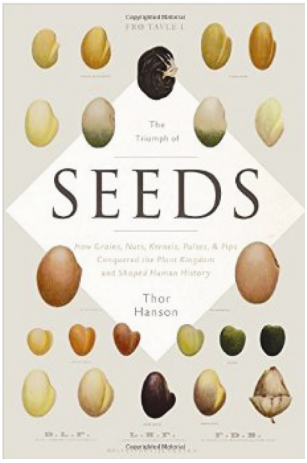


The Triumph of Seeds. Thor Hanson. Basic Books, New York, 2015. 226 pages. Price: US$ 26.99.

Accomplished artists may have painted hundreds of verses on a kernel; but the unwritten genetic instructions a seed carries make it an indomitable botanical marvel. The 'fierce energy' a seed carries, as George Bernard Shaw would describe it, can help it explode into becoming any one of the estimated 352,000 kinds of plants that use seeds to reproduce, from humble mustard to mighty oak. Given our dependence on seeds, from morning till night, it can hardly be denied that humans might not have evolved in a world without seeds. Spread across five absorbing chapters, *The Triumph of Seeds* captures the traits and habits of seeds that have not only nourished mankind but have endured to sustain future human populations too. Despite rapid strides in seed science, seeds still remain the most prized possession of the national agencies and the inter-governmental organizations. No wonder, the first things to be moved out from war torn Aleppo in Syria were seed vaults, shipped to a secure location in Norway. So secure are such locations that the National Seed Bank, on the edge of the Colorado State University, is designed to withstand earthquakes, blizzards and catastrophic fires, and will stay afloat should floods submerge the area.

Conservation biologist Thor Hanson has put together an immensely readable and engrossing treatise on the history, biology and evolution of one of the vegetal kingdom's smartest inventions. That it preserves the future plant and within it is preserved the future of living beings is testimony to the seed's fascinating evolution and incredible versatility. A seed is a package of versatile features: it embodies nourishment for the future plant but can use its flesh to lure potential distributors; and, it slumps into dormancy but can swing back to life at an opportune time. Seed is the past, present and future rolled into one tiniest pop – a metaphor for life and renewal.

What makes *The Triumph of Seeds* unique is the manner in which the subject has been given a multi-dimensional treatment, without making the narrative run into the cobweb of botanical jargons. From his own research on Central American tree *almendro* to his keen observations on South American coffee, Hanson has pieced together compelling stories on evolution of seeds such that the extraordinariness of seeds is not taken for granted. Most of what we consume, from cereals to vegetables, are seeds of some sort. From starch to proteins and from oil to saturated fats, seeds are incredible storehouse of a wide variety of energies. What makes seeds even more fascinating is the fact that despite such stored energies seeds can lie dormant for several centuries. A dormant date seed recovered from the ruins of Masada Fortress in Israel germinated after lying dormant for nearly 2,000 years. It sprang to life after planting and is now a 10-foot-tall palm tree.

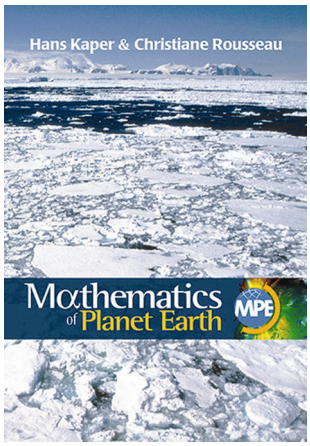
Seeds might stay dormant but these are not dormant for ideas. While seeds and warfare may sound like odd bedfellows, the dropping of four small hand grenades from the cockpit of a reconnaissance plane during the Italo-Turkish War of 1911 owed it to a type of seed. The airplane used on that historic incident was essentially a flying seed, scaled-up from the streamlined pips of a Javan cucumber. More recently, the B-2 Stealth Bomber built at a whopping cost of $2 billion apiece took inspiration from the flying-wing design of the same cucumber seeds. What is shocking, however, is that while the cucumber seeds evolved to spread life, the stealth bomber has the capacity to extinguish life instead.

Given the progress in science *albeit* genetic manipulation of living organisms, the future of naturally occurring seeds could be anything but uncertain, a subject that Hanson seems unsettled about. That plant geneticists have the tools to add, delete, and alter the genetic traits of seeds, and that big corporations have the resources to monopolize production and distribution of seeds have tossed up serious moral and ethical questions of dealing with the global common pool of seeds. The development of infamous 'terminator seeds', the name given to genetically modified plants which produce sterile seeds, is against the very nature and rhythms of seeds, and stands to break the tangible connection from past to future.

