

MACROSCOPIC IDENTIFICATION OF MOST
IMPORTANT IRANIAN WOODY SPECIES

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MACROSCOPIC IDENTIFICATION OF MOST IMPORTANT
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By

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INTRODUCTION

The last one hundred years have witnessed the evolution of agricultural science from largely empirical arts into the realm of applied science. The science of forestry has also evolved as a result of great advances in our knowledge.

Man's first conscious interests in the forest and trees are recorded in the history of old nations, such as China, India, Asia Minor, Greece and Persia. The interest in choosing suitable woods for different uses has been a highly developed art for thousands of years especially in cabinetmaking. Certain uses of species of wood in ancient palaces testify to the height to which this art was developed.

Since forests affect the general welfare and prosperity of a nation, they have always been regarded as an important natural resource. They are, in fact, the only replenishable resource, which adds to their importance. The great role in our lives played by the products of the forest tends to stimulate research in order to bring about more practical usages in this field.

Forestry has been regarded as a science in Iran ever since the first agricultural college was established 34 years ago, but a real scientific approach to forestry problems dates back only 15 to 20 years. Progressive improvement in the handling of Iranian forests is largely due to the activities of Professor Saii, late professor of forestry at the University of Tehran.

Research in the field of forestry and forest products in Iran is directed by the Forest Products Laboratory, University of Tehran, and by the Research Department of the Iranian Forest Service.

Iran has one of the highest per capita consumptions of forest products in Asia. Future requirements of Iran and economic advantages should stimulate better management, utilization and export trade in forest products.

The first step to establishing better practice in forestry and forest products utilization in Iran is to define present deficiencies and to recommend remedies. The writer has tried to describe the problems confronting the wood using industries in Iran and he hopes that this analysis may serve as a guide to Iranian foresters and private wood industries to stimulate acceptance of better forestry practice and to introduce more intensive forest products utilization methods.

C H A P T E R I
FOREST COMMUNITIES IN IRAN

FOREST COMMUNITIES IN IRAN

1. General

The earth's surface may be divided into areas which support regional biogeographic units. Such units are climatically controlled for the most part and are more extensive regional groupings of somewhat smaller but rather more definite communities of organisms. Vegetation dominates the biotic scene and these regional biogeographic units often carry the name of the dominant plant life form, e.g. forest, grassland, or shrub.

In a region of environmental variation, such as Iran, these large vegetation categories, such as forest, occupy widely scattered areas of suitable environment, and since the environments of the areas differ, the forests occupying them also differ. A resumé of the distribution and composition of the main forest communities of Iran follows.

The community nomenclature used in this paper follows that of the Zurich-Montpellier school of geobotany. Since ecological studies of Iran are not as yet extensive, the treatment must remain general.

It should be also pointed out that natural vegetation is more or less lacking in some parts in Iran, as it is in all regions long occupied by man. The vegetation available for study thus reflects man's long and continuous impact. Cultivation, gathering of firewood, grazing, disease and fire all exert drastic effects. More recently plantings and the introduction of exotic species have further altered the composition of the vegetation.

1

2. Distribution of Forest Communities in Iran

A. Caspian Sea Coastal Region

If we examine with inquiring eyes every tree in the Caspian zone, especially near the sea coast, we may be able to read the story of the forest communities which in certain cases no longer exist.

Although it is not advisable to wait for regrowth of new forest communities, it is possible to reconstruct a picture of plant communities as they once existed by examining different places with the same climatic and geological conditions.

Before their destruction for fuelwood and cultivation there were oak communities in a plain along the Caspian seashore. These were almost a pure type (Quercetum), composed of Quercus castaneaefolia C. A. M.

There are still in existence some remnants of this oak forest, but most of it has been destroyed and replaced by agricultural lands.

At moderate elevation (less than 1000M) a short distance inland from the coast, there is another community of oak and hornbeam, which is composed of Quercus castaneaefolia C. A. M. and Carpinus betulus L.; this community is designated as Querceto-Carpinetum.

In some instances where oak has been destroyed, Carpinus betulus L. dominates. The resulting community is designated Carpinetum.

On some coastal slopes we find a pure community of Parrotia persica D. C. in place of the oak type, while further from the sea shore but at the same altitude is situated a mixed community of Parrotia persica D. C. and Carpinus betulus L., known as Parrotieto-Carpinetum.

It appears that there is a great deal of similarity in ecological requirements for Quercus castaneaefolia C. A. M. and Parrotia persica D. C.

At higher altitudes than the preceding there occur pure stands of beech Fagus sylvatica L., forming a beech community, designated Fagetum. Locally, Carpinus betulus L. occurs with beech in mixed stands of Fageto-Carpinetum.

In addition to these more widely ranging forest communities in the Caspian province there exist locally other stands of special interest. Some of these are the Cupressetum, in which dominant species is Cupressus sempervirens var: horizontalis Targ. and the Buxetum, which exists in coastal areas and produces very dense forests. The dominant species of this community is Buxus sempervirens L.

Beside these prominent forest types there are other plant communities which in many cases do not produce an abundance of timber. On the slopes of the Elburz mountain chain in the coastal region there are shrub communities of the pomegranate shrub Punica granatum L., designated punicetum, of pomegranate and Rhamnus (Pumcetum-Rhamnetum), and of Paliurus spina-christi Mill. (Paliuretum).

Some communities of the silk tree Albizzia julibrissin Willd., designated Albizzietum, and planted communities of Gleditschia caspica Desf., designated Gleditschietum, are other communities of interest in the Caspian forests.

In the latter species both pods and branches are cut for live-stock feeding. The increasing importance of these may be the result of their growing use as livestock feed.

Besides these there exist communities of Alnus, designated Alnetum, and Alnus and Pterocarya fraxinifolia Willd. (Alneto-Pterocaryetum) on sites with special microclimates and soil.

Stands of Populus hybrida M. B(Populetum hydridae) and a mixture Alnus with poplar (Alneto-populetum hybridae) are of interest in the Caspian region.

It seems clear that certain communities are a result of destruction of the forest by cultivation. For instance, that of Paliurus spina-christi Mill. (Paliuretum) is a local community and may be the result of disturbance of the forest in the coastal area.

Diagrams 2-3 show the various zones of the Caspian forests in the Elburz mountains. The native vegetation associated with different altitudes and other environmental conditions is indicated in these diagrams.

B. Other Provinces of Iran

Since the main forest resources of Iran are located in the Caspian region these forest communities are better known and more frequently studied. Except for western Iran in which there exists a xerophytic forest composed mostly of oak (Quercus persica J. et. sp.), and certain other small areas in the northwestern, south- and northeastern parts of the country, the other sections of the country are non-forested.

In the northeastern Juniper forests is another community of interest, the dominant species in which is Juniperus polycarpus E. Kock (Plate 1 - limestone mountain forest).

1

In the pistacio forests the dominant species are Pistacia khinjuk Stocks and Pistacia mutica F. et. M. (Plate 1- pistacio tree forest).

In the subtropical forest the species of interest is Ziziphus spina-christi (b) Willd.

CHAPTER II

IRANIAN WOODY PLANT SPECIES

Iranian Woody Plant Species

Wettstein's botanical classification is used in classifying the Iranian woody species. The species are divided into different types, chiefly dependent on the quality of the site, and the amount of precipitation the sites receive.

I. The Caspian forests belt is composed of:

<u>Acer insigne</u> . Boiss	<u>Acer laetum</u> C. A. M.
<u>Acer campestre</u> L.	<u>Acer opulifolium</u> . Willd.
<u>Albizzia julibrissin</u> . Willd.	<u>Alnus glutinosa</u> . Willd.
<u>Alnus subcordata</u> C. A. M.	<u>Buxus sempervirens</u> . L.
<u>Carpinus belutis</u> L.	<u>Carpinus orientalis</u> . Mill.
<u>Cercis siliquastrum</u> L.	<u>Crataegus ambigua</u> C. A. M.
<u>Cydonia oblonga</u> . Mill.	<u>Crataegus melanocarpa</u> M. B.
<u>Crataegus monogyna</u> (Willd.)	<u>Danae racemosa</u> L.
<u>Diospyros lotus</u> L.	<u>Evonymus latifolia</u> Scop.
<u>Evonymus velutina</u> . Fret. M.	<u>Fagus sylvatica</u> L.
<u>Fraxinus coriaria</u> L.	<u>Ficus carica</u> . L.
<u>Gleditschia caspica</u> Desf.	<u>Ilex aquifolium</u> L.
<u>Juglans regia</u> L.	<u>Jasminum fruticans</u> L.
<u>Jasminum officinalis</u> L.	<u>Ligustrum vulgare</u> L.
<u>Mespilus germanica</u> L.	<u>Olea europea</u> L.
<u>Melia azadirach</u> L.	<u>Morus alba</u> L.
<u>Paliurus spina-christi</u> . Mill.	<u>Parrotia persica</u> D. C.
<u>Pirus cordata</u> . Desv.	<u>Pirus communis</u> L.

