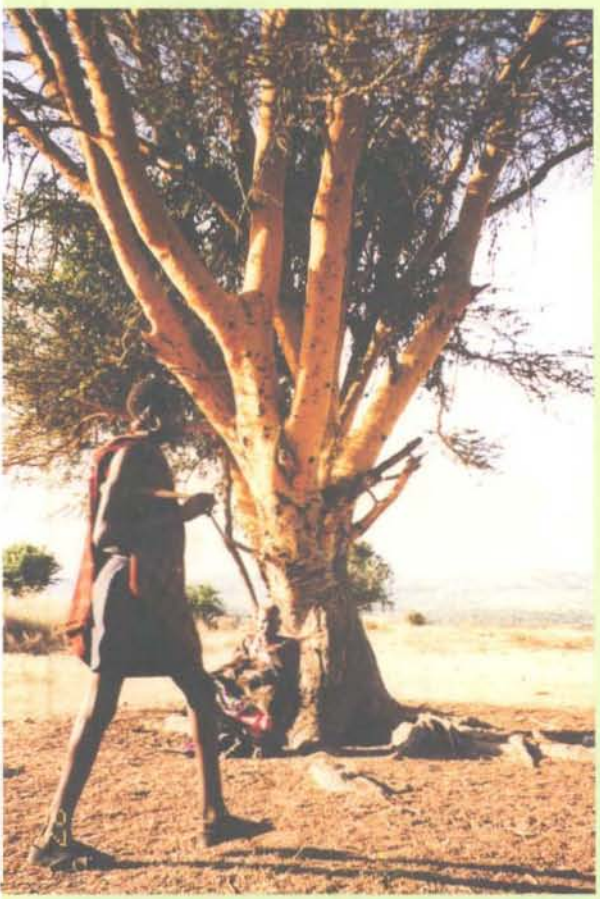
TECHNICAL HANDBOOK No. 35

Useful trees and shrubs for Kenya

Edited by Patrick Maundu and Bo Tengnäs
Principal illustrators: Nicholas Muema and Ann Birnie



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Nicholas Muema and Ann Birnie

World Agroforestry Centre

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World Agroforestry Centre—Eastern and Central Africa Regional Programme

2005

THE WORLD AGROFORESTRY CENTRE, formerly the International Centre for Research in Agroforestry (ICRAF), contributes to alleviating poverty, improving food security and conserving the environment through the use of trees, tree products and agroforestry. These goals are pursued through research, education and development activities. The production of this publication has been funded by the Swedish International Development Cooperation Agency (Sida).

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Top: *Acacia brevispica*, Mwala, Machakos District
Bottom left: Chief Maasai Laibon, Mokombo ole Simel, resting under an *Acacia xanthophloea* (fever tree), Loita, Narok District. His son in the foreground.
Bottom right: Making a canoe from a trunk of *Ficus sycomorus*, Mnazini, Tana River

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In memoriam—Caroline Agola

Caroline Agola was responsible for editing, designing and laying out this book. She worked diligently to produce this volume, but sadly she did not live to see the fruits of this work—she passed away on 22 December 2004, just after she had completed the layout.

Over the years, Caroline was involved in many similar productions: the first edition of *Useful Trees and Shrubs for Kenya*, and the *Useful Trees and Shrubs* volumes for Ethiopia, Tanzania, Uganda and Eritrea; *Wild Food Plants and Mushrooms of Uganda*; and *Edible Wild Plants of Tanzania*, to mention a few. Her meticulous eye and practical mind, the breadth and depth of her knowledge of biological science, and her tireless work have greatly contributed to the quality and importance of these productions.

The entire team involved in the production of this book would like to recognize Caroline's efforts. ICRAF and RELMA would like to recognize her enormous contribution to the field of agroforestry in the eastern African region. This book will remain a good testimony of her dedication and commitment.

Contents

Foreword

The interest in agroforestry and in promoting tree growing in rural areas has increased drastically during the last few decades. In the late 1970s and early 1980s, serious concern was expressed all over the world about looming energy crises in rural areas. Projects to promote tree planting to counteract the expected firewood crises were established in Kenya and in many other developing countries. From the 1980s, interest in the capacity of trees and shrubs to ameliorate soil fertility also grew and technologies were developed that would provide solutions to the energy crises and improve agricultural productivity.

Gradually, the interests of the farmers and pastoralists were put higher on the agenda. It was realized that farming systems are complex, with innumerable combinations of crops, trees and animals, and that this complexity is important as it provides multiple outputs and a safety net for the livelihoods of local people. Therefore, there is need for knowledge not only of a few exotic species of trees and shrubs, but of a whole range of woody species that are relevant and important for farmers and pastoralists.

Such knowledge was at that time either unavailable or not well synthesized. Earlier literature focused mainly on taxonomic descriptions and lacked detailed information on uses and propagation. Some small booklets were produced and published for Kenya during the 1980s followed by *A Selection of Useful Trees and Shrubs for Kenya* published by ICRAF in 1992.

Since then research has progressed and much more information has been gathered from local communities with regard to their preferences and uses of trees and shrubs. Therefore, a decade after the first edition was published, it was felt that there is need to incorporate all the new information and produce an updated book with more information on each species and with more species added.

I would like to commend the authors, Patrick Maundu and Bo Tengnas, and the principal illustrators, Nicholas Maundu and Ann Birnie, and all others who have taken part in the teamwork that generated, compiled and processed all the information contained in this very useful publication.

During the 1990s ICRAF evolved into the World Agroforestry Centre with a vision that by 2010, 80 million agricultural poor would get access to agroforestry research innovations that will improve their livelihoods and help sustain the global environment. This publication will go a long way in advancing this vision.

Popularization of the rich flora of trees and shrubs that exists in Kenya is an important element for conserving and continuing use of these resources. Indigenous knowledge on the usefulness of the flora is also important—in fact, as important as the conservation of the flora itself.

This publication is intended to be a handbook that is useful for a wide range of people. By making information on trees and shrubs available to a broad range of Kenyans, the World Agroforestry Centre hopes that more Kenyans will take an interest in tree growing and forest conservation. It is our sincere hope that the book will contribute to a greener Kenya!

Bashir Jama
Regional Coordinator
Eastern and Central Africa Regional Programme
World Agroforestry Centre

Acknowledgements

This publication is a result of a truly participatory process extending over close to 15 years. It draws heavily on an earlier book, *A Selection of Useful Trees and Shrubs for Kenya*, published by the then International Centre for Research in Agroforestry, ICRAF, in 1992.

This earlier publication was compiled by a team of people with technical input coming from Amare Getahun, Ann Birnie (who also drew many of the illustrations), Abineah Chavangi, Karin Fahlström, Alice Kaudia and Bo Tengnäs. Editorial input came from Jan Beniest and David Brett (who also oversaw the production). Many other people also provided inputs, among them: E. Barrow, D. Boland, N. Gachathi, R. Haller, D. Lowe, P. Maundu, F.W. Mbote, G. Mungai, P. Mung'ala, L. Omoro, F. Owino, A. Robertson, P. von Carlowitz and A. Wacira.

