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OBITUARY

Madhav Gadgil: Science, Society, and the Making of India's Ecological Conscience

Shivaprasad Khened

Chatrapati Shivaji Maharaj Vastu Sangrahalaya. Mahatma Gandhi Road, Kala Ghoda, Fort, Mumbai, Maharashtra 400001

(Formerly at Nehru Science Centre, Mumbai-400018)

Email: khened@gmail.com

ABSTRACT

Professor Madhav Dhananjaya Gadgil (1942–2026) was among the most influential ecological thinkers of post-Independence India, whose work reshaped how nature, society, and development are intertwined and how their understanding shapes society and the subcontinent. Trained in mathematical ecology at Harvard University and deeply rooted in field-based natural history, Gadgil forged an integrative vision of ecology that combined scientific rigour with ethical responsibility and social justice. This essay traces the arc of his life and work—from his formative years as a young birdwatcher in Pune, influenced by Salim Ali, to his institution-building role at the Indian Institute of Science, Bengaluru, and his extensive research across India's diverse landscapes, including the Nilgiris and the Western Ghats. Particular attention is given to his landmark writings, notably "*This Fissured Land"* and "*Ecology and Equity"* (co-authored with Ramachandra Guha), which established ecology as a historically grounded and socially embedded discipline. The essay also examines Gadgil's contributions to biodiversity governance, especially the *People's Biodiversity Registers* and the *Western Ghats Ecology Expert Panel*, highlighting his commitment to democratic environmentalism. By situating Gadgil's scientific work within broader debates on equity, development, and sustainability, the paper argues that his enduring legacy lies in redefining ecology as a moral and civic enterprise—one urgently relevant to contemporary environmental challenges, which India and the world is facing.

KEYWORDS: Ecology; Equity; Science Communication

1. Introduction: A Life in Ecology and Ethics

Few scientists in post-Independence India have so seamlessly united rigorous ecological science with ethical responsibility and public engagement as Professor Madhav Dhananjaya Gadgil (1942–2026). Over a career spanning more than five decades, Gadgil shaped ecology not merely as an academic discipline but as a moral and civic enterprise—one attentive to landscapes, livelihoods, and long-term sustainability, much before sustainability was mainstreamed by the United Nations and its Sustainable Development Goals (SDG). His work ranged from theoretical population biology to field-based conservation, from institution-building, the Centre for Ecological Science at the Indian Institute of Science (IISc), Department of Environment in the Union Government, which has now become the Ministry of Environment, Forests and Climate Change, to policy interventions that redefined environmental governance in India.

This essay traces the arc of Gadgil's life and work: from his formative years as a young naturalist in Pune, through his interdisciplinary training at Harvard University, to his pioneering research, writings, and public service across India. Drawing on his major publications—especially those co-authored with Ramachandra Guha—his fieldwork in regions such as the Nilgiris and the Western Ghats, and his enduring influence on policy and pedagogy, the essay argues that Gadgil's legacy lies in a distinctive synthesis of science, society, and ethics.

2. Early Life: Nature as a First Classroom

Madhav Gadgil's intellectual journey began far from laboratories and policy corridors. Born in Pune on 24 May, 1942, into an illustrious Gadgil family - son of the distinguished economist Dhananjay Ramchandra Gadgil (D.R. Gadgil) and his mother, Pramila Gadgil - he grew up in a household where scholarship and public life were deeply valued. His father was a well-known scholar who initiated him into bird watching and a love for nature, deeply influencing his later work in ecology. D. R. Gadgil was an eminent economist and planner, also possessed a keen interest in natural history. Weekend walks, birdwatching excursions, and conversations about the natural world became an integral part of young Madhav's upbringing. These early

experiences cultivated not only a love for nature but also an ethic of attentive observation.

A defining childhood episode—often recalled by Gadgil himself—captures the spirit of his early curiosity. As a boy of about eleven, he was captivated by the green bee-eater, a bird whose vivid plumage and agile flight enchanted him. He noticed that the bird's long central tail feather appeared in one season and vanished in another. He first felt that he had actually observed a different species of the bird. Unfortunately, the books which he had in his house did not support his understanding, and therefore, he asked his father for clarification. When local field guides also could not explain his observations, his father suggested that he write directly to Dr. Salim Ali, India's pre-eminent ornithologist. Incidentally, Sali Ali was friends with his father. To his delight, Ali replied, explaining that the bird lost and regrew the feather during its annual moult.