<u>Populus hybrida</u> !	<u>Prunus divaricata</u> Ledeb
<u>Prunus mahaleb</u> L.	<u>Prunus avium</u> Moench.
<u>Prunus laurocerasus</u> . L.	<u>Pterocarya fraxinifolia</u> Lam.
<u>Punica granatum</u> L.	<u>Quercus cataneaefolia</u> C. A. M.
<u>Quercus iberica</u> Stev.	<u>Quercus macranthera</u> F. et. M.
<u>Quercus atropatena</u> !	<u>Rhamnus grandifolia</u> F. et M.
<u>Rhamnus frangula</u> . L.	<u>Rhamnus cathartica</u> L.
<u>Rhus cotinus</u> L.	<u>Salix fragilis</u> L.
<u>Salix caprea</u> L.	<u>Sorbus aria</u> Cranz
<u>Sorbus aucuparia</u> L.	<u>Tilia rubra</u> D. C.
<u>Ulmus campestris</u> L.	<u>Ulmus montana</u> S. M.

II. Juniper forests are composed of:

<u>Acer monspessulanum</u> L.	<u>Acer opulifolium</u> Willd.
<u>Amygdalus reuteri</u> . B. et. Bh	<u>Amygdalus spartioides</u> Sp.
<u>Celtis caucasica</u> . Willd.	<u>Cotonoeaster numularia</u> F. et M.
<u>Crataegus ambigua</u> . C. A. M.	<u>Fraxinus oxycarpa</u> W. End.
<u>Juniperus communis</u> Var: depressa. Boiss.	<u>Juniperus sabina</u> L.
<u>Lonicera caucasica</u> . Pall.	<u>Lonicera iberica</u> . M. B.
<u>Lycium ruthenicum</u> . Murr.	<u>Paliurus spina-christi</u> . Mill.
<u>Pistacia mutica</u> F. et. M.	<u>Pistacia vera</u> L.
<u>Populus hybrida</u> !	<u>Prunus divaricata</u> Ledeb.
<u>Pteropryum aucheri</u> Jet Sp.	<u>Ribes grossularia</u> L.
<u>Rhus coriaria</u> L.	<u>Salix acmophylla</u> . Boiss.
<u>Salix purpurea</u> L.	<u>Salix australior</u> And.

<u>Salix zygostemon</u> . Boiss.	<u>Sorbus aria</u> Cranz
<u>Viburnum opulus</u> L.	<u>Viburnum lantana</u> L.

III. The Western Oak Forests are composed of:

<u>Acer cinerascens</u> . Boiss.	<u>Amygdalus reuteri</u> B. et, Bh.
<u>Celtis caucasica</u> . Willd.	<u>Crataegus</u> sp.
<u>Daphne angustifolia</u> C..Kock..	<u>Ficus carica</u> var. <u>Johannis</u> . Boiss.
<u>Fraxinus</u> sp.	<u>Lonicera arborea</u> . Boiss.
<u>Lycium barbarum</u> L.	<u>Myrtus communis</u> L.
<u>Pirus glabra</u>	<u>Pirus syriaca</u> . Boiss.
<u>Pistacia khinjuk</u> . Stochs.	<u>Pistacia mutica</u> F. et. M.
<u>Platanus orientalis</u> L.	<u>Prunus</u> sp.
<u>Quercus persica</u> J. et Sp.	<u>Tamus communis</u> . L.

IV. The Pistacio forests are composed of:

<u>Pistacia khinjuk</u> . Stocks.	<u>Pistacia mutica</u> F. et. M.
<u>Amygdalus reuteri</u> . B et Bh	<u>Amygdalus scoparia</u> . Sp.
<u>Tamarix pallasii</u> . Desv.	<u>Tamarix mannifera</u> . Ehrenb.
<u>Acer cinerascens</u> . Boiss.	<u>Ficus carica</u> L.
<u>Fraxinus oxycarpa</u> . W. End.	<u>Fraxinus</u> sp.

V. The Subtropical forests are composed of:

<u>Acacia arabica</u> Willd.	<u>Acacia nubica</u> . Bth.
<u>Acacia seyal</u> Del.	<u>Calotropis procera</u> (Willd) R. Br.
<u>Capparis decidua</u> (Forsk. Edgew)	<u>Dodonaea viscosa</u> L.
<u>Euphorbia larica</u> . Boiss.	<u>Grewia asiatica</u> L.
<u>Grewia populifolia</u> Vahl.	<u>Haloxylon aphyllum</u> (Minkw) Iljin

Nannorhops ritchiana Wendl.. Nerium odorum Soland Var: Kotschyi. Boiss
Ochradenus baceaata Del. Periploca aphylla DC.
Phoenix dactylifera L. Prosopis specigera L.
Salvadora persica Garcin Stochsia brahuica Bth.
Tamarix stricta Boiss Zataria multiflora Boiss.
Ziziphus spina-christi (L.) Willd.

1

IRANIAN WOODY PLANT SPECIES

Family	Genus	Species
Aceraceae	Acer	
	"	campestris L.
	"	cinerascens Boiss.
	"	insigne Boiss, Bh.
	"	" Velutinum Boiss.
	"	laetum C.A.M.
	"	lobelii Ten.
	"	monspessulanum L.
	"	opulifolium Willd.
	"	platanoides L.
	"	tataricum ? L.
Anacardiaceae	Cotinus	coggygia Scop.
	Mangifera	indica L.
	Pistacia	L.
	"	khinjuk Stocks.
	"	mutica F.M.
	"	vera L.
	Rhus	coriaria L.
Apocynaceae	Nerium	odorum Soland Kotschy Boiss.
	Rhazya	stricta Dcm.
Aquifoliaceae	Ilex	aquifolium L.
Aroliaceae	Hedera	L.
	"	colchica C. Koch.
	"	helix L.
Asclepiadaceae	Calotropis	procera (Willd) R.Br.
	Daemia	cordata R.Br.
	Periploca	L.
	"	aphylla Decm.
	"	graeca L.
Berberidaceae	Berberis	L.
	"	crataegina D.C.
	"	integerrima Bge.
	"	" Macranthera Boiss.
	"	Serratifolia, Boiss.
	"	vulgaris L.
	"	" Brachybotrys Boiss.

Continued

Iranian Woody Plant Species - Continued

Family	Genus	Species
Betulaceae	Alnus	
	"	glutinosa Willd.
	"	subcordata C.A.M.
	Betula	alba L.
	Carpinus	Tourn.
	"	betulus L.
Borraginaceae	"	orientalis Mill.
	Corylus	avellana L.
	Cordia	crenata
	"	mixa L.
Buxaceae	Buxus	sempervirens L.
Capparidaceae	Capparis	decidua (Forsk.) Edgew.
Caprifoliaceae	Lonicera	L.
	"	arborea Boiss. Persica (Jet. Sp.)
	"	caucasica Pall. Rheader
	"	floribunda Boiss., Bh.
	"	iberica M.B.
	Viburnum	L.
Celastraceae	"	lantana L.
	"	opulus L.
	Evonymus	L.
	"	europaeus L.
	"	japonica
Chenopodiaceae	"	latifolius Scop.
	"	velutinum Fich., M.
	Haloxylon	Bge.
	"	ammodendron C.A.M.
	"	aphyllum (Minkw.) Ujin.
Combretaceae	Seidlitzia	rosmarinus Ehrenb
	Terminalia	L.
	"	belerica Roxb.
	"	catappa L.
	"	chebula Resz
Cornaceae	"	citrina Roxb.
	Cornus	L.
	"	australis C.A.M.
	"	mas L.
	"	sanguinea L.

Continued

1

Iranian Woody Plant Species - Continued

Family	Genus	Species
Dioscoraceae	Tamus	communis L.
Ebenaceae	Diospyros	L.
	"	kaki L. Fil.
	"	lotus L.
Elaeagnaceae	Elaeagnus	angustifolia L.
	Hippophae	ramnoides L.
Euphorbiaceae	Andrachne	colchica F. M.
	Euphorbia	L.
	"	larica Boiss.
	"	tirucalli L.
Fagaceae	Fagus	sylvatica L.
Gastanea	Sativa	Mill.
	Quercus	Tourn.
	"	atropatana ?
	"	castaneaefolia C.A.M.
	"	iberica Stev.
	"	macranthera F., M.
	"	persica J. et., Sp.
Hamamelidaceae	Parrotia	persica D.C.
Juglandaceae	Juglans	regia L.
	Pterocarya	fraxinifolia Lam.
Lythraceae	Lawsonia	inermis L.
Meliaceae	Melia	azedarach L.
	"	sp.
Mimosaceae	Acacia	Willd.
	"	arabica Willd. nilotica.
	"	mubica Bth.?
	"	seyal Del.
	Albizzia	Durazz.
	"	julibrissin (DC.) Willd.
	"	lebbek Benth.
	"	sp.

