie also we have consulted the wildlife department of Ladakh, but they said we have any data regarding the species of bird and they only provide us oral data regarding magpie as there is not study carried on yet on a magpie. For the study, we choose a few places randomly and the places are Taisuru, Sankoo, and Tangol in Kargil while Thiksey, Stok, and Achinathang in Leh. We also used secondary data such as newspaper articles and different researched pieces published in scholarly journals. Our focused review suggests a need for identifying areas of commonality. It focuses on the multiple impacts of climate change on Magpie.

### Impact of climate change on magpie

"Climate change is emerging as the greatest threat to natural communities in many, if not most, of the world's ecosystems in coming decades, with mid-range climate

change scenarios expected to produce greater extinction rates than habitat loss, currently deemed the top threat to biodiversity” (Thomas *et al.*, 2004; Malcolm *et al.*, 2006) <sup>[26, 15]</sup>. Extreme weather events, such as prolonged frozen spells and droughts, can have catastrophic effects on bird populations, including long-term effects on whole cohorts (Stenseth *et al.* 2002) <sup>[24]</sup>. Highly sensitive to climate and weather, birds are pioneer indicators of climate change (Berthold *et al.*, 2004) <sup>[3]</sup>. Climatically-forced shifts can harm a bird’s reproductive success and survival, and could even contribute to the collapse of breeding populations over the long term (Sanz *et al.*, 2003) <sup>[22]</sup>. Changes are expected to alter the makeup and functioning of most, if not all, the world’s ecosystems (Root and Hughes, 2005) <sup>[20]</sup>.

### **Change in distribution and its dwelling areas**

There is compelling evidence that birds, along with other animals and plants, are already shifting their ranges in response to climate change (Parmesan and Yohe, 2003) <sup>[17]</sup>. Following speculation and trying to make them more rational by way of gathering more observed data via repeated large-scale surveys of suitable habitats, with great efforts often by a large number of observers. In practice, this is mainly achieved by mass participation surveys. From the survey, it was clearly understood that from the past there occurred a great change in the distribution and number, But a drastic change occurred in the last 10 years, as the degree of warming and pollution increased more, because of that the shift to near suitable locations. The uphill shift of species due to warming temperatures reduces their ranges, sometimes entirely, pushing them to mountain tops. In montane species, range size can be best used to predict the threat of extinction as most of the species have very small range sizes (Harris and Pimm 2008) <sup>[11]</sup>. During the survey, we also found a change in altitudinal which is likely to occur as a result of climate change. This shifting manner was clearly noticed as the colonization of Magpie previously took place over the low laying settlement areas now, they are shifted towards the snow-covered mountain site. This impact of climate and shifting factors reveals a large effect on their future distributions. The presence of Magpie which was earlier more common in every street and lane in the urban as well as other settlement areas were now totally disappeared in the urban localities and quite scarce in the village settlement areas. Also, we analyzed the distribution pattern with factors other than climate. From which we got a clear understanding of the impact installation of mobile towers on the distribution of Magpie.

### **Dwindling in Magpie population**

The low end of the precipitation range brings the population near reproductive failure. Any change in climate that would increase the frequency of extremely dry conditions would likely endanger populations of these species. (Bolger *et al.*, 2005) <sup>[4]</sup>. From the survey, we concluded that the Magpie population has declined in numbers from the past. This decline in number is come to notice at the time of the survey. As there is a great fall in the number of habitats. For this, we did count the number of nests in the particular village areas, and in all, we found the number of nests is less than the previous time. Also, the declining rate is quite higher than in the earlier period. Birds start breeding earlier than their usual breeding season or produce lesser offspring due to reduced reproductive rate resulting in population

decline (Both and Visser 2001; Wormworth and Sekercioğlu 2011) <sup>[5, 29]</sup>. The decline took place in such a drastic way that it is felt by every individual in any part of Ladakh. The phonological disjunction between predator and prey has led to a trend in selection differentials, such that an increasingly greater proportion of recruits in the following year come from early nesting individuals. The dwindling nature of this species can be analyzed more genuinely from the lesser number of nests found in the study area than earlier time. Also, we find villages without even a single nest. All these reveal the decline in this bird community from the past. Urgent need for its conservation is of vital importance. For this government and other responsible authorities like the wildlife department of Ladakh as well as the ministry of wildlife should take necessary initiatives to prevent it from extinct.

