

# BIOGRAPHY



FOUNDING CEO OF THE IOE

**Professor Maharaj K. Pandit**

Prof. Maharaj K. Pandit is a Professor of Environmental Studies and the Chief Executive Officer, Institution of Eminence at the University of Delhi. He also holds the position of Chairperson, Research Council, University of Delhi. Prior to assuming this office, he was the Ngee Ann Kongsi Distinguished Visiting Professor at National University of Singapore and Radcliffe Fellow (Life Sciences) at Harvard University, Professor and Head of Environmental Studies and Dean, Faculty of Science at the University of Delhi. He is also an Adjunct Full Professor at the Graduate School, Department of Natural Resources Science, University of Rhode Island, USA.

## *Academic Profile*

Professor Maharaj K. Pandit is a renowned scholar of Himalayan ecology, the environment and sustainability. His work on the impact of dams on biodiversity and human communities was described as “unparalleled elsewhere in the world” by one of the reviewers (*Science*, 2013; *Conservation Biology*, 2012). The primary quest of Prof. Pandit’s research is also to understand the genetic and genomic causes of plant rarity and invasion (*Jour. Ecol.* (2011) (see *Nature*, 2011); *New Phytologist*, 2014), and impact of land use and climate change on human livelihoods, ecology, biodiversity, rivers and water resource sustainability (*Nature*, 2013; *BioScience*, 2014).

Prof. Pandit has had profound influence on invasion ecology with respect to his work on plant genome size and polyploidy. His pioneering work, encompassing global analysis of ploidy, genome size, chromosome number, published in *Evolutionary Ecology Research* (2006), *Journal of Ecology* (2011) and *New Phytologist* (2014) have proven to be ground-breaking and have deeply influenced this field of research. These papers initiated novel line of investigations globally by way of providing genetic/genomic basis for spread of plant invaders. Prof. Pandit’s work has inspired ecologists around the globe to study genomic and genetic traits as important correlates of rarity and invasion. In one of its commentaries his work, *Nature* (2011) wrote, “*This study adds an important brick to the construction of those efforts*” (Gilbert, *Nature*, 2011). Prof. Pandit over the years has established a reputation for focussing on important ecological-evolutionary problems which have somehow remained unaddressed.

While at Radcliffe Institute of Advanced Study, Harvard University, Prof. Pandit authored a book – *Life in the Himalaya: An Ecosystem at Risk* published by the Harvard University Press. He also successfully competed for the **Radcliffe Exploratory Seminar Award** by Harvard University for a seminar project titled, “*Intertwined Component Complexity and Interconnectedness between Geological and Biological Processes*”. Prof. Pandit also heads the Himalaya Lab at University of Delhi which he founded. His book – *Life in the Himalaya: An Ecosystem at Risk* (2017, Harvard

University Press) illustrates his acumen for interdisciplinary and cross-disciplinary approach to research blending his knowledge of earth sciences and life sciences beautifully. A review of this book sums it nicely, “*Scientists who venture beyond the confines of their narrow disciplinary silos, should be commended for their boldness: [it] not only helps the younger generation of scholars get a feel for the scope of the challenges they will face across a spectrum of disciplines ... , it also forces other disciplinary scientists to come up with their countervailing narratives if they feel otherwise. This is how science should advance*” (Gyawali, 2018).

Prof. Pandit has a deep and abiding interest in Science Policy related to nature conservation and sustainability and has published his contributions in the topmost scientific journals (*Nature*, 2020; *Science*, 2020) addressing global audience.

A consummate scholar, Prof. Pandit is a rare combination of principle and practice of life science at interfaces. Many of his papers in highly influential journals such as *Science* and *Nature* cover topics from climate change, species’ range shifts, land use conversion, and biological invasions, fisheries, and conservation as part of toolkit in diplomacy and international cooperation. Prof. Pandit’s approach to science and to the complexities of ecology and the environment have contributed to his success and influence.

Prof. Pandit ably led the team to author the IoE proposal for the MHRD and presented to the Expert Empowered Committee. His concern was to focus on the broad idea-centric themes as opposed to disciplinary silos, which are inadequate to address the contemporary challenges of the world. The on-going epidemic is an apt example of inter-component complexity and interconnectedness between medicine, sociology, economy, information technology and so on. A popular teacher Prof. Pandit continues to be a global leader in research while also serving as a Dean and Chief Executive Officer at the University of Delhi.

