https://jalopnik.com/there-was-a-freaking-bat-flying-around-inside-a-spirit-1836921374

JGi JAIN
DEEMED-TO-BE UNIVERSITY

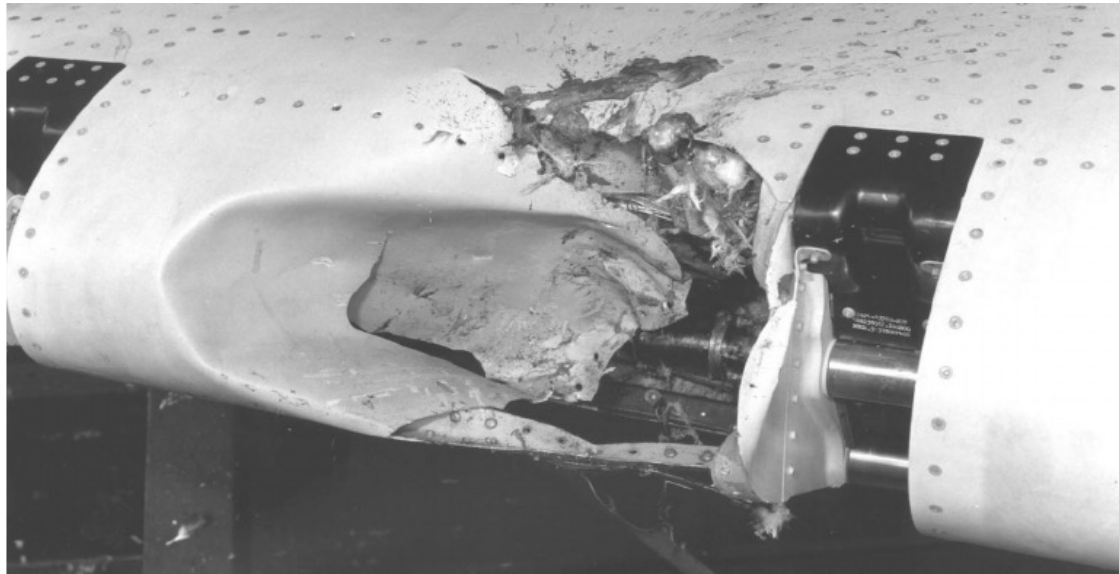
Bat Strikes and Ecological Engineering for Mitigation

Dr. Chetan Nag K S, Deputy Director
& Associate Professor, CUBEC

14th December 2023

Aviation and Wildlife Collisions

Impact



Why should one be concerned about Aircraft-Wildlife Collisions?

- Rising threat to aviation safety, that have led to increased risk, human fatalities and major economic losses for the global aviation industry

- In 2018 alone, US airline industry revenues exceeded US$812 billion (Sixty eight crore four lakh four thousand seven hundred fifty Rupees)(IATA 2019) carrying over four billion passengers by aircraft

Why should one be concerned about Aircraft-Wildlife Collisions?

- Airport/airfield managers, operators and staff have a legal obligation to alleviate wildlife threats at airfields and to understand the relative risk associated with each species.

- Important to prioritize and implement effective Management Plans.

Aviation and Wildlife Collisions- Impact

Sl No	Date	Location/ Country	Bird Species	Occupants	Killed	Injured
1	4 Oct 60	Boston, USA	European Starling	72	62	9
2	12 Nov 75	Bahia Blanca, Argentina	Gulls	139	0	11
3	25 Jul 78	Michigan, USA	American Kestrel	43	0	3
4	29 Sep 86	Madras, India	Black kite	196	0	11
5	15 Sep 88	Amhara, Ethiopia	Speckled Pigeon	104	35	21
6	20 Mar 99	Equitorial Guinea	Unknown bird	33	0	0
7	19 Apr 2K	Congo	Unknown bird	24	24	0
8	29 Nov 04	Barcelona, Spain	Eurasian Buzzard	146	0	10
9	25 Jan 07	France	Northern Lapwing	54	1	Not known
10	10 Nov 08	Rome, Italy	European Starling	171	0	5
11	15 Jan 09	New York, USA	Canada Goose	155	0	1
12	28 Sep 12	Kathmandu, Nepal	Black Kite	19	19	0

Table 1.1. List of major civil aircraft accidents in the world due to bird strikes.

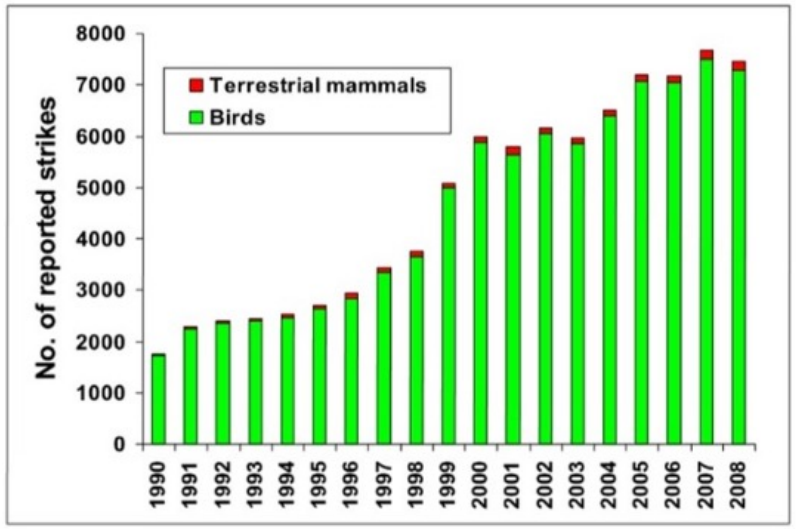
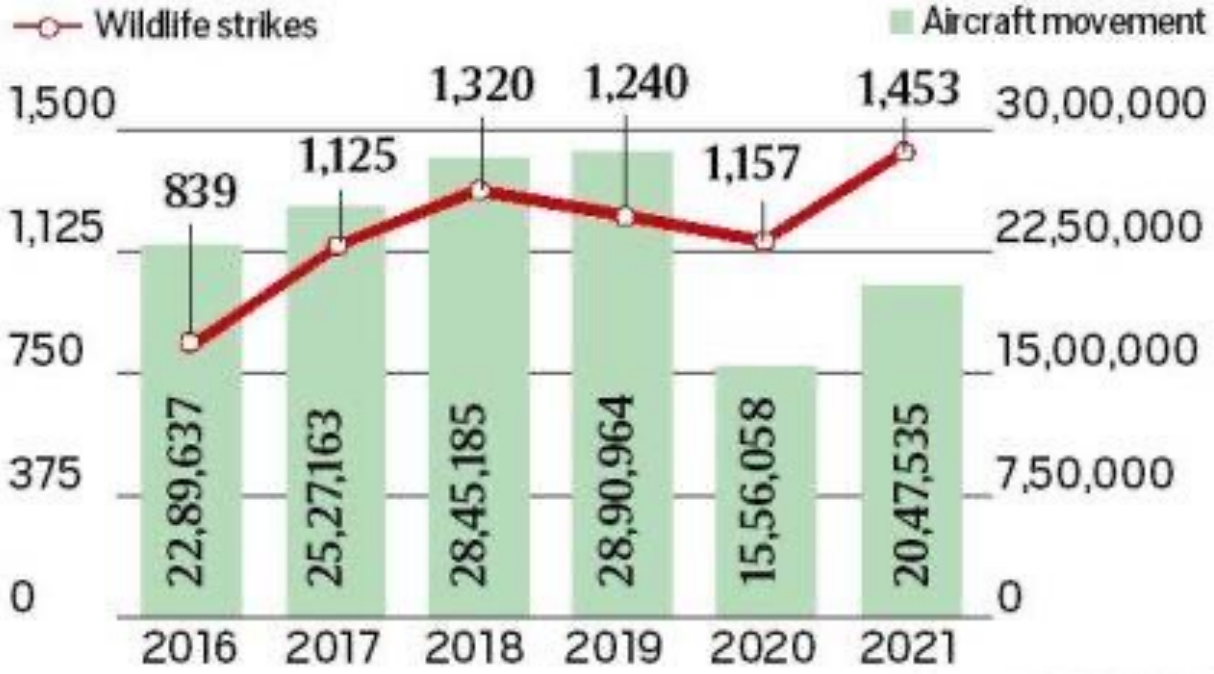


Figure 1. Number of reported bird (N = 87,416) and terrestrial mammal (N = 1,912) strikes to civil aircraft, USA, 1990–2008. Additionally, 299 and 100 strikes involving bats and reptiles, respectively, were reported for a total of 89,727 strikes by all species of wildlife (see Table 1).

