Ruining the ecology of Hesaraghatta Lake - the role of bird photographers

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Summary

Activities such as bird and wildlife viewing, bird photography, hiking and nature trails appear benign but an increasing body of evidence suggests otherwise. While there are several positive aspects for visitors and tourists, there is usually little benefit to the habitat from such recreation. Assessing and documenting the impacts visitors may have on the ecology of the habitat is among the fundamental premises and challenges in the emerging branch of science termed as 'Recreational Ecology'

Here, a rapid assessment of the impacts caused by nature photographers driving on the dry Hesaraghatta lake bed has been attempted. Results indicate that a wide and extensive network of vehicle tracks amounting to about 43 km exist in the lake area.
About 136 ha of habitat was either lost or disturbed because of vehicle movement and on an average, 20 vehicles were found to be pursuing birds on weekends and holidays.
Several incidents where unethical means such as chasing the bird till it is tired and reluctant to fly were being used to photograph birds, especially the rare, vagrant and migrant birds (including the Red Data Book [19] species as well). While we suggest several methods to mitigate the impacts of this unregulated mode of operation, we believe that self regulation is the best way forward (even though it has had limited success in the past) for the habitat, life-forms and for photographers. The findings from this study are widely applicable to nature tourism, eco tourism and other recreational activities in natural areas as well.

An exhausted Kestrel (*Falco tinnunculus*) being photographed

Introduction

Nature awareness, affordability of binoculars, cameras, digital technology and vehicles has increased participation in nature related activities. However, increased human presence in wilderness areas is damaging the habitat and adversely affecting ecological processes. In Bangalore, many nature enthusiasts and photographers visit natural areas often, especially on weekends and holidays to photograph winter migrant birds (September-April). Hesaraghatta lake is one such place. Use of vehicles for photography is becoming increasingly common. This is because birds in general, are far more tolerant to people in vehicles than on foot.

The Problem: This mode of photography damages the habitat that the birds live in, rather than the bird directly. The situation in Hesaraghatta lake area has aggravated with the occurrence of rare birds like the European Roller or the Pied Harrier, being chased and cornered by 15-20 photographers till it is tired. This problem has persisted for over four years since it was first highlighted in 2009 [1]. This generated several discussions and suggestions such as withholding location information, public shaming and self regulation were made [1]. However, the problem continues with more photographers in the fray. This study aims to assess the damage caused by off road driving for photography on the ecology of the Hesaraghatta lake.

Study Site: Hesaraghatta lake is located about 30 km North West of Bangalore and is under the Minor Irrigation Department of the Government of Karnataka. This lake was once an important source of water supply to Bangalore and is therefore of historical importance. The total area of Hesaraghatta lake bed is about 744 ha (1912 acres) and the water spread area in August 2009 was about 400 ha (or 980 acres). However, in recent years, the lake has been essentially dry.

The Vegetation: The lake bed vegetation is in transition. From being a true aquatic community, the vegetation in the lake bed is undergoing a process of 'Ecological Succession' [following 2, 3]. It shows in various parts, different 'Seral' stages of terrestrial vegetation formations and is currently a grassland-savannah-woodland complex [following 4]. The centre of the lake has more open grasslands while the woodland component increases towards the periphery. Apart from various species of grasses, aquatic and terrestrial plants like *Typha*, *Ipomea*, *Sonchus emilifolia*,*Cassia mimosoides*, *Cassia siamea*, *Tephrosia*, *Sida*, *Altenanthera*, *Celosia*, *Stachytarpeta indica*, *Parthenium hysterophorous*, *Acacia leucophloea*, other *Acacia* species, *Calotropis gigantia*, *Lantana camara* and *Eupatorium* are found there.

Birdlife: When the lake had water, many open water dependent migrants such as the Northern Shoveller (*Anas clypeata*), Northern Pintail (*Anas acuta*) and Garganey (*Anas querquedula*) would inhabit the lake. Among the shorebirds, several waders like Common Redshank (*Tringa totanus*), Common Greenshank (*Tringa nebularia*), Wood Sandpiper (*Tringa glareola*), Common Sandpiper (*Actitis hypoleucos*), Black-winged Stilt (*Himantopus himantopus*), Little Ringed Plover (*Charadrius dubius*) were also found there.

With the drying of the lake, only birds which prefer the grassland or marginal wetlands come here. The Western Marsh Harrier (*Circus aeruginosus*), Pallid Harrier (*Circus macrourus*), Pied Harrier (*Circus melanoleucos*) and Montagu's Harrier (*Circus pygargus*) are known to roost in this area. Several eagles like Short-toed Snake Eagle (*Circaetus gallicus*), White-eyed Buzzard (*Butastur teesa*), Lesser Spotted Eagle (*Aquila pomarina*), Greater Spotted Eagle (*Aquila clanga*), Tawny Eagle (*Aquila rapax*) are also found here. These eagles usually prefer perches on tree-tops or on termite mounds. Several smaller falcons like Lesser Kestrel (*Falco naumanni*), Common Kestrel (*Falco tinnunculus*), Red-headed Falcon (*Falco chicquera*) are known to frequent the area. Also found are the Indian Peafowl, cuckoos, wren-warblers, pipits, larks, drongos, and bush-chats which are seldom pursued by photographers. Currently, the lake is dry except for a puddle and none of the water birds other than egrets are found.

Kestrel (*Falco tinnunculus*), a frequently sought after species by photographers, on an *Acacia* tree.

Methods

Vehicle counts: The number of vehicles active in the study area was counted by at least three observers, located in a position to view the entire lake bed from morning to noon. On two occasions, vehicle counts were also obtained in the evening. The type of vehicle, time of first detection and time of exit from the lake were recorded. Photographers entering the study area in four and two wheelers were counted on four days (one Saturday and three Sundays). Weekends were chosen as the numbers of photographers are high on these days.

Vegetation damage assessment: The damage to vegetation was estimated by measuring the length and width all the existing vehicle tracks in the study area. Tracks were first mapped with a GPS receiver. Subsequently, tracks visible on Google Earth® (latest available satellite images as of September 2012) were also digitized and added. The survey teams walked, excepting a one-time two wheeler ride to estimate track length. The vehicles which they used to reach the lake bed were also included.

