ings of Latin and vernacular names, economic and medicinal uses since earlier times with references to the *Mahabharata*, *Ramayana*, *Charak Samhita* (500 BC), *Sushrut Samhita* (AD 300), mythological anecdotes and localities in Mumbai where the trees stand.

The derivation of botanical names makes interesting reading; to cite a few: *Areca catechu* – Areca could have come from Kannada 'Adaka' and *catechu* could be with reference to the chewing action. *Tamarindus* is derived from the Arabic Tamar-e-Hind (Indian date). *Azadirachta* has its roots in Azae-darakht, terms used by the Iranian travellers meaning good health at no cost. Etymology of the monocarpic *Corypha* is traced to Malayalam Kodapanam, i.e. umbrella palm. Its abundance in Kerala has reportedly earned it the title of God's own country. *Calophyllum inophyllum* means a tree made beautiful because of its veined leaves: *Calo* = beautiful, *phyllum* = leaves and *ino* = veins. Mice-killer *Gliricidia* has roots in *gliris* (mice) and *caedo* (killer).

In the first chapter on the 'Princes of the plant kingdom' – the palms, Marselin Almeida presents a wealth of information on ten species. The chapter on mangroves points out the worsening scenario and shrinkage in the area of what was once the dominant element in the seven islands that the city originally was. The silver lining is the Mangrove Park project launched by the company Godrej under the guidance of Chaphekar. Given the paucity of mangrove species, what may be suggested is the creation of a Mangrove Arboretum within the framework or the Park project, with introduction of mangals from other parts of India (e.g. *Nypa* and *Heritiera* from the Sunderbans) and other warm countries. For the massive *Adansonia*, C. S. Lattoo has collected voluminous data; the huge, hollow trunk could accommodate 30 persons, an African tribe buries its dead in the tree. Missing is the Indian legend that robbers used to hide inside the trunk during daytime and commit robberies at night. Hence the Gujarati name 'Chor-Amlo', the robbers' tamarind. Two candidates contest for the title of the oldest living tree: A specimen of *Adansonia* claiming to be 6000 years old is challenged by a bristle cone (not care) pine, 5000 years of age. Among such other fascinating points of interest in the book figures the mythological significance of planting *Couropita* around Shiva temples; to the devotees its flower represents the image of the Lord as 'linga', sun-shaded by the hood of the 'naga'. In the case of the rain tree (*Samanea*), the rain is not a water-shower but the excreta of certain insects inhabiting the tree. The heavy, hanging fruits of *Kigelia* could provide a novel idea for the Motor Vehicles Department! Incidents of these fruits making dents on cars parked underneath the tree, suggest planting of *Kigelia* trees in no-parking zones. The reviewer is reminded of a query from an eminent lawyer: 'Why is it that there is not a single police or court case of a coconut falling from a height of 25 m on someone's head, grievously injuring him?' Though I did not find mention of this curious fact in the chapter on palms, the reason may be that the nuts are collected before maturity or that the fruit-fall occurs during night-time. A glaring omission is the mention of a special coconut day celebrated in Maharashtra; probably to thank the ocean currents that brought the fruit to our shores. On this occasion coconuts are offered as return gifts to the sea. On *Pongamia*, the author is silent on the use of its seeds as biodiesel.

A matter of inconvenience is that the species are listed neither in alphabetical order nor according to an accepted taxonomic system. The family Sterculiaceae is separated into four groups, *Sterculia foetida* (p. 138), *S. urens* (p. 287), *Firmiana* (p. 285), *Pterospermum* (p. 269). *Mimusops* (p. 78) and *Manilkara* (p. 260) are treated in different chapters, though earlier the latter was placed in the genus *Mimusops*. The reason for this discrepancy is the choice given to the authors to deal with trees of his/her liking. The photo plates show the same trends: *Diospyros malabarica* (p. 14) deserved a place near *D. embryopteris* (p. 172), *Lannea* (p. 144; Anacardiaceae) near *Mangifera* (p. 66), *Haldina* (p. 6; Rubiaceae) near *Neolamarkia* and *Mitragyna* (pp. 146, 147).