The significance of this exchange of letters and also an opportunity that the young Gadgil had to meet Dr Ali in person and interact with him and encouragement that he received from Dr Salim Ali on his curious observation and which Dr Ali said was central to science immensely motivated young Madhav Gadgil. This episode left a lasting impression on Gadgil, who later recalled that it inspired him to imagine a life devoted to understanding nature, much like Ali himself. This early mentorship—however indirect—foreshadowed Gadgil's own lifelong commitment to field studies and nurturing young scientists and engaging with the public.

3. Education in India: Biology, Mathematics, and Intellectual Breadth

Gadgil's formal education reflected the breadth of his interests. His interest in natural history, shaped by his childhood days of bird watching and walking by the woods, motivated him to pursue his undergraduate studies in biology at Fergusson College, Pune, followed by a master's degree in zoology at the Institute of Science, Mumbai. Incidentally, part of the Institute of Science building now houses the National Gallery of Modern Art in Mumbai, which I had the honour to head for five plus years. While studying for the master's in the Institute of Science,

Gadgil opted for a thesis, though not mandatorily required, which involved mathematical modelling and that helped him, self-learn maths and statistics required for completing his thesis. This was a time which coincided with a period when Indian higher education was expanding but still heavily compartmentalised. Maths and Biology were often considered as two separate fields and that maths was not necessary for a master's in biology. Gadgil resisted this narrow specialisation by embracing mathematics and analytical reasoning alongside natural history.

This intellectual stance challenged a common stereotype—that biology was a refuge for those uncomfortable with quantitative methods. Gadgil's early exposure to population dynamics and systems thinking convinced him that ecological phenomena could not be fully understood without mathematical models. This conviction would later define his work in theoretical and mathematical ecology, positioning him at the forefront of an emerging interdisciplinary field. While studying for his master's at the Institute of Science, Gadgil had applied for research at Harvard, and he received a communication asking him to appear before a touring Professor from Harvard in Mumbai for his interview. It was in this interview that his knowledge in maths and statistics came in handy, and Gadgil was selected for his research study at Harvard.

4. Harvard University: Interdisciplinary and Mathematical Ecology

In the late 1960s, Gadgil travelled to the United States to pursue doctoral studies at Harvard University. Harvard at the time was a crucible of intellectual innovation, particularly in evolutionary biology and ecology. Gadgil had originally planned to work on fish taxonomy under Giles Mead at Harvard. However, after attending to one of E. O. Wilson's lectures, widely regarded as one of the architects of modern evolutionary biology and often referred to as modern Darwin, Gadgil was so inspired by Wilson's brilliance that he pivoted his entire career toward evolutionary ecology. Incidentally, Wilson, later, referred to Gadgil as the "brightest young star" in the field at that time.

At Harvard, Gadgil worked in an environment shaped by figures such as E. O. Wilson. Although Wilson was not his direct supervisor, the intellectual milieu emphasised synthesis—linking empirical field observations with theoretical frameworks. Dr. Wilson and Bossert had done something revolutionary in their work titled the Pheromone Math. They had collaborated on the first mathematical models of how chemical signals (pheromones) disperse in the air and how ants follow those trails. An interaction of Wilson with Gadgil had firmed up an idea in Wilson's mind that Gadgil must work with William Bossert.

Accordingly, Wilson asked Madhav Gadgil to work for his PhD under the guidance and supervision of William H. Bossert. Gadgil's interaction with Bossert, his PhD supervisor, was centred on the emerging field of theoretical population biology and mathematical ecology, with Bossert guiding Gadgil's research on life-history strategies. William Bossert's background was a fascinating example of the "interdisciplinary revolution" that was shaping Harvard in the 1960s. While Bossert had opted for his career in biological sciences, his formal training and methodology were rooted in applied mathematics and engineering. The turning point in Bossert's career was his collaboration with Edward O. Wilson, who had assigned Gadgil to work with him.