This rapid assessment of habitat damage had two objectives:

Determine the extent of vehicular usage in the lake area, in terms of vehicle counts and measurement of the resulting track length.

Estimate the trampling impact on vegetation due to vehicles.

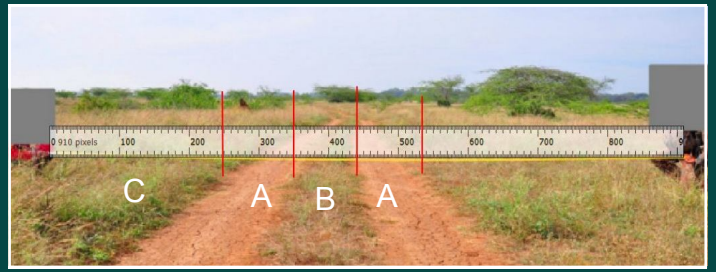
Damage to vegetation on the vehicle tracks was assessed using randomly placed rope-line transects [5] across existing tracks. In this improvised method, two persons held a standard 6 m. tape across the track at the height of the vegetation, which was photographed by a third person on the centre of the track and perpendicular to the tape. This was carried out at 77 random points on the tracks. The location details and corresponding photograph numbers were recorded for analysis. The absolute width of the track was determined from the photographs using the procedure described next.

Analyis of photographs: The track photograph considered for measurement was opened on a computer and a screen pixel measuring tool (used both JR Screen Ruler and Ruler by Jeff Key) was overlaid on the tape in the photograph.

The pixel length of the tape was measured between the thumbs of two individuals holding it. The distance between the thumbs was maintained at 6 m.

The fully damaged (A), partially damaged (B) and not damaged (C) parts of the track were measured using the pixel ruler.

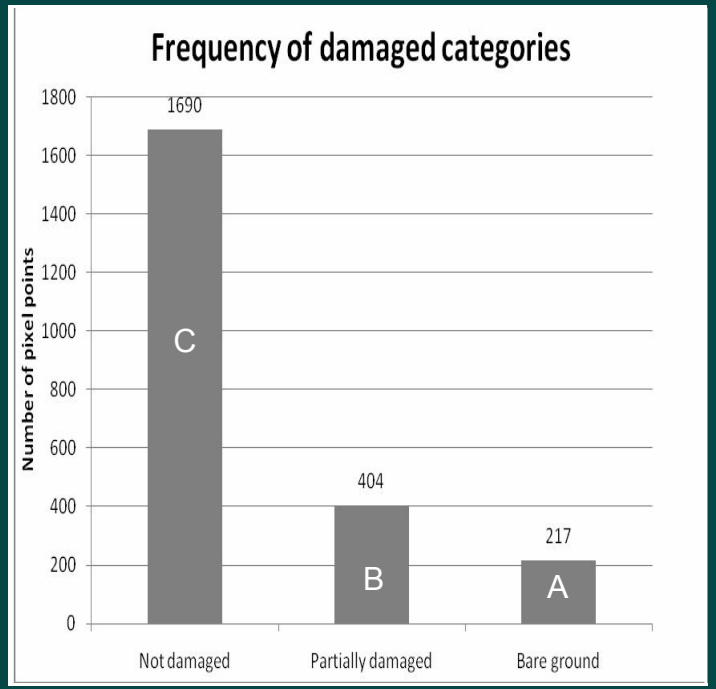
The width of the damaged track was determined by considering the relative proportions of the tape and the track on the photograph.

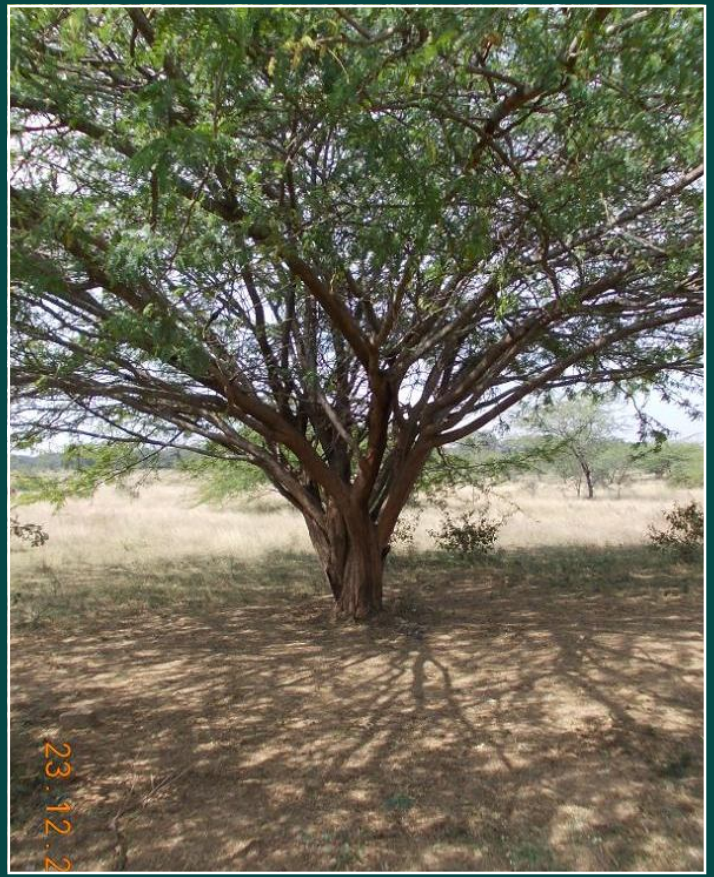


Vegetation damage frequency: As a parallel check, a frequency based assessment for each image was made at 30 regular points . on the photograph using the pixel ruler. The vegetation damage for each point was noted.

The points were tabulated as “Not Damaged” (C), “Partially Damaged” (B) and “Fully Damaged” (A), based on the flattening of vegetation, appearance of bare patches and cracks on the dry ground.