At this time when plant engineering is outpacing natural evolution, and when corporate interests are manipulating seeds to make profit, the world is passing through deep moral and cultural crises. Through this lively and intelligent book, Thor Hanson cautions that unless we remain watchful there will be more such canny transformations. If you love your popcorns and the cup of coffee, we each have an obligation to protect the seeds.

SUDHIRENDAR SHARMA

7 Triveni, A6 Paschim Vihar,
New Delhi 110 063, India
e-mail: sudhirendarsharma@gmail.com



Mathematics of Planet Earth: Mathematicians Reflect on How to Discover, Organize, and Protect our Planet. Hans Kaper and Christiane Rousseau (eds). Society for Industrial and Applied Mathematics, 3600 Market Street, 6th Floor, Philadelphia, PA 19104-2688, USA. 2015. xii + 205 pages. Price: US$ 39.00.

It is well known that applied mathematics has found many uses in the studies of ecology and associated domains. This is due to the ongoing issues of global warming, severe weather events, and

climate change; and also, of course, the overarching concerns of resource management and over-exploitation, or wastage of nature's bounty.

Though there is certainly a contemporary urgency in the use of mathematics to study such matters, with disciplines such as *mathematical ecology* having found a firm foothold in recent decades, there is a long history behind such modern efforts. Ecology itself has modern roots in the famous works of Carl Linnaeus and Alexander von Humboldt, but was also discussed by the ancient Greeks, and Kautilya's *Arthaśāstra*. Likewise, solar energy, a current favourite of conservationists, was perhaps first harnessed by Archimedes as a weapon of war against the Romans besieging Syracuse in the second century BCE. It was extensively studied through the ages, with the first recognizable (in the modern sense) solar cooker being built by Horace de Saussure in the 18th century.

Mathematical studies, computational models and techniques have given a sharper edge to studies of ecology and conservation, and we now know that there are limits (not dependent on current technology) to what can be accomplished. The 'Butterfly Effect' and chaos theory are common knowledge among the scientifically literate. (While there is no mathematical proof that the weather equations actually satisfy the requirements of chaos theory, this is widely believed to be the case.) Such limits have practical consequences; weather, especially extreme events such as hurricanes, cannot be accurately predicted far enough in advance to give sufficient time for the logistical efforts required to prepare for them. This is even more true of tsunamis and earthquakes. Such events thus regularly catch humans off-guard and have cost thousands of people their lives even in recent years. In 1999, hurricane *Floyd* threatened space shuttles at NASA's Cape Canaveral in Florida with utter destruction, because it gained in strength suddenly and forced an immediate evacuation of personnel, without time for any protracted safety measures. (Fortunately for the US space programme, the hurricane ultimately gave the launch pad a miss and headed elsewhere.)

In 2013, there was a collective effort called Mathematics of Planet Earth (see the website at http://mpe2013.org), by mathematicians from SIAM, the American Mathematical Society, and a number of research institutions and organizations worldwide. Though originally intended to last for a year, it appears to have been extended. One of the outcomes of this international partnership was a large number of blog posts on specific topics, written by mathematicians but supposed to be accessible to the scientifically literate non-mathematician.

This present volume is a selection of over a hundred such blog posts by applied mathematicians describing various theoretical aspects of the Earth's climate cycle, biological processes, and techniques for analysing and modelling such. The writings are organized into four themes: 'A Planet to Discover', 'A Planet Supporting Life', 'A Planet Organized by Humans' and 'A Planet at Risk'.

Most of the essays are well written and quite interesting. They are, however, for the most part written in an informal manner common to online blogs, and can generally give only superficial insights rather than in-depth understanding. They are also shorter than typical academic writings dealing with their topics (consider that over a hundred such blog posts are collected in this anthology in less than 200 pages). Readers may thus find it better to also consider more detailed and in-depth articles such as the one by Rothman[1], in addition to reading this book.

1. Rothman, D. H., *Bull. Am. Math. Soc.*, 2015, **52**(1), 47–64.

SHRISHA RAO

International Institute of Information Technology-Bangalore,
26/C, Electronics City, Hosur Road,
Bengaluru 560 100, India
e-mail: shrao@ieee.org