Srinidhi. (2021). Assessment of Management strategies of the Bird hazards to aircraft in Select indian air force airfields

AIRCRAFT MOVEMENT DOWN, BUT BIRD HITS UP



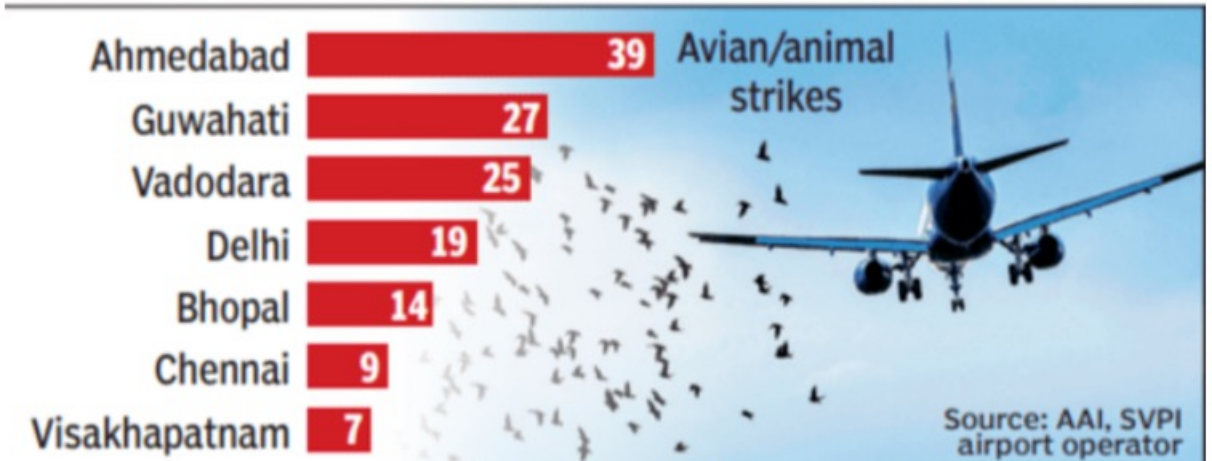
Source: DGCA/AAI

Getty Images

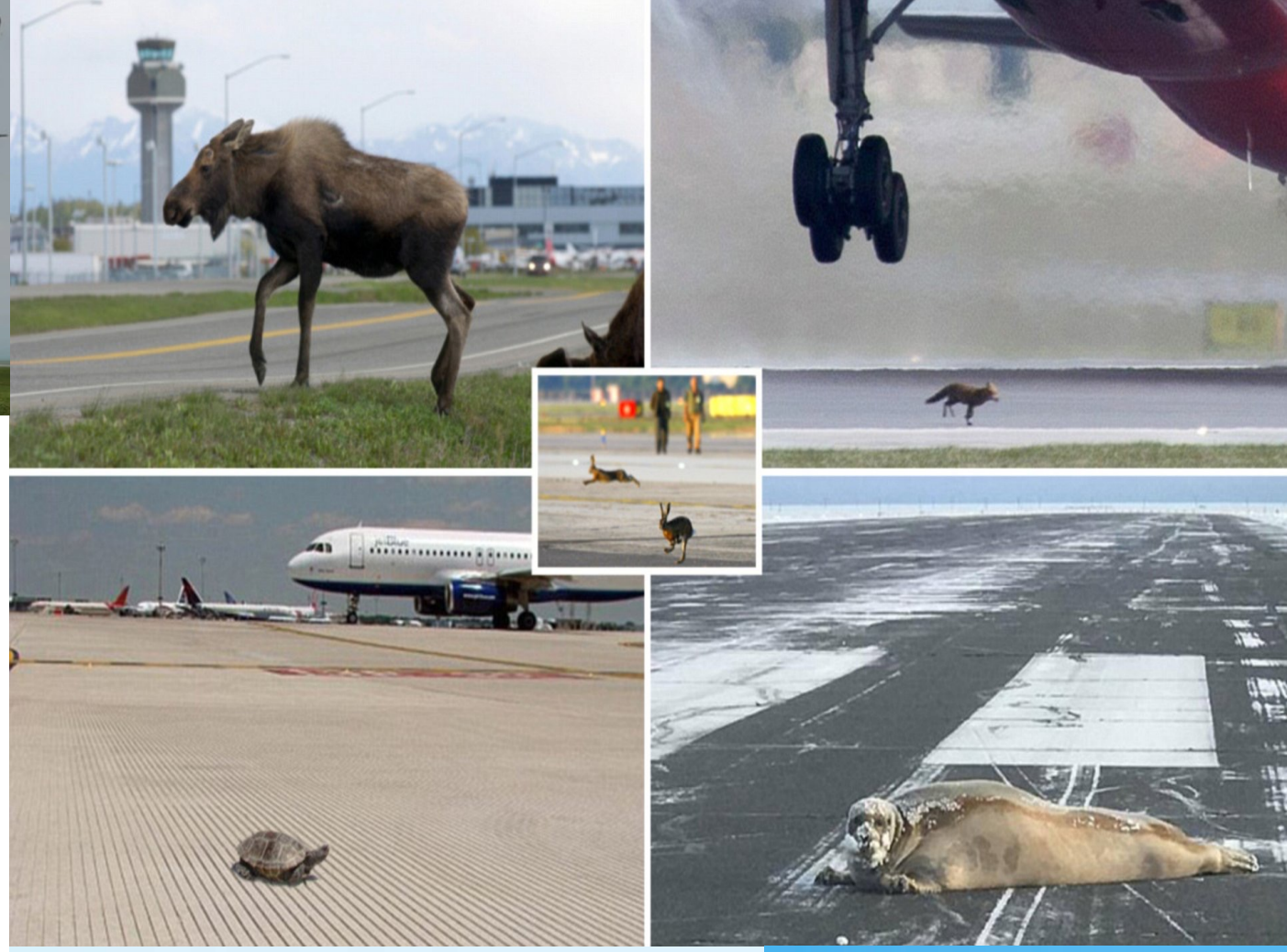
Airports with most wildlife strike incidents in 2021

Delhi	231
Mumbai	140
Ahmedabad	71
Kolkata	70
Kochi	56

BIRD STRIKES AT INDIAN AIRPORTS



March 2023



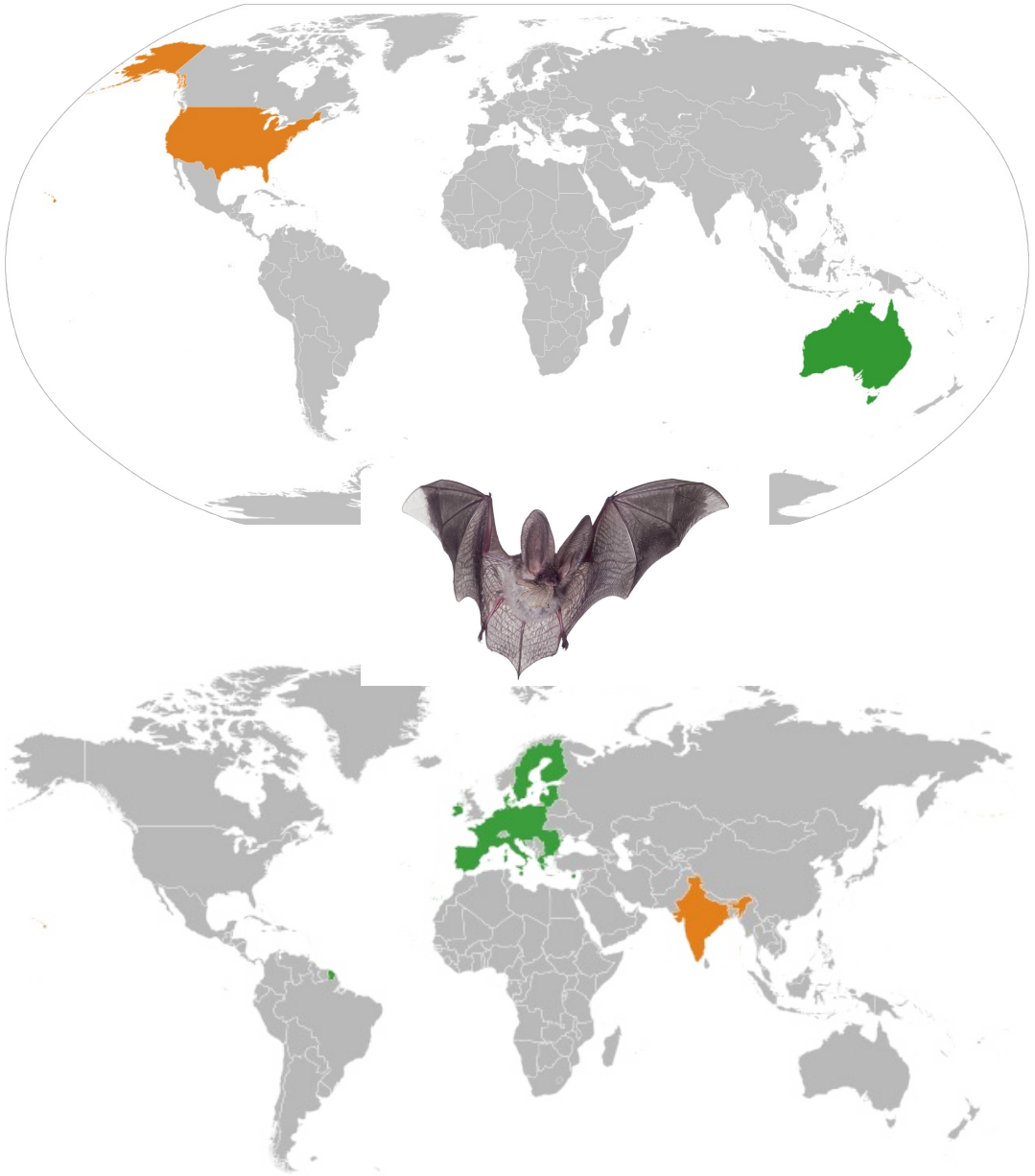
Increasing evidences of mammal strikes

Dolbeer 2015

Shutterstock.com

- Bats , alongside birds are the only mammals with the potential to be struck by aircraft and bat strikes in aviation have received less attention