Of the 30 equally spaced points, equivalent to being 20 cm apart on the rope transect used to estimate the width of the track, most points fell on un-damaged vegetation. This graph is to show that the length of the rope transect chosen was adequate and wide enough to sample the width of the damaged track.

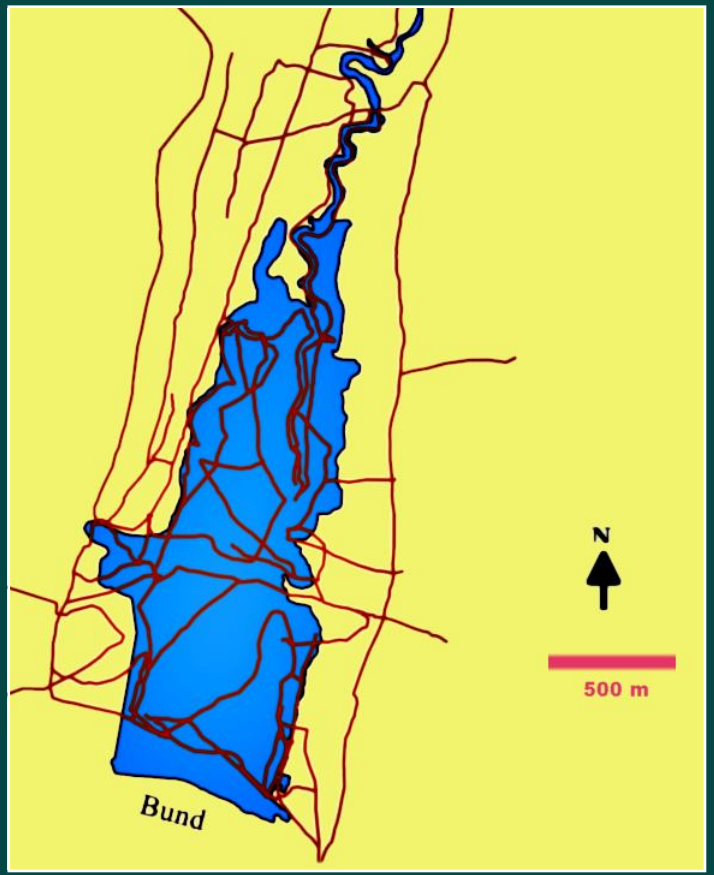




Results

Vehicular movement: A total of 71 four wheelers (cars and SUVs), a three-wheeler and six two-wheelers were counted on four days. This averaged to 20 vehicles per day. The highest number of four wheelers, 26, was counted on a day that had a rare bird sighting (The European Roller *Coracias garrulus*). The vehicles were seen approaching the bird and following it relentlessly as it flushed from one open perch to another. Incidentally, the bird has been listed as "Vulnerable" in the Red List published by the International Union for Conservation of Nature and Natural Resources (IUCN) [19].

The average time duration spent by each vehicle pursuing the birds was 3.5 hrs. However, a few vehicles were present from 0600 to 1800 hrs, with a break between 1200 and1400 hrs. Each vehicle was observed to drive at least five times in the entire study area. Some of these vehicles were driven at visually estimated speeds of 40-50 kmph to get to a perching bird which was then stalked carefully at speeds less than 10-20 kmph. Most individuals photographed from vehicles while a few got down from the car and crawled to approach a bird. Whenever a vehicle stopped near a bird, about 4-5 vehicles converged on to the spot and circled around. If the bird flushed, there would be a frenzy to reach the bird again first.



The network of tracks which exists today in brown; water spread of August 2009 in blue

Vehicle Track Length: The total track length was about 43 km, including existing pathways. Photographers' contribution to the track length was estimated to be about 25 km. This was deduced from interactions with local people and by field observations.

Much of the tracks seen on Google Earth® imagery and in the field today are post 2010 as the study site was marshy till then. There were both arterial tracks and their branches. The total track length measured in this survey is an underestimate because several lesser used branches were not considered for the measurement. Most photographers enter the study area on one or two tracks but then branch off depending on where the birds are. It was also observed that the vehicle tracks were more extensive near and around trees or shrubs on which birds perch. The vehicle borne photographers locate a bird on such a perch, drive cautiously towards it, inching as close to the bird as possible. On a particular day, ten vehicles were found to encircle a perch in a period of about five hours. The radius of such circles was 10-15 m. Birds normally fly away from an approaching vehicle. However, on several occasions, when vehicles approached a Common Kestrel close, the bird ran to avoid the photographers rather than flying. We believe that this avoidance behaviour was not because the bird was too lazy to fly but it was too tired to fly. It is likely that other vehicles had pursued the bird earlier and it had little energy left.

Vegetation loss: Effects of moving vehicles were measured on photographs of 77 sample points spread randomly across the tracks. The average damage to vegetation (partially damaged and fully damaged) was 27%. This estimate is of the width of the fully exposed ground plus the partially damaged shoulder and inter-track space. Therefore, for a 6 m. sample width, an average of 27% damage amounts to 1.62 m. This means that every time a vehicle drives over natural vegetation, an average swath of 1.62 m. is damaged or lost.

Multiplying this value with the total track length of 43 km results in an area of 7 ha (17 acres). 17.6 km of tracks were found on the erstwhile water spread area of 400 ha.

Highlights

Total area of lake bed: 744 ha

Waterspread area in August 2009: 400 ha

Average number of vehicles per day: 20

Average time spent chasing birds: 3.5 hrs

Number of sampling points: 77

Rope transect length: 6 m

Mean width of track: 1.62 m (±0.16 SE)

Total length of tracks: 43 km

Total length of tracks on ex-waterspread area: 17.65 km

Flushing distance: 15 m

Road effect zone in area: 136 ha

Tracks of different usage intensities visible on Google Earth or Google Maps for the Hesaraghatta lake bed

Discussion

Studies elsewhere have shown that the vegetation height along the road shoulders reduced with increasing vehicle movement. Trampling leads to changes in vegetational composition and structure. Off-road driving causes extensive crushing of vegetation and it has been estimated that a standard car on hard ground exerts 1500 g/cm^2 of pressure as compared to 206 g/cm^2 for an average sized human male or 160 g/cm^2 for an average sized human female walking on hard ground [6]. Apart from affecting vegetation, trampling and driving also destroy the nests of ground nesting birds like the Skylarks, pipits, and lapwings, to name a few.

