RAMAN SUKUMAR

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Education : Bachelor of Science 1977, University of Madras

Master of Science 1979, University of Madras

Doctor of Philosophy 1985, Indian Institute of Science

Positions held : Professor, Centre for Ecological Sciences, Indian Institute of Science (IISc.) (2003-2020). Faculty since 1986 at the same Institute.

Associate Faculty, Divecha Centre for Climate Change, IISc (2009-20)

Fulbright Fellow, Princeton University (1991-92)

Adjunct Senior Research Scientist, Columbia University (2001-10)

Visiting Professor, Institute for Advanced Study, Kyoto University (2018)

Specialization : ECOLOGY AND CONSERVATION BIOLOGY

- *Animal Ecology and Evolution* (Asian elephant ecology and management; Population dynamics; Wildlife-human conflicts; Behavioural ecology, Genetic diversity, Conservation Biology)
- *Tropical Forest Ecology* (Diversity, structure and dynamics of tropical dry forests; Fire ecology; Invasive plant ecology; Conservation of tropical forests)
- *Climate Change (*Reconstructing Quaternary climate change; Himalayan climate change, Assessing impacts of future climate change on forests and biodiversity)

Scientific Metrics : H-index (google scholar) – 75, i10 index: 203, Citations: 24989.
Ranked in the top 1% of scientists globally and 2nd in India in Ecology & Evolution (https://research.com/scientists-rankings/ecology-and-evolution/in)

Conservation and Research Experience

Conservation Experience and Achievements

Conservation of Guindy National Park:

During 1975–1979, I began my early natural history pursuits in the city of Madras (Chennai) by studying the flora and fauna of the Guindy Park, a remnant jungle and contributed natural history information to its management plan and its eventual recognition as a national park. Today, the Guindy National Park is an oasis of nature within a bustling city, harbouring a remnant of the tropical dry evergreen forest of the east coast, with more than 150 species of birds, and endangered mammals such as the black buck (*Antilope cervicapra*).

Design of Nilgiri Biosphere Reserve:

Beginning in 1980, I carried out several field surveys and helped design the Nilgiri Biosphere Reserve, a 5500 sq. km area that is India's first biosphere reserve declared in 1986. As part of this conservation programme I also formulated research programmes and set up an information system pertaining to the Nilgiri Biosphere Reserve for the Department of Environment, Government of India. Several long-term research projects that interface with conservation and management were also set up, some of which are still ongoing. The Nilgiri Biosphere Reserve was eventually recognized by UNESCO's Man and Biosphere programme in 2000.

Strengthening conservation areas in the Eastern Ghats

Based on recommendations arising from my early doctoral research of elephants, the Government of Karnataka strengthened the Biligirirangaswamy Wildlife Sanctuary and set up a new sanctuary, the Cauvery Wildlife Sanctuary, along a 100-km stretch of a major riverine habitat in the little-explored region of the Eastern Ghats in southern India. Together with the better known Nilgiri Biosphere Reserve in the Western Ghats, the extensive and contiguous landscape of over 12,000 sq. km became the bastion of not only the largest global population of the Asian elephant but a number of other large mammals including the tiger and the gaur.

Policy and Action Plans for Asian Elephant Conservation:

During 1989-92, I played a major role in preparing the action plan for India's flagship conservation project, Project Elephant, that was launched in 1992. This work involved bringing together information on elephant population distribution and ecology for preparing landscape scale plans for conservation, identifying elephant corridors, protecting populations from poaching and mitigating elephant-human conflicts (The Gajatamé Report, 1992). Since then, my scientific research has played an important role in government policy on elephant management. Continuing this work, I was a member of the second task force set up by the Indian government to bring out a comprehensive review of Project Elephant (The Gajah Report, 2010). The High Court of Karnataka also appointed me as the Chair of the Elephant Task Force to recommend measures for reducing elephant-human conflicts and conserving the species in the state (The KETF Report, 2012).

Population and Habitat Viability Analyses for Conservation of Mammals:

During the early 1990s I was actively involved with the IUCN/SSC Conservation Breeding Specialist Group in assisting them with Population and Habitat Viability Analyses for several Asian mammals. I primarily carried out the VORTEX modelling for species such as the Asian Elephant (in Sumatra), Asian one-horned rhinoceros, Sumatran rhinoceros, and Manipur Brow-Antlered Deer.