### **Research**

Prof. Pandit employs his knowledge of earth sciences and blends it beautifully with life sciences. His book – *Life in the Himalaya: An Ecosystem at Risk* (2017; Harvard University Press) is quite illustrative of his interdisciplinary and cross-disciplinary thinking and research. A quote from one of the many reviews of his book sums it beautifully, “*Scientists who venture beyond the confines of their narrow disciplinary silos, should be commended for their boldness: doing so not only helps the younger generation of scholars get a feel for the scope of the challenges they will face across a spectrum of disciplines related to Himalayan studies, it also forces other disciplinary scientists to come up with their countervailing narratives if they feel otherwise. This is how the science of the Himalaya should advance*” (Gyawali, 2018, *Population & Development Review*, 44:179-181). Gyawali further writes, “*As one reads the book, (s)he feels learning quite a bit while reading about the region’s natural phase; it is when reading about the mechanical phase that ...one feel(s) the need to switch gears from being a student to a debate protagonist. The switch occurs in the stand-alone Chapter 6 ..... Here Pandit explores the dark and sad conflict between conservation and development..It is precisely in provoking such additional questions to further the debate on sustainability that this book will have immense value for younger and future scholars of the Himalaya*”.

Over the past nearly three decades, Prof. Pandit and his team are engaged in research on ecology, the environment and conservation of the Himalayan biodiversity and ecosystems. The broad area of Pandit’s research pertains to understanding various drivers of species’ extinction, rarity and invasiveness. He studies ecological transformation of the mountain landscapes including river

regulation by dams and the ensuing changes in the terrestrial and aquatic ecosystems. Pandit's research on the Himalayan land use changes have attracted global attention [<http://www.nature.com/news/flood-of-protest-hits-indian-dams-1.11932>].

### ***Research Area 1: Land-use Change and Species Extinctions in the Himalaya***

Prof. Pandit's researches have significantly contributed to our understanding of the impacts of land use changes by deforestation, dam building and climate change on the Himalayan terrestrial and aquatic biodiversity, and human communities. He has published a number of original research papers in some of the best-known journals [*Biodiv. & Conservation*, 16:153-163 (2007); *Cons. Biol.*, 26:1061-1071 (2012); *Conserv. Biol.*, 23:1346-1347 (2009); *Nature*, 501:283 (2013); *Science*, 339:36-37 (2013); *BioScience*, 64:980-992 (2014); *Biol. Conserv.* 233: 176-184 (2019); *Fish & Fisheries Review* 26: 25-38 (2015); *Animal Conserv.*, 22:525-526 (2019). In his recent contributions, Pandit has outlined the need for using conservation and cooperation as a part of the toolkit for diplomacy between nations with border conflicts with specific reference to India and China [*Nature*, 583:9 (2020); *Science*, (2020)].

Prof. Pandit's research group pioneered a study on the role of dams in driving biotic extinctions which paved way for taking informed policy decisions by the Federal Government vis-à-vis dam building in the Himalaya. He showed how pursuit of haphazard dam-building in the Himalaya would exacerbate extinction of species across taxonomic groups and recommended caution and science-based planning of hydro-power [*Science*, 339:36-37 (2013); *Cons. Biol.*, 26:1061-1071 (2012); *BioScience*, 64:980-992 (2014)]. Using modelling tools, his group also showed that dams potentially transform macroecological patterns of fish by interfering with water discharge availability - the key drivers of fish diversity and distribution in rivers [*PLoS One* 7(9): e46237 (2012)] and demonstrated how river regulation had impacted fish migration [*Fish & Fisheries Reviews* (2015)].

### ***Research Area 2: Biological Conservation: Plant Rarity & Invasiveness***

Prof. Pandit's researches on fundamental ecological question - why some species are endangered while others turn invasive - has significantly contributed to furthering the advancement of the field of ecogenomics. He has expanded his research effort to global level studies, leading to generalizations and applicability to many ecological systems. His novel hypotheses have furthered our understanding of plant rarity and invasiveness influenced by genetic and genomic traits. His works have appeared in high impact journals, where he showed how ploidy is related to plant rarity and invasiveness [*Evol. Ecol. Res.*, 2006; *Bot. Jour. Linn. Soc.*, 2006; *Jour. Ecol.*, 2011; *New Phytologist*, 2014]. In an exclusive review of his *Journal of Ecology* paper, *Nature*, (2011) commented, "There is a need to improve our ability to predict the potential invasiveness of alien species and this study adds an important brick to the construction of those efforts" [<http://www.nature.com/news/2011/110406/full/news.2011.213.html>]. This contribution was also chosen for the journal editorial [*Journal of Ecology*, 2012] as an important contribution of 2011.