Continued

Iranian Woody Plant Species - Continued

Family	Genus	Species
Moraceae	Ficus	L.
	"	bengalensis L.
	"	carica L.
	"	" Genuina Boiss.
	"	" L. Johannis Boiss.
	"	" L. rupestris Housskn.
	Morus	L.
	"	alba L.
	"	nigra L.
Myrtaceae	Myrtus	communis L.
Oleaceae	Fraxinus	L.
	"	coriariaefolia Scheele
	"	excelsior L.
	"	oxycarpa Willd.
	Jasminum	Tourn.
	"	fruticans L.
	"	officinale L.
	Ligustrum	vulgare L.
Papilionaceae	Cercis	siliguastrum L.
	Ceratonia	siligua L.
	Colutea	L.
	"	arborescens L.
	"	persica Boiss.
	"	uniflora
	Gleditschia	caspica Desf.
	Halimodendron	halodendron (L.Fi.L.) Villm.
	Parkinsonia	aculeata L.
	Prosopis	spicigera L.
	Robinia	pseudoacacia L.
	Tamarindus	indica L.
Platanaceae	Platanus	orientalis L.
Polygonaceae	Atraphaxis	spinosa Boiss.
	Calligonum	L.
	"	comosum L. Herit.
	"	persicum Boiss., Bh.
	Pteroporum	aucheri J., sp.

Continued

Iranian Woody Plant Species - Continued

Family	Genus	Species
Punicaceae	Punica	granatum L.
Ranunculaceae	Clematis	L.
	"	ispahanica Boiss.
	"	orientalis L.
Resedaceae	Ochradenus	baccatus Del.
Rhamnaceae	Paliurus	spina-christi Mill.
	Rhamnus	L.
	"	cathartica L.
	"	fragula L.
	"	grandifolia F.,M.
	"	iranica Bornm.
	"	pallasii F.M.
	Zizyphus	Juss.
	"	nummularia (Burm.)
	"	spina-christi L. Willd.
	"	vulgaris Lam.
Rosaceae	Amygdalus	L.
	"	eburnea Sp.
	"	reuteri Boiss., Bh.
	"	salicifolia Boiss.
	"	scoparia Spach.
	"	spartioides Spach.
	Cerasus	Juss.
	Cotoneaster	Med.
	"	nummularia F.M.
	"	" Ovalifolia Boiss.
	"	vulgaris Lindl.
	Crataegus	L.
	"	ambigua C.A.M.
	"	lagenaria F.,M.
	"	melanocarpa M.B.
	"	monogyna (Willd) Jacq.
	"	" hirsutior Boiss.
	Cydonia	oblonga Mill.
	Hultemia	persica (Michx.) Bornm.
	Malus	pumila Mill.
	Mespilus	germanica L.
	Pirus	L.
	"	communis L.
	"	cordata Desv.
	"	glabra Boiss.

Continued

Iranian Woody Plant Species - Continued

Family	Genus	Species
Rosaceae	Pirus	salicifolia L.
	"	syriaca Boiss.
	"	" abbreviata Bornm.
	Prunus	Tourn.
	"	avium Moench.
	"	divaricata Ledeb.
	"	laurocerasus L.
	"	mahaleb L.
	"	microcarpa C.A.M.
	"	prostrata Labill.
	"	sp.
	"	tortuosa Boiss., Haussk.
	Rosa	L.
	"	anserinifolia Boiss.
	"	glutinosa Sibth.Sm.
	"	hemisphaerica Herrm.
	"	iberica Stev.
	"	lutea Mill.
	"	" Punicea.?
	"	orientalis Dup.
	Rubus	L.
	"	caesius L.
	"	ulmifolius Schott. Analolicus
	Sorbus	L. Focke.
	"	aria Crantz.
	"	aucuparia L.
	"	torminalis G.
	Spiraea	crenata L.
Salicaceae	Populus	Tourn.
	"	alba L.
	"	euphratica Oliv.
	"	hybrida
	"	nigra L.
	"	" L. Pyramidalis Roz.
	Salix	Tourn.
	"	acmopylla Boiss.
	"	aegyptiaca L.
	"	angustifolia Willd.
	"	australior And.
	"	babylonica L.
	"	caprea L.
	"	carmanica Bornm.
	"	fragilis L.

Continued

Iranian Woody Plant Species - Continued

Family	Genus	Species
Salicaceae	Salix	micans And.
	"	persica Boiss.
	"	purpurea L.
	"	zygostemon Boiss.
Salvadoraceae	Salvadora	persica Garc.
	"	oleoides Dcne.
Sapindaceae	Dodonaea	viscosa
	Stochsia	brahuica Bth.
Saxifragaceae	Ribes	grossularia L.
Simarubaceae	Ailanthus	glandulosa Desf.
Solanaceae	Solanum	dulcamara L.
	Datura	L.
	"	fastuosa L. Alba.
	Lycium	L.
	"	barbarum L.
	"	ruthenicum Murr.
	"	turcomanicum Turcz.
Tamaricaceae	Myricaria	germanica Desv.
	Tamarix	L.
	"	articulata vahl.
	"	bachtiarica Bge.
	"	bungei
	"	florida Bge.
	"	laxa Willd.
	"	mannifera Ehrenb.
	"	meyeri Boiss.
	"	octandra Bge.
	"	pallasii Desv.
	"	rosea Bge.
	"	serotina L.
	"	stricta Bge.
	"	szowitsiana Boiss.
	"	ispahanica Bge.
Tiliaceae	Grewia	L.
	"	populifolia Vahl.
	Tilia	rubra D. C.

Continued

Iranian Woody Plant Species - Concluded

Family	Genus	Species
Thymeleaceae	Daphne	L.
	"	angustifolium C. Koch.
	"	gnidium L.
	"	mezereum L.
Ulmaceae	Celtis	L.
	"	australis L.
	"	caucasica Willd.
	"	tournefortii Lam. glabrata.
	Ulmus	densa L.
	"	montana S.M.
	"	procera Salisb.
	Zelkova	
	"	crenata Desf.
Verbenaceae	Vitex	agnus castus L.
Vitaceae	Vitis	vinifera L.
Zygophyllaceae	Zygophyllum	atriplicoides F.M.
	Nitraria	schoberi L.
Family	Genus	Species
Abietaceae	Pinus	eldarica Medw.
Cupressaceae	Cupressus	Tourn.
	"	sempervirens L. fastigiata
	"	Var. horizontalis
	Juniperus	L. Mill
	"	communis L. depressa Boiss
	"	polycarpus C. Koch.
	"	sabina L.
	Thuja	orientalis L.
Taxaceae	Taxus	baccata L.
Ephedraceae	Ephedra	L.
	"	distachya L.
	"	major. Host. prosera. F. et M.

CHAPTER III

KEY FOR THE IDENTIFICATION OF
THE MORE IMPORTANT IRANIAN
WOODY SPECIES.

KEY FOR THE IDENTIFICATION OF THE MOST IMPORTANT
IRANIAN WOODY SPECIES

Based on Macroscopic Features

(Features discernible with the naked eye and the 10X hand lens.)

1. Wood without vessels; tissue between rays consists wholly of tracheids arranged in the radial rows; rays fine, and not visible to the naked eye (Figs. 1-5). 2
1. Wood with vessels; tissue between the rays consisting wholly or largely of fibers (mechanical tissue) and parenchymatous (storage tissue); rays indistinct or distinct to the naked eye (Figs. 6-64).6
 2. Longitudinal and transverse resin canals normally absent (Figs. 2-5). 3
 2. Longitudinal and transverse resin canal present; longitudinal resin canals appearing as small openings, transverse resin canals appear as small radial streaks. Growth rings distinct, not homogeneous, consisting of alternate layers of lighter springwood and darker summerwood; transition from springwood to summerwood gradual. Rays fine. Wood light, yellowish-brown to creamy light-brown; without any odor, moderately hard and even-grained.

Pinus halepensis var: eldarica Medw. (Fig. 1.)

3. Wood fragrant.4

3. Wood not fragrant, ill-scented,--reddish-brown, hard and heavy and close-grained. Growth rings distinct; delineated by a band of darker summerwood, excentric and frequently wavy and irregular

Taxus baccata L. (Fig. 4)

4. Growth rings distinct, wavy. Rays fine and form small flecks on the quarter surface. Wood light yellowish-brown, even-grained and fairly heavy.