While at Harvard, Gadgil was heavily influenced by E.O. Wilson, even as he worked under the guidance of Bossert for his doctoral research. Bossert's influence on using mathematical modelling for ecological studies would stay with Gadgil for the rest of his career. Gadgil completed his PhD in 1969 with a thesis titled "Life History Strategies: A Theoretical Investigation". Gadgil Bossert's collaboration resulted in the publication of a significant paper in The American Naturalist in 1970 titled "Life Historical Consequences of Natural Selection". Under Bossert, Gadgil focused on applying optimal resource allocation theory to ecological phenomena. Although it was quite normal for the students to wait for nearly five years for their PhD, Gadgil's revolutionary interdisciplinary work in association with his guide Bossert resulted in his getting his PhD in just three years.

Based on his work and merits, Gadgil was offered a teaching post at Harvard, which was a sure-shot story for his lucrative academic career in US. But then Gadgil was determined to return back to India after working for a brief period at Harvard. Therefore, he did not opt for this assignment. Instead, with help from his guide, Bossert, who had an association with IBM, Gadgil earned a scholarship from IBM to work as a lecturer at Harvard for two years. Gadgil worked for two years (1969–1971) at the Harvard Computing Centre and as a lecturer of biology, during which he continued to engage with the quantitative approach to ecology championed by Bossert.

This interdisciplinary training reinforced Gadgil's belief that ecology must combine field sensitivity with analytical rigour. It also exposed him to a global scientific culture in which collaboration across disciplines was not only possible but essential. Despite being offered opportunities to continue his career in the United States, Gadgil made a deliberate choice to return to India—a decision that would profoundly shape the country's ecological sciences.

It is also to be noted that Madhav Gadgil's wife, Sulochana Gadgil (1944–2025), a distinguished mathematician and climate scientist who became one of the world's leading authorities on the Indian monsoon, travelled with him to Harvard for her PhD. Madhav Gadgil and Sulochana Gadgil were two "intellectual equals" who travelled to Harvard together in 1965 after their marriage, following their master's degrees in India.

5. Returning Home: Institution-Building at IISc

Both Madhav and Sulochan Gadgil returned to India in 1971, which marked a pivotal moment in their career. Their decision was contrary to the norms of the time when people were keener to work in US, more importantly, in an esteemed institution like Harvard, where Gadgil had an offer to work. They left US to return to India with no assured work in hand. Fortunately, on their return to Pune, they got an opportunity to work with the Agharkar Research Institute and Maharashtra Association of Cultivation of Science, in Pune.

Dr Sulochana Gadgil received a pleasant communication from IISc that Prof Satish Dhawan, Director IISc, Bangalore, was keen to avail of her service at IISc in the Centre for Theoretical Studies, a multidisciplinary department. This opportunity was used by Sulochana Gadgil to brief Prof Satish Dhawan about her husband and his interest to work at IISc. They both were invited for an interaction at IISc, and the rest is history. They both were selected, and they joined IISc, one of India's premier research and academic institutions, in 1973 and remained there for nearly four decades. It was here that Gadgil envisioned ecology as a discipline that bridged laboratory science, fieldwork, and social relevance.

In 1983, he founded the Centre for Ecological Sciences (CES) at IISc. Incidentally, his wife, Sulochana Gadgil, was also instrumental in the creation of the Centre for Atmospheric and Oceanic Sciences (CAOS) at IISc.

Under the leadership of Madhav Gadgil. CES became a pioneering hub for ecological research in India. It fostered studies in population biology, plant and animal ecology, conservation science, and human–environment interactions. Equally important, under the influence of Dr Gadgil, CES emphasised rigorous fieldwork—often in challenging terrains—and encouraged students to engage with real-world ecological problems.

Gadgil's role as a mentor was central to CES's success. He trained generations of ecologists who would go on to shape conservation research, policy, and activism across India. His pedagogy emphasised independence of thought, ethical responsibility, and a deep respect for local knowledge systems.