- Perceived low risk impacts of bat strikes (with almost no behavioral information on encounters between bats and aircraft) in relation to high risk larger bird impacts



- Data on chiropteran strikes with aircraft have been largely reviewed in the US and Australasia

- Miniscule data, incomparable database or analysis for Europe and Asia.

Roux and Waas 2012; Anagnaostopoulos ,2012

Table 2. Wildlife Strikes and associated data for different time periods between 1970 and 2018

	1970-1988 (Civil & Military)	1993-2009 (IAF)	2010-2018[+] (IAF)
Number of WS reported	1228*		
Average annual number of WS reported	53.39		
Crashes / complete destruction of aircraft	50 (IAF)+ 1(Civil)	17	3
Annual average of Cat I accidents (crashes)	2.21	1	0.33
Crashes with fatal injuries (All IAF)[$]	7	5	1
Number of WS incidents considered/samples in which species identified (n)	360** (1966-1989)	192	489
Average number of incidents[#] in which species was identified per year for the time period	15.65	11.76	55.77
Number of species identified (Birds + Bats)	67 Birds + 03 Bats	76 Bird +05 Ground mammals	115 birds+ 12 Bat + 03 insect + 06 ground mammals

*Minimum numbers. Compiled from different literatures[23 and 24]. ** Species identification data has been taken from a PhD thesis[17]

[+] Financial years from 2010-11 to 2018-19 data is taken. $ In addition, at least eleven people died on ground in 1990 when an IAF aircraft crashed.

Critical species involved in WS in different time periods with their percentage of contribution to overall wildlife strikes.

Species	Period 1966-1989 (n_1=360)[17]		Period- 1993-2009 (n_2=192)		Period- 2010-18 (n_3=489)	
	Number	Percentage	Number	Percentage	Number	Percentage
Black Kite	73	20.28	16	8.33	77	15.74
Vultures (03 species)	78	21.67	3	1.56	04	0.8
Bat (03 Species)	5	1.78	10	5.20	62	12.67
Cattle Egret	4	1.11	8	4.16	20	4.09
Swallows	1	0.28	08	4.16	54	11.04
Swifts	24	6.7	06	3.12	69	14.11
Lapwing Sp.	10	2.85	44	22.91	44	8.99
Eurasian Thick-knee	7	1.97	01	0.5	22	4.49
Pigeon	28	7.78	10	5.2	32	6.54
Larks	3	0.84	04	2.08	50	10.22

Table 4. Number of damage causing incidents involving various critical species for the period from 2005 to 2018.

Species	Incidents with damage	Incidents with No damage	Total incidents	Percentage of damage	Accidents (Crashes)	Remarks
Black Kite	52	33	85	61.17	3	02 Fatal accidents
Bats	32	36	68	47.05		12 types of species
Lapwings	27	46	82	32.92		Group of 03 species
Swifts	16	59	75	21.33		Group of 04 species
Rock Pigeons	13	27	40	32.50		
Lark	13	39	52	25.00		Group of 08 species
Thick-knee	11	11	23	52.17	1	Night crash
Sparrow	11	11	22	50.00		
Swallows	10	50	60	16.66		Group of 06 species
Dove	7	13	20	35.00		Group of 03 species
Cattle Egrets	7	20	27	25.92		
Small birds#	6	2	8	75.00#		
Indian Roller	4	14	18	22.22		
Others	89	149	238	37.39	3*	86 different species.
Total	307	-	535	-	7**	-

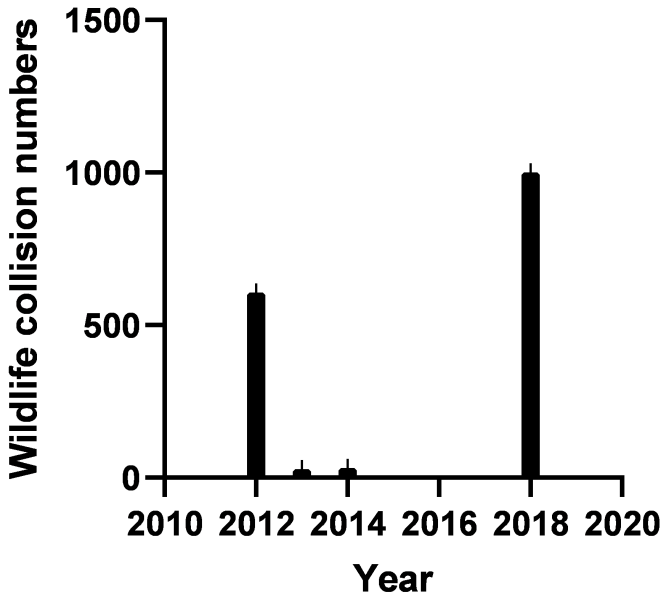
* Crashes involved a Marsh Harrier, Honey Buzzard and Plovers (in one accident each)..

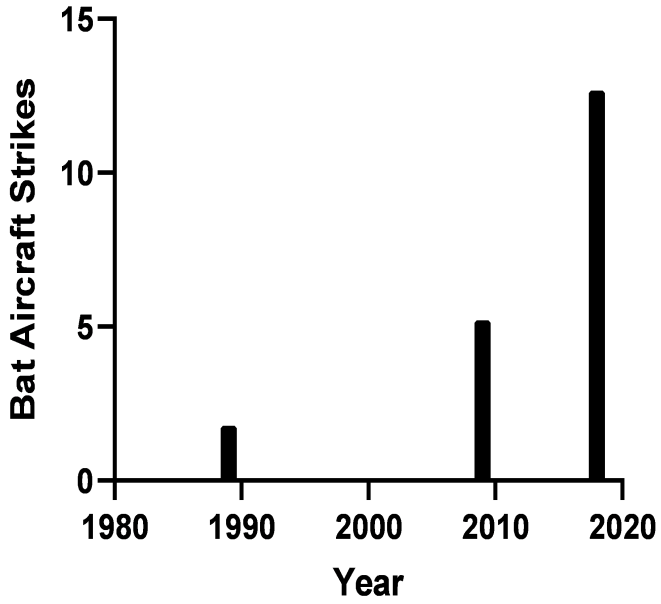
** Species could not be identified in one crash which is not included in this data

Species identification has not been reasonable for this group. It is expected to include Larks, Swallows, Swifts, Sparrows and other birds. Hence, this group is excluded for comparison of percentage of damage causing incidents. But, information is provided here for an overall appreciation.

Bat strike data from India

- Chiropteran (Bat) strikes with aircraft in the Indian scenario is very scanty with few stray and old reports





Satheesan et al 1992, Satheesan, 1993, Grubh 1989, Mathew et al, 2003.

Need of the hour

- “Coexistence can be conceived of more loosely as a set of ideas (see below) that are useful for enabling **diverse research disciplines, and non-researchers, to collaborate on mutual challenges** relating to how best to facilitate sharing landscapes with wildlife, without requiring total agreement on a definition” (Page 5, IUCN 2023)

IUCN (2023). IUCN SSC guidelines on human-wildlife conflict and coexistence. First edition. Gland, Switzerland: IUCN

Need of the hour

- “qualitative or quantitative studies from a range of disciplines – for example, anthropology, archaeology, climatology, geography, historical ecology, history, linguistics and population ecology – on relevant role players (humans and wildlife) and aspects of human-wildlife and human-human relations in an ecological context in the area of concern.” (Page 69, IUCN 2023)

IUCN (2023). IUCN SSC guidelines on human-wildlife conflict and coexistence. First edition. Gland, Switzerland: IUCN

Why Jain University

Introduction

JAIN (Deemed-to-be-University) was declared by the Government of India, on the advice of the University Grants Commission (UGC), as an Institution Deemed-to-be-University under section 3 of the UGC Act, 1956 vide notification No. F. 9-57/2007-U.3A dated 19/12/2008

JAIN
DEEMED-TO-BE UNIVERSITY

Major Timeline Of JAIN:

1990

The University began its journey as the Sri Mahaveer Jain College (SBMJC) at VV Puram

2008

The journey of JAIN (Deemed-to-be-University) as a deemed-to-be university began in 2008, with the commencement of academic programs in 2009.