Survey and conservation of elephants in Southeast Asia

Over a three-year period (1993-96) several surveys were carried out of the extensive elephant habitats in the Pegu Yoma and Arakan Yoma range in Myanmar under my guidance. These surveys provided some of the first objective estimates of the elephant abundance in the country. As a result of this work the country set up its first elephant sanctuary, the Gwa Elephant Sanctuary, in 1997.

During 2000, training in field research methods was provided to staff of the Cat Tien National Park, and a detailed survey of the remnant elephant population of the park carried out during 2001 using conventional and molecular genetic methods with a view to providing an action plan for its conservation (*Conservation Genetics*, 2007; *Oryx*, 2008).

Advocacy for the Asian Elephant:

In 1997 I was invited by the US Congress to testify at a hearing on legislation pertaining to the Asian Elephant Conservation Act which was eventually passed into law the same year. I believe that as the only representative of an Asian elephant range state and the only non-American to testify at the hearing, my statements and meetings with Congressmen played an important role in the passage of the bill. The Asian Elephant Conservation Fund set up as a consequence has provided substantial assistance to a large number of conservation projects in the range states over the years.

Mitigation of elephant-human conflicts for societal benefits:

My team has also been active for many years in grassroots-level engagement with local communities in southern India in elephant-human mitigation measures which range from simple modifications in lifestyles to the use of low-cost measures such as chili-rope fences and community managed fences to technologically sophisticated early warning systems through camera-based and GPS-collars to detect and track elephants. We also introduce farmers to fair markets and help them sell their produce as 'elephant friendly' so as to incentivize them to grow crops without harming elephants and using part of the profit in maintenance of conflict mitigation measures. We have also been addressing the mitigation of elephant deaths in collisions with trains in northeast India.

I coordinated a multi-institutional and comprehensive research programme on wildlife-human conflicts under a joint Indo-Norwegian initiative during 2008-10. Aspects covered include the ecological and social dimensions of conflict of humans with several species of herbivores (elephant, blackbuck, nilgai, wild pig) and carnivores (leopard, wolf) across the country (*Current Conservation*, 2010). Since then, with funding from the German GIZ (Gesellschaft für Internationale Zusammenarbeit), a study on the economics and efficacy of conflict mitigation methods was carried out in Karnataka state.

Scientific Contributions to Animal Ecology and Conservation

The ecology of Asian elephants and interactions with people in southern India

Beginning in 1980, this research was part of the Ph.D. programme and focused on elephant-human conflicts in relation to the natural ecology of elephants in southern India. It is recognized as not only a pioneering scientific study of wild Asian elephants but also as the first to address in depth the ecological basis of conflicts between a large mammal and humans. The study resulted in a dissertation (1985), several peer-reviewed papers (*Current Science* 1987; *Animal Behaviour* 1988; *Proc. Indian Academy of Sciences* 1988; *J. Tropical Ecology* 1989, 1990; *Biological Conservation*, 1991) and a monograph by Cambridge University Press (1989).

Monitoring ivory poaching and the dynamics of Asian elephant populations

Long-term monitoring of the population dynamics of Asian elephant populations was carried out at three sites (Mudumalai, Nagarahole, Periyar) in southern India including two within the Nilgiri Biosphere Reserve, and the impact of ivory poaching assessed. This study resulted in the first realistic estimate of the numbers of elephants poached in southern India (*Animal Conservation*, 1998), and was followed by a modeling approach to determining the factor by which illegally killed elephants are underestimated in an elephant population (*Biological Conservation*, 2013).

Stable isotope ecology of elephants

I pioneered the application of stable carbon isotope ratios in animal bone collagen to trace the diet (C3 plants versus C4 plants) of a large mammal (the Asian elephant) in India. This work brought out the importance C3 plants or browse (and, hence, forested habitats) in contributing amino acids for protein synthesis in this large herbivorous mammal when the predominant view was that the elephant mainly ate grasses (*Current Science* 1987; *Oecologia* 1992).