Since then, significant progress has been made in our understanding of Kenya's flora of trees and shrubs and how they are used in various parts of the country, thanks to research by both local and international organizations such as the World Agroforestry Centre (ICRAF), the International Plant Genetics Research Institute (IPGRI), the Kenya Agricultural Research Institute (KARI), the Kenya Forestry Research Institute (KEFRI), the National Museums of Kenya and institutions of higher learning. Working with farmers and local people has also widened our understanding of these plants. In the forefront in this area are the Ministry of Agriculture, the Forest Department and a number of NGOs, among them the VI Agroforestry Project, which now has a long history in the country.

In the early stages of compiling material for this book a group of people from different institutions contributed their knowledge at a workshop organized at KEFRI in Muguga, and another at Gede Museum in Kenya's Coast Province. The participants at these two workshops are listed in the appendix. The contributions made by the following experts deserve special mention as they contributed not only during the workshop but also by providing written information: J. Ahenda, F.N. Gachathi, S. Gitonga, G. Mashauri, M.T.E. Mbuvi, A.M. Mohamed, C.J.A. Mullah, B. Muok and T. Omenda, all of KEFRI, and S. Jembe, S. Kibet, P. Kirika, J. Muasya and M. Pakia, all of the National Museums of Kenya. A number of other persons contributed their knowledge as well: A. Birnie, M. Imbumi, J. Kimani of the Ministry of Agriculture, A. Mnyenze, B. Owuor and A. Robertson. Material was also extracted from other sources. It should be noted here that the production of the earlier book was followed by production of similar books for Tanzania, Ethiopia, Uganda and Eritrea that were published by the Regional Soil Conservation Unit (RSCU) of the Swedish International Cooperation Agency (Sida). The information gathered during these processes was useful also in developing this publication. Two prominent East African 'Messrs Trees' who have contributed from their wealth of knowledge deserve special mention: A.B. Katende of Uganda and C.K. Ruffo of Tanzania. We also thank Inga Hedberg, Associate Professor of Systematic Botany, Uppsala University, Sweden, for her advice on nomenclature and taxonomy.

Data for the distribution maps were extracted by a team of staff at the Kenya Resource Centre for Indigenous Knowledge (KENRIK) at the National Museums of Kenya led by R. Adeka and J. Wanjiku and assisted by J. Ayayo, J. Mutisya, R. Kamau, A. Mumbua and G. Otieno. The data were obtained from KENRIK and from sheets at the East African Herbarium. The plotting was done by N. Muema and R. Wamukoya. We are grateful to the National Museums of Kenya for the data and general support. GIS analysis for the preparation of other maps included in the book was done by G. Aike and F. Muchori of GIS Unit, ICRAF, with technical input from P. Maundu and Bo Tengnäs.

Most new illustrations for this book were prepared by N. Muema at KENRIK. A. Birnie provided important technical input. In addition, a large number of her illustrations that were prepared for earlier books have been used here. Some illustrations that originate from other sources and were used with permission in the earlier book have been used in this book too. ICRAF attempted to contact the original publishers for permission to use illustrations and successfully got in touch with the following, who were kind enough to grant their permission:

- Food and Agriculture Organization of the United Nations: *Acacia nilotica* in P.J. Skerman, *Tropical Forage Legumes*. Rome, 1977.
- Kenya Energy and Environment Organizations (KENGO): *Afzelia quanzensis, Senna (Cassia) siamea, Dombeya goetzenii, Faurea saligna, Maesopsis eminii, Olea capensis (O. hochstetteri), Piliostigma thonningii, Prosopis chilensis, P. juliflora, Terminalia spinosa, Vitex*

keniensis and *Ziziphus mauritiana* in W. Teel, *A Pocket Directory of Trees and Seeds in Kenya*, Nairobi, 1984.

- Mennonite Central Committee: *Phoenix dactylifera* in T. Gammell, *Date Palms in Kenya*, African Centre for Technology Studies (ACTS), Nairobi, 1989.
- Oxford University Press: *Cadaba farinosa* in F.R. Irvine, *Woody plants of Ghana,* Oxford, 1961
- Royal Botanic Gardens, Kew: *Cordeauxia edulis* in D. Prain (ed.), *Hooker's Icones Plantarum,* vol. 29, London, 1909; *Berchemia discolor, Boscia coriacea, Calodendrum capense, Entada abyssinica, Hymenaea verrucosa, Olea capensis (O. welwitschii), Salvadora persica* and *Zanthoxylum chalybeum* in various volumes of the *Flora of Tropical East Africa,* earlier published by Crown Agents for Oversea Governments and Administration and later in Rotterdam by A.A. Balkema.
- Zimbabwe. Department of Natural Resources. *Brachystegia spiciformis* and *Strychnos spinosa,* in R.D. Drummond, *Common Trees of the Central Watershed Woodlands of Zimbabwe*, Harare, 1981.

The copyright for all illustrations mentioned above remains with the publishers and individual illustrators. The copyright of photos rests with the photographers. ICRAF would also like to acknowledge its dependence on other sources of material that are listed in the bibliography and apologizes to any publishers and authors with whom it was not able to make contact and would be happy to hear from them so that due acknowledgment may be made in any future edition of this publication.

Production of this book would not have been possible without the farmers, pastoral groups and other local communities in Kenya who over the years have shared their knowledge on trees and shrubs with researchers.

The editors enjoyed the efficient administrative support and good spirit of Yasmin Kalyan. She assisted with word processing at various stages and also made arrangements for the workshop in Muguga. Anna Karlsson-Lindqvist coordinated the final stages of the book and oversaw its production. Language editing and layout were handled by Caroline Agola, as always with the highest degree of professionalism.

Last but not least, the financial support received from Sida—both directly and through the Regional Land Management Unit (RELMA)—is very gratefully acknowledged.

Patrick Maundu *Bo Tengnäs*

Introduction

This handbook has been prepared with the purpose of giving answers to everyday questions related to useful trees and shrubs in Kenya and to provide helpful information for people working with them at a practical level.

Botanical and ecological diversity

Plants are essential for human existence. Some species are the source of the world's staple foodstuffs, while others are important sources of herbal medicine, drugs and their derivatives. Other species provide products or services that people depend on directly or indirectly, for example by fixing nitrogen in the soil, conserving soil and water, providing shade, fodder for livestock, fibre, materials for construction—the list is a long one!

Kenya owes its high biological diversity to the enormous variation in climate and topography, which results in a great range of habitats (see maps on Colour plates 14 and 16). This in turn has provided a wide variety of ecological niches and a rich flora of about 7,000 native plant species. Several hundred of these are endemic to the country. The land rises from the hot and humid coast adjacent to the Indian Ocean and adjoining dry lowlands of the east and north-east of the country to the cool highlands and mountains at the centre of the country, where the Aberdare Range (3,999 m) and the snow-covered summit of Mt Kenya at 5,199 m are the dominating features. The land drops abruptly in the west to the floor of the Great Rift Valley with numerous lakes, the main ones being Turkana, Baringo, Nakuru, Naivasha, Magadi and Amboseli. The Rift Valley splits the Kenyan highlands into eastern and western highlands, the later rising to over 3,000 m in the Mau Range and Cherangani Hills. The western highlands give way to the lowlands of the Lake Victoria basin in the south-west. Mt Elgon (4,321 m), on the border with Uganda, is the highest mountain of the Western Highlands. The rest of the country is interspersed with smaller mountain ranges, mountain peaks and hills, but these are still capable of influencing the local climate significantly. This wide altitudinal range has a great influence on temperatures and precipitation, both of which are important factors influencing vegetation types and land use. Day maximum temperatures range from about 40°C in the dry north to sub-zero on the high mountain peaks. Precipitation ranges from about 150 mm annually in the dry low-lying deserts of the north and north-east, such as the Chalbi Desert, to over 2,000 mm on the slopes of Mt Kenya and parts of western Kenya. Likewise, vegetation changes enormously from almost bare rock in the deserts of the north, through *Acacia–Commiphora* bushland and scrub to grassland with scattered trees, tropical rain forests, dry highland forests to afro-alpine vegetation on the higher mountains and mangrove forests at the coast.