Juniperus polycarpus C. Kock. (Fig. 2)

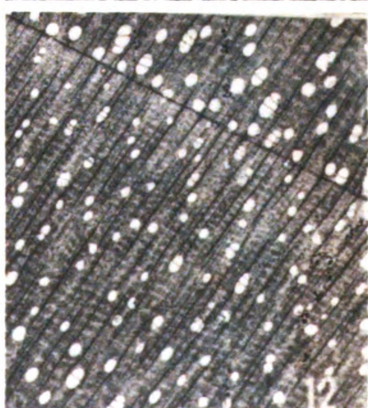
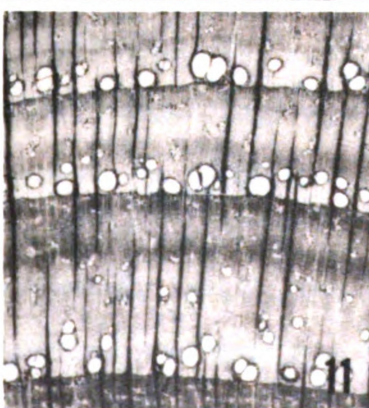
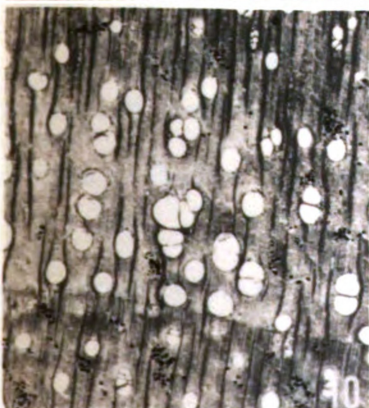
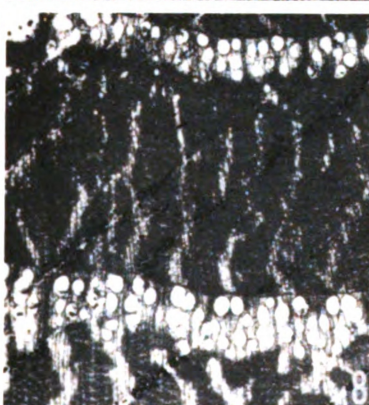
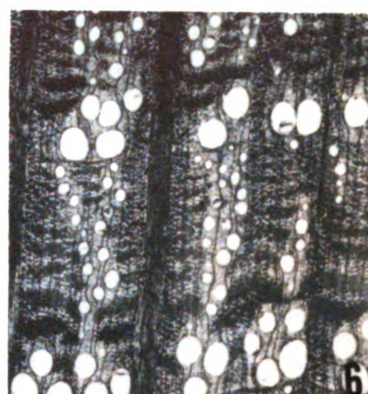
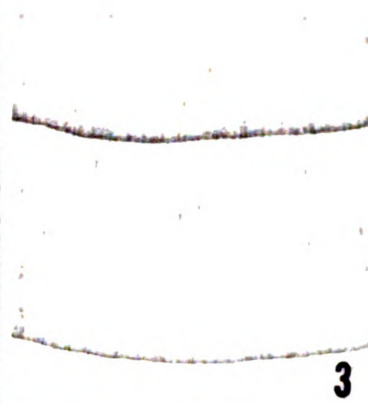
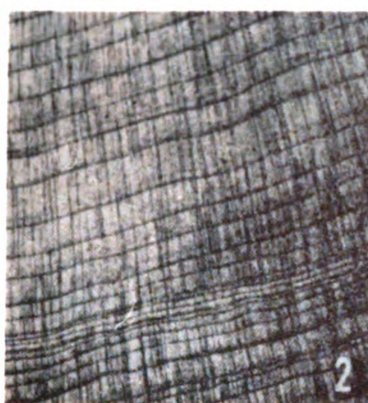
4. Growth rings distinct, usually not wavy. 5
5. Growth rings conspicuous, summerwood considerably harder than springwood; transition from springwood to summerwood, gradual to more or less abrupt. Rays fine and forming a fine conspicuous fleck on the quarter surface. Wood white to pinkish-brown, rather coarse-textured and soft.

Thuja orientalis L. (Fig. 3)

5. Growth rings distinct; transition from springwood to summerwood gradual. Wood white to whitish-yellow and reddish, medium-coarse textured and close-grained. Rays fine.

Cupressus sempervirens: var. horizontalis. Mill (Fig. 5)

6. Wood ring porous, springwood zone sharply defined; springwood pores conspicuously larger than the summerwood (Fig. 6). 7
6. Wood diffuse porous, springwood zone not sharply defined, pores exhibit little or no variation in size indicative of seasonal growth. Pores in springwood not conspicuously larger than those in the summerwood. (Fig 34). 27



7. Broad rays present, conspicuous, forming a broad ray fleck on the radial section (Fig. 6). 8
7. Broad rays absent (Fig. 18). 10
8. Sapwood narrow. Growth rings moderately wide, summerwood pores embedded in conspicuous flame-shaped patches of parenchyma. . . . 9
8. Sapwood wide. Growth rings narrow. Wood softer than other oak species, close-grained. Summerwood pores in flame-shaped patches of parenchyma.

Quercus persica J. et sp. (Fig. 7)

9. Large vessels in springwood are usually in two rows; summerwood pores, thick-walled; in very conspicuous flame-shaped patches; summerwood pores easy to count. Rays wide. Heartwood reddish-brown to brown.

Quercus castaneaefolia C.A.M. (Fig. 6)

9. Large vessels in springwood are usually in 2-3 rows. Summerwood pores in flame-shaped patches, summerwood pores relatively difficult to count. Rays wide. Wood light-brown.

Quercus iberica Stev. (Fig. 8)

10. Springwood pores conspicuously larger than the summerwood; transition in size of pores from springwood to summerwood abrupt (ring porous) 17
10. Springwood pores not conspicuously larger than the summerwood pores; transition in size of pores from springwood to summerwood gradual (semi-ring porous). 11
11. Parenchyma evident under the lens as a broken tangential line or punctate (Fig. 12) 12

11. Parenchyma not evident.14
12. Growth rings distinct and conspicuous.13
12. Growth rings visible, but usually not conspicuous.

Heartwood-gray to dark purplish-brown. Wood relatively hard, heavy, strong and close-grained, with storied rays forming ripple marks on tangential surface. Pores in short radial groups.

Diospyros lotus L. (Fig. 14)

13. Heartwood light-brown to brown. Wood moderately heavy, irregular or straight-grained, generally beautifully mottled.

Juglans regia L. (Fig. 12)

13. Heartwood pinkish-white. Wood light, not mottled.

Pterocarya fraxinifolia Lam. (Fig. 13)

14. Heartwood ranging in color from grayish-brown to light-brown, or light reddish brown.15

14. Heartwood light gray to light-brown. Growth rings clearly marked by dark colored zones of summerwood; delineated by narrow, inconspicuous bands of porous tissue. Pores small, pores at the beginning of the ring, somewhat larger than pores in the summerwood, but not visible with the naked eye.

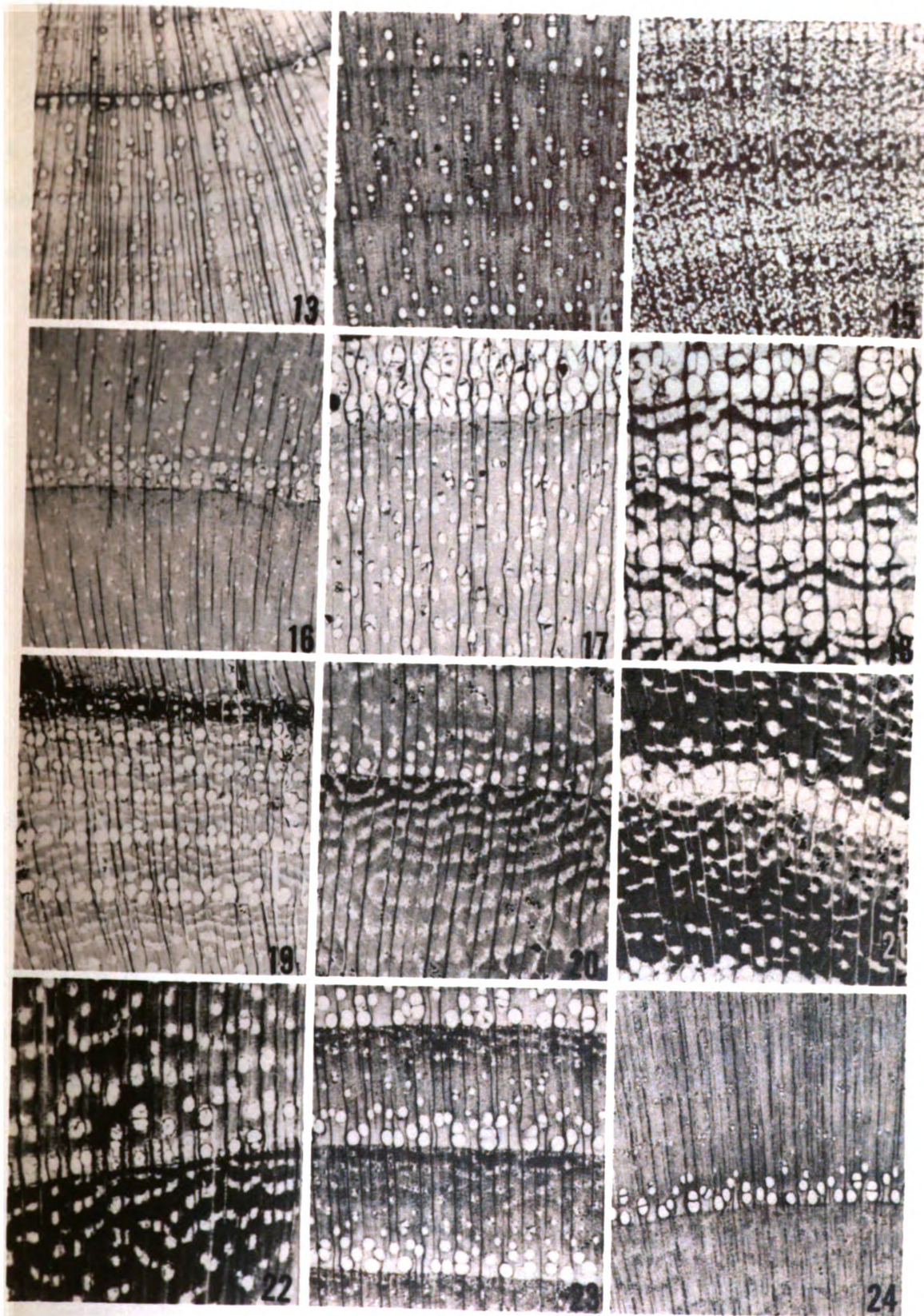
Prunus divaricata ledeb. (Fig. 15)

15. Heartwood grayish-brown to light-brown. Wood with a faint aromatic odor, soft, light, straight and coarse-grained. Pores scattered, never occupying approximately half the area between the rays. Rays plainly visible with a hand lens.

