Biodiversity and Climate Change: Challenges and Interventions With special reference to Migratory Birds

Submitted by:-

Author 1
Mrs. RohiniYadawar
Assistant Professor, Department of Geography
Shri Ratanlal KanwarlalPatniGirls'College,
Kishangarh, Ajmer

Author 2
Dr. Ajay Kumar Sharma
Associate Professor,
SPC,Govt. College, Ajmer

Author 3
Dr. ShailendraPatni
Vice Principal
Shri Ratanlal KanwarlalPatniGirls'College,
Kishangarh, Ajmer

Introduction:

According to NASA , our planet is constantly getting warmer. There has been a constant rise of about 2 degrees Fahrenheit (1.1 degrees Celsius) since the late 19th century. The major cause of this constant rise in temperature is increase in carbon dioxide and other human-made emissions into the atmosphere. If the current rise in global temperatures continues it will create irreversible impacts on our planets.

Source:NASA, this graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO_2 has increased since the Industrial Revolution. (Credit: Vostok ice core data/J.R. Petit et al.; NOAA Mauna Loa CO2 record.)

According to UK based newspaper Guardian, the glaciers of Asia will shrink by a third by 2100 which will threaten the fresh water supply in rivers which will further create huge water shortage.NASA's Gravity Recovery and Climate Experiment revealed that Greenland lost 150 to 250 cubic kilometres (36 to 60 cubic miles) of ice per year between 2002 and 2006.In the southern hemisphere Antarctica lost about 152 cubic kilometres (36 cubic miles) of ice between 2002 and 2005.Besides the shortage of water supply high warming scenarios will include rise in sea levels which is quiet alarming as sea level is risen by 8 inches in the last century.

We are already witnessing worsening storms like Harvey in North America, typhoon Hato in Hongkong.If warming of our planet continues there will be a series of irreversible climatic changes that will long for

centuries. The sea levels will rise by 1-4 feet by 2100, Arctic region will be ice-free, and climate will continue to be extreme. With such harsh global climatic changes, biological diversity of this planet can't remain unaffected.

Impact of Global Climate Change on Biodiversity

Biological elements need to be adaptive and proactive to the changes in their surroundings in order to survive, failure to which may lead to their extinction. Some of the effects of climate change on biodiversity and ecosystems include species extinction, biodiversity loss and phenological changes.

World Wildlife Fund (WWF) International has observed that "the population explosion, sustained by human science and technology, is causing almost insoluble problems for future generations. It is responsible for the degradation of the environment through the pollution of the air and water; it is consuming essential as well as non-essential resources at a rate that cannot be sustained. Above all, it is condemning thousands of our fellow living organisms to extinction"

According to millennium ecosystem assessment (2005); there has been a crucial loss of biodiversity on earth, with 10-30% of mammal, bird and amphibian species threatened to be extinct. Many factors are responsible for loss of biodiversity, which includes habitat loss and degradation of available habitat, diseases along with Global Climate change.

Bret Scheffers from University of Florida has highlighted that rise in temperatures globally has affected 77 of 94 different ecological processes, which includes changes in species' genetics, seasonal responses, overall distribution pattern, physical traits which includes body size and shape.

Coral Reefs also called the rainforest of the sea are also undergoing many changes. Warmer waters are causing increase in the coral diseases such as black band disease, white band disease, white plague, and white pox, along with coral bleaching, all of which can lead to mass mortality of coral, and subsequently the entire ecosystem it supports.

Biodiversity includes variety of flora and fauna that has wider scope of study. The present research paper focuses on the impact of global climatic changes in the annual cycles of the migratory birds, selective areas of study of the world, causes of changes in annual migratory patterns, present conditions of migratory birds and future predictions.

Purpose of study

The purpose of the study is to highlight the challenges thrown by the global climatic changes on the phenology of selective migratory birds. The study also attempts to highlight the interventions which brought positive changes in biomes. The recovering of wetlands and possible interventions, can be helpful to reduce or slow down the impact of global climatic changes on biodiversity.

Migratory Birds and Impact of Global Warming

The ways in which migratory birds respond to these environmental changes differ from on specie to other.It is easy for short and middle distance migrating birds to adapt to climatic changes, whereas long distance migrants are at a disadvantage. The migration rhythm is usually more fixed and they struggle with readjustment to changing temperatures. Because of this rigidness, they suffer more from the impacts of climate change than other birds.Climate change is likely to impact migratory birds in a number of different ways.