2023

with 5300 staff members and eight campuses and dedicated research centers

JAIN
DEEMED-TO-BE UNIVERSITY

According to the India Today Rankings for 2023, Jain is ranked as the 5th among the leading private general universities in India

JAIN (Deemed-to-be University) is a member of the Association of Indian Universities (AIU), Association of Universities of Asia and the Pacific (AUAP), Association of Common Wealth Universities and has been awarded the ISO 9001:2008 certification by TUV Nord.

nirf

NIRF Ranking

NIRF Ranking (2023) - JAIN (Deemed-to-be University) ranks 68th, the Faculty of Engineering and Technology secures 115th, and CMS Business School secures 85th position in India

Six Faculties

1

The Faculty of Sciences

2

The Faculty of Humanities and Social Sciences

3

The Faculty of Commerce

4

The Faculty of Management

5

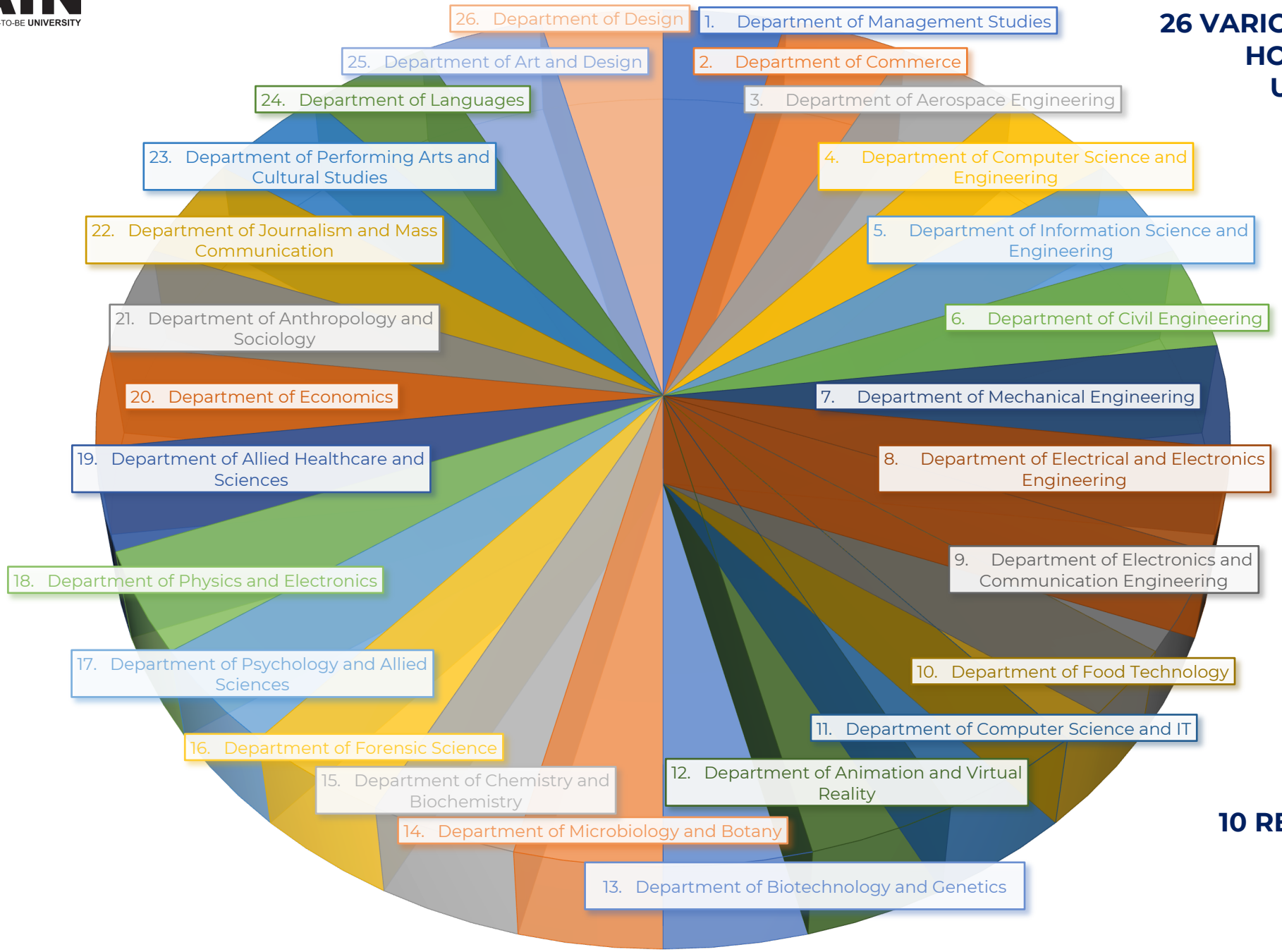
The Faculty of Engineering & Technology

6

The Faculty of Creativity & Design

JAIN
DEEMED-TO-BE UNIVERSITY

26 VARIOUS DEPARTMENTS HOSTED BY THE UNIVERSITY

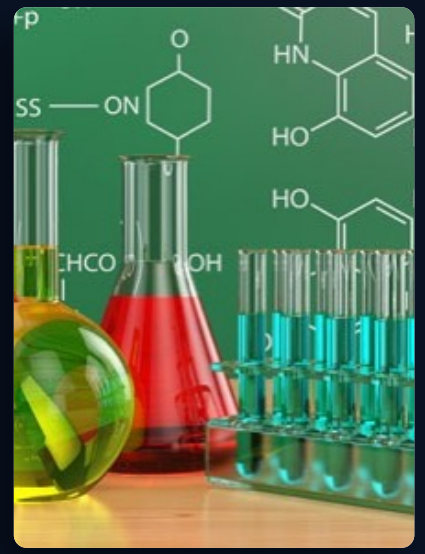


10 RESEARCH CENTRES

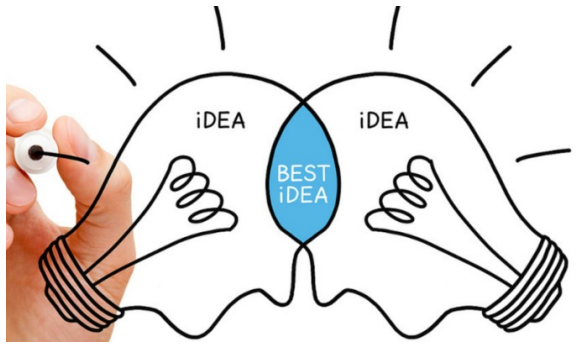
JGI JAIN DEEMED-TO-BE UNIVERSITY

CUBEC

Center for Urban Ecology, Biodiversity, Evolution, and Climate Change

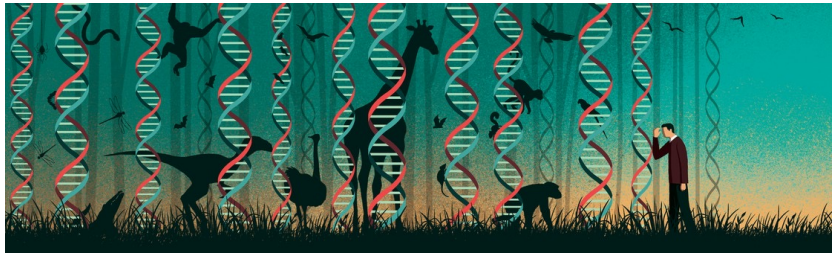


Intention of CUBEC



JGI JAIN DEEMED-TO-BE UNIVERSITY

Research areas of CUBEC

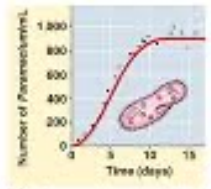


EVOLUTIONARY BIOLOGY

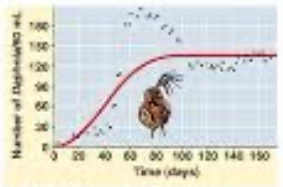
CONSERVATION BIOLOGY

Human Wildlife
Hazard management

CLIMATE CHANGE STUDIES



(a) A *Paramecium* population in the lab



(b) A *Daphnia* population in the lab

(c) A song sparrow population in its natural habitat