Ethnic diversity

Along with the high diversity in physical features is a high cultural diversity. Kenya is a meeting point of three major groups of people: Bantu, Nilotic and Cushitic speakers, each with a diversity of language groups (see Table 1 and map on page 4).

Altogether, over 55 distinct languages are spoken in Kenya, most of which have a number of dialects. Some of the ethnic groups speaking these languages, such as the Kikuyu and the Luo, comprise many millions of people, but others, like the Suba and the El Molo, are small and their languages are on the verge of extinction. The cultural landscape has been enriched significantly by later migrants from the Arabian peninsula, India and Europe. Each of these cultures bring with them a rich knowledge of local plant use accumulated over time through interactions with plants and the environment as a whole. It is through this knowledge that we discover plants with desired characteristics such as good shade trees, timber trees, soil improvers and medicinal plants—all of which can be tapped to enhance community livelihoods.

Table 1. Linguistic Classification of the Communities of Kenya

- **BANTU**
  - **COASTAL**
    - **Malakote**[1]
    - **Pokomo**
    - **Mijikenda**
      - Giriama[2]
      - Chonyi
      - Jibana[3]
      - Kauma
      - Ribe[4]
      - Kambe
      - Rabai[5]
      - Duruma
      - Digo
    - **Taita**
      - Dabida
      - Kasigau
      - Saghala
    - **Taveta**
    - **Segeju**
  - **CENTRAL**
    - **Kikuyu**[a]
    - **Embu**
    - **Meru**
      - Imenti
      - Tigania
      - Igembe
    - **Tharaka**
    - **Mbeere**
    - **Kamba**[b]
      - Chuka
      - Mwimbi
      - Igoji
      - Muthambi
  - **WESTERN**[19]
    - **Kuria**
    - **Kisii**
    - **Suba**
    - **Luhya**
      - Bukusu
      - Tachoni[6]
      - Marachi
      - Khayo
      - Samia
      - Nyala
      - Marama
      - Tsotso
      - Kakelelwa
      - Maragoli
      - Tiriki
      - Nyore
      - Kisa
      - Idakho
      - Isukha
      - Kabras
      - Wanga
      - Gishu
- **NILOTIC**
  - **LAKE**[20]
    - **Luo**
  - **HIGHLAND**
    - **Kalenjin**
    - Nandi
    - Terikeek[7]
    - Kipsigis
    - Ogiek[8]
    - Keiyo
    - Tugen
    - Marakwet
      - Sengwer
      - Endo
    - Kony[9]
    - Sabaot
    - Bongomek[10]
    - Pokot
  - **PLAINS**
    - **Maasai**[c]
    - **Samburu**
    - **Ilchamus**[11]
    - **Teso**
    - **Turkana**[d]
- **CUSHITIC**
  - **OROMO**
    - **Korokoro**[12]
    - **Gabra**[13]
    - **Burji**
    - **Borana**
    - **Orma**
    - **Sanya**
    - **Sakuye**
    - **Yaaku**
    - **DAHALO**[22]
  - **SOMALI**
    - **Daasanach**[14]
    - **Elmolo**[15]
    - **Rendille**
    - **Somali**
    - **Boni**
      - Murule
      - Gare
      - Degodia
      - Ajuran
      - Ogaden
        - Geri Kombe
        - Bah Geri
        - Magabul
        - Aulihan
        - Muhammed Zubeir
        - Abudwaq
        - Abdalle
      - Issaq[17]
      - Harti[17]
      - Shekhaal[18]
- **OTHERS**
  - **Swahili**[16]
    - Bajun
  - **Arabic**
  - **Asian**
  - **European**
  - Others

Key to the superscript numerals

1 = Ilwana
2 = Jiriama
3 = Jihana
4 = Rive
5 = Rahai
6 = Nandi x Maragoli
7 = Terik = Nyang'ori
8 = Also affiliated to Kisii and Maasai
9 = Elgony (Kony), Sebei in Uganda
10 = Pok or Pongomek
11 = Njemps, Ilchamus
12 = Munyo
13 = Linguistically not distinct from Boran
14 = Ng'i-Marille (by Turkana), Shangila (by Gabra/Borana), Geleba (by Rendille)
15 = Classified as Cushitic but now speak a dialect closely related to Samburu
16 = Bantu (and others) x Arabic (and others)
17 = Mainly in urban centres
18 = Mainly religious and urban
19 = interacustrine Bantu
20 = River–Lake Nilotes
21 = Divided into Southern and Eastern speakers. Both the Oromo and Somali divisions belong to the Eastern Cushitic speakers.
22 = The Dahalo, near the Tana River, are the only Southern Cushitic speakers in Kenya.

Further divisions

- **[a]Kikuyu**
  - Mathira
  - Gicugu
  - Ndia
- **[b]Kamba**
  - Masaku
  - Kilungu
  - Kikumbulyu
  - Ngulia
  - Kitui
  - Ngura
- **[c]Maasai sub-groups**
  - Ilkisonko
  - Matapato
  - Ilkaputei
  - Ilpurko
  - Ildalalekutuk
  - Ildamat
  - Ilkeekonyokie
  - Illoodokilani
  - Iloitai
    - Ilkidong'i
  - Isiria
  - Ilmoitanik
  - Ilwuasinnkishu
  - Iltiamus
  - Laikipiak
  - Ilsampur
- **[d]Turkana**
  - Ng'isonyoka
  - Ng'ibelai
  - Ng'ikebootok
  - Ng'esetou
  - Ng'ikamatak
  - Ng'imasuk
  - Ng'ing'atunyo
  - Ng'inyang'among
  - Ng'iwoiyakwara
  - Ng'ilukumong...
  - Ng'igiramuk
  - Ng'kwatela
  - Ng'ikalacha
  - Ng'inyang'atom
  - Ng'iyapakuno
  - Ng'isiger
  - Ng'ikuniya
  - Ng'ikajik
  - Ng'ibochoros
  - Ng'imonia
  - Ng'ibelae
  - Ng'ichuro

Source: Maundu et al., 1999

Overexploitation of species

The twentieth century has brought more change for the people of Kenya than perhaps any other century. With a population growth rate of over 3.2%, demand for local resources such as fuelwood and wood for construction has been increasing, and with only 20% of the land being arable the pressure for space to cultivate has been intense, with the result that natural vegetation has suffered most with some species now facing a real threat of extinction. For a long time, the focus in research and extension has been on a few exotic trees such as *Acacia mearnsii, Cupressus* spp., *Eucalyptus* spp., *Grevillea robusta* and *Pinus patula.* As a result the development and understanding of indigenous trees has lagged behind. This, combined with poor planning and reluctance to grow these indigenous trees to replenish lost trees, has reduced indigenous forest cover to less than 2% of land in the country. Some high-value species have been severely overexploited. Good examples include *Brachylaena huillensis* (muhuhu) and *Dalbergia melanoxylon* (mpingo), both of which were the backbone of the woodcarving industry until the late 1990s. The pencil cedar, *Juniperus procera,* has been poached continuously for poles and door frames, and the high extraction rate combined with its low rate of regeneration has now pushed this species to critical levels. Mvule (*Milicia excelsa*), Elgon teak (*Olea capensis*), Meru oak (*Vitex keniensis*) and East African camphorwood (*Ocotea usambarensis)* have long been declining due to exploitation for their hardwood, which is excellent for timber and furniture. In spite of this, there have been no concerted efforts to grow these species in plantations or on farms, and the country now has to import hardwood (often illegally) for the carving, furniture and timber industries. There is, therefore, an urgent need to adopt the replanting of these species, both in their original natural habitats and on the farm, where they can be a source of cash for rural people. In addition, policies that support the replanting of these trees should be adopted and implemented.