Many waterbirds migrate between different areas to avail the seasonal resources. Migratory species are dependent on the specific sites and its habitatin the course of their journey and their destinations. Increasingly these sites are altered both by climate change andother human disturbances and causes of habitat degradation Increased storm frequency, lowered water tables, higher drought frequency, sea level rise and habitat shifts resulting from climate change could all have a dramatic impact on migratory birds. Currently, several scenarios exist about the impact climate change have on migratory birds, some are discussed below:

1) **Loss of Habitats**

Climate change has a devastating impact on habitats of migratory birds. The habitats are being disappeared due to increasing temperatures, flooding or desertification. Coastal wetland are used by the migrating birds for nesting and foraging. During their migration, birds are dependent on these areas forfood and resting places. Rising sea levels due to climate change causes submergence of these areas the flooding of these habitats. Without these resting places, the birds have insufficient reserves to continue and have difficulties completing their journey, resulting in the phenological changes.

Example: The Sahara expansion due to reckless cutting of trees, agricultural land requirements, combined with destruction of the habitats, gradually makes it nearly impossible for African-Eurasian migrants to cross this ecological barrier successfully. Many migratory birds fail in their journey and die.

2) **Climate change affected patterns of migration**

The annual migratory rhythm of the migratory birds is often disturbed with changes in the climate.The migratory birds tend to change their routes, shorten or completely cancel their journeys as a result of seasonal changes in temperatures.

Example:Some small bird species do not go in winter to Spain, France or in the north of Africa. Instead, they prefer to stay in England, where they breed. Cranes, which normally migrate to Spain and Portugal, stay in Germany, accompanied by Starlings. This inactivity has severe consequences. They are not able to adapt themselves to cold temperatures and in case of a hard onset of winter most of them do not survive.

3) **Insufficient breeding places because of warm weather**

Gradual changes in temperature and its increase create conditions for easy survival of resident birds. They consume food resources and breeding places of long distance migrants. As a consequence, long distance migrants might find their breeding grounds preoccupied by a large number of resident birds. This creates a shortage of breeding place for migratory birds.