Molecular genetics and phylogeography of Asian elephant populations

A comprehensive study of population genetic structure, variation and phylogeography of Asian elephant populations through extracting DNA from dung and characterizing mitochondrial haplotypes and microsatellites was carried out for Indian and Myanmar elephants. This study (during 1999-2005) provided the much-needed data for the two major populations of this species in order to derive the evolutionary relationships among Asian elephant populations across the continent (*Heredity*, 2005; *Animal Conservation*, 2005). Using a larger data base across Asia, a detailed phylogeographic and evolutionary history of the Asian elephant, driven by the Pleistocene glacial-interglacial cycles, was constructed (*Proc. Royal Society B*, 2009). One of the first full-genome sequences of an Asian elephant, published in 2015, showed the rapid evolution of genes related to olfaction (*J. Biosciences*, 2015). This work has been since extended to full-genome sequencing of Asian elephants across India to identify Single Nucleotide Polymorphism markers for use in a variety of studies.

Radio-telemetry and GPS monitoring of elephants in West Bengal, India

A detailed study of elephant ecology was carried out during 2001-06 in the Indian state of West Bengal that experiences one of the highest levels of elephant-human conflict in Asia. Under this study 14 elephants were fitted with radio-collars to study their movement, use of corridors and patterns of conflict with human settlements across a fragmented landscape. The novelty of this study was the first “satellite-collaring” of elephants in the country serving as prototypes for an internet-based “early warning” system for field managers of the movement of elephants in conflict with people. The GPS

data was used in a mathematical modeling exercise to demonstrate that the elephant is the most efficient dispersal of fruit in tropical forests (*Ecology*, 2015; *Conservation Biology*, 2017).

Behavioural ecology of elephants

The role of tusks and musth in the behavioural ecology of Asian elephants was investigated during 2012-15 in northeastern India. This study brought out the importance of musth, as opposed to the mere presence of tusks, in the outcome of male-male competition and female choice of mates in this species (*Animal Behaviour*, 2013; *Behaviour*, 2015). For the first time, acoustic communication and their behavioural contexts were documented in Asian elephants (*J Acoustical Soc America*, 2009; *Animal Behaviour*, 2020). The emergence of novel, all-male groups as an adaptive response to the extensive spread of agricultural crops was documented in southern India (*Scientific Reports*, 2019). This ongoing research in southern India tracks the ecology and behaviour of over 250 individually identified elephants in an increasingly urbanized landscape.

Reproduction physiology of elephants

My colleague Prof. Polani B Seshagiri and I have collaboratively developed non-invasive faecal biochemical assays to monitor aspects of reproductive physiology (progesterone levels and estrous cyclicity) in female Asian elephant and musth (testosterone levels) in male elephants for application in free-ranging populations (*Theriogenology* 2010; *Gen. Comp. Endocrinology* 2012; *PLoS One* 2013).

Stress physiology of elephants

A new study during 2013-20 looked at the physiological consequences of crop raiding by elephants in southern India, in particular the impact of higher risk taking by elephants in human-dominated areas on levels of stress. Contrary to expectation, it was seen that the superior nutrition derived by elephants in human production landscapes resulted in lower levels of the stress hormone, glucocorticoids, as compared to levels in elephants which remain confined to protected forest areas (*Conservation Physiology*, 2017; *Animal Conservation*, 2018). Such results have important implications for the management of elephant-human conflicts. In collaboration with Kyoto University, my team also carried this work forward by determining cortisol levels in the tail hair of elephants in relation to stressful events in their lives during their life at the Kyoto City Zoo (*PeerJ*, 2021).

Vocal communication in Asian elephants

The earliest and the most detailed studies of the rich repertoire of vocal communication in Asian elephants in the context of their behaviour has been carried out in my laboratory (*J Acoustical Soc America* 2009, *Animal Behaviour* 2020, *Mammalian Biology* 2024)

Evolutionary trends in the Proboscidea

Along with my collaborator, Prof. Rajeev Patnaik (Panjab University), we traced the dietary trends, using stable isotopes, in ancestral proboscideans or elephants in the Indian subcontinent over the past 14 million years. This reconstruction brought out the links between proboscidean evolution and climate change, with shifts in dental morphology and diet from C3 plants (browsing) to C4 plants (tropical grasses) during the mid-Miocene (8 million years ago), with a recent (0.2 million years ago) shift back to C3 plants in response to competition among proboscideans as well as early humans in the region. This work gave interesting pointers to the evolutionary basis of crop raiding behaviour of the modern Asian elephant (*Quaternary Science Review*, 2019).