Underutilized species

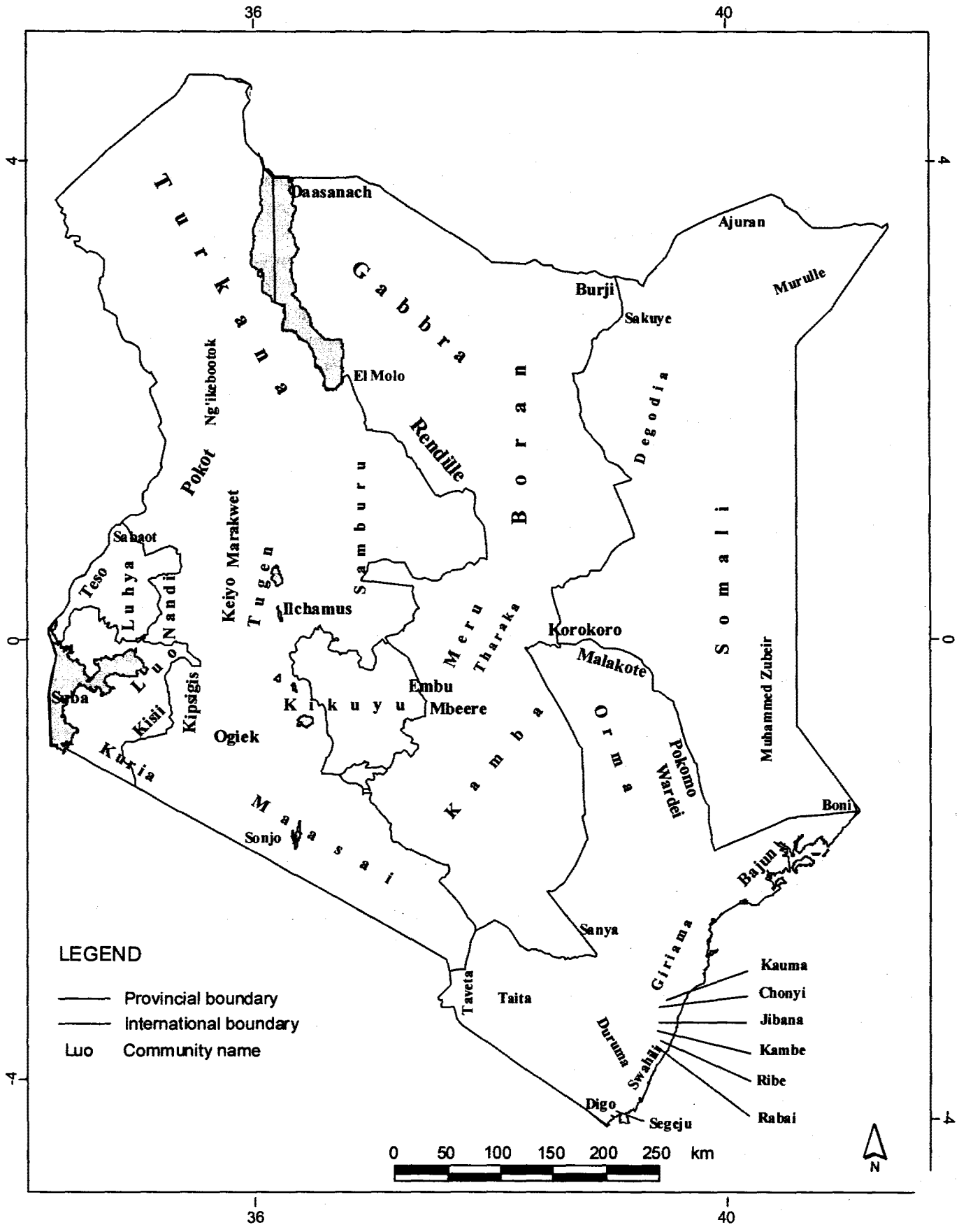
Most species presented in this book can be termed underutilized as their full potential is yet to be realized. However, the potential of a few indigenous species was recognized early on and they are now widely used. Good examples are the Nandi flame (*Spathodea campanulata*), podo (*Podocarpus* spp.), Cape chestnut (*Calodendrum capense*), Meru oak (*Vitex keniensis*), *Markhamia lutea* and *Croton megalocarpus.* Most of these are planted as ornamentals or shade trees. A great majority of indigenous trees are still in the wild and need to be brought to cultivation. One underutilized group is for hedges and live fences. Most people depend on kei apple (*Doryalis caffra*), *Plectranthus barbatus,* cypress (*Cupressus* spp.), finger euphorbia (*Euphorbia tirucalli*), *Croton megalocarpus* and a few others for these purposes. This book provides many more alternatives such as *Carissa* spp., *Saba comorensis* and *Landolphia* spp., which also bear important fruits, as well as *Acokanthera oppositifolia, Commiphora* spp., *Euphorbia candelabrum* and *Maytenus* spp. Food plants too are underutilized. In spite of their delicious fruit, most indigenous fruits are picked only from the wild. Among these are the rubber vine (*Landolphia kirkii*), tamarind (*Tamarindus indica*), the marula tree (*Sclerocarya birrea*), *Strychnos* spp., *Vangueria* spp., *Rubus* spp. and *Ximenia americana.*

Species introductions: the pros and cons

It would be hard to imagine a Kenya without some important introduced plants, e.g. fruit trees like mango and avocado, but also others like neem (now the backbone of the woodcarving industry and source of important medicinal products); *Grevillea* (a main source of fuelwood and now a key source of timber after the depletion of plantation timber); *Eucalyptus* spp. and *Acacia mearnsii*, or black wattle (both of which are a main source of poles and fuelwood), and others like *Senna siamea* and *Senna spectabilis,* which are important ornamentals. But some introductions have done more harm than good. *Prosopis*, or the mesquite, in northern Kenya has blocked rivers, made large areas useless and interfered with plant diversity. *Lantana camara*, or the 'curse of India', which is easily distributed by birds, is an aggressive colonizer that is not only expensive to eradicate but also a threat to other species and a hideout for tsetse flies. The later is a typical example of plants that were introduced with good intentions but have now got out of control. In addition to potential invasive species, introductions pose a high risk of bringing with them pests and diseases that can affect or even eradicate local species. In spite of all this, introductions are likely to continue to be made as humans will always find new species of interest as they move round the globe. While existing policies and laws regarding introductions need to be enforced, there is also a need to formulate comprehensive policies for controlling the expansion of invasive species.