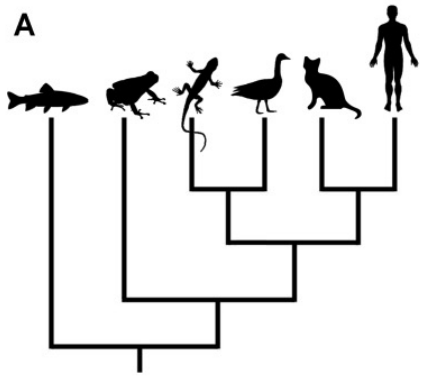
POPULATION GENETICS

JAIN
DEEMED-TO-BE UNIVERSITY

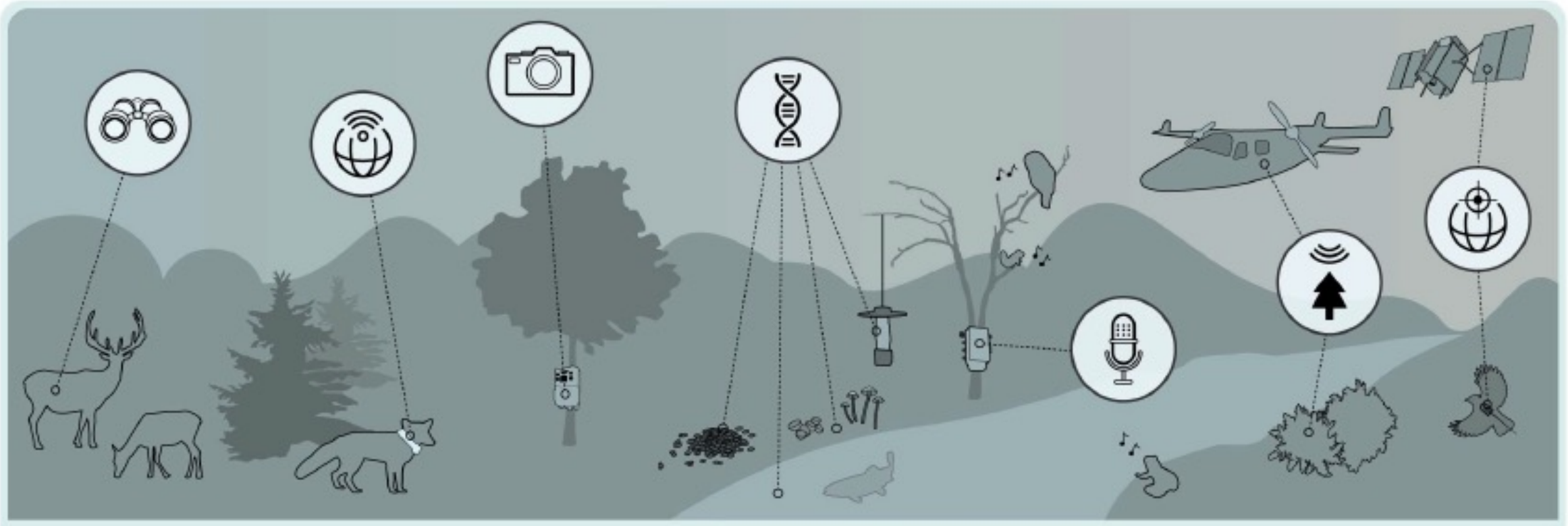

NATRAJ


MIND IT!
➤ Keep your surroundings clean
➤ Compost food / organic waste or give to BBMP garbage vans
➤ If you spot a snake, don't hit or attack it
➤ Keep a distance of 20 steps from snake and remain still
➤ Don't handle snakes on your own; call BBMP helpline 080-22221188
SLITHERING ALL OVER

Research framework of CUBEC



Research tools



Tosa MI, Dziedzic EH, Appel CL Urbina J, Massey A, Ruprecht J , Eriksson CE, Dolliver JE, Lesmeister DB, Betts MG, Peres CA, and Levi T (2021) The Rapid Rise of Next-Generation Natural History. Front. Ecol. Evol. 9:698131. doi: 10.3389/fevo.2021.698131

CUBEC's Taxon of focus

CUBEC's Molecular Ecology Lab

MinION
Oxford Nanopore Technologies

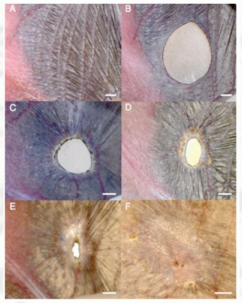
CARCASS IDENTIFICATION- DNA PROFILING

Biopsy – 3mm, 5mm

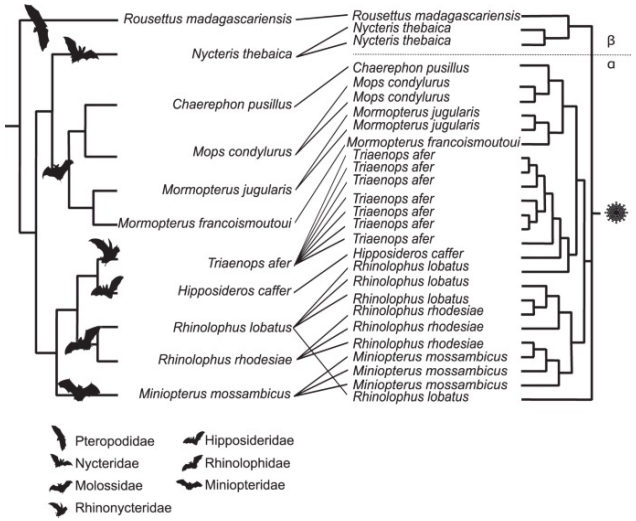
https://www.pfmmedical.com/productcatalogue/kai_biopsy_punches/standard_biopsy_punch/index.html

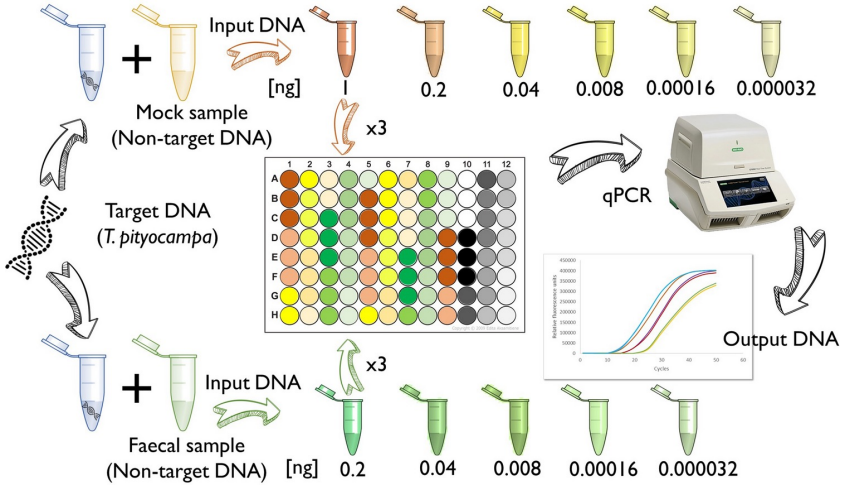
Taking wing punch

Wound healing



Faure, P.A., et.al., 2009





CUBEC's

Collaborators

IISc, Bengaluru

ZSI, Pune

SACON, Coimbatore

BCIT, Bengaluru

Funding Agencies

https://jalopnik.com/there-was-a-freaking-bat-flying-around-inside-a-spirit-1836921374

BAT CONSERVATION INDIA TRUST

Bat Strikes and Ecological Engineering for Mitigation

Rajesh Puttaswamaiah

Trustee & Citizen Scientist

14th December 2023

Glimpse into Bats of India

- 130 Species identified across India
- 14 Species of fruit bats
- 116 Species of insectivorous bats

- Fruit bats: Weight ranges from 50 gm to 1500gm
- Insectivorous bats: 15+ Species weigh more than 20 gm