### **Change in phenology**

Phenology means the area of study for which there is the strongest evidence of the impact of climate change on the birds. The impacts of climate change on demographic factors, breeding performance, and survival, which affect the population dynamics of species, have been less well explored than phenology (Crick (2004) <sup>[6]</sup>. We carried out a particular study to show the time of nest building and laying dates, many of which are based on the observation made over the study areas with the help of key informants. To complement such extensive studies, intensive studies undertaken at single locations have also been able to provide evidence for changes in laying date concerning climate change (e.g. Järvinen 1989, McCleery & Perrins 1998, Slater 1999) <sup>[12, 16, 21]</sup>. Magpie is the only bird who builds a new nest each year and with the onset of summer after the retreat of winter in Ladakh Magpie keep starts making the nest. Being one of the intelligent bird species Magpie always opts for a location that is at great highest above the ground surface. Mostly build the nest on poplars and willows trees and bushes. Materials used to build a nest are clay with other materials. Clay is used to plaster the inner portion of the nest and the outside is covered by twigs and other wood materials. Using clay by Magpie in making nest shows phenology because during the retreat of winter the melting of the snow creates huge muddy areas and Magpie uses these muds to make their nest. Delay in the retreat of winter disturbs the nest making, which disturbs the hatching period and breeding period of Magpie, all these show phonological ties. Another phenology is depicted by Magpie shelter in old houses and roof sheets during winter to save themselves from the severe winter cold.

### **Vulnerable to diseases**

During the survey in the study area, we came across some terrible behavior of Magpie lying near water body fully wet and also in an angry-mad mood. Also, Magpie reflects hostile behavior towards the people passing on the roads. This again shows the impact of climate on their livelihood. They dip into the water to make themselves comfortable with the warm environment. But we saw such diseased Magpie ultimately die due to failure to survive in the contemporary environment. Temporal partitioning of the breeding period due to climate-induced changes can lead to interspecific competition with severe consequences (Ahola *et al.*, 2007) <sup>[1]</sup>. Being less in number they are facing defects from other species of birds which we often see in the

localities of the study area. Due to its strategic geographical location, four groups of birds can be identified, depending upon their time of occurrence within Ladakh limits (PFISTER 2001) <sup>[18]</sup>. Among the four types, one is resident birds and Magpie belongs to this category of birds. The scarcity is very much noticeable that during summer mid-day time magpie is hardly seen as the little left flock of this species. If birds rested themselves under shadow or over great height to avoid day heat. But if we find so, they are susceptible to disease and show odd behavior.

### Finding and results

The review suggested that climate change has been identified as a crucial factor affecting. So to revive its number we should utilize environmentally friendly fuels, instead of fuels causing greenhouse gases. Early time magpie is very common everywhere. Also, we find nests of magpies more commonly. But due to climate change, these communities of birds face challenges to survive. This also reveals the level of pollution in Ladakh than past. This change in climate and its temperature change affect the survival of the magpie bird community. We propose that Magpie is affected by Climate Change, directly as well indirectly. In our model, we suggest that climate does so by causing environmental degradation, which is bi-directionally affected by this, in turn, leads to issues of biodiversity.

The following detailed record of observations of magpies made by different key informants.

#### 1. Maymay Tstring Stanzin (76) Stog, Leh has observed the following things

For the villagers, especially the cattle herders the existence of the magpie bird is of immense significance. They help them in alarming them about the prevailing danger that is going to befall their animals by quirking around when they see wolves and foxes. Magpie bird is believed to be one of the most intelligent of all because their nest is quite different than other ordinary nests that we see around us in terms of the structures and materials they used. They spend a lot of time and energy in accumulating materials and building a proper nest to lay eggs.