Agroforestry, biodiversity and livelihoods

Indigenous trees provide local farmers with a wide range of products and services. With increasing pressure on land and decreasing size of land holdings, it is vital to promote the cultivation of a range of species on the farm to provide basic products and services the family needs. Multi-storeyed planting ensures the growing of many species with different uses over a relatively small area. By tapping into local knowledge resources, the characteristics of each tree or shrub may be determined, and farmers and extension workers can predict the best combinations, e.g. shade-tolerant shrubs planted under trees while climbing plants are grown next to appropriate trees to climb on. We can consciously and actively maintain high biodiversity at the farm level. A live fence, for example, need not be one species or one type



Language groups of Kenya

only. *Carissa spinarum* (*C. edulis*), a liana with delicious fruits but vicious thorns, makes a good protective hedge, and *Saba comorensis*, also a fruit plant, can form another type of hedge without thorns, and both can climb on an existing fence of another species. Many exotic species yield important benefits and therefore can be combined with indigenous trees. It is this potential diversity that offers future generations the choices they need to be able to re-design farming systems to suit new situations and to meet new demands.

Selection of the trees and shrubs included in this book

This book covers 333 species of trees and shrubs as main entries and a similar number for which further information is added under the 'Remarks' sections. Altogether, these still represent only about 25% of the woody plant species found in Kenya. Reference is made to *Kenya Trees, Shrubs and Lianas* (Beentje 1994) for a more comprehensive botanical coverage of most indigenous tree and shrub species. The selection of species included in this handbook was based on extensive consultation among scientists and with farmers and field staff (see Acknowledgements). Most species were included because of their potential for more extensive use by Kenyan farmers and pastoralists. Some well-known species, for example *Citrus* spp., apples, pears, plums and grapes, were excluded because they are so well known and widely covered in other publications.

Species included under 'Remarks' are those for which there was related or interesting information available but it was judged insufficient to justify inclusion as a main entry.

Clearly, many other species that might be worthy of coverage in a handbook such as this have been omitted, and the authors would be happy to receive comments on this.

Medicinal use of wild plants

Many of the plants described in this book are also known to be used as medicines for treating human and livestock diseases. Often, wild plants provide the only medicines cheaply and readily available to many rural dwellers in Kenya, as is the case in many other developing countries in the world. They are also a source of many active ingredients in the industrial manufacture of pharmaceuticals. However, local knowledge on precise methods of preparation and dosages is needed, and the guidance of an authentic herbal practitioner should always be sought before using these plants medicinally. This is important as the side effects and active compounds for most of them have still not been precisely determined.

A note for genetic and information prospectors

Most of the information on the uses of the species included in this book has been obtained from local communities, and such knowledge belongs to the communities concerned. Any proposed commercialization of this intellectual property, and the associated genetic resources, should be initiated in good faith with acknowledgement to and the full participation and knowledge of the relevant peoples.

Notes on the contents and use of this book

This handbook consists of six major sections:

- This introduction with an illustrated glossary of botanical terms
- Part I: A list of the common (vernacular) names for the species included
- Colour plates of selected species or their products
- Part II: The main section, which describes the species with regard to their ecology, uses and methods of propagation and management
- Part III. A summary table listing uses of the species
- A list of families and species and an index of species with page references to text as well as to colour plates where applicable.

If you wish to find information about a particular plant but know its name only in your own language:

1. Look for the language you want in the list of common names (the languages are organized alphabetically)
2. Find the name you are looking for in that list
3. Check the scientific (botanical) name that is listed next to it
4. Look up the page for that plant in its alphabetical place in the main section of the book (or simply go to the index at the end of the book).

Common names

Although the inclusion of vernacular names is potentially useful, it is recognized that there are two limitations associated with their use in this book—variable spelling and the existence of several dialects within a particular language. The editors would be glad to receive feedback on correct names and spellings as well as missing alternative spellings.

Description

Proper identification of a tree or a shrub is of paramount importance if it is to be planted for a specific use. Striking or important identifying characteristics have been emphasized in bold type. All sizes should be taken only as a rough guide as there can be great variation in the sizes and shapes (habits) of the trees themselves and of various parts such as the leaves.

Ecology

The Agroclimatic Zones listed for each species are shown on the agroclimatic map (see Colour plate 16). Occasionally indications are provided on the time of the year when the tree is usually in flower or fruit. It should be noted, however, that this varies a great deal from year to year and from area to area as rainfall patterns and other factors are not uniform.

Uses

It is important to note that the uses listed are those that have been *reported or deemed to be worth reporting*. The use of

trees and other plants in herbal medicine is a huge subject, and for several reasons this book does not provide details on local preparations and administration of herbal medicines.

Propagation

Most trees and shrubs are propagated through seed but often vegetative reproduction is possible.

If a species is propagated by seed, information is given on the number of seeds per kilogram, seed properties with regard to storage, simple pre-sowing treatment (if required or recommended) and whether the species can best be raised through direct seed sowing at the desired site, seedlings raised in a nursery (the word 'seedlings' is used to indicate this method), or by collecting naturally growing seedlings from the wild for transplanting at the desired site (the word 'wildings' is used). When raising seedlings in a nursery, seeds can either be sown in seedbeds for germination and later pricked out into containers or directly in containers. For species well suited for sowing in containers this method is mentioned. When no particular method is mentioned, this indicates that sowing in a seedbed for germination and subsequent pricking out is likely to give the best result.

Before sowing, seed of many species should be treated to encourage germination. Different species require different treatment. The most common method of seed treatment is soaking in cold water, or immersing the seed in hot water then allowing the water to cool and the seed to soak in it for some time. In fact, using water in the right way for seed treatment solves most problems relating to germination. However, for some seed other methods are recommended. Some seeds with a hard shell germinate better if cracked, but this should be done only lightly to avoid damaging the inner part of the seed. Seeds with a wing often germinate better if the wing is removed ('de-winging'). For yet other seeds germination may be enhanced if the hard seed coat is nicked with a knife or a nail clipper. Only a small nick is required and care must be taken not to nick the end of the seed where the germ is located. Nicking seed is time consuming and can only be recommended for small quantities of seed. The different forms of seed treatment generally work because they improve penetration of water into the seed, which in turn stimulates germination. Seed should be sown immediately after treatment.

Some species are easy to multiply vegetatively. An advantage with vegetative multiplication is that the 'new' trees and shrubs obtained by this technique have exactly the same characteristics as the one from which they originated since they are genetically identical. They also often grow quicker than seedlings. The more common vegetative multiplication techniques listed are use of cuttings and root suckers. Other approaches—grafting, air layering, budding, etc.—have not been tried for many species and require more complicated techniques that are not elaborated on in this handbook.

Seed

The length of time for which seed can be stored is indicated under the sub-heading 'storage'. The information given is as precise as is available, but readers are encouraged to carry out their own experiments. If the text indicates that seeds can be stored, then unless otherwise stated, the reader should assume that this means they should be well dried and then kept dry and cool to prevent mould and insect infestation. Insect attack can also be prevented or reduced by mixing the seeds with ash and keeping them in tightly closed containers. Check seed once in a while during storage and take action immediately if there are signs of damage.