Disturbance: *Moving vehicles damage habitats.*

Vegetation: *The visible irreversible impacts on vegetation include flattening and breakage of standing stalks especially if woody, crushing of foliage, destruction of floral parts, prevention of regeneration either by seed and seedling damage. Such damages result in reduction of species diversity and facilitate an explosive spread of ecologically dominant species, usually weeds.*

Soil: *Repeated vehicular movement affects soil variously, top-soil damage being visually prominent. Soil compaction, caking and cracking, change in textural class, breaking of soil aggregates together contributing to reduced water retention and percolation. Different levels of soil erosion (surface creep and suspension) may lead to deposition of soil particles on foliage resulting in reduced photosynthesis and thereby growth.*

Fauna*: Damage to animals is observable. Birds, invertebrates, amphibians and reptiles are likely to be run over by vehicles. Damage is compounded as several ground nesting birds loose their nests and young ones.*

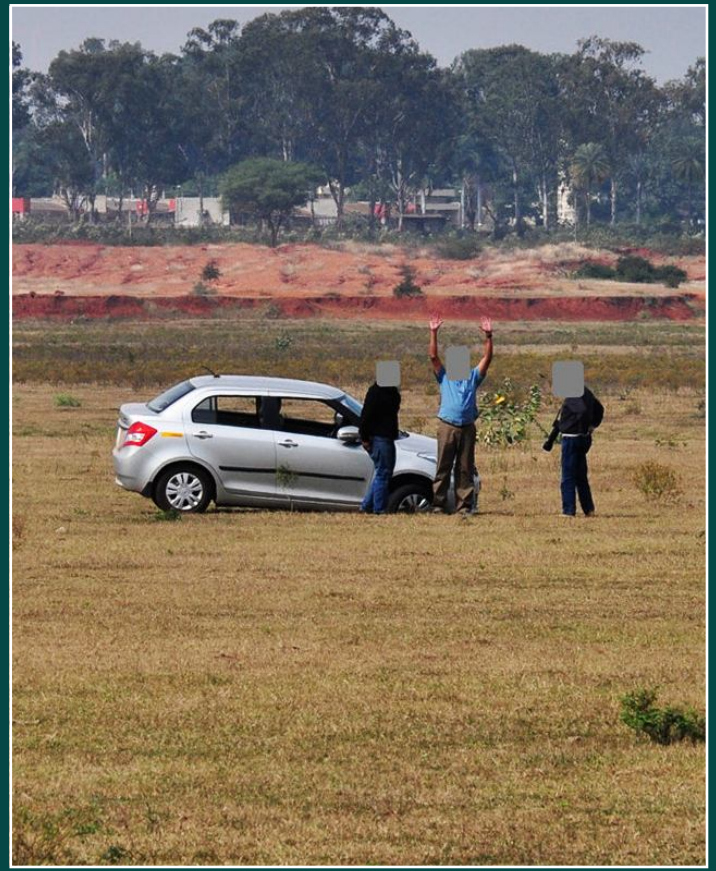
Long term impacts: *may extend to reduction in complexity of food webs and imbalance in food chains. (For example: loss of ground vegetation > reduction in abundance of grasshoppers > reduction in prey base for insect feeding birds).*

The possibility of the dried up grass catching fire and spreading due to increased human activity is not ruled out either [following 10].

The impact of such pressure causes proportional loss or compression of vegetation, preventing regeneration and soil compaction.

Assuming that each vehicle drives atleast five times on the lakebed, then 20 vehicles on one weekend day could drive over any point a 100 times. Extrapolating this to 42 weekend days between October and February where migrant birds are plenty, we get 4200 passes on every track. Elaborate experiments elsewhere have shown that vehicles cause more crushing/ trampling than walkers and anywhere up to 1828 passes will reduce the vegetation cover and biomass by 50 percent depending on the area, terrain, etc [6]. The end result of vegetational cover loss is analogous to calculating half life. Assuming the same rate, given the number vehicles and the passes they make, about 75 percent destruction should be caused every migratory bird season.

Plant succession: The long term damage to vegetation and ecological processes is something which is not apparent at first look. Bangalore falls in the Tropical Dry Deciduous Bioclimatic zone [8]. As mentioned earlier, grassland-savanna habitats in a tropical dry-deciduous bio-climatic zone are habitats in flux. Left alone, it can be expected that such habitats will tend to grow into dry-deciduous forests by a process of ecological succession [9]. The damage to vegetation will affect this ecological process. If in the event of water flowing in again, grass would get inundated but trees have a good chance of surviving flooding. They thus would continue to provide substrates to those forms living on them.

