



A Walk Up the Hill: Living with People and Nature. Madhav Gadgil. India Allen Lane, Imprint of Penguin Random House India, New Delhi. 2023. 412 pages. Price: Rs 999.

Madhav Gadgil's *A Walk Up the Hill* (AWUTH) is as much a dizzy roller coaster ride up and down verdant hills and valleys teeming with trees and flowers, bees, birds, monkeys, and elephants as it is about the dismal fate of the natives and nomads eking out a living on slippery slopes. Migrants living in slums also expose an equally dark and dismal picture of urban society. It is against this reprehensible backdrop that international events and summits seem more like urban pageants orchestrated for the benefit of a privileged few atop the Cantril ladder of prosperity, oblivious to the struggling billions displaced physically, culturally and economically.

Gallop oil, petrochemical and pharmaceutical businesses since World War II have defied the 1970s oil shocks that triggered a 500% price rise, as well as the 1991 Gulf War. These events inspired the 1992 Earth Summit in Rio de Janeiro and the first Conference of the Parties (COP1) in Berlin. Unfortunately, the world has already surpassed sustainable limits of recycling metals and plastics with 360 CO₂ molecules per million caused by burning fossil fuel and biomass, besides forest fires. Inspired by AWUTH as a preamble to COP28 and 2024 Earth Day, this review presents some thoughts on viable development strategies for deploying satellite surveillance. Quantitative ecology extending beyond statistics and qualitative commentary entails monitoring air, land and water pollution for short-term local forecasting in addition to aiding the formulation of long-term seasonal models.

Adopting sober yet tantalizing chapter titles in triads like Hunters, Poachers, Foresters (chapter 9) or Pests, Pesticides and Pollution (chapter 10), 3-body contests arising from peasant–professor–policy maker conflicts are discussed at length in AWUTH along with egalitarian solutions wherever amenable. However, as witnessed globally with catastrophic consequences, urban lifestyles geared up for beating global competition are either ignorant of or indifferent to the clarion call of genuinely concerned experts like Gadgil. Air, water and soil quality affect all flora and fauna, both wild and cultivated, causing extinction as well as proliferation of certain species including humans. The quality and quantity of land reserved for forests and national parks is becoming scarce owing to exponentially increasing urban demand for food, fuel, recreation, tourism, and travel by road, water and air. Gadgil (p. 178) put it bluntly, recalling how Khejadli antelopes roamed around freely among the people, even entering the houses except whenever a Jodhpur scientist showed up driving all day in a jeep and found them always napping in the afternoon.

Gadgil (p. 141) described the situation as even more poignant during the East India Company (EIC) anarchy that led to the first war of independence following which the nomadic tribes were declared criminal. *The Anarchy* authored by Dalrymple¹, chronicling EIC excesses, makes a gory prequel to AWUTH. This resentment caused by historical forces lingers all through AWUTH. While recalling the Bhopal gas tragedy after four decades (pp. 150–153), Gadgil asks: Why are these facts mostly ignored by the better-off in Indian society? There is no easy answer for sceptics in contemporary society fed up with misinformation on the one hand and an overdose of big data on the other. Paradoxically, big data analytics are luring young scholars away from authentic field experiences. Farming and mining based on short-term corporate agendas without tackling uncertainties and instabilities caused by floods, famines and earthquakes will neither be financially viable nor be a prudent policy in the long-term.

Environmental regulations will never be perfect. In the early history of environmental protection before the Rio Summit, controversies and ambiguities surrounding Environmental Protection Agency (EPA) initiatives such as CHES (Community Health and Emission Surveillance System) were exploited and contested, leading to uncontrolled mining and production of

food, fuel, cement and plastics. Overwhelming levels of urban emissions and effluents have caused pandemics, fires and floods to ravage the new millennium. Despite negligible Indian contribution to the global tally of CO₂ : CH₄ at 415 : 2, rapidly diminishing fuel and mineral reserves are throttling the growth and development of energy, agriculture, transportation and mining sectors. Regulating individuals and corporations for societal health and harmony requires tactful legal reforms blending hygiene and technology besides carbon tax.