Scientific Contributions to Tropical Forest Ecology

Beginning in 1988 a programme of long-term monitoring of the dynamics of tropical forest communities in relation to climate, fire, impact of elephants, invasive species and human disturbances was initiated in the Nilgiri Biosphere Reserve. A number of permanent forest plots, including one large 50ha plot and 20 smaller 1ha plots were set up in Mudumalai National Park and the montane Nilgiris. These plots presently monitor about 150,000 individual trees from about 200 species, and constitute the largest and longest running programme of its kind in India.

Several novel insights on forest-climate relationships have been gained from this work. The pivotal role of rainfall and fire, as well as the interactions between the two factors, in determining tree diversity and dynamics was firmly established for this tropical dry forest (*J Vegetation Science*, 2018; *Oecologia* 2021), as is the impact of elephants on selected species. The rapid spread of a highly invasive shrub (*Lantana camara*) was shown to be related to a stochastic combination of prolonged drought and fire (*PLoS One*, 2013). The relationship between weather factors and fire in Mudumalai was quantified as a simple fire risk model as well as across a rainfall gradient in a landscape (*Intl. J Wildland Fires*, 2014; *PLoS One*, 2016). Patterns of tree mortality in this tropical dry forest were size-related with fires, elephants and natural causes being the major causes of mortality in progressively larger-sized stems. Interestingly, there was a longer time lag in tree mortality due to drought in this dry forest as compared to tropical moist forest or temperate forests (*Forest Ecology and Management*, 2010). Contrary to expectation, deeper-rooted tree species suffered higher mortality during a prolonged drought because of water deficit in the deepest vadose zone they accessed (*Journal of Ecology*, 2018). In spite of numerous disturbances, this tropical dry forest has shown high resilience and capacity to increase its carbon stocks because of very low mortality rates in large trees, an adaptation over many generations in highly stochastic environments.

In fact, the role of environmental stochasticity as the major driver of forest dynamics, suggested for Mudumalai in 1993, has since been shown across a spectrum of tropical forests globally experiencing high to low rainfall (*Ecology Letters*, 2014). From a theoretical perspective, the long-term ecological data of dominant tree species in the Mudumalai dry forest has brought out the importance of autecological differences between species arising from their evolutionary and biogeographic histories in species co-existence, as opposed to the more conventional and popular niche-based or neutral theoretic explanations (*Ecology*, 2017; *Oecologia* 2021).

The Mudumalai Forest Dynamics Plot of 50 hectares has also since its inception networked with the international consortium of large-scale forest plots coordinated by the CTFS-ForestGEO project of Smithsonian Institution, USA. The collaborative publications from this consortium have addressed fundamental issues as diverse as co-existence of tree species in tropical forests, spatial patterns in tree species distribution, estimates of tree species richness in the tropics, metabolic theory and tropical tree sizes, carbon stocks of forests and the importance of large trees, and published in high-impact journals such as *Science*, *Proceedings of the National Academy of Sciences* (USA), *Global Change Biology*, *Proceedings of the Royal Society B*, *The American Naturalist*, *Ecology Letters*, and *Journal of Ecology*.