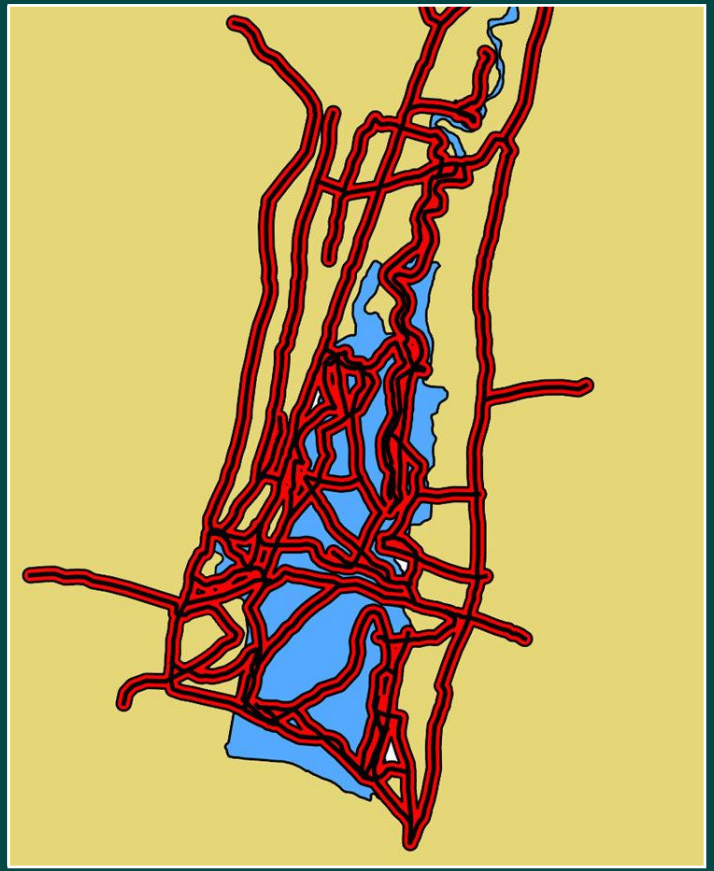


Calling out for help! Irresponsible driving can lead to problems for people too!

Disturbance and flushing of birds:

Considering bird behaviour, road disturbance would not refer to the width of the road alone but to a broader strip on both sides of the road (road effect zone) defined by the flushing distances of birds. Flushing distance is the closest distance a bird would allow a vehicle to approach before flying off. This distance varies with species, habitat and prior disturbance. To determine the road effect zone in a rapid assessment is difficult and hence, we have used a road effect zone of 15 m on either side of the road [10]. This behaviour has been extensively used for determining the impacts of anthropogenic activities on wildlife [11]. Ten observations made randomly validates the earlier assumption of a 15 m flushing distance. Adding this 'road effect zone' to the actual vegetation lost, the impacts become more signficant. A total width of 30 m is disturbed on either side of each track. For the entire 43 km of track, the road effect zone amounts to 136 ha or 336 acres. For the tracks on the waterspread area alone, which was 17.65 km, the road effect zone is 56 ha or 138 acres which is roughly about half the area of Lalbagh Gardens (97 ha). If computed to the total water spread area, 138 acres amounts to about 41 percent.

A single vehicle is bad enough, but if 20 vehicles per day making 100 passes on the lake bed area each day for the entire winter season are considered, the impact would be very high.



Tracks in black with the road effect zone in red and the waterspread area of August 2009 in blue

Loss of host plants for Butterflies: A rare species of butterfly the Lilac Silverline *(Apharitis lilacinus*) was observed and photographed during the study by one of the authors (Nitin RA), after a span of 103 years, since it's last confirmed sighting from *Soledevanahalli* located north of Bangalore. A small population of about 15-20 individuals was seen on the grass during the day. This species of butterfly is protected under the Wildlife Protection Act of 1972 [18]. This species was earlier known from only a few localities and was patchily distributed throughout the country. The recent rediscovery from Hesaraghatta provides an opportunity to gain insights into the ecology and behaviour of this species. The food plant of this butterfly is not known. However, it was observed that several host plants of other butterflies were crushed by off-road vehicle movement. Butterflies have specific host plants on which females deposit eggs and the larvae feed on the plant, pupate and metamorphose into adult butterflies. During this critical stage of development, the butterflies are not given to moving and will succumb to any damage inflicted on the host plant. Persistent off-road driving will not only destroy common butterflies but also this rare and protected butterfly species in this area.

Ethics: For most small sized raptors, feeding frequently is important. The more a bird is flushed from its perch (by an over enthusiastic photographer in this case), the more time and energy it spends in flying from one perch to another [12]. This reduces the time available for it to find food. In experimental studies elsewhere, a significant decrease in the food gathering rate was documented in wading birds due to vehicle movement [11]. Such actions impose immense physiological stress on the bird and may even lead to its death. On several occasions in the past, there have been reports of how photographers in vehicles chased Pied Harriers, a relatively uncommon winter migrant to India, until the birds were tired and did not have any stamina to fly any further.

It is also to be noted that some photographers are rumoured to regularly bait birds of prey with live snakes which are tied to a peg on the ground. This practice is repugnant and unethical and contravenes the law.

This Bluefaced Malkoha (Phaenicophaeus viridirostris), killed off-road at Kalakad-Mundanthurai Tiger Reserve, illustrates what could happen with overspeeding in wilderness areas (July 2011)

A wider perspective

In geological history, plants have pioneered the colonization of land. They setup the energy flows through the ecosystem. If the plant cover is lost, the insect community dependent on it will decline and consequently the food available to birds too. This then, will lead to a decline in bird populations. The mindless act of off-road driving just to get images of rare and vagrant birds is counterproductive.

Fame and popularity that photography gives to people has to a large extent, fuelled this craze for migrant, rare or charismatic species. This race to get the rarest and the best picture crosses the thin line between seeming ignorance and outright wilful unethical practice. In the past, there have been instances of nest photographers destroying bird nests after their photo-shoots to prevent others from clicking the same. Today, nest photography is banned in almost all nature photography competitions, repositories or social media pages. Could we take lessons from this? Indeed, nature photography forums should be discouraging such practices of deliberately destroying the habitat for the purpose of photography. They could discredit any photographer who deviates from ethical practices and is caught cheating. Personal websites could be discredited next.

In other parts of the world where human use of wildlife areas for recreation is allowed, they are strictly monitored and controlled [For example,13]. Walkers are expected to follow specific trails and stick to them. Gaining public support for the conservation of biodiversity is fundamental in nature conservation and managing human use has been one of the cornerstones in conservation science. The recent issue of Supreme Court enforcing a blanket ban on tourism in tiger reserves is an example [14]. A sad consequence of such a blanket ban, which is often necessary, is that it excludes the very people who are needed to lobby for conserving wildlife. If people following unethical practices do not correct themselves, a blanket ban is not out of place. Therefore, regulating such recreational activities is the key. Peer pressure could help greatly in achieving this. The measures mentioned below, coupled with a strong and strict code of

conduct have worked wonders with the same wildlife-photography community in the past and we see no reason why it should not work again.