4) **Other Reasons which brings phenological changes**

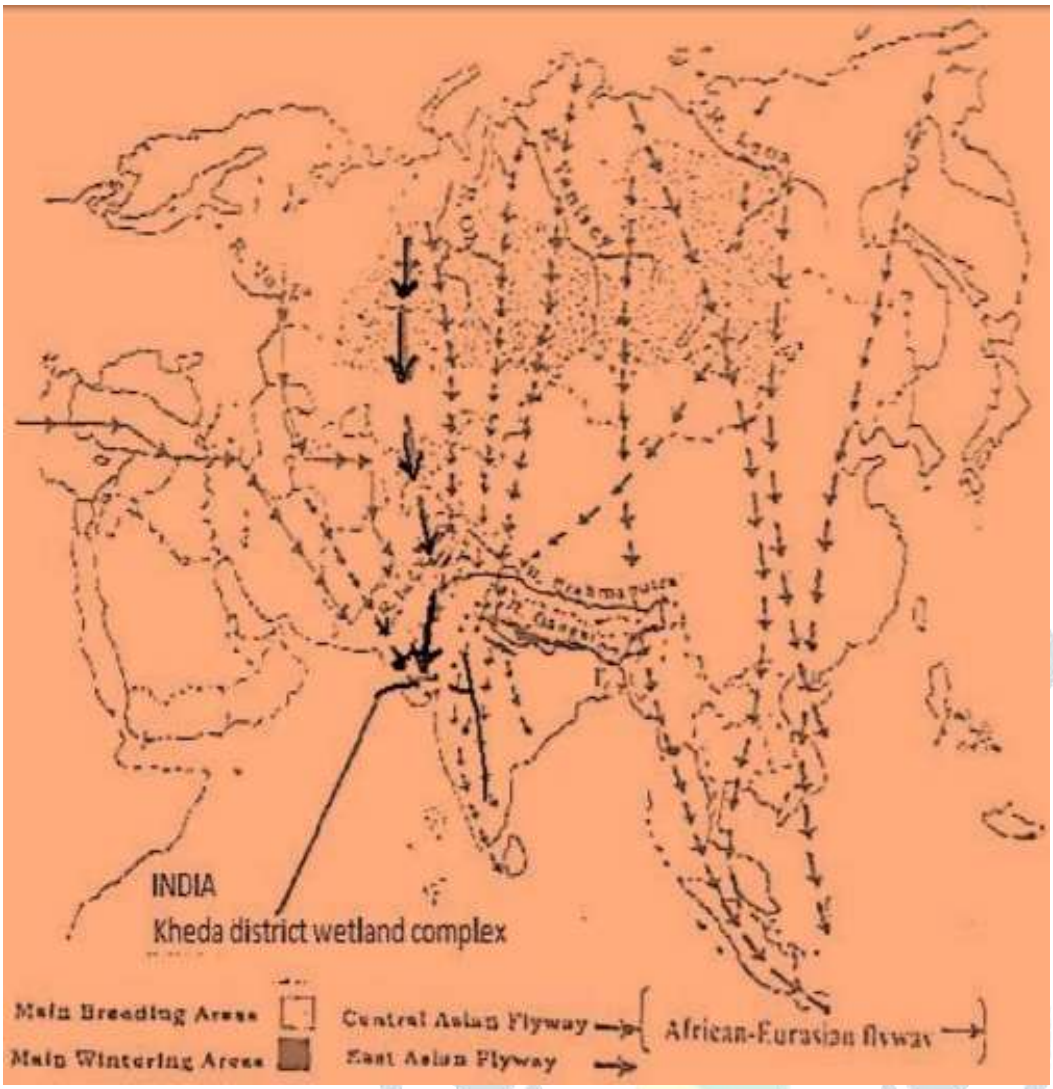
The habitats of the world are undergoing tremendous changes like pollution, fragmentation, or conversion and overbuilding. Furthermore, migratory bird species also faces tough competition with newly introduced alien species, this further pushes them towards vulnerability.

Impact of Global Warming on migratory birds:Selective Case Studies

Central Asian Flyway and Migratory Birds

The Central Asian Flyway area is through 21 countries from the Arctic Ocean in the North to the Indian Ocean in the South. It includes both the African-Eurasian Flyways in the West and East Asian-Australasian Flyways in the East. The flyway is characterised by many important wetlands, which are being destroyed by

human encroachment. Some of the globally threatened migratory birds species included areAythyanyyocaGrusleucogeranus, Ansererythropus, ,Oxyuraleucocephala.



Source :Chapter 5, Birds and Birds Behaviour ,shodhganga.inflibnet.ac.in page no. 55

The birds migrate during October-March in large number from countries of Middle, Central and Southern Asia. Countries to India, Pakistan, Sri Lanka and Iran .There has been considerable decline in the population of migratory birds in the second half of the 20th century, and is considered ongoing. Many migratory species will soon be included in list of Globally Threatened Bird Species and in the IUCN Red Data List.

American Robin

National Wildlife Federation USA (2013) has published a report highlighting changes in migrating pattern of American Robin birds. In Colorado, robins migrate in spring from lower to higher elevations, typically arriving well before bare ground is exposed by snowmelt. Over a 19-year study period they arrived at the higher elevations on average 18 days earlier, even though the average date of snowmelt was unchanged. With robins arriving earlier but no change in the blossoming date of herbaceous and flowering plants, this mismatch in timing could eventually result in scarcity of springtime food resources.

Red Knot

Another bird migratory pattern has been changed under the impact of global climatic change. According to the report published by National Wildlife Federation US 2013 the red knot occurs on the shores coastal margins of Maine, New Hampshire, Virginia, North Carolina, Florida and Oregon.109 Some red knots migrate 9,300 miles one way from their Arctic breeding grounds to the southernmost tip of South America where they overwinter. This long-distance migrant has a strong dependence on key habitats. A recent assessment of the red knot's vulnerability to climate change indicated a large increase in extinction risk due to the likely loss of more than half of its winter range, as well as its high degree of habitat specialization

Migratory Birds changing pattern in India

About 20 years ago, Chilika lake of Odisha was much pleasant for migratory birds as it was much cooler. The migratory birds from Arctics found it moderately cooler and spent winters in these destinations. This migratory patterns have changed. Chilikalake and other coastal wetlands of India, once popular as migrating bird important destinations, have become warmer because of climatic changes. The result is, reduced number of birds
coming to India during their winter migration.