#### 2. Jigmet Angmo (74) Thiksey Leh has observed the following things

As per popular belief, the chirping of magpie birds in the wee hours of early morning has its significance attached to it. Since the ages, the general people considered it as a sign of guest who is going to visit their home. As many of us might have seen or heard the elder members of family saying that guest is going to visit our home today because magpie has made a chirping sound.

#### 3. Mohd Ali (70) Achinathang, Leh has observed following

He said being a farmer is very much familiar with a magpie. In summer it's more often seen in the early morning and evening only, but magpies take a rest during the sunny hours of the day. This bird is very active and sensitive compared to other bird communities of my locality. Another significance of this bird is that it will imbibe all the air-borne diseases that prevail in the area and will guard the people against affecting it. Magpie is the only bird that changes its nest annually.

#### 4. Mohd Yasini (78) Sankoo, Kargil has observed following things

The Magpie bird community is very irritating also as this is the only bird who steals soaps and other items useful to humans, as such things are often seen in their nests. But this bird also facing trouble in the contemporary environment because of the warming of the climate. He also added that the decline in the population of this species of birds has noticed just one decade ago. May be become the introduction of modern sophisticated tools and devices in society. This addition of the knowledge is worth mentioning as it is said by many scientists dealing with birds and other ecological studies, that it's the electromagnetic radiations (EMR) that is very harmful to our feathered friends. Similar effects of EVR harming magpie in Ladakh also.

#### 5. Ajang mohammad (70) taIsuru, Kargil, has observed a very different thing which is as follows

In all common birds of his region, its magpie who entered other nests and break their eggs to feed their offspring. Adding to his observation he said magpie build in the first month of the Tibetan calendar i.e. Tangpo (mid-April) as during this time melting of snow takes place with the retreat of winter created wet mud which they take with its peek to plaster inside the nest. After the construction of a beautiful nest, they start breeding, pair up with mates, lay eggs in the nest.

#### 6. Haji Ghulam (68) Tangol, Kargil has observed the following things

Magpie is limited to Parkachik beyond this village it's rare. But it's felt by everyone that its population is declined drastically and with this many exotic diseases spread in our region. This bird species lays only 4 eggs. Females are bigger than males. Now a day their nests are not well developed maybe because of the shifting of seasons and corresponding environmental conditions.

### Conclusion

Undoubtedly, both flora and fauna of ecologically sensitive regions like the Himalayan area come under the vivid impact of climate change. Birds of the tropical mountains including the Himalayas are most vulnerable to climate change (Wormworth and Sekercioğlu 2011) <sup>[29]</sup>. A focused review on the mechanism via which climate change affects the natural habitats of Magpie with a focus on important mediating factors such as environmental degradation its direct impact on Magpie. Climate change has severely affected the breeding activity of birds especially in the higher elevation areas of Sikkim leading to reproductive failure. There are breeding records of species such as Ruddy Shelduck *Tadorna ferruginea*, Ibisbill *Ibidorhyncha struthersii*, Common Redshank *Tringa totanus*, and Black-necked Crane *Grus nigricolis* in Sikkim (Ali 1962, Ganguli-Lachungpa 1990, 1998; Ganguli-Lachungpa *et al.*, 2007) <sup>[2, 7-9]</sup>. Similar challenges also facing magpie. Conservationists are entering a new era of conservation, one in which last-ditch stands to save species where they currently exist may not be enough. (Hannah *et al.*, 2005) <sup>[20]</sup>. The same is needed for the conservation of the magpie in Ladakh. Unusual weather events and the warming temperature has a multifarious effect on forests and bird habitats (Walther *et al.*, 2002; Xu *et al.*, 2009) <sup>[28, 30]</sup>. Alteration in habitats prompts birds to shift their ranges vertically and horizontally (Sekercioğlu *et al.*, 2012) <sup>[23]</sup>. While we have ample examples to prove that many species of birds and animals have responded to climate change but precise

responses are not known. To understand and address the climatic effect on flora and fauna in Ladakh. We recommend widespread and long-term monitoring across the entire Ladakh region. Studies on the birds of Ladakh started way back in the second half of the nineteenth century when Tibetan Plateau was open to outsiders (Tak *et al.*, 2008) [25]. But still the avian community in Ladakh facing a multi-dimension thread for their survival.

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