

thing, because it renders land more scarce, and, thus, more valuable and worthy of investment. So long as there are market opportunities available and reasonable security of land claims, then demographic growth might produce a virtuous circle of improvement and of intensification.

Turkana Herders of the Dry Savannah describes the findings of the South Turkana Ecology Project started more than 20 years ago, which brought together a wide range of researchers, from human physiology and nutrition to range ecology and social network analysis. The Turkana are a nomadic pastoral group living in the hot, dry rangelands of northern Kenya, who have been remarkably successful in adapting to the environment. The Turkana pastoral system is shown to be highly unpredictable, with droughts, raids, disease attacks and other events dealing frequent blows to herd numbers and to household viability. Human and livestock numbers are never sufficient to have an adverse impact on soils and vegetation, because herds are always in the process of recovering from the last drought.

Simple and highly flexible social organization enables the Turkana to be mobile, and thus able to exploit opportunities when they arise. However, in spite of being distant from major settlements, they have never been isolated from the rest of the 20th century. Governments (both colonial and independent), donor agencies, missionaries and non-governmental organizations have all had their impacts on these nomads. The Turkana also migrate out of the pastoral system when life gets too tough, with the poorer and marginal households regularly being 'sloughed off' in years of crisis, but they are rarely able to come back.

Aridity: Droughts and Human Development takes a much broader view of drylands worldwide. It brings together an extensive body of work carried out by French geographer Monique Mainguet over the past 30 years. In spite of its broad title, it focuses mainly on biophysical processes in arid ecosystems, and is at its strongest when presenting either the technical aspects of sand dune movement, the changing water levels in Lake Chad or the history of the ancient irrigation-based cultures of the Middle East.

Mainguet's book straddles the two schools of thought regarding drylands outlined earlier, and, confusingly, switches between the two. Through much of the text, she adopts the narrative of environmental crisis⁶ and presents dryland areas as 'the most degraded regions of our planet ...'. Much is made of the damage done by 'over-grazing' around bore-holes, but then evidence is produced which shows that, in Senegal, grassland productivity is highest in areas close to wells, owing to manure deposition and trampling of soils by herds. Mainguet sees population growth as inevitably nega-

tive, yet acknowledges the path-breaking work of Mortimore and Tiffen, which argues the contrary position.

The French original was written some years ago, and has not been brought up-to-date in several important respects. Thus, all of the discussions regarding rice farming in Senegal refer to the period before the 1994 devaluation of the West African franc. This is a pity, because the change in prices and incentives, brought about by halving the CFA franc's value, has demonstrated the great capacity of Sahelian farmers and herders to respond to improved profit margins. The translation from the French leaves much to be desired, there are numerous errors with technical terms and many cumbersome sentences.

I was really looking forward to the section called 'What is really happening?', which I hoped was going to bring me up-to-date with evidence on the incidence and rate of degradation in different dryland regions of the world. However, this section merely reproduced much of the United Nations Environment Programme (UNEP) statistics on areas suffering from different forms of degradation, which have come in for detailed and justifiable criticism. With an appetite whetted by the interesting questions posed at the start of the book, I was left rather unsatisfied at the end.

Thus, these books provide contrasting perspectives on dryland peoples and their prospects, and demonstrate the difficulties of making general statements about the diverse settings, processes and people who try to make a living in these challenging environments. The *Turkana* study will probably be of most interest to an academic audience, keen to untangle the complex relationships between environment, health and patterns of socio-economic organization. But, its detailed approach would be difficult to replicate in other dryland areas. *Aridity* will be of value to those physical geographers who want a survey of the main geomorphological processes under way in arid areas of the world. However, the book demonstrates the dangers of trying to make generalizations about highly diverse situations.

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Advanced plant sex

Gender and Sexual Dimorphism in Flowering Plants

edited by M.A. Geber, T.E. Dawson and L.F. Delph

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Of the approximately 250 000 species of flowering plants over 90% are hermaphroditic, with individuals producing both female and male gametes. The remaining species possess sexual systems in which unisexual individuals occur with or without hermaphrodites. The occurrence of populations with both combined versus separate sexes provides a fascinating series of questions that have intrigued evolutionary biologists since Darwin¹ devoted attention to the subject in one of his three books on plant reproduction. Given the obvious risk for sessile organisms of producing a single gamete type, what are the costs and benefits of unisexuality versus hermaphroditism? How often and by what evolutionary pathways has gender dimorphism originated? What selective mechanisms favour the spread of unisexuals in hermaphroditic populations? What is the genetic basis of gender and sexual dimorphism? This book represents the first comprehensive attempt to address these questions and is an important contribution that should be of considerable interest to anyone who has pondered over why sexual systems in plants and animals are so different.

In species with gender dimorphism the sexes often have contrasting morphological and physiological characteristics, unlike other sexual systems in plants involving self-incompatibility in which the mating types do not differ in life-history traits. Because of this, the ecology of the sexes is an important topic and considerable work over the past decade has documented differences between the sexes and has attempted to interpret their adaptive significance. In this book, numerous tables summarize information on all manner of contrasts between females and males, including various life-history traits, floral and inflorescence characters, secondary chemicals, and susceptibility to parasites and herbivores. Thus, the evolutionary ecology of

gender dimorphism is a major theme of the book. Another topic that receives considerable attention is the evolution of dioecy. Theoretical models indicate that to understand the evolution of separate sexes from combined sexes requires an understanding of several key factors, of which the fitness consequences of selfing and outcrossing, the genetic control of female and male sterility, and the optimal allocation of resources to the two sex functions are most important. Several chapters review progress made in determining the pathways by which dioecy has evolved, the selective mechanisms involved and the ecological correlates of gender dimorphism.