The language used is at times too poetic. I, for one, prefer plain English. Also there are several anthropomorphic expressions. For example, on p. 27, there is a reference to 'Strangulating Ficus', an oft repeated textbook statement. The banyan seed germinating on the palmyra trunk develops roots that clasp the palm for support. But do they really choke the host with the intension of killing it? 'Adventurous traveller' (p. 175), 'Born in' instead of the country of origin, 'Living happily', 'Obesity' in the baobab, and the 'Ghost tree' *Sterculia urens* are few more examples. Likewise the noteworthy distribution of the Doum (Dome) palm *Hyphaene dichotoma* is not discussed. Like the Gir (Kathiawar) lion, this palm too has almost endemic status in Diu, an erstwhile Portugese enclave in Kathiawar. Given the concentration of the genus *Hyphaene* in Angola, also a past Portugese colony in Africa, indigenous or introduced occurrence since earlier times would be a good subject for historical and palaeo-palynological research.

Errors are few. *Peltophorum* (p. 87) bears the heading *Pterocarpus indicus*. *Saraca asoka* plate is on p. 126 and not on p. 116 as indicated in the photo-index. 'Deciduation (p. 201) is not a well-recognized term for leaf-shedding. An appendix of vernacular names with the corresponding botanical names would have helped readers not familiar with the local language. One would have also appreciated a map showing major localities. The price is on the higher side for students to afford a copy. Anyway, it is a useful reference book which universities, institutes and college libraries should have. For the budding botanists it would be a good guide to know the trees and their location. The publication is, however, essentially addressed to tree-lovers; not only Mumbaiites but also to those residing in other cities and towns who would enjoy reading it – a veritable collector's item for those interested in plant-life, ecology, and the very history of the metropolis.

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Groundwater Management in India: Physical, Institutional and Policy Alternatives. M. Dinesh Kumar (ed.). SAGE Publications India Pvt Ltd, B1/11, Mohan Cooperative Industrial Area, Mathura Road, New Delhi 110 044. 2007. 354 pp. Price: Rs 480.

Groundwater constitutes a vital natural resource for sustaining India's agricultural economy and meeting the country's social, ecological and environmental goals. It is a unique resource, widely available, providing security against droughts and yet it is closely linked to surface-water resources and the hydrological cycle. Its availability depends on geo-hydrological conditions and characteristics of aquifers, from deep to alluvium, sediment

crystalline rocks to basalt formations; and agro-climate from humid to sub-humid and semi-arid to arid. Its reliable supply, uniform quality and temperature, relative turbidity, pollution-safe, minimal evaporation losses, and low cost of development are attributes making groundwater more attractive compared to other resources. It plays a key role in the provision of safe drinking water to rural populations. For example, already almost 80% of domestic water use in rural areas in India is groundwater-supplied, and much of it is being supplied to farms, villages and small towns.

Inadequate control of the use of groundwater, indiscriminate application of agrochemicals and unrestrained pollution of the rural environment by other human activities make groundwater usage unsustainable, necessitating proper management in the face of the twin demand for water of good quality for domestic supply and adequate supply for irrigation, ensuring equity, efficiency and sustainability of the resource. Groundwater irrigation has overtaken surface irrigation in the early 1980s, supported by well energization. It is estimated that there are about 24 million energised wells and tube wells now and it is driven by demand rather than availability, evident through the greater occurrence of wells in districts with high population densities. Apart from aquifer characteristics, land fragmentation and landholding size are the factors that decide the density of wells. The 'rise and fall' of local economies dependent on groundwater can be summarized as: the green revolution of 1980s, groundwater-based agrarian boom, early symptoms of groundwater overdraft, and decline of the groundwater socio-ecology. The social characteristics and policy interventions typical of each stage provide a fascinating insight into the human-resource dynamics.