Black-Tailed Godwit

Its scientific name is Limosa Limosa.It migrates from Indian Subcontinent, Australia, West Africa and parts of Western Europe.The main threat for this species is the loss of habitat. Draining of the wetlands for the constructuion of dams and agricultural use created a critical situation for it as it is left homeless.The IUCN Red List categorizes the Black-Tailed Godwit as near threatened— it is estimated that the world population has declined by between 14 and 33 per cent in the past 15 years, according to Bird Life International.Presently it is falling in the verge of threatened .

These are few selective examples and a brief of the migratory of birds which are presently facing threat because of changes in their migratory patterns. Besides these there are inumerable birds species which are currently in threat but the present study could only encompass few.The migratory patterns were disturbed due to globla climate changes which are initially caused by human activities.

Necessity to Conserve Migratory Birds and their phenological Patterns

Migratory birds are of great ecological and economic value to every country. They contribute to biological diversity and bring tremendous enjoyment to millions of people who study, watch, feed, or hunt these birds throughout the world.

Migration is a difficult journey and involves a wide range of threats. The challenges given by nature are still sometimes not that brutal as the human activities like encroachment for settlement, agriculture, grazing etc. is the main threat migrating birds as they are dependent on finding suitable breeding and wintering grounds as well as stopover sites along their flyways where they can rest and feed.

Source :Creative Commons photo by Andreas Trepte

Any changes in these sites used by the birds during their annual cycle could have a dramatic impact on the birds' chances of survival.

Recovering and Restoring of Wetlands: Case Studies

Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season. Wetlands supports both flora and fauna. When there is prolonged presence of water,it creates conditions that favor the growth of specially adapted plants and promote the development of characteristic wetland soils.

Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation and other factors, including human disturbance. When these wetlands undergo ecological disturbances due to climatic changes or human induced factors the natural habitat is disturbed. Migratory birds as one of the ecological elements also get affected. If these wetlands are restored timely there are chances that the disturbed migratory patterns of birds can be recovered back and ecological balance can be maintained again. Here is a brief given about such case studies:-

Man made wetland in Karnataka becomes have for birds

Malyady (also known as Malyadi), is a small town about 22 kilometres from Udupi in Karnataka has benefited the birds of the region. A depression that turned into a wetland here has become a paradise for birdwatchers in the last 25 years with many visiting the region between September and March**.**

Source: indiasendangered.com, Red Shank (Tringatotanus)

It all began 25 years ago when the topsoil of Malyady, was found to be suited for tile manufacturing by locals.It was dug up to depths of two meters and used as raw material in the tile factories of the district. The resulting depression turned the area into a wetland of about 1.5 sq. km, and over the last 25 years this wetland has become a hotspot for many migratory as well as domestic birds**.**The migratory birds that regularly visit Malyadyinclude,Red shanks (Tringatotanus),Golden plovers, (Pluvialisdominica)Common sand pipers (Actitishypoleucos),Green shank (T nebularia)**,**Ringed plovers (Charadriusdubius).The Department of Forests has meanwhile submitted a proposal of Rs. 19.51/- lakhs to the district administration for the purpose of construction of five watchtowers and an information centre, plantation of fruit and bamboo seedlings, and for fencing of the area where possible**.**

Bringing back the hope for an endangered species: Bermuda Petrel

The Endangered Bermuda Petrel was thought to be extinct for almost three centuries before a small population was discovered nesting on a group of four tiny rocky islets in Bermuda in 1951. An intensive recovery programme involving provision of artificial nest burrows raised the population from 18 pairs when rediscovered to 70 pairs in 2003, but then heavy seas during a severe hurricane destroyed many of the nesting burrows. In 2004, 14 chicks were translocated to Nonsuchisland, which is larger, higher, and therefore safer.

In 2008, the first translocated chicks returned to the island and hopes are high that within the next few years the birds will start to breed for the first time on the island for nearly 400 years.