Government and university departments dealing with geology and mining have often been unfairly criticized on social media. World history is replete with references to uninterrupted pillage and plunder of forests and mineral wealth, and modern society is no exception, as lamented by Gadgil in AWUTH. Discarding experts' appeals reiterated year after year during COPs, the rising demand for food, fuel and energy in these sobering post-pandemic years seems strange and terrifying in the new millennium flaunting unlimited social media interaction.

Emissions from farming, mineral development and exploration as a whole are minuscule and well within acceptable limits. The two main anthropogenic species CO₂ and CH₄, rose by 50% and 160% respectively, between 1750 and 2020. Presently, as monitored by satellites, airborne LIDAR, drone and aircraft surveys, rising CH₄ with 20 times more global warming potential than CO₂ is a serious issue today. Expanding satellite and aerial surveys over cities and economic zones augment conventional land-based inventories complying with UNFCCC goals immensely to aid climate calculus and mitigation strategies.

There is also a need to allay public fears and to correct general misperceptions that mining and exploration are unleashing flooding and landslides caused by melting glaciers and torrential rain, besides massive fires wiping out entire forest lands. Hopefully, COP28 can set the record straight for promoting controlled mineral development and exploration. Avoiding the rhetoric of the 2050 propositions and instead highlighting intensified surveillance of the atmosphere over urban land and economic zones, COP28 can move away from arbitration towards concrete action protocols.

Efforts to achieve zero emissions in Indian mining have been exemplary. In response to the contemporary shift towards photovoltaics and wind power, India must approach the Himalayas with prudence while also expanding copper mining activities in

other areas. Oil and gas discovered in the Himalayan foothills of Assam in 1825 were attributed to CA Bruce, who pioneered Indian tea plantations and initially played second fiddle to coal until the entry of automobiles, which propelled petroleum and transportation to dominate world trade. Untrammelled mobility of people, goods and services underpinning urban prosperity coupled with leisure and recreation abetted the rise of urban population that doubled every 20 years, surpassing 50% of the present world population. Compounding the problem of CO₂ and CH₄ emissions, the global leakage and wastage of food, fuel, water and electric power in Indian cities occupying hardly a thousandth of the land area may very likely exceed the combined consumption in the rest of the world! There is no simple remedy for limiting urban consumption, but monitoring emissions and effluents, and deploying smart sensors and surveillance devices in conjunction with active public participation could hopefully steer the world towards meeting the G20 2050 targets set recently in India. There is abundant technology available today for online monitoring of solid waste, emissions and effluent testing and surveillance (SWEETS).

The appalling contrast between frugal rural existence and wanton urban affluence undermining the eco-quality Q can be gauged by invoking the reciprocal notion of entropy S advocated by the Nobel Prize winner Ilya Prigogine in the 1984 classic *Order out of Chaos*². The pervasive notion of entropy in science, economics and ecology has generated huge literature ranging from the philosophical aspects in the 1984 classic to the esoteric mathematics of John Harte in the book *Maximum Entropy and Ecology*³. Recent articles in the *Journal of Biosciences* by Lloyd *et al.*⁴ and Pawar⁵ give rapid access to relevant literature. Avoiding complex physics and mathematics, this article attempts to estimate S based on per capita consumption and population density applicable for all quantifiable products like food, water, fabric, fuel, garbage, electric power, etc. Considering the power consumption P (sum of electric, motive and captive power in KW) and the population density N (per square kilometre), Q depends on P and N . It is difficult to estimate P , but the peak electric power demand is a convenient proxy for empirically quantifying $S = P \log N$. Illustrating this concept for Bangalore (area = 741 km²), the peak demand touched 13,837 MW at 10 AM on 11 March 2021. For a population of

1 crore individuals (crore = 10 million), $P = 1.383$ KW and $N = 10^6/741 = 13,500$, giving $S = 5.71$ reflecting high N , which can be even tenfold higher in congested slums and shopping malls. In contrast, a 1 km² hamlet with 100 people sustained solely by solar panels generating 10 KW gives an idyllically low $S = 0.2$!