Catalpa speciosa Ward (Fig. 17)

Catalpa cardifolia Moench (Fig. 16)

9



15. Heartwood grayish white or reddish-white. Pores numerous, usually occupying approximately half the area between the rays. Rays scarcely visible with a hand lens.16

16. Heartwood grayish-white to whitish-yellow or light gray.

Wood moderately soft, medium-textured and straight-grained.

Populus nigra var: pyramidalis. Roz. (Fig. 44)

Populus nigra var: pubescens L. (Fig. 45)

Populus alba L. (Fig. 47)

Salix aegyptiaca L. (Fig. 47)

Salix australior. And (Fig. 48)

16. Heartwood light reddish-brown in color, more or less interlocked.

Populus euphratica Olivier

17. Pores in the summerwood form continuous or interrupted wavy tangential bands, separated by bands of mechanical tissue. (Fig. 18).18

17. Pores in the summerwood not in continuous wavy tangential bands (Fig. 23).23

18. Summerwood pores form continuous or interrupted, wavy pattern consisting of concentric light colored bands.19

18. Summerwood pores tend to be arranged in interrupted, wavy bands. Annual rings marked by lines of more numerous and larger springwood pores; summerwood pores small, surrounded by parenchyma. Rays fine and numerous. Heartwood grayish-brown to yellowish-brown, beautifully mottled with darker

yellow and gray-veins. Wood very hard and finely grained.

Pistacia mutica F. M. (Fig. 28)

19. Pores in springwood completely occluded with tyloses (Fig. 22). 22

19. Pores in springwood not completely occluded with tyloses (Fig. 18)

. 20

20. Heartwood brown, or brownish-gray. Wood straight-grained, moderately heavy and fairly hard. Rays indistinct to the naked eye in cross section, strongly defined on the radial section in pronounced flecks. 21

20. Heartwood reddish-brown, wood hard and tough.

Zelkova crenata Desf.

21. Summerwood bands wide.

Ulmus montana Smith (Fig. 18)

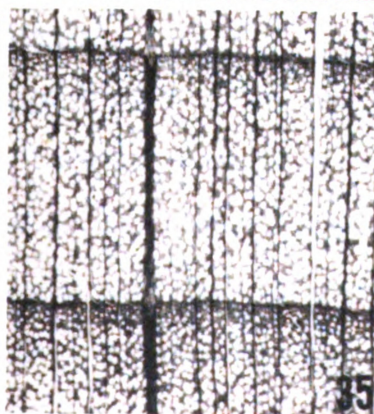
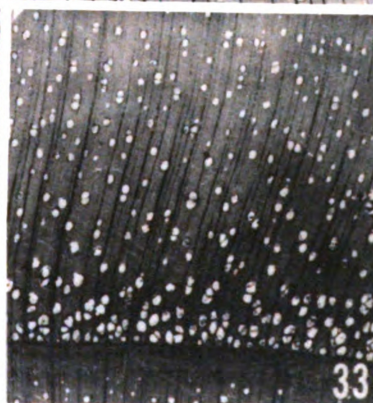
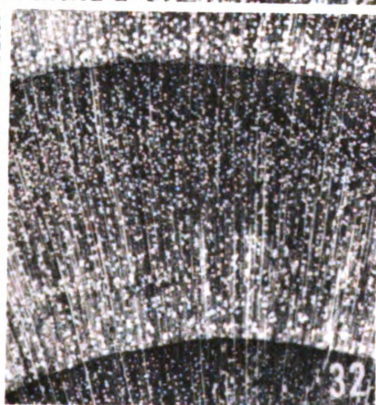
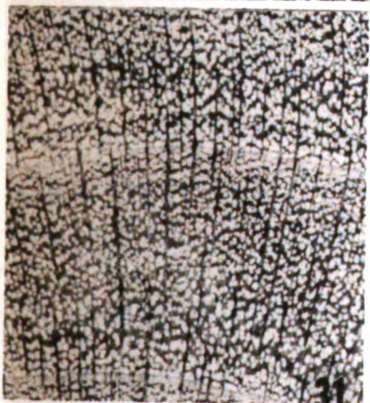
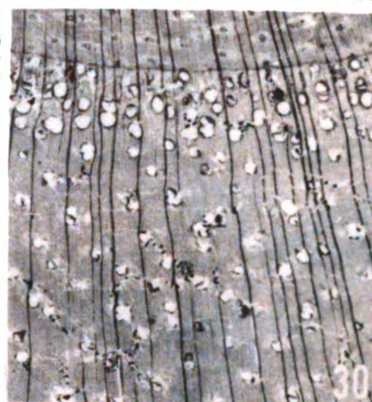
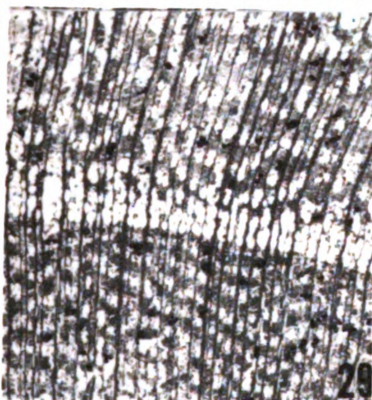
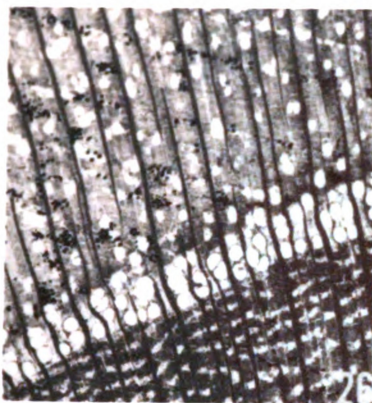
21. Summerwood bands narrow.

Ulmus campestris L. (Fig. 19)

22. Heartwood grayish-yellow to yellowish brown. Wood lustrous, hard, exceedingly strong and tough. Springwood pores, comprising a light-colored band, 2-3 pores in width; summerwood pores small, forming interrupted concentric bands. Vessels all plugged with tyloses and appear as clear yellow spots; coloring substance not readily soluble in water.

Robinia pseudoacacia L. (Fig. 22)

22. Heartwood light orange to golden yellow darkening upon exposure. Springwood pores appear as light colored bands, 2-3 pores in width; summerwood pores small, forming interrupted



concentric bands. Coloring substance in vessels readily soluble in water.

Maclura aurantiaca. Nutt (Fig. 21)

23. Rays fine, not distinct in cross section with the naked eye. . .24

23. Rays broader, visible to the naked eye in cross section. . . .26

24. Springwood pores are large and open, irregular in distribution, often surrounded by a patch of parenchyma. Parenchyma not visible. Rays exceedingly fine, wide apart, not visible to the naked eye, sometimes hardly visible with a lens. Heartwood brown, or golden-yellow marked with lighter and darker streaks. Wood lustrous, shallowly interlocked-grained or straight-grained, heavy and hard.

Albizzia julibrissin. Willd. (Fig. 10)

24. Springwood pores forming a band 2-4 pores in width; summerwood pores, small, solitary and in 2-3 multiples, forming a ripple-pattern in the late summerwood. Heartwood grayish-white to light-brown. Wood hard, heavy and somewhat lustrous.

Fraxinus excelsior L. (Fig. 23)

Fraxinus oxycarpa W. Erd. (Fig. 24)

25. Heartwood, rose to light brownish-red, or grayish-orange. . . .26

25. Heartwood brown to orange-brown. Growth rings distinctly marked by a belt of large pores; transition from springwood to summerwood gradual to more or less abrupt. Rays visible to the naked eye, sometimes showing as a silver fleck on radial surface. Wood soft to moderately hard and generally straight-grained.

Eleagnus angustifolia L. (Fig. 9)

26. Heartwood grayish-orange. Wood moderately heavy, hard, with a beautiful satin-like lustre. Growth rings distinct. Pores in the springwood large, in the summerwood small or moderately sized. Rays visible to the naked eye, with a satiny lustre, few and moderately broad.