Amazing story of one village and 15,000 birds

Khichan, a village in north-west India has been declared a World Heritage Site by the International Crane Foundation. More than 15,000 of these migratory birds, the smallest of the cranes, descend on Khichan every winter. It attracts bird lovers, photographers and tourists from India and abroad. But earlier it was not so.More than 40 years ago, Maloo returned to Khichan to take care of his elderly uncle and was given the job of feeding pigeons.. After many months of attracting the usual squirrels, pigeons and peacocks, Maloo noted the arrival of a dozen demoiselle cranes And, slowly, his feeding efforts saw a steady increase in crane numbers. Encouraged, Maloo asked the local government to allocate him some land for a designated feeding ground for the birds and space to build a granary to store the grain that had started pouring in from grain traders who supported the conservation of the birds.

Interventions suggested:

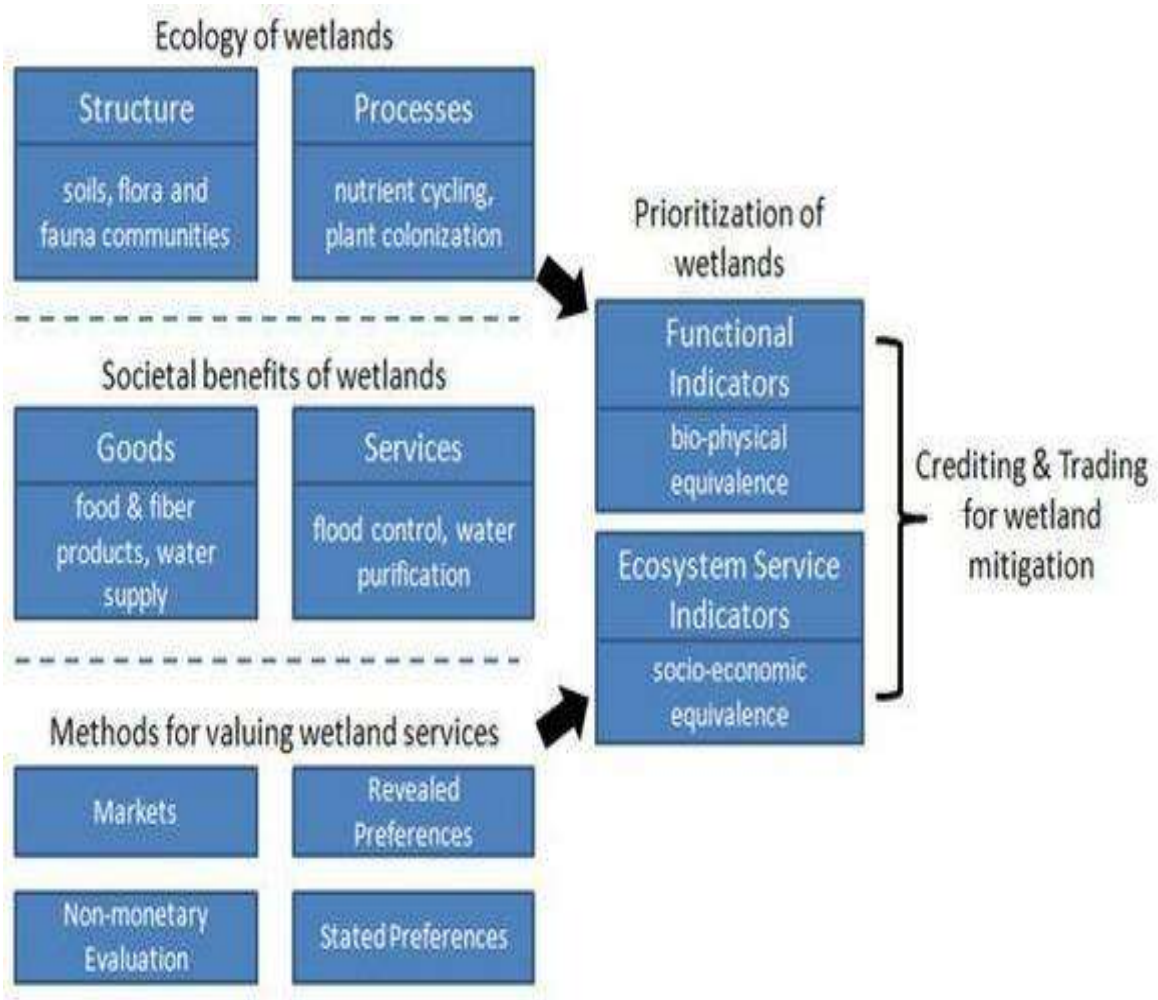
Constant efforts need to be done in order to conserve and restore the migratory patterns of the birds.The present paper suggests some interventions which could be taken to slow down the impact of global climate change on our biodiversity. This is indispensable step to sustain our ecological balance.