Scientific Contributions to Climate Change

High mountains around the globe are some of the most vulnerable systems to climate change and of great concern for biodiversity conservation and human livelihoods. The past climate and vegetation of the Western Ghats, going back to the late Quaternary (about 40,000 years before present), has been studied through stable carbon and oxygen isotope analyses of peat bogs at elevations above 2000m in the plateau. This work resulted in a landmark paper in *Nature* (1993) which demonstrated that the isotopic signals in the peat sediments of the Nilgiri hills record the well-documented global climatic events such as the Last Glacial Maximum and the Holocene Optimum. Following up on this work, we carried out with Nagoya University a higher resolution radiocarbon dating of the Sandynallah peat bog which firmly established an unbroken stratigraphy since about 25,000 years BP in this region (*Quaternary Geochronology*, 2016). Ongoing investigations using stable isotopes (in collaboration with Research Institute for Humanity and Nature, Kyoto), C/N ratios, elemental profiles, charcoal and pollen profiles of this bog are expected to further improve our understanding of past climate change in this region, as well the nature of forest-savanna dynamics (*The Holocene* 2021). A notable observation is that a major drought about 3500 years before present caused an expansion of grasslands, fires and the migration of a pastoral community to the highest elevations of the Nilgiri hills (*Environmental Archaeology* 2021).

The Himalayan mountains are experiencing a higher warming rate than average global warming, accompanied by shifts in vegetation along the altitudinal gradient. We have been trying to understand climate change in the western Himalaya over the past few centuries through the study of tree rings. Work carried out in the Nepal Himalaya showed that summer monsoonal precipitation and humidity influenced stable oxygen isotope ratios of tree rings of fir (*Abies spectabilis*); further, this work showed a weakening trend of summer monsoon over the past two centuries (*The Holocene*, 2012). Following up on this, we began investigations of climate-growth relationships of west Himalayan Fir (*Abies pindrow*) along an altitudinal gradient in Kashmir. Variations in climate significantly influence cambial phenology and wood formation. The onset of wood formation occurred at the same time at all altitudes but its cessation occurred earlier at higher altitudes indicating temperature control of radial growth in this temperate tree. At the same time, precipitation during the growing months regulated cambial activity, resulting in a more complex growth-climate relationship across the elevational gradient (*Dendrochronologia* 2020). Using these relationships, the past climate of Srinagar was reconstructed from the late 16th century; this captured many of the well-recorded historical climatic events such as floods and droughts as well some of the lesser-known climatic deviations.

The potential impact of future climate change on forests in the India was assessed through models integrating global and regional climate change projections with vegetation change models. The dynamic global vegetation models applied to the Indian subcontinent showed that about one-third of the country's natural vegetation cover can be expected to change by the end of the century. Regions which are especially vulnerable to change from global warming were identified (*Mitigation and Adaptation Strategies to Global Change*, 2011). On a regional scale, the model was applied to the northern Kashmir Himalaya to quantify the extent of upward migration of vegetation types and reduction of the snow line (*Climatic Change*, 2015). Such research provides the scientific basis for policy changes in the forestry sector for climate adaptation.

For the first time, an artificial intelligence neural network model was applied on a global scale to predict wildfires in the context of weather and land-use factors in the different continents. Our model achieved much higher predictability of fires, both spatial and temporal, as compared to the data-intensive fire models in vogue (*Scientific Reports* 2021).

Teaching, Training and Lectures

I taught courses on Ecology and Conservation Biology for graduate students during 1986-2014.

My conservation team has undertaken several training programmes for forest/wildlife department personnel from Asian countries including India, Bangladesh, Myanmar, China, Vietnam, Malaysia, and Indonesia.

I have assisted in or appeared in several documentary films on elephant ecology and conservation, including those produced by channels such as BBC, Discovery and National Geographic.

I have also spoken extensively on conservation issues relating to Asian elephants and tropical forest ecology at venues around the world including:

Universities and Colleges:

University of California at San Diego, Davis and Berkeley; Stanford University, Pasadena Institute of Technology, University of Minnesota, University of Wisconsin-Milwaukee, Princeton University, Columbia University, Cornell University, Boston University, University of Massachusetts, University of Florida, University of Oxford, University College-London, University of Zurich, University of Kiel, Yale University, University of Michigan, Gettysburg College, St. Olaf College, University of the Witwatersrand, Kyoto University, University of Hokkaido, University of Tokyo.