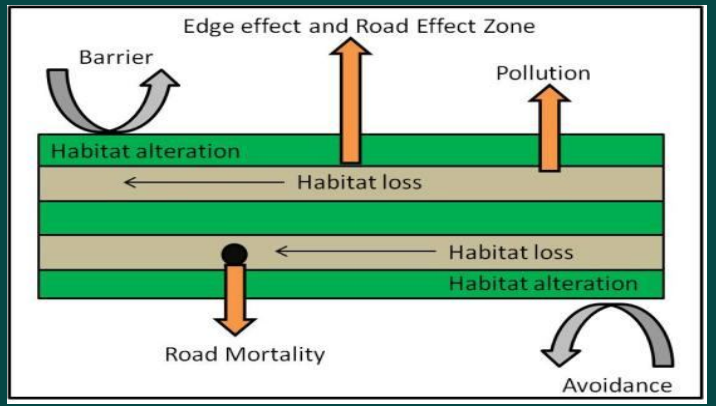
Relevance of this study to wilderness areas where tourism exists: The results from this study are relevant to wilderness areas in India where vehicle tracks have been laid for wildlife safaris and transportation. For example, the Rajiv Gandhi (Nagarahole) National Park had close to 700 km of roads, visibility lines and fire lines in 1985 [15] which accounts to about 15 % of the park area. Some of the impacts identified from this study, especially damage to vegetation and soil caused due to movement of vehicles, can also be extended to these wilderness areas. The technique used in this study can provide a simple and cost-effective way to accurately assess the impacts in these areas.

Importance of grasslands: Grasses are fundamental in supporting and sustaining a "grassland ecosystem". The distribution of natural grasslands within Peninsular India is patchy. Very little ecological knowledge exists about them in comparison to say, a forest ecosystem.

Grasslands are often chosen targets for agricultururral and urban devolopment. Often, grasslands are termed as waste lands and planted with trees by the Government. Such changes destroy the ecology of this fragile ecosystem.

Several grassland specialist birds are found there (Migrants: Harriers, Falcons, Eagles, Floricans; Residents: Pipits, Larks, Quails, Partridges, Lapwings). Apart from birds, other fauna like amphibians, reptiles, mollusks and insects, including the **recently rediscovered Lilac Silverline Butterfly were** found there in good numbers.

A third of all birds ever recorded from Bangalore can be found in Hesaraghatta. Our city will only be the poorer if we lose such a biologically diverse habitat. Majority of the habitat specialist species will be gone once and for all.



Conclusions

From this rapid assessment study, it is clear that the unregulated movement of bird photographers has had a severe impact in the form of permanent vehicle tracks. The feeding and foraging activities of birds are altered if constantly pursued by vehicles. This imposes severe stress on the birds living there.

Damage to vegetation is more severe by a moving vehicle than an individual walking. The regeneration of plants and in turn the process of succession is negatively affected by this. Several grasses and woody saplings are permanently affected, especially in their growth phase. Studies elsewhere have shown that there is ample scope for such habitats to recover if provided respite from constant movement [6]. In Hesaraghatta however, the situation is far from it. Since 2009, when the issue of off-road driving was reported, the number of people indulging in it has only increased. Such activities have not been limited to the study site but are becoming increasingly common in other dry lake beds and grasslands throughout Peninsular India.

It appears that several newer entrants into photography are either unaware of the damages they may inadvertently be causing or choose to blatantly ignore the fact that they cause damages to the habitat and the birds which they intend to photograph. Several well meaning photographers may simply follow others who are indulging in off-road driving and add the already worsening problem.

Given the variability in factors leading to the problem, it becomes imperative that whatever be the mode of activity in Hesaraghatta and similar habitats, some form of regulation is a must. Driving on the lake bed in a vehicle is detrimental to the habitat and it must be stopped.

This rapid assessment study is only an attempt to highlight the problem with supporting evidence. Drawing out solutions to the compounded problem from this short duration study would be unjust. However, we suggest several ways to mitigate the negative impacts.

Protection: the options available

Need for a regulation: Clearly off road driving on the lake bed damages the habitat and should be stopped. Photographers need to understand and accept the fact that the habitat saved for posterity has more value than a close up photograph. If at all one needs photographs, it has to be made by walking and not by driving and pursuing the bird.

Self regulation has seen limited success in the past. Much of the photographers seen in Hesaraghatta and similar habitats appear to be well educated and are concerned about birds. Given this assumption, we suggest that they show some 'empathy' and voluntarily abstain from what they are doing. What is needed is a strict conformity to a code of conduct resulting in ethical photography. On several occasions, members of the photographer community have themselves proposed this. Many countries have standards which can be simply followed [See for example,16].

Need for a stakeholder committee: It may be necessary set up a panel of stakeholders to find viable long term solutions to this problem. The panel could have as its members a few veteran photographers, new entrants to photography, ecologists, representatives of lake users and government. This panel should initiate a much more detailed study (than this) and attempt to identify means and ways of regulating the activity by providing clear guidelines. The panel should aim to address these two questions: 1. Should vehicles be allowed at all ? 2. If yes, how many and where are they allowed to go?

Demarcation of pathways on the ground, and having no go zones on the grassland lake bed, with moral policing and public shaming of 'offenders' by the photographic community. The off-road driving of vehicles can be controlled by a second level of self regulation. Photographers deviating from such trails could be photographed and discredited on various forums where he/she uploads the photograph (For eg: India Nature Watch, Indiabirds, and other Facebook pages).

Digging a trench along access roads or lining them with stone posts to create a physical barrier, or visible guidelines for limits on off-road driving. This will prevent any vehicle from leaving the designated path. Any photographer violating this by covering the trench or removing the stones could be subjected to moral policing and discredited.

Policing by the Forest Department and Bangalore Water Supply and Sewage Board (BWSSB). Though the movement of vehicles and people in the lake bed area does not amount to trespassing, the concerned authorities could be involved in regulating the number of vehicles entering the lake bed. Vehicle movement increases soil erosion and BWSSB has every reason to worry about turbid waters when inflow to the lake increases. Forest Department should come into the picture as wildlife and protected species are involved.