- **Bird Conservative Initiatives** which should include voluntary, public-private partnerships that work to conserve the wetlands habitats. Joint Ventures are important as it help in development of coordinated site-specific habitat management programs and projects.
- **Planning Regarding Conservation** with special reference to Wetlands identification of migratory birds species, regular monitoring, surveying and identifying the problematic sites is important.
- **Specific Bird areas Program:**The aim of the Important Bird Areas Program is to identify and protect a series of sites to help maintain naturally occurring bird populations for which a site-based approach is important. Important Bird Areas (IBAs) are places of significance for the conservation of birds across multiple landscapes, and they are chosen using standardized, credible criteria based on biological common sense. IBAs include sites for species during the breeding and non-breeding seasons.
- **Bringing Awareness in general Public**: Hosting Bird Photography Exhibitions**,** Competitions in general, encouraging birds conservations through media, introducing policies, Postage stamps are some of the efforts which could be initiated by the local and state governments.
- **Recovering and Restoring our Wetlands most important initiatives:** Protecting our biomes, ensuring minimum human encroachment, significant reduction in extraction of resources is crucial in reference to our wetlands. It should emphasize on restoring its natural fauna and flora.

    - Reestablishing the appropriate natural structure can bring back beneficial functions. For example, restoring the bottom of the wetland is important for reestablishing the hydrological regime, natural cycles and ecosystems. In order to maximize the benefits of the restoration project, it is essential to identify what functions should be present and make missing or impaired functions priorities in the restoration.
    - Designing the project keeping in mind the local context is also important. Keeping in mind the average water runoff, vegetation cover patterns, climatic changes and duration of changes should be strictly monitored
    - Understanding and identifying the major causes of degradation of Wetland and measures should be taken to rectify it timely.
    - Future Changes should be also anticipated before final run-through of the Wetland restoration project. For example in repairing a stream channel, it is important to take into account potential

changes in runoff resulting from projected increases in upstream surface area due to development and it should be checked before the final layout.

- Using Passive restoration is the key: Lets nature takes its course. Before active restoration the project should give some pace to nature to restore the ecosystems in its own way. Sometimes unnecessary active restorations may not bring the desired results
- Restoring of native species is more important, as non-native species may disturb the ecosystem or may alter it irreversibly.
- Promoting bioengineering is also important.Bioengineering techniques can often be successful for erosion control and bank stabilization, flood mitigation and even water treatment. Specific projects can range from the creation of wetland systems for the treatment of storm water, to the restoration of vegetation on river banks to enhance natural decontamination of runoff before it enters the river.



Source:Oregon Explorer, Ecology of Wetlands, Adapted from Hein, et al (2006), and Turner and Daily (2008),