The main strength of this book lies in the considerable literature that is reviewed, and in the diversity of approaches brought to bear on how and why gender dimorphism has evolved in plants. Two chapters deal exclusively with theoretical models on the evolution of dioecy and sexual dimorphism (D. Charlesworth; M. Geber, respectively), while eight others review empirical data and observations on biogeography and phylogeny (A. Sakai and S. Weller), evolutionary pathways (C. Webb), ecology (V. Eckhart; L. Delph; and J. Ågren *et al.*), physiology (T. Dawson and M. Geber) and genetics (S. Grant; T. Meagher). Most chapters provide a thorough synthesis of the literature, but few present original experimental data or significant new ideas not already in the primary research literature. However, this is not necessarily a bad thing because information on plant gender is remarkably scattered among diverse journals and having it available in one source is a major benefit of this work.

Are there any important topics that are not covered in this volume? In general the editors have done an excellent job in providing broad coverage, however, a few areas could have been strengthened. One conspicuous omission is the complete absence of phylogenetic trees depicting the evolutionary history of gender dimorphism and traits associated with its evolution. To an outsider this might appear surprising given the plethora of trees appearing in the plant literature and considering the fact that dioecy was one of the first traits that was ever subjected to a thorough historical analysis in Donoghue's important paper² on evolutionary sequences published over a decade ago. Several chapters sing the praises of the phylogenetic approach, but without providing much solid evidence that reconstructing history has as yet provided many insights that were not already evident from microevolutionary investigations. Part of the problem here lies in the uncertainties in tree construction, the lack of resolution in molecular trees at the species level and problems with character mapping. Perhaps in another decade, phylogenies will have fulfilled the early promises of their staunchest advocates.

A related topic that is not covered in much depth is the issue of how often dioecy evolves via the monoecious versus gynodioecious pathways. Here, phylogenetic information has proven useful. A recent analysis of the monocotyledons³ challenges an earlier claim⁴ that because monoecy and dioecy are often associated within genera the shift from monoecy is probably the most common route by which dioecy evolves. How distinct the pathways to dioecy always are and how often changes in gender are governed by major versus minor genes are central to resolving this issue. It is also significant that, in this book, sparse attention is paid to the role of nuclear–cytoplasmic interactions in controlling gender expression given their importance⁵. A large effort has been made by French and Dutch workers over the past two decades in understanding these interactions in *Thymus* and *Plantago*, respectively. Little of this work is discussed in this volume or in more recent studies on the role of metapopulation dynamics in the maintenance of these sexual systems⁶.

Plants provide experimental biologists with outstanding opportunities for field studies through the use of clonal material, the experimental manipulation of sex phenotypes and the application of genetic markers for measuring mating parameters. Much of the empirical data reviewed in this volume come from correlative studies and it seems probable that future research will involve a greater emphasis on testing theoretical models through the use of manipulative field experiments. Fortunately, one of the strengths of this book is that it provides plenty of guidance on the important questions that need to be addressed and guarantees that plants with gender dimorphism will continue to attract a disproportionate amount of attention in spite of their relatively low frequency among flowering plants.

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Fish and chips

Quantitative Fish Dynamics

by T.J. Quinn, II and R.B. Deriso

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Modelling of fish population dynamics has advanced and diversified immensely in the past few decades. In both theoretical and practical applications, model complexity has increased to account for spatially and temporally disaggregated processes within fish populations, and to account for dynamic interactions between the components of fish ecosystems. Recently, more sophisticated statistical and computational approaches (e.g. Kalman filter, Bayesian and state-space modelling) have been applied to estimate fish population parameters by incorporating more diverse types of data, and by accounting for differing error structures and uncertainty in models and data^{1–5}. Methods of quantitative decision analysis have also been applied to account, more rigorously, for uncertainty in the use of models and data for the provision of management advice^{2,3}.

These advances represent syntheses of diverse theory, methods and data, and have fuelled increasing sophistication in the application of population modelling within many fishery management settings. *Quantitative Fish Dynamics* should stimulate additional valuable syntheses of diverse theory and methods, deepen our understanding of their properties and ensure wiser applications of management modelling. The book covers a broad spectrum of the recent developments in quantitative fish dynamics, provides considerable theoretical and mathematical depth, and provides an excellent synthesis for many of these diverse developments. However, with its high level of mathematical detail the book might not be for the numerically faint-hearted.

In other recent books dealing with quantitative fish dynamics, many of the general theories and methodologies have been reasonably well covered^{6,7}. These books have provided relatively simple conceptual descriptions of the key models and the most elementary parameter estimation methods (e.g. linear regression and least squares for non-age structured, delay-difference and age-structured models). However, several major advances are poorly covered by previous books, especially advances in surplus production models, age- and size-structured models, spatially explicit models and methods for parameter estimation. For example, one recent book⁷ misprints and misinterprets the mathematical form of the Pella–Tomlinson model⁸, a well-known generalized surplus-production equation.