6. Writing Ecology into History: Collaboration with Ramachandra Guha

One of Gadgil's important contributions came through his collaboration with Bangalore-based historian Ramachandra Guha. Together, they produced works that redefined how ecology and history could be studied in tandem. Their seminal work resulted in a book, "This Fissured Land: An Ecological History of India (1992)". This book traces the ecological history

of the Indian subcontinent, demonstrating how patterns of resource use, social hierarchy, and state power have shaped landscapes over centuries. Rejecting simplistic narratives of environmental degradation, Gadgil and Guha showed that ecological change was deeply entwined with social and political processes.

They followed up with another book, "Ecology and Equity: The Use and Abuse of Nature in Contemporary India (1995). In this follow-up work, they turned their attention to post-Independence India. They introduced influential concepts such as "ecosystem people," "ecological refugees," and "omnivores," highlighting the unequal distribution of environmental costs and benefits. The book argued that environmental sustainability could not be achieved without addressing issues of social justice and equity.

Together, these works and his fieldwork established Gadgil not only as a scientist but also as a public intellectual, capable of engaging historians, policymakers, and activists in a shared conversation about India's environmental future.

7. Fieldwork Across India: Landscapes and Livelihoods

While at IISC, Gadgil's theoretical insights were grounded in extensive fieldwork across India. His research took him to forests, grasslands, coastal regions, and agricultural landscapes, spanning early 18 states and union territories of India, where he studied both ecological processes and human interactions with nature.

8. The Nilgiris and Biosphere Reserves

Gadgil played a key role in conceptualising and supporting the designation of the Nilgiris Biosphere Reserve, India's first biosphere reserve. This initiative sought to integrate conservation with sustainable livelihoods, recognising that protected areas could not be isolated from human communities.

9. The Western Ghats

Perhaps Gadgil's most widely discussed contribution was his leadership of the Western Ghats Ecology Expert Panel

(WGEEP), which produced the seminal Gadgil Report (2011). The report recommended that large portions of the Western Ghats be designated as Ecologically Sensitive Areas (ESAs), with zoning based on ecological vulnerability and community participation. The report faced political resistance and therefore, was not acted upon for a long time. It was, however, later modified under the Chairmanship of Dr Kasturirangan. Yet Dr Gadgil's emphasis on decentralisation, transparency, and scientific integrity reshaped national debates on development and conservation. Gadgil's insistence that local communities be active participants—not passive subjects—remains a touchstone for sustainable development discourse in India.

10. Biodiversity Documentation and People's Knowledge

A distinctive feature of Gadgil's work was his commitment to documenting and valuing traditional ecological knowledge. He was instrumental in developing the framework for People's Biodiversity Registers (PBRs), which sought to record local knowledge of flora, fauna, and ecological practices.

These efforts influenced the drafting and implementation of India's Biological Diversity Act (2002), embedding community participation into national biodiversity governance. Gadgil viewed such initiatives as essential to democratising science and ensuring that conservation policies were socially legitimate.

11. National and Global Engagements

Beyond academia, Gadgil served on numerous national and international committees. He advised the Government of India, contributed to the Scientific Advisory Council to the Prime Minister, and worked with global bodies such as the Global Environment Facility. His contributions were recognised through numerous awards, including the Shanti Swarup Bhatnagar Prize, Padma Shri, Padma Bhushan, and international honours such as the Volvo Environment Prize and the Tyler Prize for Environmental Achievement.

12. Philosophy: Ecology with a Human Face

At the heart of Gadgil's work lay a simple yet thoughtful philosophy: humans are not external to nature but integral to

ecological systems. He consistently argued that conservation must account for livelihoods, cultural practices, and historical contexts. His vision of ecology was neither anti-development nor technocratic; it was ethically grounded, scientifically rigorous, and socially inclusive.

13. Ecology, Equity, and the Indian Environmental Debate

One of Madhav Gadgil's most enduring contributions lies in his insistence that environmental questions in India cannot be separated from questions of equity, access, and historical injustice. Through his writings—most notably Ecology and Equity—he articulated a framework that challenged both technocratic conservation and uncritical developmentalism. Gadgil argued that India's ecological conflicts often arise because the costs of environmental degradation are borne disproportionately by the poor, while the benefits of resource exploitation accrue to powerful actors.