It would be amiss to conclude this AWUTH review without some remarks on the lifelong dedication of Madhav Gadgil to Western Ghats' (Sahyadri) ecology, culminating in a monumental set of reports that were widely appreciated but were not implemented despite repeated appeals. This spectacular 100-million-year-old range of mountains roughly 100 km wide and running north-south for 1500 km with peaks no more than 2 km high regulate the quanta and courses of all the major rivers debouching their waters along the coastline of the peninsula. The much younger 40–50-million-year-old Himalayas running east-west in the north, however, outbeats Sahyadris not only in the world's tallest peaks but also succeed in launching and guiding the course of some of the mightiest rivers sustaining the livelihood of billions of farmers. Himalayan rivers, lakes and glaciers, having inspired cultural discourse across millennia dating back to the earliest periods of human civilization, are revered and considered sacred in the same way Gadgil describes how some hills and groves considered sacred by the people have survived the onslaught of lumbering and quarrying during the despicable EIC period and the aftermath.

In the context of mushrooming hill stations brought up repeatedly by Gadgil, hilly terrain is rendered catastrophically unstable in the rainy season with land and mud slides. The dry season is also risky if the hills are fissured and fragmented, rendering such terrain avalanche-prone, especially during quarrying for rocks and minerals. Gadgil gives a glimpse into various other issues facing Himalayan and north-eastern communities including visiting a quaint village chief living in a house of bamboo (p. 252). On bamboo growth mechanics (p. 109), photosynthetic and structural matter grow proportionately until the big-bang flowering bifurcation. Statistically, the 401-page AWUTH, composed of 25 chapters with 173 sections, some figures and tables, along with a bibliography, is a magnificent primer elucidating the contours of prudent ecology urgently needed for inspiring youth in the New Millennium. It is impossible to retrace or even identify the terrain descri-

bed by Gadgil because of the relentless decimation of the flora and fauna over the decades. However, even a glimpse of a chance sighting of a rare species or a landmark described can become a secret source of strength for practicing ecological prudence.

Concluding this AWUTH review as a preamble to COP28, controlling urbanization in consultation with community leaders and town planners is key to reducing wastage. Blazing forest fires vying with volcanoes in terms of emitting ash and gas also demand more serious discussion. It is vital to regulate plastics produced for mundane needs like packaging and footwear but also to promote novel conducting polymers to substitute for copper and aluminium. Notwithstanding controversies, protecting and promoting cooperative farming, mining and exploration appears desirable. Ecology, geology and mining continue to attract the elite and proletariat, entrepreneurs and explorers alike, to stimulate the academic and industrial R&D agenda. Finally, compiling books highlighting vital social, cultural and ecological issues ranging from wastage of food, fuel and minerals, besides emphasizing testing and surveillance of land, air and water, is equally critical for COPs to guide and monitor the global distribution of food, fuel, wood, metal, plastics and electricity. In this endeavour, I wish that all school and college authorities recommend *A Walk up the Hill* by Madhav Gadgil as an iconoclastic must-read book for students to inculcate an egalitarian outlook while discussing India's social, cultural and economic diversity.

1. Dalrymple, W., *The Anarchy*, Bloomsbury Publishing, London and New Delhi, 2019.
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3. Harte, J., *Maximum Entropy and Ecology: A Theory of Abundance, Distribution, and Energetics*, OUP Oxford, Oxford, UK, 2011.
4. Lloyd, D., Nanjundiah, V., Engelmann, W. and Johnsson, A., *J. Biosci.*, 2023, **48**(4), 34.
5. Pawar, S., *J. Biosci.*, 2023, **48**(1), 4.

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