FRUGIVORES


Indian Flying Fox


Short Nosed Fruit Bat


Cave Nectar Bat


Fulvus Fruit Bat


Salim Ali's Fruit Bat

INSECTIVORES

INSECTIVORES

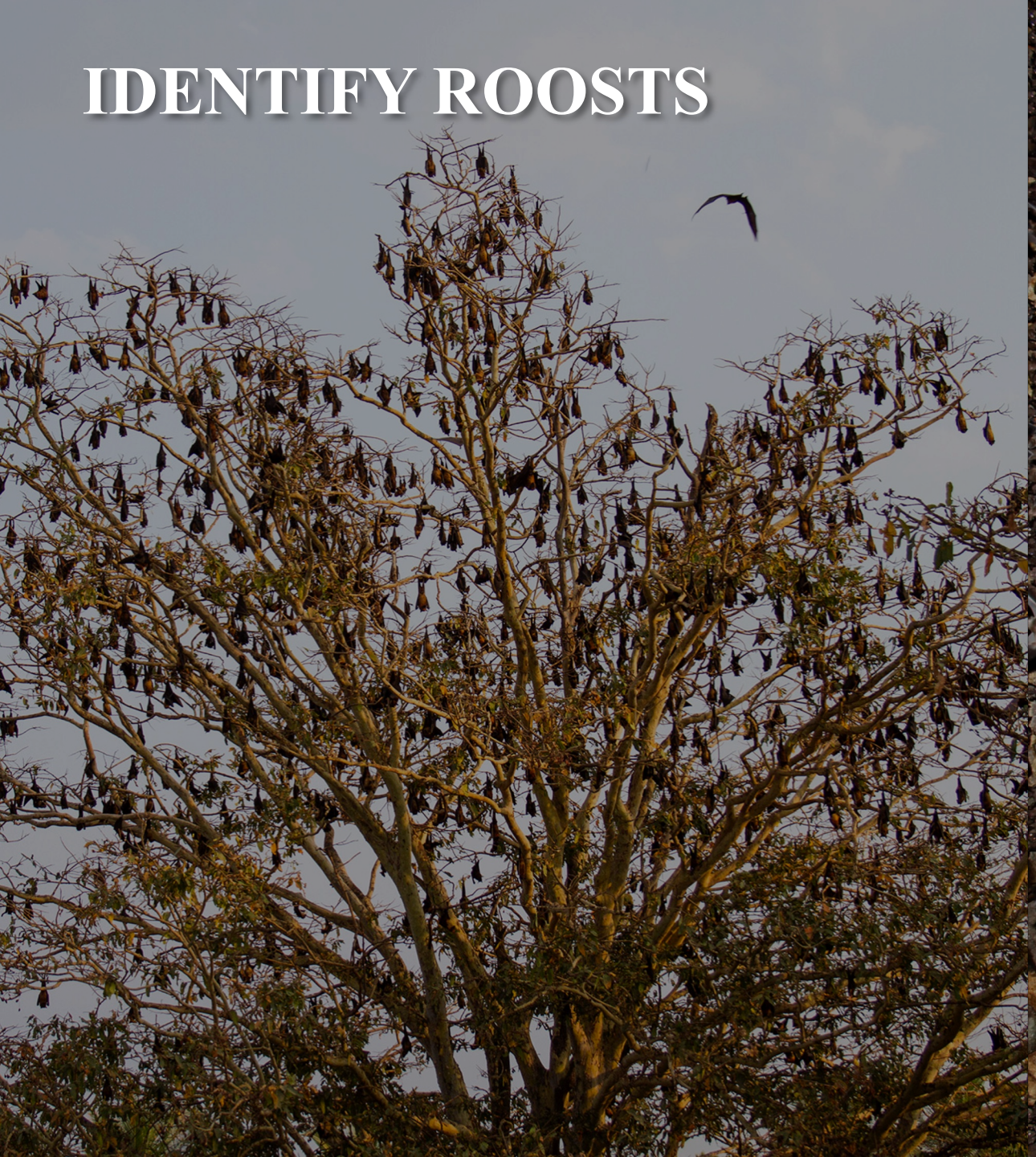
Do Bat Strikes have impact on Aviation?

IMPACT OF BAT STRIKES

- Bat strikes can also cause significant damage to an aircraft.
- The damage depends on factors like bat size, aircraft type, altitude of flight and speed of the aircraft.
- Flight operations suspended to avoid collision resulting in loss of business. Few examples are
  - BLR HAL Airport has “No Fly Time” between 17:30 to 19:30 and 03:00 to 05:00 hrs.
  - Some Airforce stations also have “No Fly Time” between 17:30 to 19:30.
- Suspension of training schedule due to bat activity.

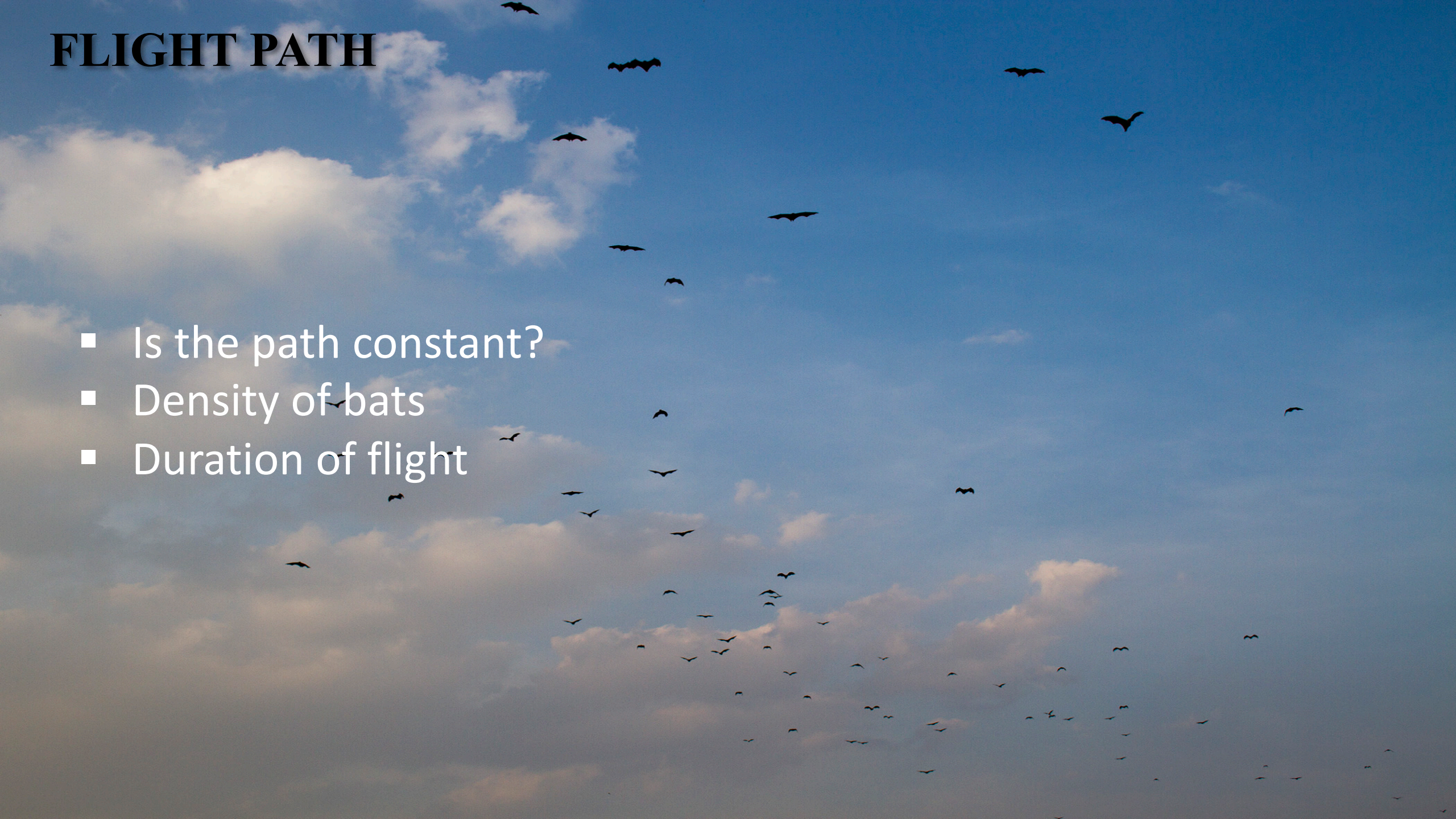
How do we address the Bat Strikes?

IDENTIFY ROOSTS



- Roost Size
- Roost type
- Species

FLIGHT PATH



- Is the path constant?
- Density of bats
- Duration of flight

FORAGING ECOLOGY

- Are bats feeding within the airport/airfield ?

FORAGING ECOLOGY

- Are bats feeding nearby the airport/airfield ?

FORAGING ECOLOGY

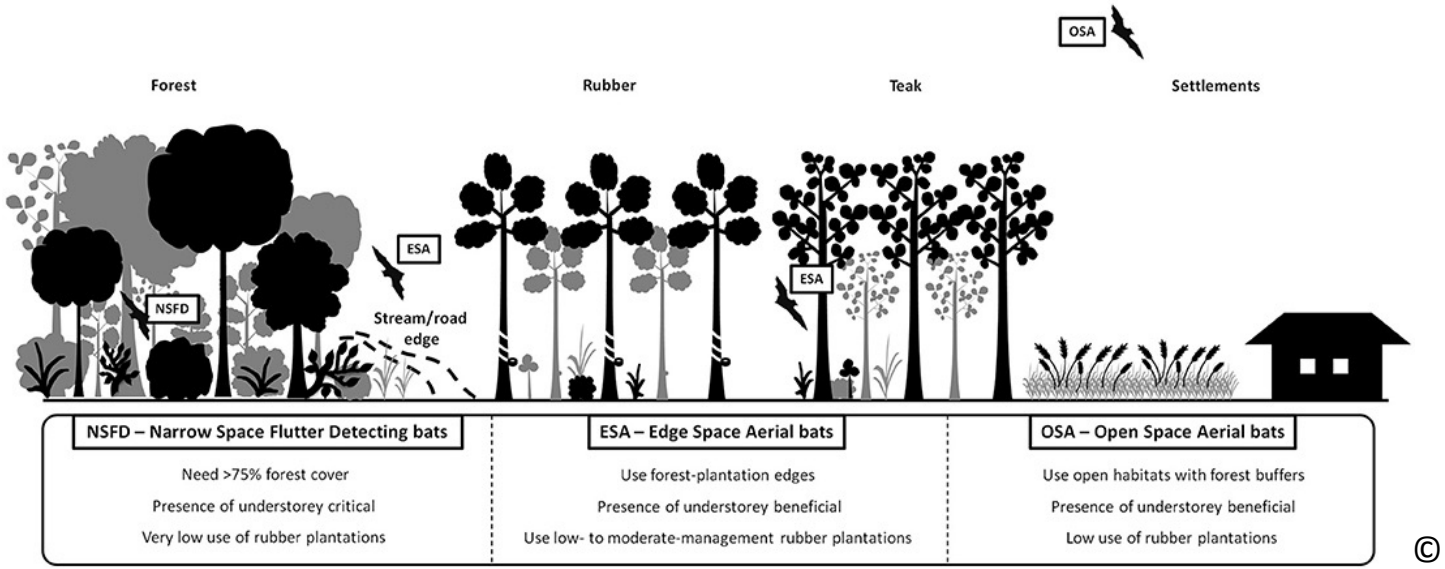
- What are the size of bats feeding within the airport/airfield ?