He classified Indian society into evocative analytical categories such as ecosystem people, who live directly off local ecosystems; ecological refugees, displaced by environmental degradation; and omnivores, who consume resources from across regions and ecosystems. These categories were not meant as rigid typologies but as tools to reveal structural inequalities embedded in patterns of development. This conceptual vocabulary entered policy debates, academic syllabi, and activist discourse, fundamentally reshaping how environmental justice was discussed in India.

Crucially, Gadgil rejected the false binary between conservation and development. He maintained that long-term economic well-being depends on ecological prudence and that conservation strategies ignoring social realities were doomed to fail. His ideas anticipated later global discourses on sustainability, resilience, and inclusive development.

14. Science Communication and Writing for the Public

Parallel to his academic output, Gadgil sustained a lifelong engagement with science communication. Like his Pune fellow scientist, Dr Jayant Narlikar, Gadgil began connecting science

with people with his early writings in Marathi popular science magazines such as Srushtidnyan. He consistently sought to make ecological knowledge accessible beyond university walls. His books, essays, and public lectures reflected a rare ability to translate complex ecological ideas into language intelligible to policymakers, students, and citizens alike.

This commitment stemmed from a conviction that environmental stewardship requires an informed public. Gadgil believed that scientists had a civic duty to speak clearly, honestly, and courageously—especially when evidence challenged dominant political or economic interests. His public interventions, whether on dam construction, forest governance, or biodiversity policy, exemplified this ethic of engaged scholarship.

15. Policy, Dissent, and Democratic Environmentalism

Gadgil's involvement in environmental policy was marked by both influence and controversy. His leadership of expert committees, advisory roles to government bodies, and participation in international panels placed him at the heart of India's environmental governance. Yet he was never merely a technocrat. Gadgil welcomed dissent and debate, viewing them as essential to democratic decision-making.

The Western Ghats Ecology Expert Panel remains the most visible example of this stance. While the panel's recommendations faced resistance from political and industrial lobbies, Gadgil consistently defended the report's scientific integrity and participatory approach. For him, the backlash underscored the very problem his work sought to address: development decisions made without adequate ecological understanding or community consent.

16. Mentorship and the Making of a Discipline

Beyond publications and policy, Gadgil's influence is perhaps most deeply felt through the community of scholars he mentored. Students trained under him at IISc and through associated networks went on to become leading ecologists, conservation biologists, policy analysts, and educators. Many carried forward his integrative approach—combining fieldwork, theory, and ethical reflection.

Gadgil fostered a research culture that valued curiosity, independence, and social relevance. He encouraged students to question orthodoxies, engage with local communities, and remain attentive to the moral implications of their work. In doing so, he helped shape ecology in India as a discipline deeply attuned to the country's diversity—biological, cultural, and social.

17. Anecdotal Connection with NCSM.

National Council of Science Museums (NCSM), an autonomous scientific institution, functioning under the Ministry of Culture, Government of India, and an institution which was separated from CSIR with an objective to mainstream development of science centres and science museums across India, is tasked to develop science centres and museums across India and present exhibitions covering a plethora of scientific subjects. During my 35-plus years of association with NCSM, I fondly remember the guidance of Prof Madhav Gadgil in shaping the content of some of the exhibitions in the science centres and museums, which include among others, Biodiversity, Climate Change, Planet Under Pressure, Water the Elixir of Life etc. Our last interaction was during the curating and making of the exhibitions Planet Under Pressure and Water the Elixir of Life exhibitions were presented at the Nehru Science Centre in the year 2013 and 2015, respectively and the exhibition Biodiversity was one of the exhibitions in the Kottayam Science Centre, which was inaugurated in 2024.

18. Conclusion: A Lasting Legacy

From a boy observing birds in Pune to a scientist influencing national and global environmental thought, Madhav Gadgil's life exemplifies the power of curiosity guided by conscience. He leaves behind more than a corpus of scientific work; he leaves a way of thinking about nature and society that is at once rigorous, humane, and courageous.

In an era marked by accelerating climate change, biodiversity loss, and social inequality, Gadgil's insistence on ecological literacy, democratic participation, and ethical responsibility

remains deeply relevant. His legacy endures in the institutions he built, the ideas he articulated, and the many individuals and communities he inspired. For India—and for the world—his life stands as a reminder that science, when allied with empathy and integrity, can help chart a more just and sustainable future.

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