Editorial*

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“In the end, we will conserve only what we love; we will love only what we understand, and we will understand only what we are taught.”

This oft-quoted sentiment was voiced by the Senegalese forestry engineer, Baba Dioum, at the General Assembly of the International Union for Conservation of Nature (IUCN) held in New Delhi in 1968. While the last part of the quote is undoubtedly debatable, the first has resonated with many. There have been several reasons for and approaches to biological conservation—religious beliefs, aesthetics, and perceived utility, in terms of a species’ place in the ecosystem, in terms of importance to human sustenance and survival, and in terms of monetary value. Thus, there could be disparate incentives to conserve, say, an antelope species: because it is a clan totem or believed to be one’s ancestor, to ensure its survival so that sport hunting of the species can continue, so that there is prey-base for a lion population, or seed dispersal of an economically important plant, or income from wildlife tourism.

In a world that was increasingly valuing utility and monetary gain, Michael Soulé, who helped shape conservation biology into the discipline it is today, emphasised that conservation required a combination of scientific approach and love for and connection with the living world. This combination is, unfortunately, uncommon. There have been many demonstrations of how previously undervalued species or habitats are valuable—for example, honeybees are crucial for the pollination of not just wild plants but also cultivated crops; snakes are important in managing rodent pests; whales may help the vertical distribution of nutrients in the ocean; forest stands may be net sinks of carbon from the air.

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However, if we stick to utility or monetary gain, should we deem to extinction the species that we have not yet found to be useful? Should the Western Ghats be protected only because there may be unknown, useful compounds in plants that have not yet been studied? Would New York City’s watershed environments have been protected instead of building water filtration plants if the latter had not been more prohibitively expensive? Is it even ethical to place a monetary value (as we are currently doing; an article on carbon credits also appears in this issue) on a species or an ecosystem service such as pollination or clean air or water? Conversely, if conservation were based only on aesthetics or our love for a species, since we have innate biases towards certain charismatic vertebrates, we might approve of conserving the tiger or the giant panda, but not soil nematodes or honeybees, which are likely to be more important for ecosystem functioning. Soulé was very critical of basing conservation on utility for humans, and economic profit and incentives, and stressed that species have intrinsic value.

Soulé is featured in this issue, and Sindhu Radhakrishna has written about his work and life. A classic paper by Soulé (1985)—‘What is Conservation Biology’—is also reproduced. In this paper, Soulé brings out the multidisciplinarity of the field. Conservation biology straddles diverse areas of natural and social sciences such as population ecology and genetics, biogeography, physiology, veterinary medicine, forestry, public policy and management, hazard evaluation, and ecophysics, in order to protect genetic, species, habitat, and ecosystem diversity. Soulé also emphasised that since communities comprise species that have coevolved, it is important to be holistic in conserving entire communities and ecosystems so that ecological complexity and biotic diversity are conserved, and evolutionary processes can continue. This is something that we need to keep in mind, especially with initiatives like tree planting: a forest that is cut down cannot be replaced by a plantation of trees. Similarly, appreciating that habitat types differ is important, and planting trees in a grassland or managing swamps or deserts as wasteland can be very destruc-
tive. Again, focusing only on the numbers of specific species like the tiger may detract from protecting biodiversity overall—such counts may be used as indicators of protection but should not be an end in itself (nor is it healthy or possible for a population to keep increasing over long periods of time)! Soulé also warned against holism being confused with mysticism, and emphasised that scientific studies are required to understand the functioning of the whole and its individual components.

Conservation biologists are faced with many complex questions, of which I will mention a few. A common rhetoric faced is that of conservation hindering development. However, the question one must ask is: development for whom and at whose cost? Those of us living in urban areas, which were forests that had been cleared a long time ago, are usually the beneficiaries of developmental projects (think more electricity, internet, all sorts of modern gadgets), whereas those living around the margins of land that is cleared now bear a disproportionate brunt of the costs; the latter includes dealing with negative interactions with wildlife, which urban folk often expect those living on the margins to save! Thus, we need to think about how closely the people who make decisions are affected by the fallout of those decisions. Indigenous people managing fishing in a local stream for sustenance would face immediate consequences of overfishing, compared to commercial trawling for fish for consumers far away, which has been leading to a tragedy of the commons. On the other hand, everything cannot be managed locally because large, contiguous spaces are required for much meaningful conservation.

Another issue involves the idea of what is natural. While there have been romanticised notions of pristine habitats in the past, especially by colonial powers, it is increasingly being recognised that humans and their activities (such as extraction of forest produce, hunting, and fires) have been part of many ecosystems historically. While current rates of extractive activities by humans are clearly not sustainable, the question is what is the natural baseline we should aspire to. We have also moved around a lot of plant and animal species through our activities, many of them
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becoming invasive. How do we then deal with such species, and when does an invasive species become natural? Other issues include thinking about how monetary resources are allocated for the conservation of different species. If resources are limited, which species should be protected, what kinds of studies are required to decide this, and to what extent should sociopolitical considerations influence this.

While anthropogenic changes seem to be giving rise to the sixth mass extinction on Earth, it is important to understand how various organisms have responded to past environmental changes, even if they were likely to have been much slower changes. Plants have evolved a slew of adaptations to deal with different conditions of light, temperature, rainfall, and atmospheric carbon dioxide concentrations, among others. One important adaptation is the evolution of microscopic stomata on leaves, which regulate transpiration, water stress, and carbon uptake. Swarna Ramakrishnan and Jayanti Ray-Mukherjee describe the diversity, development, evolution, and function of stomata and how stomatal response might affect plant response to pollutants in the atmosphere and increasing temperature due to climate change.

Sayantan Ganguly writes about the conservation of underground water, pointing to the relatively minuscule proportion of all water that is available to us for use in the form of surface freshwater and groundwater. Various problems arising from creating surface water reservoirs such as dams have led to the technique—aquifer storage and recovery—of storing water below the ground and extracting it when needed, and using the artificial recharge technique to move surface water underground in order to recharge the alarmingly depleting groundwater due to borewells and the like. Ganguly describes the rationale and workings of these techniques.

Gnanamani Simiyon and Ansha Elizabeth Mammen suggest a method to replace ammonium buffer, and thus avoid exposure to toxic ammonia vapours, during complexometric estimation in the lab.

Moving from earth to space, B L Fanaroff describes the Square
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Kilometre Array, an international project to build the world’s largest radiotelescope. Combining signals from thousands of dishes and nearly a million antennas, a collecting area of over one square kilometre will be obtained. With telescopes to be constructed in South Africa and Australia, it is expected that this project will shed light on various astrophysical phenomena, enable the study of galaxy evolution and dark energy, and test predictions of general relativity, among others. Kulinder Pal Singh, in another General Article, describes AstroSat, India’s first astronomy satellite, and the specifications and capabilities of the UV and X-ray telescopes aboard this satellite. In orbit since 2015, AstroSat has allowed researchers to study stars and galaxies.

We have two Series Articles in this issue. Jyotirmoy Sarkar and Mamunur Rashid, in the first article of their series, contemplate the external shape of the novel Coronavirus from a mathematician’s point of view. Hussain Reddy describes the synthesis, antioxidant properties, and applications of some natural compounds such as vitamins in his third and final article on the chemistry of antioxidants. Other articles in this issue include General Articles on the driven tight-binding chain, equivalent resistance between nodes of an electrical circuit, the chemotherapy drug Cisplatin, and the six exponentials theorem, and a Classroom Article on the paradoxes in special relativity. I hope you enjoy the issue.