DeAgostini/Getty Images

FORAGING ECOLOGY

Indian Flying Fox

- Weight: Approximate 1500 gm
- Forages on the fruiting trees like Fig, Ficus, Indian Almond, Singapore Cherry, Spathodia, Areca,
- Large colonies sometimes ranging upto 10,000 individuals
- Flight height of less than 200 ft from ground
- Usual impact during take-off and landing

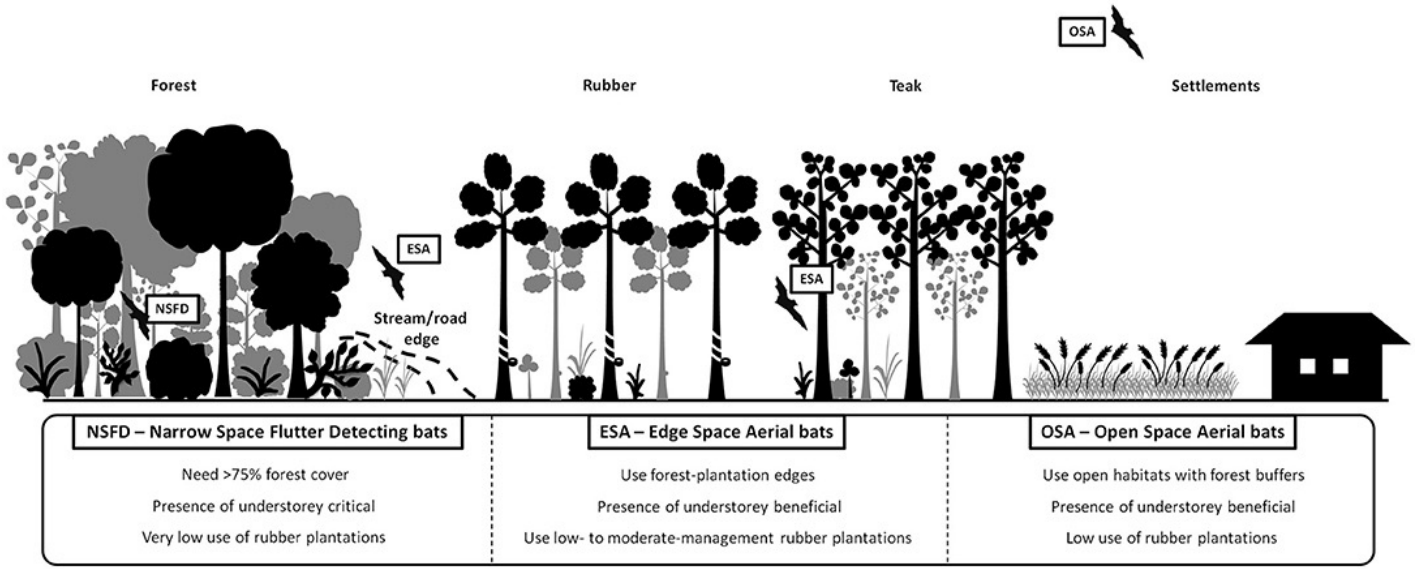


Ex: Most airports/airfields, HAL Airport, Bengaluru

FORAGING ECOLOGY

Short Nosed Fruit Bat

- Weight: Approximate 50-65 gm
- Forages on the fruiting trees like Fig, Ficus, Indian Almond, Singapore Cherry, Spathodia, Areca, Mast Tree, Tender leaves
- Solitary flight or in fewer than 3-5
- Flight height of less than 100 ft from ground
- Usual impact during take-off and landing

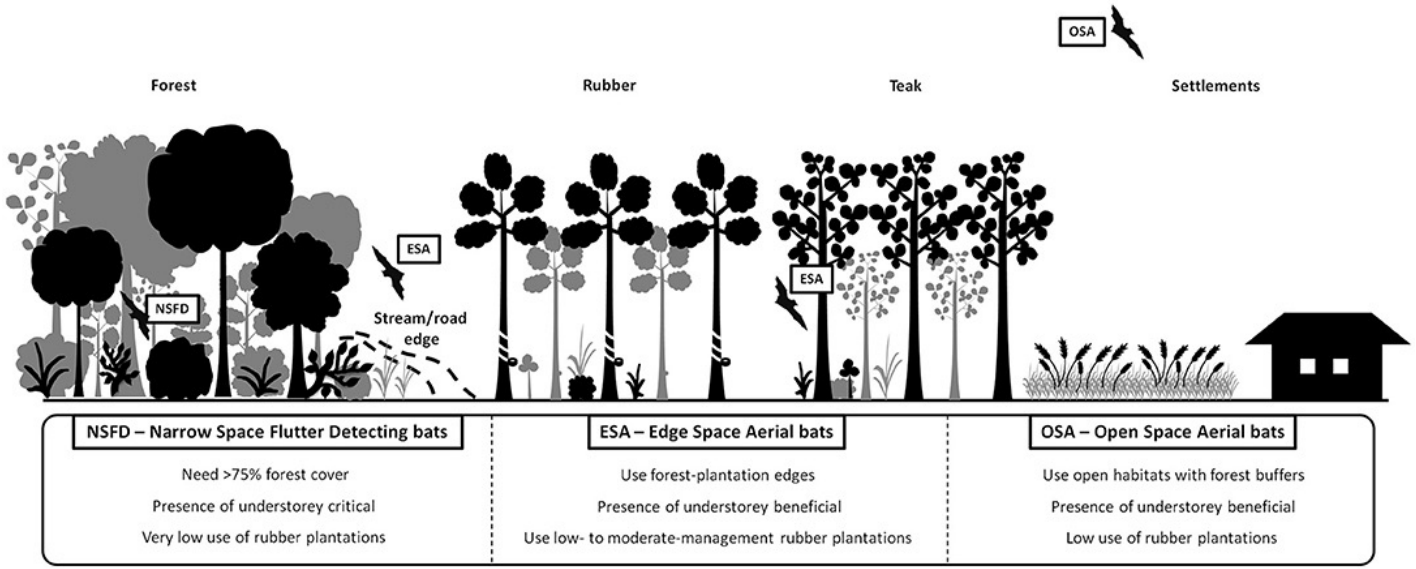


Ex: Most airports/airfields

FORAGING ECOLOGY

Pipistrelle Bats

- Weight: Approximate 5-8 gm
- Forages on the edge of the tree canopy and in open air
- Flight height of less than 100 ft from ground
- Usual impact during take-off and landing