Zoos & Zoological Societies:

San Diego Zoo, Los Angeles Zoo, Oakland Zoo, Minnesota Zoo, Brookfield Zoo (Chicago), Lincoln Park Zoo (Chicago), Syracuse Zoo, Bronx Zoo (New York), National Zoo (DC), Philadelphia Zoo, Jacksonville Zoo, Riddle's Elephant Sanctuary. St. Louis Zoo, Houston Zoo, Baltimore Zoo, Woodland Park Zoo (Seattle), Cincinnati Zoo, Rotterdam Zoo, Emmen Zoo, Munster Zoo, Antwerp Zoo, Chester Zoo, Zoological Society of London, Melbourne Zoo, Kyoto City Zoo.

Congresses & Symposia:

Major international meetings/symposia in which I have made presentations include the Society for Conservation Biology, Association for Tropical Biology, International Congress of Ecology, International Congress of Mammalogy, British Ecological Society, Ecological Society of America, European Geophysical Association, Mammoths and their Relatives conference, Tropical Biodiversity Conference of Kyoto University, Elephant Keeper's Association of North America, and International Elephant Foundation.

Awards and Honours

National Awards

- National Science Talent Award, National Council for Educational Research and Training, 1973.
- Fellow of the Indian Academy of Sciences, Bangalore (elected in 2000).
- TN Khoshoo Memorial Award for Conservation, India, 2004 (first recipient of this award).
- Fellow of the Indian National Science Academy, New Delhi (elected in 2005).
- UGC National Swami Pranavananda Saraswati Award in Environmental Science and Ecology, 2006.
- Fellow, Geological Society of India (elected in 2006).
- B.P. Pal National Environment Fellowship Award for Biodiversity, India, 2007.
- Commendation by the Prime Minister of India for contributions to the Intergovernmental Panel on Climate Change (IPCC) that shared the Nobel Peace Prize, 2007.
- J.C. Bose National Fellow, Department of Science & Technology, India (2010-2023).
- Taru Lalvani Award for Protection of the Environment, Rotary Club of Bombay (2011).
- Doctor of Science (*Honoris causa*), Vidyasagar University, West Bengal, 2012.
- Fellow, National Academy of Sciences, Allahabad (elected in 2017).
- National Science Chair Professor, Science and Engineering Research Board, New Delhi (2022-25)

International Awards

- Presidential Award of the Chicago Zoological Society, 1991.
- Order of the Golden Ark, The Netherlands, 1997.
- Whitley Gold Award for International Nature Conservation, U.K., 2003.
- International Cosmos Prize, Japan, 2006.
- Fellow, The World Academy of Sciences, Trieste, Italy, (elected in 2013).
- Doctor of Sciences (*Honoris causa*), St. Olaf College, Minnesota, USA, 2015.

Membership of Key Professional Advisory Bodies and Committees

- Deputy Chair, IUCN/SSC Asian Elephant Specialist Group (1988 -1996), and Chair, IUCN/SSC Asian Elephant Specialist Group (1997 - 2004)

  As Deputy Chair, I provided key support to the Chair of the group in providing the scientific framework for field methods and organizing training programmes for estimating elephant populations in forests, and setting up of a field survey project in Myanmar. This was also a period when I lectured extensively worldwide on the plight of the Asian elephant and the urgent need to launch projects for their conservation.

  During my chairmanship of the group, some of the key achievements were providing technical inputs to setting up CITES/MIKE (Monitoring the Illegal Killing of Elephants) as mandated by the Conference of Parties to CITES (at Harare in 1997), revising the Asian Elephant Action Plan (along with Deputy Chair, Charles Santiapillai and several members of the group), and organizing a major meeting in Cambodia that brought international focus on the plight of Asian elephants in Indo-China.

- Member, IUCN/SSC Conservation Breeding Specialist Group (1990 - 2003);

  As a member of this group I helped carry out several of the early PHVAs (Population and Habitat Viability Analysis) for species such as the Lion-tailed macaque, Sumatran rhino, Asiatic One-horned rhino and Asian elephant (in Sumatra).

- Member, Technical Advisory Group, Monitoring the Illegal Killing of Elephants, CITES (2001-2021)

  As a member of this group, I have provided technical inputs to setting up the monitoring programme, particularly in Asia, and assisted in obtaining data on Asian elephant mortality for CITES to prepare their reports to the Conference of Parties.