For the past four years, along with his graduate students and post-doctoral research scientists, Prof. Pandit's research endeavours are focused on providing mechanistic explanations behind plant invasions mediated by the rhizobacterial microbiome [*Current Microbiology* (2021)]. Using predictive metabolic profiling of the rhizosphere bacterial communities, this research demonstrated that exotic invasive polyploids recruit a unique rhizobacterial microbiome which proffers them a fitness advantage and positively influences their invasion success.

In a recent study, his research group demonstrated that polyploids in *Geranium* spp. in the Himalayan highlands colonized open, dry and warm degraded mountain habitats (landslides), poor in nutrition, while the diploids preferred cool, shaded, rich soils of forested slopes [*Taxon*, 2020].

Prof. Pandit's group continues researches on mechanistic explanation of biological invasions and its impacts on native biodiversity and soil hydrology – **less understood so far in ecological literature**. Literature on plant invasion has focused on the negative impacts on biodiversity, economy, public health, etc.

### ***Research Area 3: Climate Change & Plant Species Responses in the Himalaya***

Prof. Pandit's research group provided first evidence of plant species' range shifts in the Himalaya under impact of warming in the last century [*PLoS One* 8(2): e57103 (2013); *PLoS One* 7 (9), e46237. They reported that the Himalayan mountains had experienced higher warming rates compared to other mountain ranges of the world in the last century.

Extending this study, his group projected that climate change induced species' range shifts have led to ingress of woody elements and shrubs into alpine meadows, known for their exclusive herbaceous vegetation [*Model. Earth Syst. and Environ.*, 2016]. These changes in the plant community structure have potential consequences for the highland yak populations in terms of loss of their trophic base [*Pandit*, 2017].

In a recent study combining field data and modelling, his research group found that the changes in species' geographic ranges have necessitated redrawing of the existing protected area (PA) boundaries and that there was a need for including newer and additional areas to these PAs [*Biol. Conserv.*, 2019].

### ***Research Area 4: Macro-Ecological Patterns along Himalayan Elevational Gradients***

Investigating a fundamental ecological problem of species richness patterns along elevational gradients, Pandit provided first evidence of hump-shaped macroecological patterns across taxonomic groups, such as the higher plants, mammals, birds, fish, butterflies, etc. in the Himalaya (*Conserv. Biol.*, 2012).

Taking this work forward, one of his graduate students reported interesting results on the macroecological patterns in angiosperms, rejecting previous studies on these richness patterns that suggested unimodal richness patterns following faulty study designs (*Jour. Plant Res.*, 2017). This study also reported that with increasing spatial scale of extent, the richness patterns change from a monotonic to a hump-shaped pattern and richness maxima shift toward higher elevations across all growth forms. These investigations showed that the “*combination of ambient energy (air temperature, solar radiation, and potential evapotranspiration) and water availability (soil water content and precipitation) were the main drivers of elevational plant species*” [*Jour. Plant Res.*, 2017].

His research group reported that phylogenetic diversity (PD) was the highest at mid-elevations for all growth forms and PD had a significant positive correlation with endemic species richness in the Himalaya. Species at mid-elevations were dominated by the ancestral/primitive taxa and phylogenetic clustering was observed at higher elevations and phylogenetic overdispersion at lower and mid-elevations for the majority of the growth forms (*Plant Ecol. & Divers.*, 2018).

Besides laboratory- and field-oriented research and scientific publications, Prof. Pandit carries out regular outreach activities and has a prominent presence in media – television, electronic and print

media including TEDx Talk, where he contributes as a policy expert, columnist and a public speaker. A number of his lectures including the ones delivered at Harvard are on YouTube and have also been broadcast on WGBH in the USA.

### ***Recognition and Awards***

- **Distinguished Service Award**, University of Delhi (2019).
- **Ngee Ann Kongsi Distinguished Visiting Professorship**, National University of Singapore (2019).
- **Fellow**, Indian National Science Academy, New Delhi (2016).
- **Radcliffe Exploratory Seminar Award**, Radcliffe Institute, Harvard University (2016).
- **Radcliffe Fellow**, Radcliffe Institute for Advanced Study, Harvard University (2015-2016).
  - **Fellow**, National Academy of Sciences India (2015).
  - **Visiting Senior Fellow**, National University of Singapore (2005-2007; 2009-2010; 2012-2013)
  - **Raffles Biodiversity Award**, National University of Singapore (2004).
  - **Fellow**, Linnean Society of London (2001).