Management

Several management techniques allow tree growers to optimize or maximize tree and shrub products or services. The most common practices associated with management involve removing parts of the tree or shrub by pruning roots or branches, coppicing (cutting the main stem for the stump to resprout), lopping (cutting branches, e.g. for fodder or firewood), or pollarding (cutting the whole crown but leaving the main stem to resprout). Other management practices (e.g. thinning and weeding that reduce competition for light, nutrients and water) aim at improving the development of the plant. The relative growth rate of the different trees and shrubs is also mentioned as far as this was known.

Remarks

Some of the available knowledge on certain trees and shrubs could not be accommodated under any of the specific headings mentioned above. Such information has been included as a remark if it was deemed to be useful. Comments on related or similar species are also included under this heading.

Illustrations

Line drawings have been included for each main entry. It should be noted that habit (general shape of the tree) is a very variable feature and so are leaf shapes.

Distribution maps

The maps in the species accounts section indicate localities where specimens of each plant have been collected or sighted by botanical collectors and other workers over many years. Most of these specimens are stored at the East African Herbarium at the National Museums of Kenya in Nairobi. These maps should, however, not be regarded as providing a definite and complete picture of each species' distribution in Kenya as it may also occur in other areas not represented in the Herbarium collection. Records from the Herbarium that appeared to be unreliable have been excluded, and localities where the species is known to occur but from which it is not represented in the Herbarium have occasionally been added. The latter is more common in the case of plants with cumber-

some or fleshy parts that are hard to collect, transport or preserve. The coverage for cultivated species is poor in the Herbarium because generally botanists seem to be keener on the natural flora than on commonly planted exotic trees. For some exotic species that are widely planted, including a distribution map was deemed not meaningful as the records may not be a good representation of where the species are actually grown.

Further reading

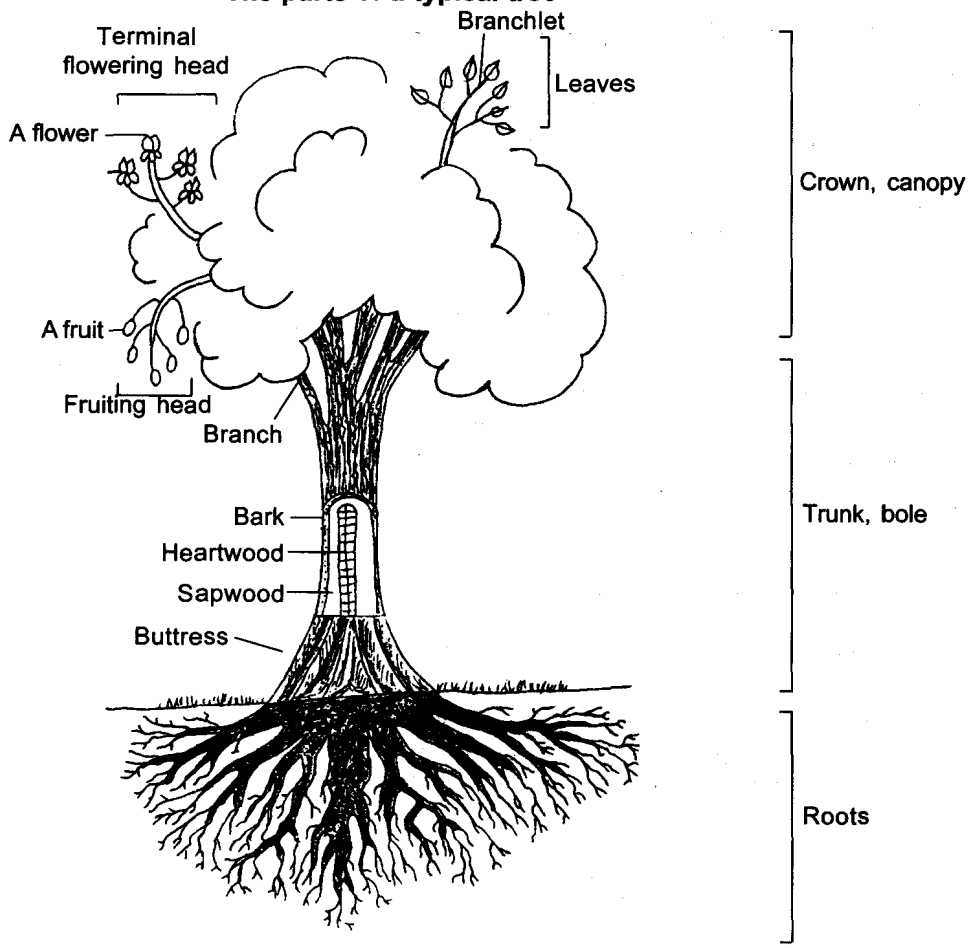
Many books providing useful information on trees and shrubs have been published during the last few decades. Nowadays the Internet is a useful source of information. This book does not provide exhaustive references to main tree and shrub species, but a few specific references are included. Reasons for choosing these books as suggested further reading were to:

- Give hints on the occurrence and uses of the species in other parts of Africa, and especially in the countries neighbouring Kenya
- Provide details from Asia on some Asian fruit trees and other trees from Asia that have been introduced into eastern Africa
- Provide information on where colour photos of the species can be found
- Provide a source of further details on specific uses such as medicine and veterinary medicine, beekeeping, agroforestry, firewood, on leguminous trees and shrubs for soil improvement, and edible species.
- Provide additional reading suggestions and open a window to the world literature on the trees of Africa
- Provide sources of more detailed information on particular areas of Kenya, e.g. Bungoma.

Details on the books and database referred to at the end of each species account can be found in the Bibliography, pages 475–477.

