i.e. algebraic, structure of the vector space.

The notion of linearity is not indispensible for defining a differential calculus, although it greatly simplifies the definition of the maps and their study. It suffices to replace the notion of a 'translation' by that of a *transition* – if E is a metric space, we consider a space of transitions, i.e. mappings $(h, x) \in \mathbb{R} \times E \mapsto \theta \ (h, x) \in E$, which satisfy a certain number of axioms. These play the role of $x + hv$. For instance, in a vector space, transitions could be defined using the solution trajectories, starting at x, of nonlinear ordinary differential equations. The value of the solution at time h would be $\theta(h, x)$.

A metric space with a space of transitions is called a *mutational space*. Given two mutational spaces E and F, and a single valued map $f : E \to_o F$, we say that a transition (on F) $\tau \in f(x)(\theta)$ is a *mutation* of f at x in the direction of the transition θ if the transition $\tau \ (h, f(x))$ of $f(x)$ and the image $f(\theta(h, x))$ of the transition of x are 'close', i.e.

$$\lim_{h \to 0_+} \frac{d(f(\theta \ (h, x)), \tau \ (h, f(x)))}{h} = 0.$$

This simple structure allows one to adapt, in the framework of mutational spaces, a large number of important results of differential calculus and analogues of differential equations called *mutational equations*. This idea can easily be extended to cover set-defined and/or set-valued maps between power spaces. In particular, one considers various mutational structures on the space $\mathcal{K}(X)$ of non-empty compact subsets of a finite-dimensional vector space X called a *morphological space*.

In the recent decades, various parallel approaches (mathematical morphology, shape optimization, graphical derivatives and mutations) have been developed. There is a deep unity of basic mathematical concepts and tools buried in these competing, yet complementary concepts. Mutational and morphological analysis offers a structure that embraces and integrates the underlying framework of these approaches and reveals that their apparent differences stem from the differences in the sources of motivation.

The monograph under review provides a fairly self-contained mathematical treatment of this subject. It is divided into four parts.

The first part is devoted to mutational analysis providing the abstract tools for studying set evolution. Most of the standard results on differential equations are adapted to the case of mutational equations.

The second part deals with morphological and set-valued analysis. The third part presents geometrical morphology and algebraic morphology. The latter connects algebraic techniques characterizing mathematical morphology with general morphological concepts arising in set evolution.

The last part is an appendix that provides a summary of the statements of basic theorems on differential inclusions used in the book.

Though the motivations come from diverse sources of real life problems, the book is written in a very rigorous mathematical style and will thus be accessible to those with a taste for, and training in, abstract and formal mathematical exposition. To ease the way, each chapter is provided with an outline that serves to orient the reader by providing a summary of the principal concepts introduced and the principal results proved in it. The book contains a fairly exhaustive bibliography.

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Flora of The District Garhwal North West Himalaya (with Ethnobotanical Notes). R. D. Gaur. TransMedia, Bhandari Bag, Srinagar (Garhwal) 246 174, India. 1999. 811 pp. Price: Rs 1600/US$ 100.

The mighty Himalayan range has lured pilgrims, practitioners of Ayurveda, geographers, mountaineers and botanists from all parts of India and the world. The Indian Himalayan Region (IHR) covers an area of 5,91,000 km^2 and extends over 2800 km in length and 220 to 330 km in width, with an altitudinal range of 300 to 8000 m asl. It is represented by 21 forest types and provides an enormous diversity

of habitats, enabling the occurrence of a wide diversity of microbes, plants and animals. The mountain dwellers have depended on the resource of the region for subsistence for millennia. The increasing exploitation of Himalaya for industry, defence, agriculture, construction of roads and dams, over-collection of economic plants, grazing and development of townships has created severe environmental problems. The foremost among these has been the loss of biodiversity and valuable top soil caused by deforestation, mining, landslides and tourism. The acute shortage of water, feed for livestock, firewood for cooking and unavailability of minor timber for implements have caused intense hardships for the Himalayan people.

What has been already recorded through the preparation of Himalayan floras and faunas is impressive. The understanding of the strategies for survival of organisms under inclement climatic conditions has added a great deal to our biological knowledge. What is still not known is enormous, as the Himalayan region is vast and formidable to explore. It is in this context that the book by R. D. Gaur comes as an excellent contribution to our knowledge of the floristic wealth of north-west Himalaya.

District Garhwal has a wide range of habitats from Teraibhabar tracts at the foot of the Siwaliks to Dudhatoli (3114 m asl) in the north-eastern parts and includes flortistic elements of the Himalayan, Indo-Malyasian and Indo-Japanese elements. 57.89% of the district is covered by forests. Rajaji National Park and Corbett National Park are located in the study area. There have been earlier botanical explorations in the north-west Himalaya. What makes Gaur's flora unique? Most floras are written by taxonomists for other taxonomists (whose numbers are regrettably dwindling as their work is highly undervalued), drawing heavily on herbarium collections. While retaining the rigour expected of a professional taxonomist, Gaur's flora meets the needs of environmental managers, conservationists, wildlife biologists, agricultural scientists, foresters, anthropologists, planners, sociologists and above all common people.