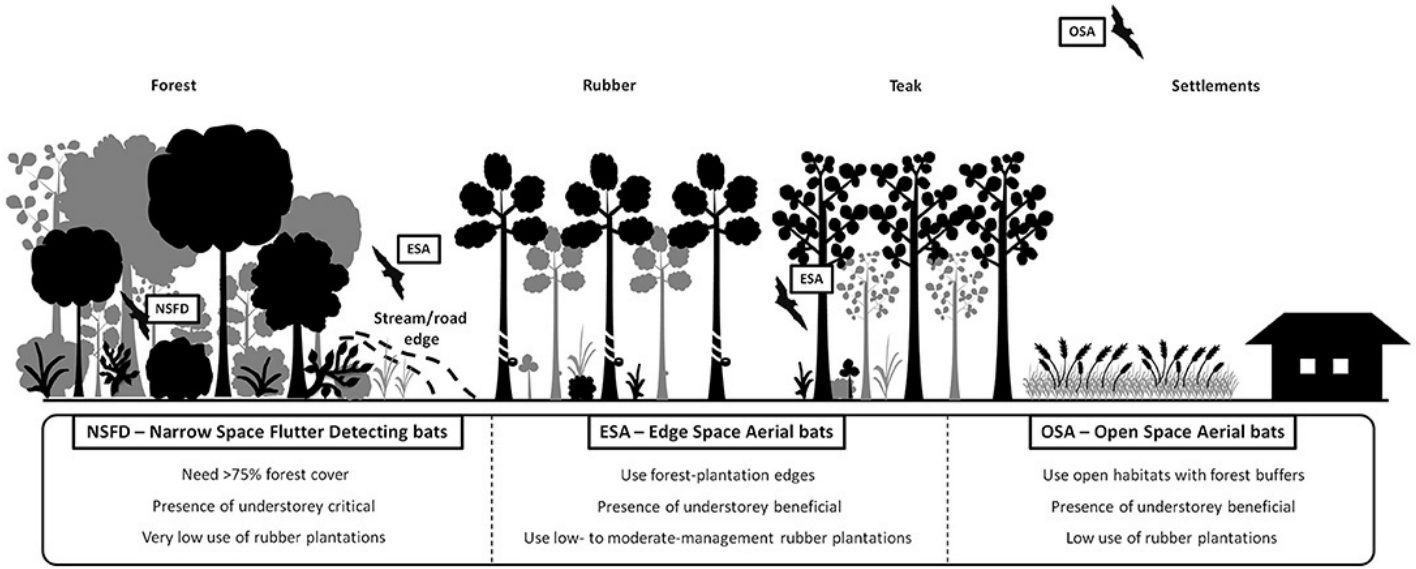


Ex: Most airports/airfields

FORAGING ECOLOGY

Free Tailed Bats

- Weight: Approximate 10-20 gm
- Forages above the tree canopy and in open air
- Flight height can be as high as 10,000 ft from ground
- Often seen chasing swarms of Locusts
- Could impact during lower flights

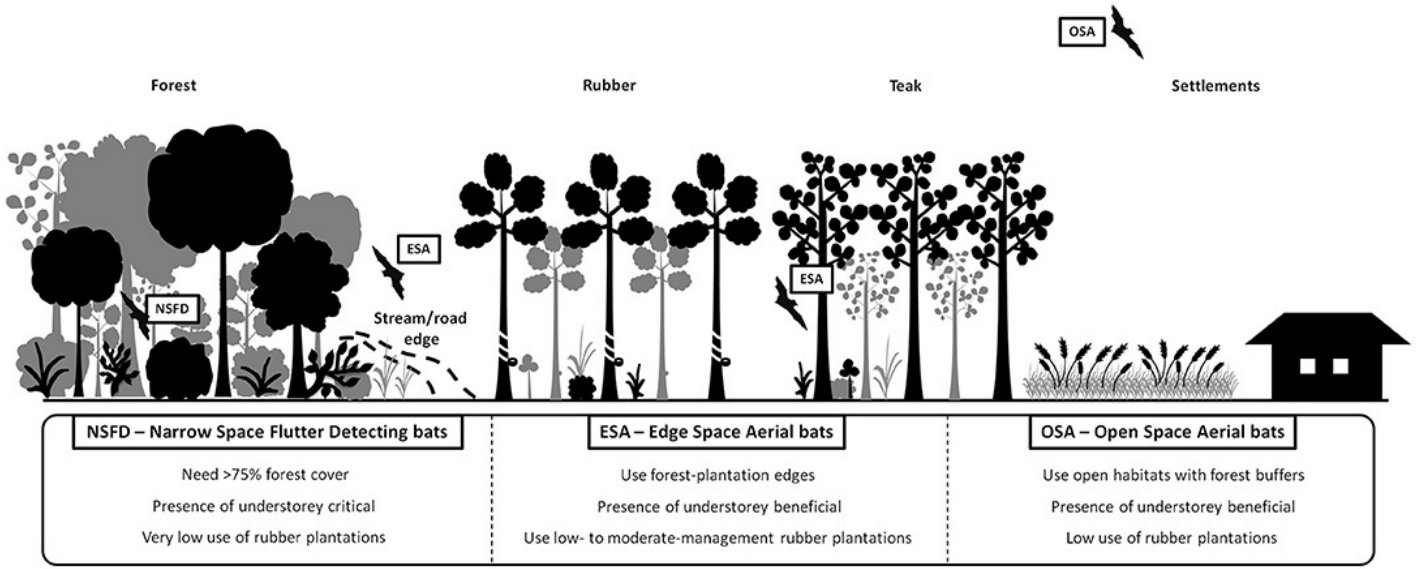


Ex: High altitude airports/airfields,

FORAGING ECOLOGY

Leaf Nosed Bats

- Weight: Approximate 40-60 gm
- Forages above the tree canopy and in open air
- Flight height is usually within 100 ft from ground
- Often seen catching insects in open grasslands
- Could impact during lower flights



Ex: Most airports/airfields in both deccan and western ghats region. Recorded in Hyderabad

What tools are required to Study bats?

TOOLS TO STUDY BATS

We have to use different tools based on species to study bats.

- GPS tracker
- Ultrasonic acoustic recorders
- Thermal and Infrared cameras to detect and track movements

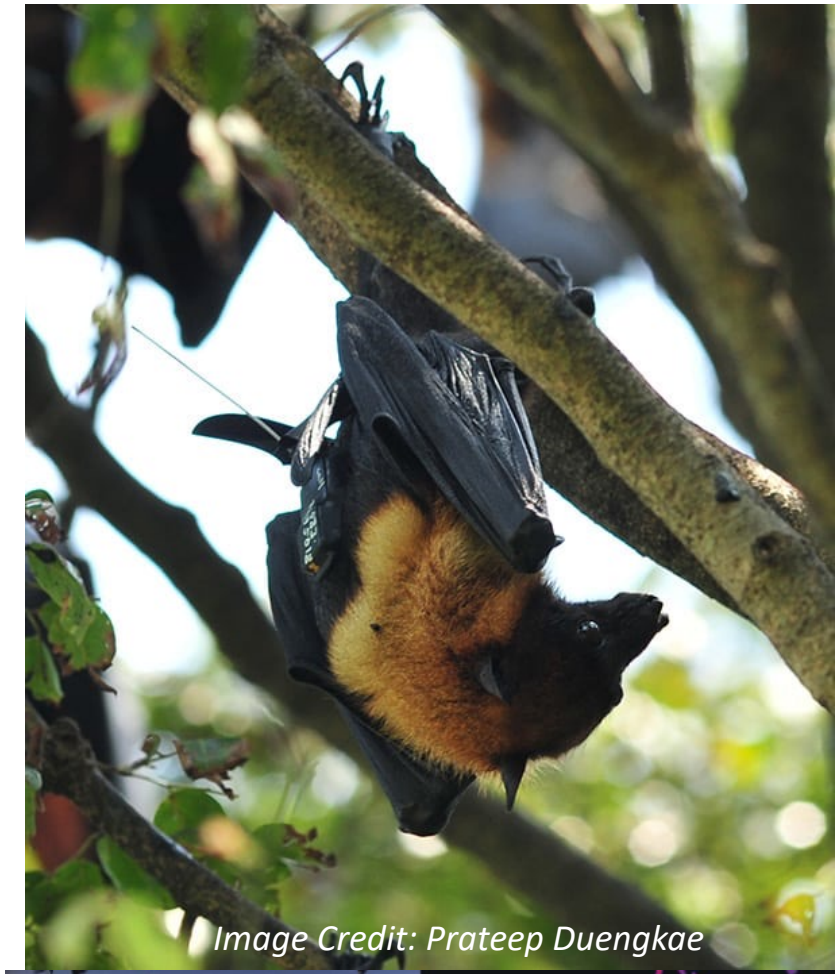


Image Credit: Prateep Duengkae

Image Credit: Winifred Frick

How can Bat Strikes be Reduced?

ECOLOGICAL ENGINEERING

Please note, the solution will depend on various factors and is not a one size fits all. We will have to assess each location, collect data and then formulate action plan.

- Reduce fruiting trees in the vicinity
- Prune the fruiting trees when they flower
- Assess the insect diversity and take measures to reduce them

Action for mitigations

- Determine spatial and temporal changes distributions of the bats around the airfields/airports.
- Determine problematic bat populations and landscape in and around the airfields/airports.
- Determine problematic fruiting and flowering bat roosting trees, habitats around the airfields/airports for effective habitat management.
- Monitoring abundance, activity patterns and baseline data on behavioural ecology of bats.
- Contribute to the usage of molecular genetic techniques and implementations of nocturnal survey techniques.

Expectations

- Potential threat-There is a dire need to study and understand rising bat strikes – Indian context.
- Need for collation of bat strike incidences across airports/air force station of India to understand the patterns- Access to the data.
- Behavioral & Ecological studies (alongside technological and other local solutions) should be given little more weightage to understand the root cause of the problem.

World Birdstrike Association

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QUESTIONS ?

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