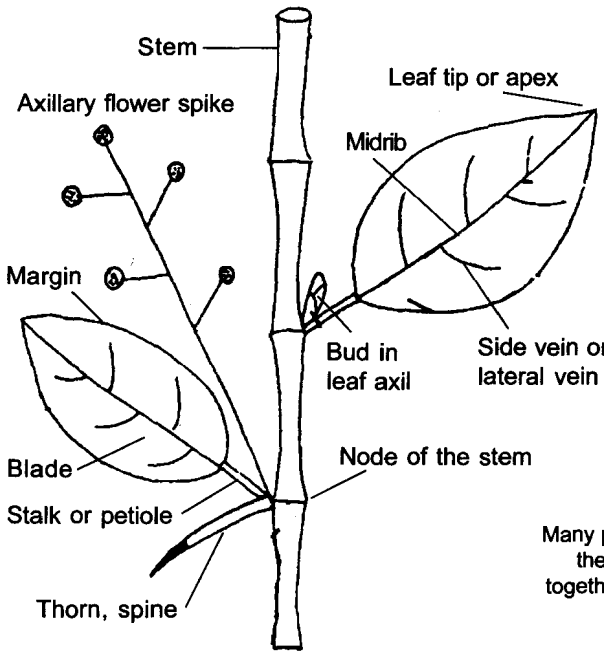
Illustrated glossary of botanical terms

The parts of a typical tree

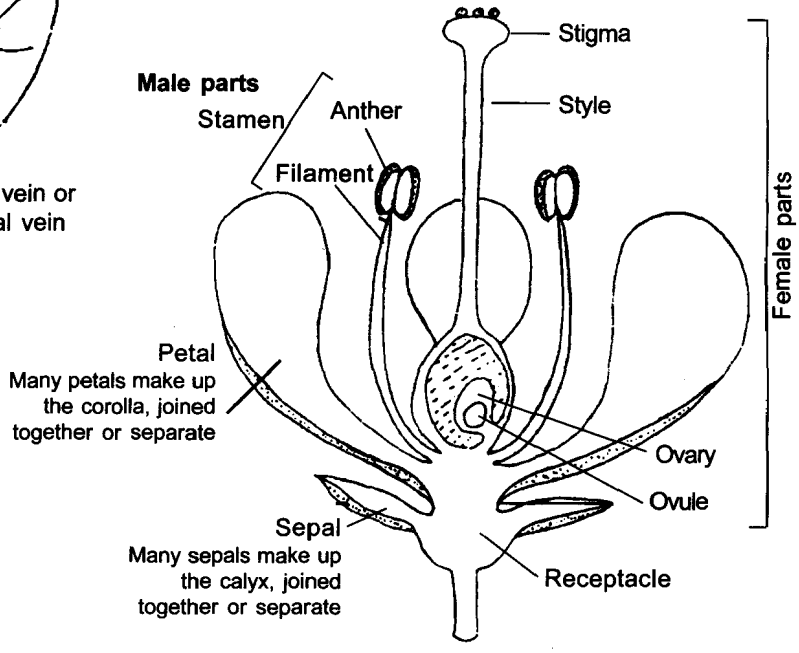


Leaves and stems

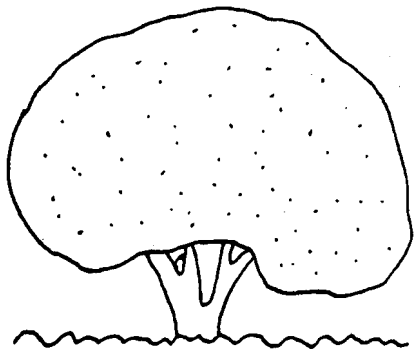
Diagram showing two simple leaves alternate on a stem