The information provided in the flora has come from painstaking work done over the last 24 years by the author and his students, involving extensive field

studies, collections, notes on local names (vernacular, Sanskrit, Hindi, English) habit, habitat, plant size, colour of the flowers, phenology, pollen characters, general availability, ecology, phyto-geography, etc. The author has recorded the traditional ethnobotanical knowledge of the Garhwalis spread over 3580 small and medium-sized villages.

The introduction gives a concise account of the geographic features, climate and inhabitants, including people and wildlife. The vegetation types of Garhwal have been classified on the basis of altitudinal zonation. The common standard abbreviations used in the text and of authors' names have been listed. A glossary of palynological terms is provided (although it is not clear from which sources these are taken). The identification of the plants has been confirmed and nomenclatural changes introduced. All the specimens collected have been deposited at the Herbarium, HNB Garhwal University, Srinagar (GUH), Garhwal.

Artificial keys have been provided for the identification of the species described. Although macroscopic features such as habit and floral parts are easily discernible, presence or absence of cambium and features of pollen require a thorough botanical background.

A statistical synopsis of the flora indicates that it contains 2150 species belonging to 1032 genera and 189 families of seed plants. Of these, gymnosperms are represented only by 10 species (8 genera and 4 families). The dominant families of flowering plants of Garhwal district are Leguminosae (228 spp.), Poaceae (193 spp.), Asteraceae (146 spp.), Lamiaceae (71 spp.), Cyperaceae (62 spp.), Orchidaceae (53 spp.), Scrophulariaceae (50 spp.), Rosaceae, (45 spp.), Euphobiaceae (43 spp.) and Rubiaceae (43 spp.).

Besides wild plants, cultigens and aliens (including weeds) have been included in the flora. Of special value to a user are the concise notes on ethnobotanical uses, valuable to practitioners of traditional systems of medicine and social forestry programmes. The study area includes 211 threatened taxa, of which 46 are endangered and the remaining rare. It is not clear whether this information is based on the Red Data Books issued by the Botanical Survey of India or quantitative data collected by the

author, using revised IUCN criteria. The reviewer has a few points which need attention by the author. For example, *Cynodon dactylon* is an important pasture and lawn grass, but also occurs in cultivated fields all over India. It has been listed in this flora as a weed of the rainy season as well as of winter and spring. It is difficult to define a weed although the term is loosely applied to a wild plant growing where it is not wanted. The generally accepted functional definition of a weed is a plant which seriously interferes in one or another activity of humans. In many Indian scientific publications spinach (*Spinacea oleracea*) has been used as synonymous with palak. Many experts think that what we consume as palak is actually *Beta vulgaris* var. *cicla* Linn. The cultivated beets fall into two groups (i) the cicla group, including leafy vegetables and (ii) the crassa group, including those grown for roots (garden beet, sugar beet, etc.). This needs verification. Also *Melia azadirach* should read *M. azedarach*.

This monumental work could have been elevated to the rank of a classic had the publishers availed the services of a critical copy editor and a competent proof reader. There are several mistakes in Latin names of plants and a few avoidable flaws in the language. The scientific names of birds listed could have been checked by referring to a standard work like the *Book of Indian Birds* by Salim Ali (Twelfth revised and enlarged centenary edition, 1996).

The cover jacket is attractive. Unfortunately, there are no colour illustrations or line drawings inside. The book is priced at Rs 1600. Only libraries and overseas botanists can afford to buy it. Gaur was probably conscious that the cost would have gone up further if he had included some pictures from his marvellous collection. In the considered opinion of the reviewer, such works which provide the resource base for knowledge and rural development should be subsidised by a central funding agency. The author must have spent a good amount of his own money, besides time and energy in preparing the manuscript for the press. In the process he has earned something more enduring – fame. V. Puri the eminent nonagenarian botanist states in the foreward to this volume that four decades ago, Gaur, his student at Meerut College, was a simple, hard-working

and intensely ambitious young man who belonged to Garhwal. After the publication of this voluminous flora that embodies hard and sustained work, Garhwal belongs to him. This is indeed a tribute to be treasured.

This admirable work produced through utter dedication by Gaur contains a wealth of information. It is recommended to any individual or organization interested in the biodiversity of Himalaya and in the sustained utilization of plant resources.

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Mountain Biodiversity, Land Use Dynamics, and Traditional Ecological Knowledge. P. S. Ramakrishnan *et al*. Oxford and IBH Publishing Co Pvt Ltd, 66 Janpath, New Delhi, India. 2000. 353 pp. Price not stated.

Among the challenges brought in by the 3rd millennium AD, integrating land use dynamics and people's traditional ecological knowledge for the sustainable management of biodiversity can be considered as the most urgent. Such an urgency is felt much more in a country like India whose human population has already crossed the one billion mark – it is also likely that within the next 5 to 10 years India's cattle population will reach similar magnitude! While many countries, which are reeling under terrific biotic pressure lack the expertise, manpower and financial resources for managing their biological resources in a sustainable manner, India certainly has the capacity to address these issues. In fact, the country has taken a lead in this regard and attempted to outline management strategies based on a number of case studies.

One major initiative that has directly addressed the issue of sustainable management of biodiversity by integrating land use dynamics and traditional ecological