- Lead Author, Intergovernmental Panel on Climate Change (1996 – 2007, 2017-22)

  I have been part of various exercises of the IPCC including the 2nd Assessment Report (1996), the Special Report on Land-use, Land-use change and Forestry (2000), 4th Assessment (2008), Special Report on Land and Climate (2019), and the 6th Assessment Report (2021).

- Member, Project Elephant Steering Committee, Government of India (1992-2007, 2012-15)

  I was a member of the task force set up in 1989 by the Indian government to prepare the blueprint for the country's Project Elephant, a conservation project that aims to protect elephants and its habitat in eleven landscapes across the country. Since its launch in 1992, for several terms I have been a member of the steering committee that sets policies and oversees their implementation. In this capacity I have been the coordinator for the southern Indian region and have worked closely with the forest/wildlife departments of the southern states of Karnataka, Tamilnadu and Kerala, as well as other states such as Odisha, West Bengal and Assam in the conservation and management of elephant populations.

- Member, Indian Board for Wildlife (1996-2003), and National Board for Wildlife (2014-present), Government of India.

  The board is the apex policy-making body for wildlife conservation in the country and is chaired by the Prime Minister of India. As a member of this board and the standing committee for several terms I have contributed to decision-making on several conservation issues including re-designing and strengthening Protected Areas, National Wildlife Action Plan, and mitigation of wildlife-human conflicts.

- Member, National Tiger Conservation Authority, Government of India (2006-08)

- Member, Expert Committee on Climate Change, Government of India (2007-08 and subsequent iterations up to the present)

  As a member of the first expert committee set up by the Indian government, I helped guide the formulation of climate change policy including the setting up of the initial eight National Missions on Climate Change. Since then, I have continued to assist the Ministry of Environment, Forest and Climate Change in preparation of the country's National Communications to the UN Framework Convention on Climate Change.

- Member, Western Ghats Ecology Expert Panel, Government of India (2010-2011) and the third committee on Western Ghats ESA (2022-present)

  I was a member of the Western Ghats Ecology Expert Panel (WGEEP) which provided the conceptual framework for declaring eco-sensitive areas/zones outside the Protected Area network. I have again been inducted into the third committee set up in 2022 to examine the issues raised by various states on the initial notification of ESA in 2013. The work of this committee is likely to conclude in 2025.

- Chair, Karnataka Elephant Task Force (appointed by Karnataka High Court), 2012.

  The High Court of Karnataka appointed me as the Chair of a task force to examine various issues relating to the management of elephants in the state. The court appreciated and accepted practically every recommendation made by the task force.

- Membership of academic bodies:

  I have contributed to the development of several academic institutions in the country in my capacity as a member of their research and curriculum committees. These include the Wildlife Institute of India, Dehradun (Chair: 2011-2014), Center for Cellular & Molecular Biology, Hyderabad (2013 – 2016), School Board in Life Sciences, Pondicherry University, Puducherry (2015- 2018), Kerala Forest Research Institute, Peechi, Kerala (2017-2023), and University Grants Commission (2023-present)

- Engagement with conservation NGOs:

  Over the years, I have been closely associated with international and national conservation NGOs including the International Biodiversity Network (erstwhile Wildlife Trust USA), Asian Nature Conservation Foundation (which I set up in 1997), Wildlife Trust of India (as Trustee) and Dakshin Foundation (as member of Advisory Board).

- Chair, Long-Term Ecological Observatories (LTEO) programme of the Ministry of Environment, Forest and Climate Change, New Delhi (2015-present)

  As the originator of this idea to establish long-term ecological research in major biomes of the country to detect signals of climate change on biodiversity, I helped the preparation of a science plan released at the Paris Climate Summit in 2015, and act as the scientific head of the LTEO programme launched in 2020 with a technical coordination cell at the Indian Institute of Science. Over 30 scientific institutions are participating in this national endeavour.

- Lead Author of joint global report of IPBES (Intergovernmental Platform on Biodiversity and Ecosystem Services) and IPCC (Intergovernmental Panel on Climate Change) on Climate Change and Biodiversity (2021).

- Vice Chair, Working Group 2, Intergovernmental Panel on Climate Change (IPCC) (2023-30)