Conclusion

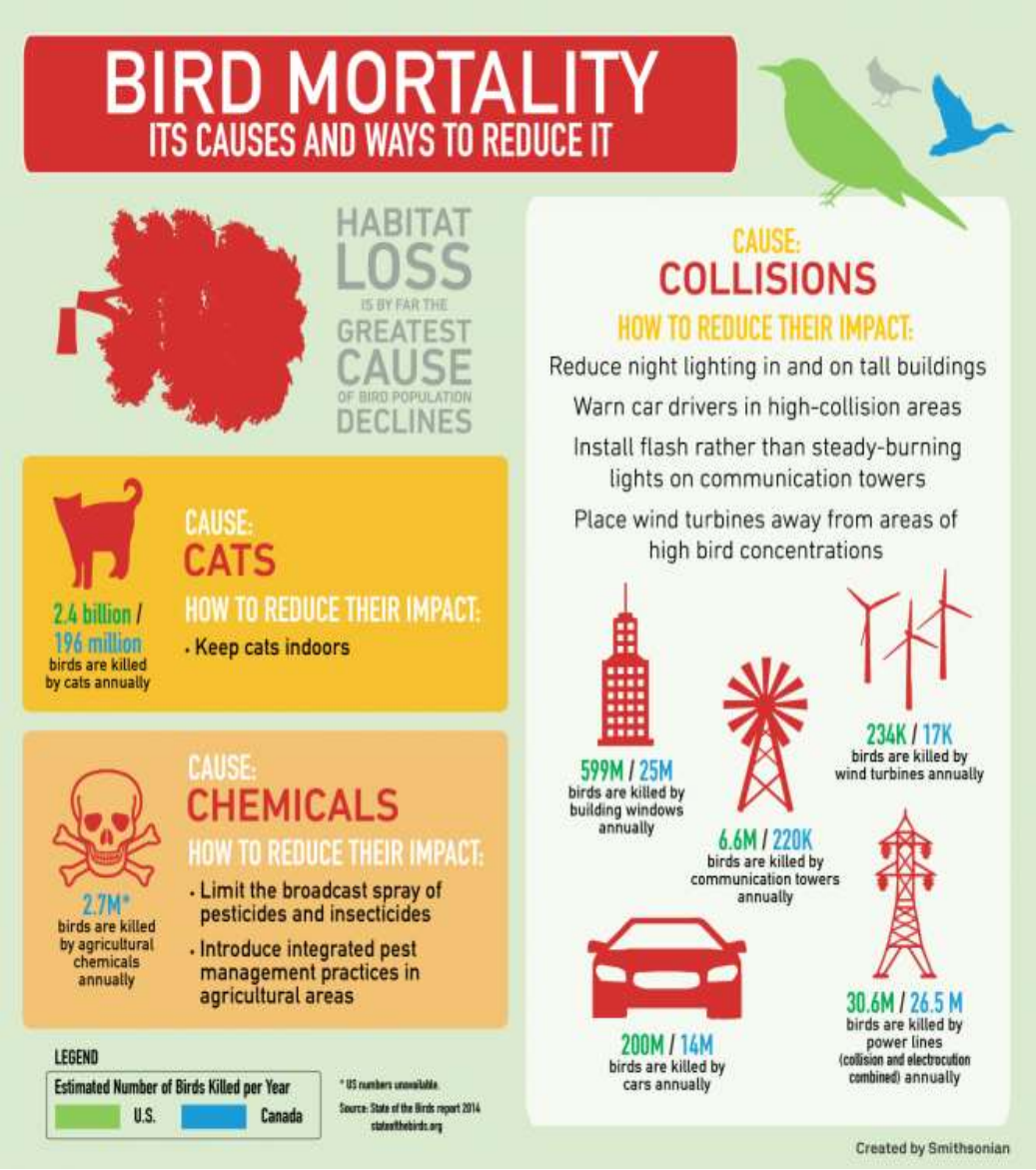
Biodiversity and Global Climate change are both intricately related. Biodiversity is constantly battling hard against the odds created in climatic changes triggered by human beings. The irreversible changes are already been witnessed by thousands of ecological elements. Huge impact is constantly been brought under light through migratory birds and their annual migratory patterns which is the focus of this study.

During the study it was observed that there has been many phenological changes in reference to migratory birds.The research paper has bring forth the devastating impact of global climate changes through selective studies of migratory birds like that of Central Asia Migratory birds American Robin, Red Knot and Flemingo, Black-Tailed Godwit. The changes like the arrival time of the birds were the most significant change which was then followed by decrease in number of the migrating birds globally. The case studies indicated that the temperature variations in different parts of the world brought changes in the phenology of migratory birds to a great extent. These changes are to some extent reversible if the natural habitat of the migratory birds are restored and recovered.

The paper not only attempts to narrate a problem, which is changing migratory patterns of birds but it also focuses on highlighting the success stories where the migratory birds flew back through their normal annual cycles and wetlands are being restored. Interventions like Birds Conservation Policies, Wetland Restoration Projects and its planning is also been suggested.

Migratory birds are waterbirds, landbirds or raptors, they fly over different parts of the world – but they all face similar threats during their migration .If the timely efforts are not taken to restore and recover our lost habitats there are chances that more migratory birds species will soon fall in the category of being extinct.

Info graphics about Birds Morta lity and its reduction.



Source: newsdesk.si.edu, State of the Birds: Bird Mortality Infographic,September 9, 2014

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