Diagrammatic section through a typical flower

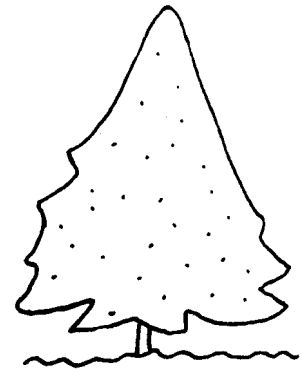


Tree shapes

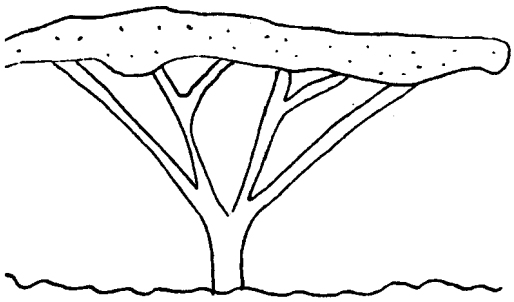


Rounded crown, dense, shady canopy

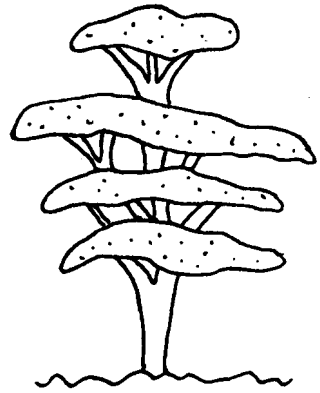
Narrow open crown, light shade



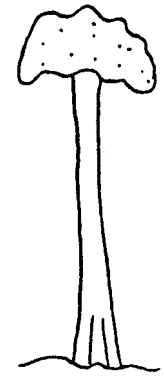
Conical crown



Flat-topped, spreading crown

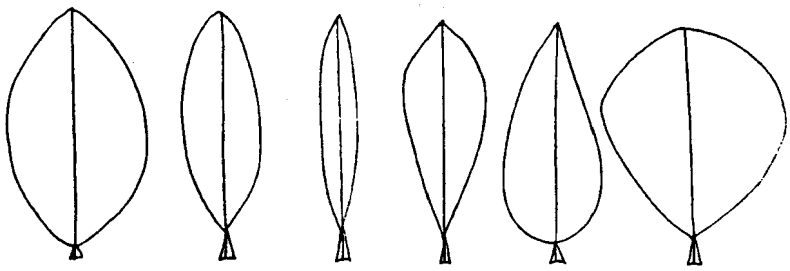


Canopy in layers

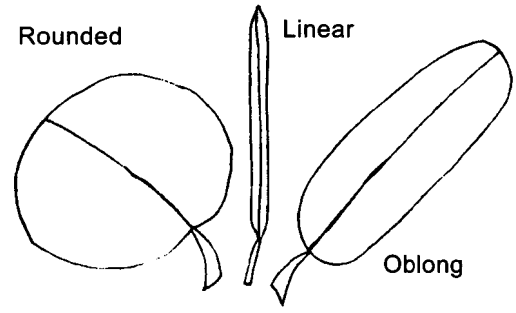


Tall bole, small dense crown

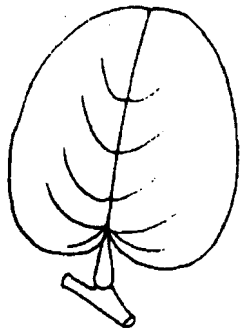
Leaves



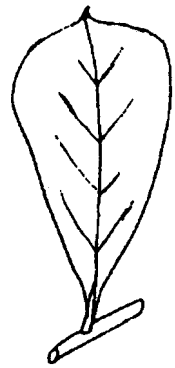
A variety of simple oval-shaped leaves



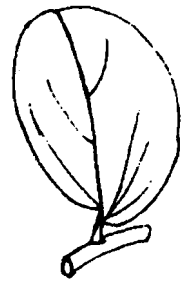
No leaf stalk, sessile



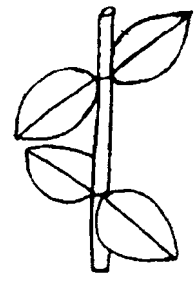
Leaf base heart shaped



Leaf base narrowed



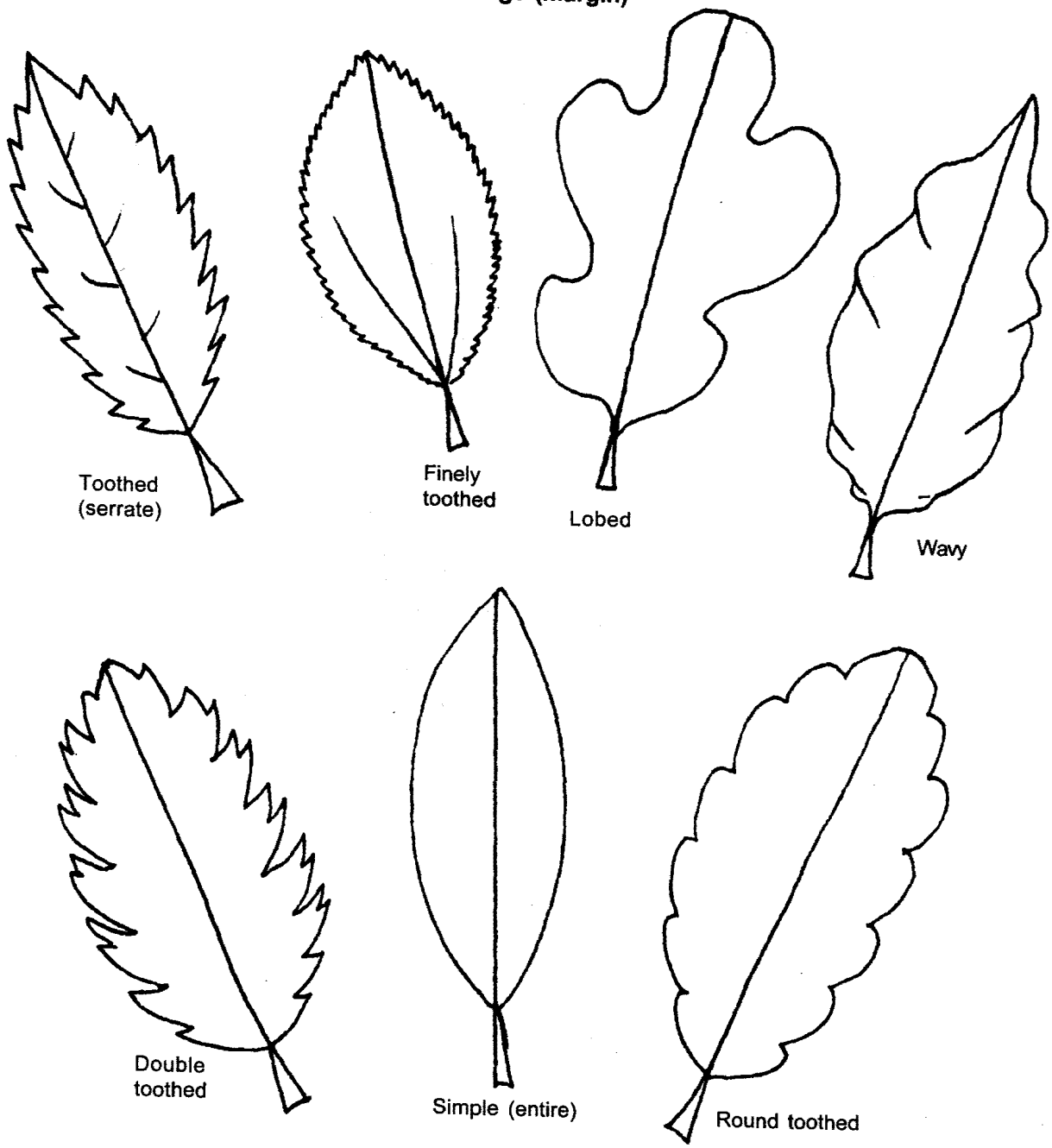
Leaf base unequal, asymmetric



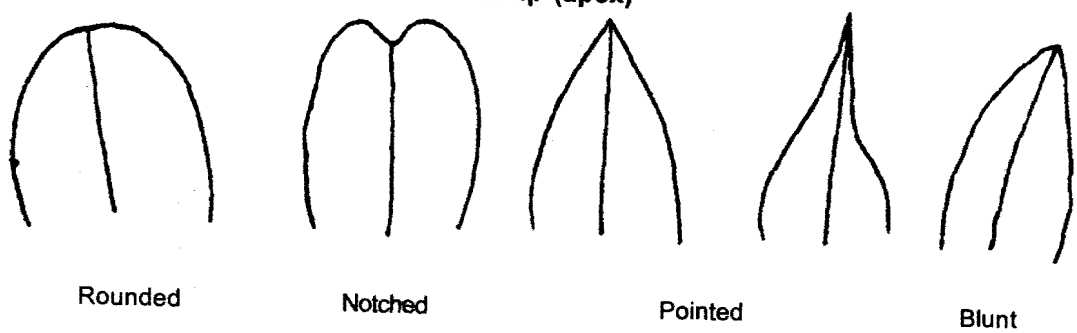
Opposite pairs of leaves

Four-whorled leaves

Leaf edge (margin)

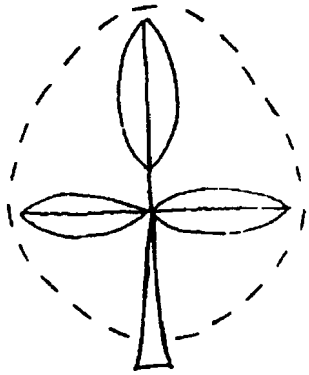


Leaf tip (apex)

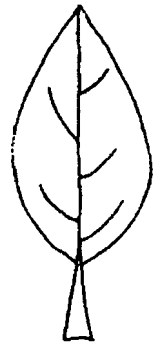


Leaves may be simple or compound

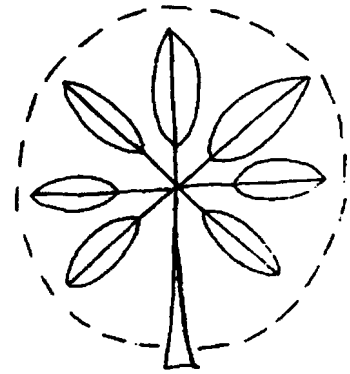
A compound leaf is a leaf whose blade is divided into smaller leaflets



A compound trifoliate leaf
Three leaflets, e.g. *Rhus*

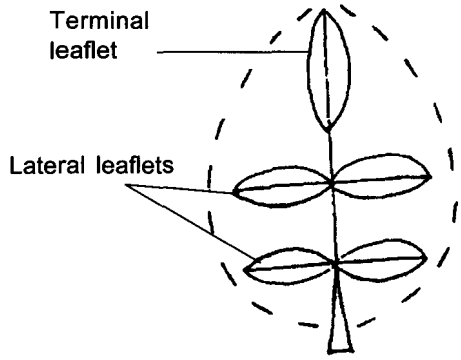


A simple leaf



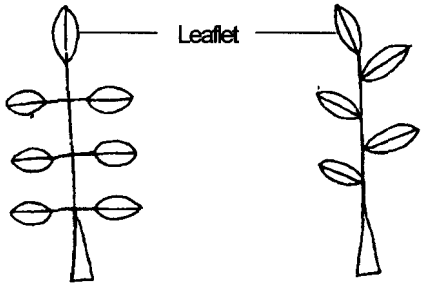
A compound palmate leaf (digitate)
Many leaflets spread like fingers of the hand, e.g. *Adansonia*

A compound pinnate leaf

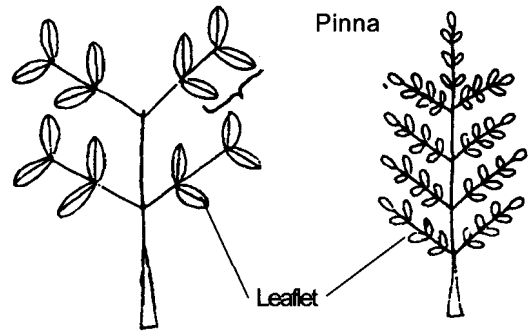


Five or more leaflets arise on either side of the leaf stalk, resembling a bird's feather (Latin *pinna*: wing)

Pinnate compound leaves are of several types.
Those with very small leaflets have 'feathery leaves'



Compound pinnate leaves
Once-compound leaves, e.g. *Markhamia*



Two pairs of pinnae Four pairs of pinnae
Twice-compound leaves (bipinnate), e.g. *Acacia* spp.