This book is a compilation of nine research papers discussing various aspects of groundwater management. It attempts to integrate knowledge about the physical system, the socio-economic system, the institutional set-up and the policy environment to come out with a more realistic analysis of the situation with regard to the nature, characteristics and intensity of resource use, the size of the economy the use generates, and the negative socio-economic consequences. Complex variables addressed in this regard focusing on northern Gujarat are the stock of groundwater available in the region, its hydrodynamics, its net outflows against inflows, the economics of its intensive use (particularly irrigation in semi-arid and arid regions), its criticality in the regional hydro-ecological regime, ethical aspects and social aspects of its use. The first chapter by Dinesh Kumar and Singh, dwells on complex groundwater socio-ecology of India, while emphasizing the need for policy measures to address indiscriminate over-exploitation of dwindling resources. The chapter also explores the nature of groundwater economy and the role of electricity prices on it. The next chapter on groundwater issue in north Gujarat provides a description of groundwater resource characteristics followed by a detailed analysis of the groundwater depletion and quality deterioration problems in the region and their undesirable consequences on the economy, ecosystem health and the society.

Considering water-buyers and well-owning farmers individually, a methodology for economic valuation of groundwater in regions where its primary usage is in agriculture, and as assessment of the groundwater economy based on case studies from north Gujarat is presented in the fourth chapter. The next chapter focuses on the extent of dependency of milk production on groundwater, which includes the water embedded in green and dry fodder and animal feed. The study made a realistic estimate of irrigation water productivity in terms of the physics and economics of milk production. The sixth chapter analyses the extent of reduction in water usage, increase in yield and overall increase in physical productivity of alfalfa with the use of the drip irrigation system. The chapter also provides a detailed synthesis of the costs and benefits associated with the use of drip irrigation systems. A linear programming-based optimization model with the objective to minimize groundwater use taking into account the interaction between two distinct components – farming and dairying under the constraints of food security and income stability for different scenarios, including shift in cropping pattern, introduction of water-efficient crops, water-saving technologies in addition to the 'business as usual' scenario is presented in the seventh chapter. The results show that sustaining dairy production in the region with reduced groundwater draft requires crop shifts and adoption of water-saving technologies.

The eighth chapter provides evidences to prove that the presence of adequate economic incentive would encourage farmers to adopt water-saving irrigation devices, based on the findings of market research with reference to the level of awareness among farmers of technologies and the factors that decide the adoption of water-saving technologies. However, now the marginal cost of using electricity for agricultural pumping is almost zero. The economic incentives are strong and visible only when the farmers are either water-buyers or have to manage irrigation with limited water from tube-well partnerships. The ninth chapter explores the socio-economic viability of increasing the power tariff and inducing groundwater rationing as a tool for managing energy and groundwater demand, considering the current estimate of the country's annual economic loss of Rs 320 billion towards electricity subsidy in the farm sector. The tenth chapter suggests private tradable property rights and development of water markets as the institutional tool for achieving equity, efficiency and sustainability of groundwater use. It identifies the externalities for local groundwater management and emphasizes the need for managing groundwater by local user groups, supported by a thorough analysis of groundwater socio-ecology in India. An institutional framework for managing the resource based on participatory approach that is capable of internalizing the externalities, comprising implementation of institutional and technical alternatives for resource management is also presented.

Major findings of the analyses and key arguments in each chapter are summarized in the concluding chapter. Case studies of the social and economic benefits of groundwater use, where that use could be described as unsustainable, are interesting. The benefits of groundwater use are outlined and described with examples of social and economic impacts of groundwater and the negative aspects of groundwater development with the compilation of environmental problems based on up-to-date research results. This publication with a well-edited compilation of case studies is informative and constitutes a useful publication for students and professionals.

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