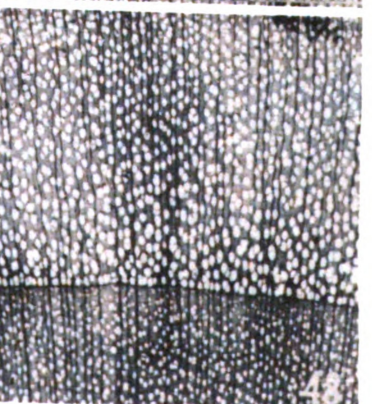
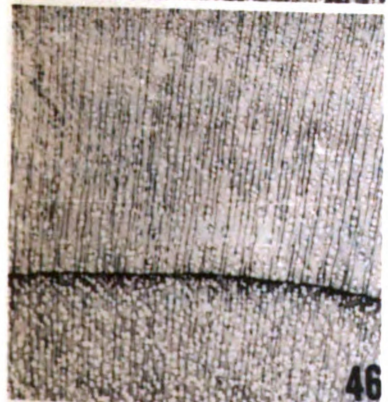
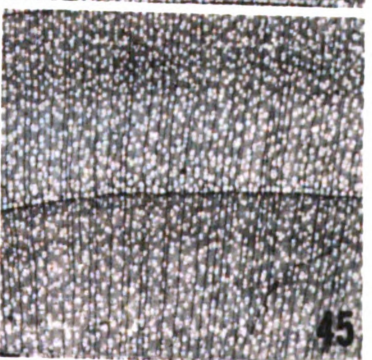
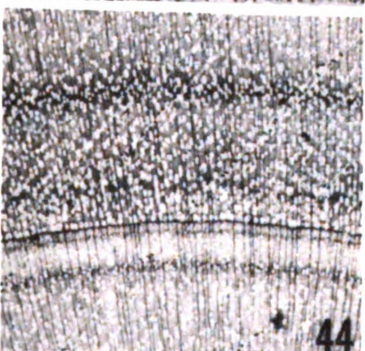
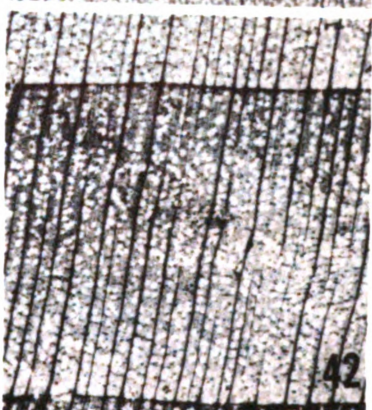
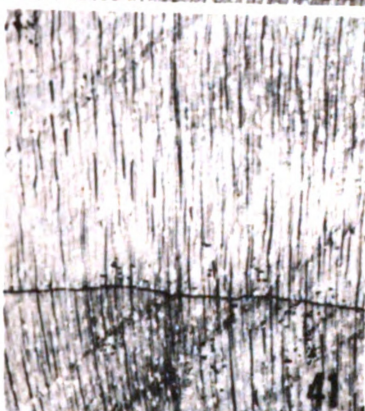
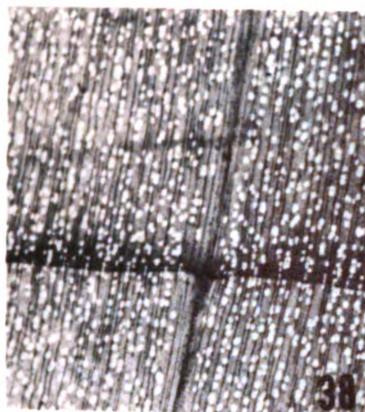
Ailanthus glandulosa Desf. (Fig. 11)

26. Heartwood, rose, or light brownish-red. Wood moderately heavy and hard. Pores in the springwood, forming a band 3-5 pores in width; summerwood pores small, solitary or in short radial groups.

Gleditsia caspica Desf. (Fig. 25)

27. Rays wholly or partly broad, conspicuous or relatively inconspicuous. (Figs. 34, 35, 36, 37, and 38).28
27. Rays mostly narrow, nearly uniform in width. If composed of broad and narrow type narrow rays scarcely visible with the aid of a hand lens. (Figs. 39, 41, 42, 43, 44, 45, 60, 61, 62, 63, and 64). .32
28. Large rays conspicuous and clearly marked, numerous and spaced at fairly close intervals. Pores half as wide as the widest rays (Figs. 34, 35).29
28. Large rays relatively inconspicuous and not clearly delineated, often widely spaced. Pores half as wide as the widest rays. (Figs. 36, 37, and 38).30
29. Rays not uniform in width, close, of two kinds, broad and narrow, forming pronounced fleck on radial face. Heartwood light yellowish-white to reddish-brown. Wood moderately hard and heavy, close and even-grained.

Fagus silvatica L. (Fig. 35)



29. Rays nearly uniform in width forming a reddish-brown or silvery fleck on the radial surface, and a characteristic pattern on the tangential surface. Heartwood variable in color from a very pale yellow to a light reddish-brown or a grayish-blue. Wood moderately hard (resembles beech but is softer) and even-grained.

Platanus orientalis L. (Fig. 34)

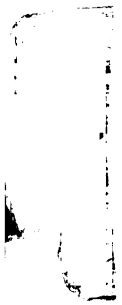
30. Heartwood reddish-white. Parenchyma in the summerwood not visible with a hand lens. 31
30. Heartwood yellowish to brownish-white. Parenchyma in the summerwood in fine, light tangential lines, visible with a hand lens. Growth rings sometimes not clearly marked in cross section, on tangential face marked by uneven dark lines, delineated by a narrow, whitish band at the outer margin. Rays irregularly distributed. Wood hard, tough, close-grained and somewhat lustrous.

Carpinus betulus L. (Fig. 36)

31. Wood white when cut, becoming reddish-white (subject to oxidative sap stain), soft, light, smooth-grained and lustrous. Growth rings distinct in cross section, delineated by a whitish or brownish line at the outer margin. Rays are clearly defined. The summerwood delineation line tends to show small curvature in contact with broad rays.

Alnus glutinosa. Willd (Fig. 37)

31. Wood white to reddish-white. Growth rings distinct in cross section. The summerwood delineation line tends to show a



conspicuous curvature (U-shaped) in contact with broad rays.

Almus subcordata C.A.M. (Fig. 38)

32. Pores small, approximately uniform in size, exhibit no, or little, variation in size indicative of seasonal growth, less than half as wide as the broadest rays. 33

32. Pores moderate to large, not uniform in size; variation in size indicative of seasonal growth, round to oval. Wood diffuse to semi-diffuse, porous; pores more numerous and larger in springwood than summerwood. Heartwood reddish-gray, hard, close-grained and slightly brittle.

Ziziphus spina-christi L. Willd. (Fig. 56)

33. Rays fine and indistinct to the naked eye in cross section . . . 34

33. Rays, distinct to the naked eye. 45

34. Pores small, numerous, generally visible with the aid of a hand lens; pores in springwood slightly larger than summerwood. Rays generally indistinct to the naked eye. 35