Legal ban and protection with penalization of offenders. There is precedence for it. Photography of the Great Indian Bustard has

been banned by the forest department owing to increasing unethical practices in photographing the birds in their breeding season causing a constant disturbance [17].

All the birds are protected species and are covered under the various clauses of the Wildlife Protection Act of 1972 and so are a few butterflies found in Hesaraghatta. The area is a lake bed, allthough dry now. India is a signatory to the 'Ramsar Convention' (Convention on Wetlands of International Importance) which it has ratified. The convention, at its heart, is based on the philosophy of 'wise use'.

India is also a signatory to the 'Convention on Migratory Species', which it has also ratified. Many of the birds facing pressure from photographers in Hesaraghatta are migratory.

Some are not just migratory but are threatened migratory species too by IUCN's listing: For example, European Roller (*Coracias garrulous)* NT; Lesser Florican (*Sypheotides indicus*) EN; Greater Spotted Eagle (*Aquila clanga*) VU etc [18].

Several of the migrant birds are already losing their habitat in and around Bangalore. Hesaraghatta lake is one place where they are found in sufficiently good numbers. Continued disturbance in this place will do unforeseen damage to the birds. India being signatory to the above mentioned treatises, can take strong legal action against the activities which threaten the existence of birds and their habitats.

Termite mounds are often a casuality of reckless driving! Apart from the mounds serving as perches, termites themselves have an important role in a grassland ecosystem.

Cumulative Bird List

Of Hesaraghatta and environs, compiled by Seshadri KS. Those marked with an asterisk are from [21] and the rest from [20]

Accipiter badius - Shikra
Accipiter gentilis* - Northern Goshawk
Acridotheres fuscus - Jungle Myna
Acridotheres tristis - Common Myna
Acrocephalus agricola* - Paddyfield Warbler
Acrocephalus dumetorum - Blyth's Reed-Warbler
Actitis hypoleucos - Common Sandpiper
Aegithina tiphia - Common Iora
Alauda gulgula - Eastern Skylark
Alcedo atthis* - Small Blue Kingfisher
Amandava amandava - Red Munia
Amaurornis phoenicurus - White-breasted Waterhen
Ammomanes phoenicurus - Rufous-tailed Finch-Lark
Anas acuta - Northern Pintail
Anas clypeata - Northern Shoveller
Anas crecca* - Common Teal
Anas penelope - Eurasian Wigeon
Anas poecilorhyncha - Spot-billed Duck
Anas querquedula - Garganey
Anastomus oscitans - Asian Openbill Stork
Anhinga melanogaster* - Darter
Anthus cervinus - Red-throated Pipit
Anthus godlewskii* - Blyth's Pipit
Anthus hodgsoni* - Oriental Tree Pipit
Anthus richardi - Richard's Pipit
Anthus rufulus - Paddyfield Pipit
Anthus similis* - Brown Rock Pipit
Apus affinis* - House Swift
Aquila clanga - Greater Spotted Eagle
Aquila pomarina - Lesser Spotted Eagle
Aquila rapax - Tawny Eagle
Ardea cinerea - Grey Heron
Ardea purpurea - Purple Heron
Ardeola grayii - Indian Pond Heron
Artamus fuscus - Ashy Woodswallow
Asio flammeus - Short-eared Owl
Athene brama - Spotted Owlet
Aythya ferina* - Common Pochard
Bubulcus ibis - Cattle Egret
Butastur teesa - White-eyed Buzzard
Cacomantis passerinus - Indian Plaintive Cuckoo
Calandrella brachydactyla - Greater Short-toed Lark
Calidris minuta - Little Stint
Calidris temminckii - Temminck's Stint
Caprimulgus asiaticus - Common Indian Nightjar
Casmerodius albus - Large Egret
Centropus sinensis - Greater Coucal
Ceryle rudis* - Lesser Pied Kingfisher
Charadrius alexandrinus* - Kentish Plover
Charadrius dubius - Little Ringed Plover
Chlidonias hybridus - Whiskered Tern
Chloropsis aurifrons - Gold-fronted Chloropsis
Chrysocolaptes festivus* - Black-shouldered Woodpecker
Chrysomma sinense* - Yellow-eyed Babbler
Ciconia ciconia - European White Stork

Ciconia episcopus* - White-necked Stork
Circaetus gallicus - Short-toed Snake Eagle
Circus aeruginosus - Western Marsh Harrier
Circus macrourus - Pallid Harrier
Circus melanoleucos - Pied Harrier
Circus pygargus - Montagu's Harrier
Cisticola juncidis - Streaked Fantail Warbler
Clamator jacobinus* - Pied Crested Cuckoo
Columba livia - Blue Rock Pigeon
Copsychus saularis - Oriental Magpie Robin
Coracias benghalensis - Indian Roller
Coracias garrulus - European Roller
Coracina macei* - Large Cuckoo-Shrike
Coracina melanoptera - Black-headed Cuckoo-Shrike
Corvus macrorhynchos - Jungle Crow
Corvus splendens - House Crow
Coturnix coromandelica - Rain Quail
Cuculus canorus* - Common Cuckoo
Cuculus micropterus* - Indian Cuckoo
Cuculus saturatus* - Oriental Cuckoo
Cypsiurus balasiensis - Asian Palm Swift
Dendrocitta vagabunda - Indian Treepie
Dendrocygna javanica - Lesser Whistling-Duck
Dicaeum agile* - Thick-billed Flowerpecker
Dicaeum erythrorhynchos - Tickell's Flowerpecker
Dicrurus leucophaeus - Ashy Drongo
Dicrurus macrocercus - Black Drongo
Dinopium benghalense* - Lesser Golden-backed Woodpecker
Dumetia hyperythra* - Rufous-bellied Babbler
Egretta garzetta - Little Egret
Egretta gularis - Western Reef Egret
Elanus caeruleus - Black-shouldered Kite
Emberiza buchanani - Grey-necked Bunting
Eremopterix grisea - Ashy-crowned Sparrow-Lark
Eudynamys scolopacea - Asian Koel
Falco chicquera - Red-headed Falcon
Falco naumanni - Lesser Kestrel
Falco peregrinus - Peregrine Falcon
Falco tinnunculus - Common Kestrel
Francolinus pondicerianus - Grey Francolin
Fulica atra - Common Coot
Galerida deva* - Sykes's Crested Lark
Gallinago stenura - Pintail Snipe
Gallinula chloropus* - Common Moorhen
Gyps bengalensis* - Indian White-backed Vulture
Gyps himalayensis - Himalayan Griffon
Halcyon smyrnensis - White-breasted Kingfisher
Haliastur indus - Brahminy Kite
Hieraaetus pennatus - Booted Eagle
Hierococcyx varius* - Common Hawk Cuckoo
Himantopus himantopus - Black-winged Stilt
Hippolais caligata - Booted Warbler
Hippolais rama* - Sykes's Warbler
Hirundo daurica - Red-rumped Swallow
Hirundo fluvicola* - Streak-throated Swallow
Hirundo rustica - Common Swallow
Hydrophasianus chirurgus* - Pheasant-tailed Jacana
Jynx torquilla - Eurasian Wryneck
Lanius cristatus - Brown Shrike
Lanius schach - Rufous-backed Shrike
Lanius vittatus - Bay-backed Shrike
Limosa limosa* - Black-tailed Godwit