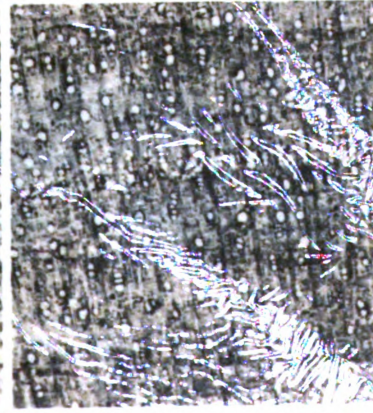
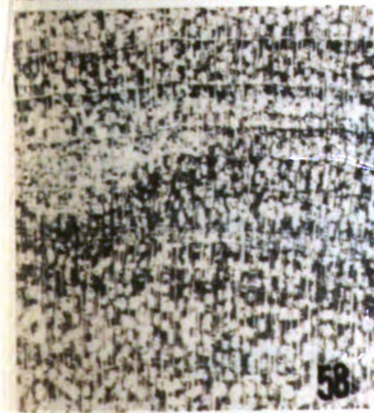
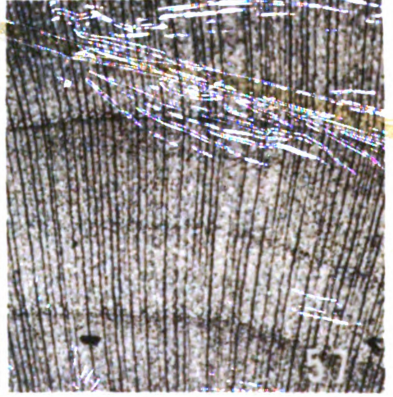
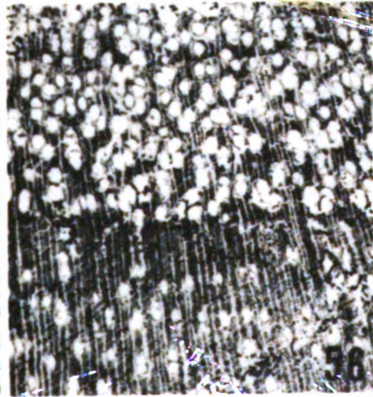
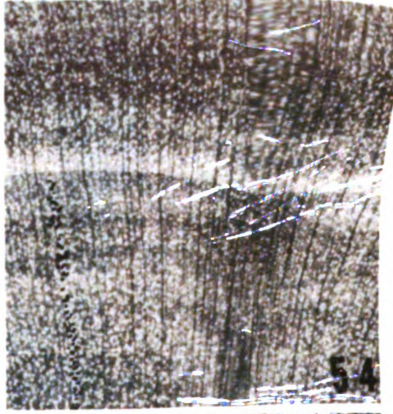
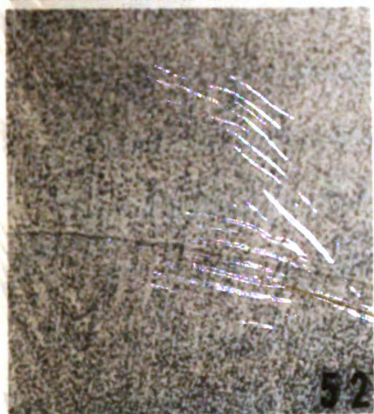
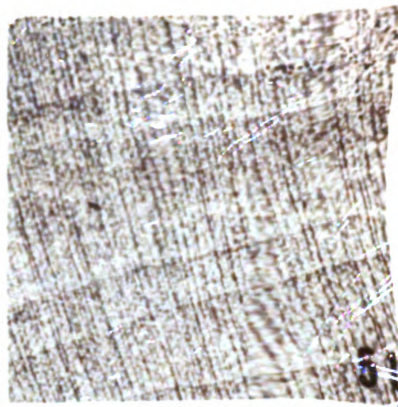
34. Pores exceedingly small, fine and numerous, or rather scanty, generally visible with the naked eye, or hardly discernible even with the aid of a hand lens. Rays very fine, numerous and indistinct to the naked eye. 43

35. Growth rings not distinct to the naked eye and lens, or wood characterized by alternate bands of soft and hard tissue. Heartwood dirty gray or yellowish-brown. 42

35. Growth rings distinct. 36

36. Heartwood gray to grayish-brown, light reddish-white to light brown or slightly yellowish or reddish. 37





36. Heartwood creamy white to whitish yellow, light grayish, brown or orange red.39

37. Rays very fine and scarcely visible, occupying half of the area on the transverse section. 38

37. Ray fine, not distinct to the naked eye, narrower than larger pores, occupying less than half of the area on the transverse section. Pores small, quite evenly distributed. Parenchyma not visible. Heartwood light reddish-white to light brown, moderately hard, straight and even-grained.

Betula alba L. (Fig. 41)

38. Heartwood slightly yellowish or reddish. Wood light, soft and fine-grained. Rays very fine and scarcely visible with a hand lens.

Aesculus hippocastanum. Linn. (Fig. 40)

38. Heartwood gray to grayish-brown or light reddish-white, to light-brown. Pores small, uniform in size, solitary under 10X magnification. Rays not distinct to the naked eye, very close wood moderately heavy and fairly hard.

Liquidambar orientalis. Mill (Fig. 39)

39. Growth rings distinct, delineated by a zone of pores in the springwood and flamboyant groups of vessels in the summerwood. Individual pores indistinct without a hand lens. Heartwood orange-red, hard and heavy.

Rhamnus sp. (Fig. 43)

39. Growth rings distinct, not conspicuous, not delineated by distinct flamboyant groups of vessels in the summerwood.40



40. Heartwood creamy white, whitish-yellow, to light grayish-brown.

Wood medium textured. 41

40. Heartwood light brown to grayish-brown. Wood light to moderately soft, weak and straight-grained.

Salix aegyptiaca L. (Fig. 47)

Salix australior. And. (Fig. 48)

41. Sapwood white. Heartwood whitish yellow to light grayish-brown.

Pores small, numerous. Rays very fine scarcely visible with a hand lens. Wood moderately soft and weak.

Populus nigra var: pyramidalis Poz. (Fig. 44)

Populus alba L. (Fig. 45)

Populus nigra var: pubescens. L. (Fig. 45)

41. Heartwood light reddish-brown to light reddish. Wood straight or interlocked grained, medium fine, uneven-textured, rather lustrous.

Populus euphratica. Olivier

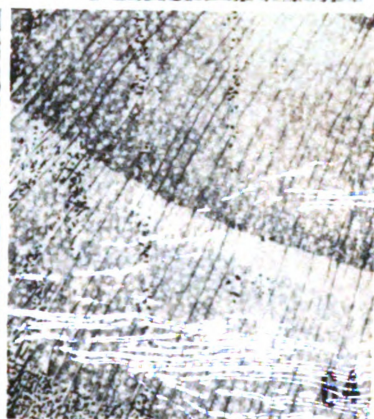
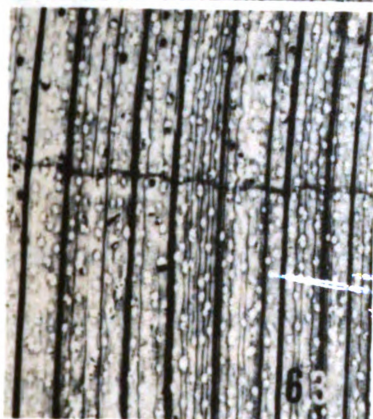
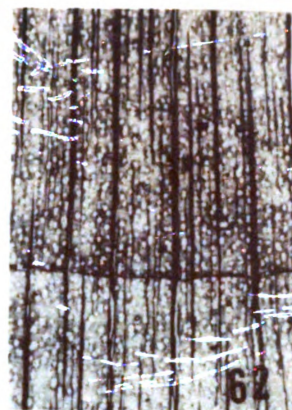
42. Pores often oval, and subdivided. Wood characterized by alternate concentric bands of soft and hard tissue, dirty gray, soft, slightly lustrous.

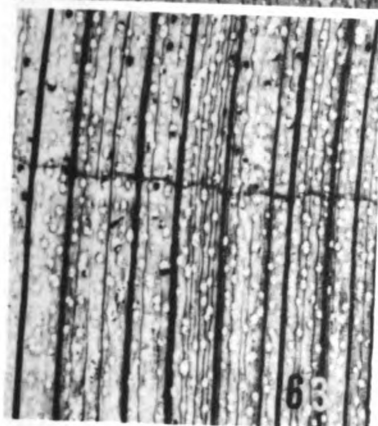
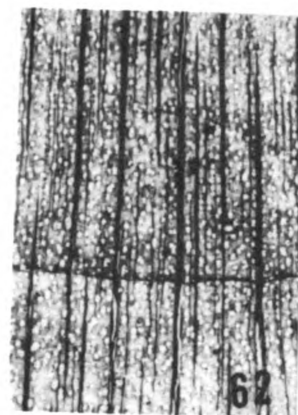
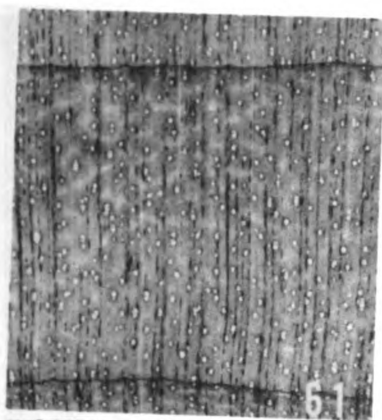
Ficus carica L. (Fig. 59)

42. Pores evenly distributed, single or subdivided, or in small groups, in patches of parenchyma. Rays fine, wavy, numerous and short. Parenchyma not visible. Heartwood yellowish-brown with irregularly wavy dark-brown streaks and mottled. Wood rather brittle.

Olea europea L. (Fig. 58)







43. Heartwood light reddish-brown or light pinkish-white. 44

43. Heartwood yellow to whitish-yellow in color. Growth rings narrow, delineated by a line of denser summerwood. Growth rings, rays and vessels are indistinct with the naked eye. Parenchyma not visible. Wood very close, hard, heavy, dense, strong and even-grained.

Buxus sempervirens L. (Fig. 50)

44. Heartwood light pinkish-white in color. Pores exceedingly small, rather scant, indistinct without a hand lens. Rays very fine numerous and regular. Wood hard, moderately heavy and even-grained.

Parrotia persica D. C. (Fig. 51)

44. Heartwood light, reddish-brown (sometimes no true heart present). Growth rings recognizable. Pores exceedingly small and numerous. Rays indistinct to the naked eye. Wood hard, tough, moderately heavy, fine, close-grained, with extraordinary evenness of texture.

Pirus cordata Desv. (Fig. 52)

45. Rays uniform in width. 46

45. Rays variable in width, composed of broad and narrow types (but narrow rays scarcely visible with the aid of a hand lens). . . . 47

46. Broadest rays about the same width as the largest pores.

Heartwood brownish-white to pale-brown, distinct, delineated by difference in size of pores in the springwood and summerwood. Pores small. Rays not distinct without a hand lens. Wood soft, close-grained and slightly lustrous.