Lonchura malabarica - White-throated Munia
Lonchura malacca* - Black-headed Munia
Lonchura punctulata - Spotted Munia
Megalaima haemacephala - Coppersmith Barbet
Megalaima viridis - White-cheeked Barbet
Merops orientalis - Small Bee-eater
Merops philippinus - Blue-tailed Bee-eater
Milvus migrans - Black Kite
Mirafra affinis - Jerdon's Bushlark
Mirafra cantillans - Singing Bushlark
Mirafra erythroptera* - Red-winged Bushlark
Motacilla alba - White Wagtail
Motacilla cinerea - Grey Wagtail
Motacilla citreola - Citrine Wagtail
Motacilla flava - Yellow Wagtail
Motacilla maderaspatensis - Large Pied Wagtail
Mycteria leucocephala - Painted Stork
Nectarinia asiatica - Purple Sunbird
Nectarinia lotenia* - Loten's Sunbird
Nectarinia zeylonica - Purple-rumped Sunbird
Neophron percnopterus - Egyptian Vulture
Nettapus coromandelianus - Cotton Pygmy-goose
Numenius arquata* - Eurasian Curlew
Nycticorax nycticorax* - Black-crowned Night Heron
Ocyceros birostris - Indian Grey Hornbill
Oenanthe isabellina - Isabelline Wheatear
Oriolus oriolus - Eurasian Golden Oriole
Orthotomus sutorius - Common Tailorbird
Otus bakkamoena* - Collared Scops Owl
Parus major* - Great Tit
Passer domesticus - House Sparrow
Pavo cristatus - Indian Peafowl
Pericrocotus cinnamomeus - Small Minivet
Pernis ptilorhynchus - Oriental Honey-buzzard
Phaenicophaeus viridirostris - Small Greenbilled Malkoha
Phalacrocorax niger - Little Cormorant
Phalaropus lobatus - Red-necked Phalarope
Phylloscopus trochiloides - Greenish Leaf-Warbler
Pitta brachyura* - Indian Pitta
Platalea leucorodia* - Eurasian Spoonbill
Plegadis falcinellus - Glossy Ibis
Ploceus philippinus - Baya Weaver
Pluvialis fulva* - Pacific Golden Plover
Porphyrio porphyrio - Purple Swamphen
Prinia hodgsonii* - Franklin's Prinia
Prinia inornata - Plain Prinia
Prinia socialis - Ashy Prinia
Prinia sylvatica - Jungle Prinia
Pseudibis papillosa* - Black Ibis
Psittacula cyanocephala* - Plum-headed Parakeet
Psittacula krameri - Rose-ringed Parakeet
Pycnonotus cafer - Red-vented Bulbul
Pycnonotus jocosus - Red-whiskered Bulbul
Pycnonotus luteolus - White-browed Bulbul
Riparia diluta - Pale Martin
Rostratula benghalensis - Greater Painted-Snipe
Saxicola caprata - Pied Bushchat
Saxicola torquata - Common Stonechat
Saxicoloides fulicatus - Indian Robin
Spilornis cheela* - Crested Serpent Eagle
Sterna aurantia - River Tern
Streptopelia chinensis - Spotted Dove

Streptopelia senegalensis - Little Brown Dove
Streptopelia tranquebarica* - Red Collared Dove
Strix ocellata - Mottled Wood Owl
Sturnia blythii - Malabar White-headed Starling
Sturnia malabarica - Grey-headed Starling
Sturnus pagodarum* - Brahminy Starling
Sturnus roseus - Rosy Starling
Sylvia curruca - Common Lesser Whitethroat
Sypheotides indica - Lesser Florican
Tachybaptus ruficollis - Little Grebe
Tachymarptis melba - Alpine Swift
Tadorna ferruginea* - Brahminy Shelduck
Tephrodornis pondicerianus* - Common Woodshrike
Terpsiphone paradisi - Asian Paradise-Flycatcher
Threskiornis melanocephalus* - Black-headed Ibis
Treron bicincta - Orange-breasted Green Pigeon
Treron phoenicoptera* - Yellow-legged Green Pigeon
Tringa glareola - Wood Sandpiper
Tringa ochropus - Green Sandpiper
Tringa stagnatilis - Marsh Sandpiper
Tringa totanus* - Common Redshank
Turdoides affinis - White-headed Babbler
Turdoides caudatus* - Common Babbler
Turdoides malcolmi - Large Grey Babbler
Turdoides striatus - Jungle Babbler
Turnix suscitator* - Common Buttonquail
Tyto alba* - Barn Owl
Upupa epops - Common Hoopoe
Vanellus indicus - Red-wattled Lapwing
Vanellus malabaricus - Yellow-wattled Lapwing

A lark on the dry lake bed observed at the nest during the survey

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A Jackal getting chased on the lake bed.
Photograph not by the authors

Notes

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