Tilia rubra. D.C. (Fig. 42)

46. Broadest rays narrower than the largest pore. Heartwood light reddish-white to light-brown. Growth rings distinct with a lens, delineated by a fine line of denser librous tissue. Pores are small. Wood moderately hard, heavy, moderately strong, straight and even-grained.

Betula alba L. (Fig. 41)

47. Wider rays stand out against the background of pores and fibrous tissue. Pores are small, uniform in size and regularly distributed. Broader rays visible to the naked eye, forming a gray fleck. Conspicuous on the quarter surface. Heartwood grayish-white to light brown, moderately hard and heavy, fine-textured, even and straight-grained.

Acer laetum. C.A.M. (Fig. 62)

Acer insigne Boiss (Fig. 63)

47. Wider rays do not stand out against the background of pores and fibrous tissue. 48

48. Heartwood pale-brown. Growth rings distinct, not sharply delineated. Pores small and indistinct without a hand lens. Parenchyma not distinct. Broader rays visible with the naked eye. Wood hard to very hard, heavy and fine-grained.

Cornus australis C.A.M. (Fig. 64)

48. Heartwood, white to pinkish yellow, or light grayish-brown, or grayish-white to pale brown. 49

49. Growth rings distinct. Pores small and evenly distributed. Rays fine but distinct, with a satiny lustre on radial surface. Pores stand out against the background of fibrous tissue. Rays not as

numerous and well defined. Heartwood white to pinkish yellow, becoming yellowish to slightly brown with age, often beautifully figured. Wood hard, medium heavy, tough, fine and straight-grained.

Acer pseudoplatanus L. (Fig. 61)

49. Growth rings fairly distinct, slightly wavy. Pores small, not stand out well against the background of fibrous tissue. Rays fine and distinct with a hand lens (more numerous and well-defined than in A. pseudoplatanus L.) ray flecks inconspicuous. Heartwood light-brown, or reddish-white. Wood moderately hard, tough with a beautiful satin lustre.

Acer campestre L. (Fig. 60)

Species Identified in Macroscopic Key

1. *Pinus halepensis* Var: *eldarica* Medw.
2. *Juniperus polycarpus* C. Kock.
3. *Thuja orientalis* L.
4. *Taxus baccata* L.
5. *Cupressus sempervirens* Var. *horizontalis* Mill
6. *Quercus castaneaefolia* C. A. M.
7. *Quercus persica* J. sp.
8. *Quercus iberica* Stev.
9. *Eleagnus angustifolia* L.
10. *Albizzia julibrissin* Willd.
11. *Ailanthus glandulosa* Desf.
12. *Juglans regia* L.
13. *Pterocarya fraxinifolia* Lam.
14. *Diospyros lotus* L.
15. *Prunus divaricata* Ledeb.
16. *Catalpa cordifolia* Moench. (*C. bignonioides* Walt.)
17. *Catalpa speciosa* Ward.
18. *Ulmus montana* S. M.
19. *Ulmus campestris* L.
20. *Zelkova crenata* Desf.
21. *Maclura aurantiaca* Nutt (*M. pomifera* (Raf) Schneid)
22. *Robinia pseudoacacia* L.
23. *Fraxinus excelsior* L.

24. *Fraxinus oxycarpa* W. End.
25. *Gleditschia caspica* Desf.
26. *Morus alba* L.
27. *Lonicera iberica* M. B.
28. *Pistacia mutica* F. M.
29. *Cercis siliquastrum* L.
30. *Paulownia imperialis* Siebold and Zuccarini
31. *Sambucus nigra* L.
32. *Ligustrum vulgare* L.
33. *Rhus coriaria* L.
34. *Platanus orientalis* L.
35. *Fagus sylvatica* L.
36. *Carpinus betulus* L.
37. *Alnus glutinosa* Willd.
38. *Alnus subcordata* C. A. M.
39. *Liquidambar orientalis* Mill
40. *Aesculus Hyppocastanum* L.
41. *Betula alba* L.
42. *Tilia rubra* D. C.
43. *Rhamnus* sp.
44. *Populus nigra* Var: *Pyramidalis*. Rozier.
45. *Populus nigra* Var: *Pubescens*. L.
46. *Populus alba* L.
47. *Salix aegyptiaca*. L.
48. *Salix australior* And.

- 49. *Salix babylonica* L.
- 50. *Buxus sempervirens*. L.
- 51. *Parrotia persica* D. C.
- 52. *Pirus cordata*. Desv.
- 53. *Cydonia oblonga* Mill.
- 54. *Mespilus germanica* L.
- 55. *Crataegus monogina* Willd.
- 56. *Zizyphus spina-christi* (L.) Willd.
- 57. *Rhus cotinus* L.
- 58. *Olea europea* L.
- 59. *Ficus carica* L.
- 60. *Acer campestre* L.
- 61. *Acer pseudoplatanus* L.
- 62. *Acer laetum* C. A. M.
- 63. *Acer insigne*. Boiss.
- 64. *Cornus australis* C. A. M.

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CHAPTER IV

DESCRIPTION OF WOODS

BY SPECIES

1. Pinus halepensis var: eldarica Medw.

Fam. Pinaceae

E. Pine-tree

F. Pin

G. Kiefer, Föhre

Origin and Distribution

Not native in Iran.

1. General characteristics and properties.

Sapwood white, heartwood light yellowish-brown to creamy light-brown. Annual rings marked by the denser autumn wood consisting of compressed tracheids with smaller lumina. Wood resinous, without any odor, moderately hard, medium-coarse textured, and even-grained, moderately weak in static and impact bending properties.

2. Macroscopic features.

Growth rings distinct, not homogeneous, consisting of alternate layers of lighter springwood and darker summerwood. Transition from springwood to summerwood gradual. Rays fine and not visible with the naked eye. Resin canals present.

3. Microscopic features.

Tracheids up to 50 microns in diameter, transition in diameter between summerwood and springwood tracheids gradual, bordered pits in one row on the radial wall of tracheids, pits are large. Parenchyma not visible. Resin canals present both longitudinal and transverse. Rays uniseriate and fusiform, average height of rays 250 microns,

average width of rays 10 microns, average number of rays per square millimeter 10.

4. Uses.

It is used for poles, building construction, posts, mine timbers, boxes, crates and pulpwood.

2. Juniperus polycarpus C. Kock. = *J. excelsa*, M. B. = *J. sabina*,
var. *Taurica*, Pall. = *J. foetida* var. *excelsa*, Spach =
Sabina excelsa, Antoine

Fam. Cupressaceae

E. Greek juniper

F. G  n  vrier en arbre

G. Hoher Wacholder

Origin and Distribution

North-eastern and northern Iran, from 500 up to 2000 meters altitude.

1. General characteristics and properties.

Sapwood white-yellowish; heartwood light yellowish-brown. Wood even-grained and fine-textured, resistant to decay, weak in some mechanical properties (bending), usually fragrant, light, fairly heavy, easy to work.

2. Macroscopic features.

Growth rings distinct, summerwood reddish-brown and darker than springwood, wavy. Springwood usually occupies most of the ring, transition from spring to summerwood abrupt or gradual. Parenchyma

present, visible with hand lens. Resin canals absent. Rays fine and form small flakes on the quarter surface.

3. Microscopic features.

Tracheids 30 microns in diameter, the difference in diameter of summerwood and springwood tracheids is noticeable; often with inter-cellular spaces at the corners; bordered pits in one row on radial walls of tracheids, tangential pitting is present in the few rows of summerwood tracheids. Parenchyma present, in tangential rows. Rays uniseriate; the average height of rays 100 microns, average width 10 microns, average number of rays per square millimeter 12.

4. Uses.

For millwork, closets, boxes and small articles.

3. Thuja Orientalis L. = Biota orientalis (Endl.) L.

Fam. Cupressaceae

E. Arbor vitae, chinese arbor vitae

F. Thuia d'orient, Arbre de paradis, Arbre de vie

G. Lebensbaum, Orientalische-
Lebensbaum, Echter Fächerlebensbaum

Origin and Distribution

Northern Iran.

1. General characteristics and properties.

Sapwood white, heartwood white to pinkish-brown. Wood fragrant, rather coarse-grained, soft, weak in mechanical properties, but highly durable and resistant to decay, especially in contact with the soil, does not warp readily.

2. Macroscopic features.

Growth rings distinct and very conspicuous, delineated by a darker band of summerwood, a high proportion of the ring is occupied by springwood, parenchyma barely visible or not. Resin canals absent. Rays very fine, forming a fine inconspicuous fleck on the quarter surface.

3. Microscopic features.

Tracheids up to 35 microns in diameter, transition in diameter of summerwood and springwood tracheids gradual. Bordered pits in one row on the radial walls, visible also in some summerwood tracheids. Lines of metatracheal parenchyma variable in distribution. Rays uniseriate, occasionally bi-seriate, average height of rays 100 microns, average width of rays 9 microns, average number of rays in millimeter 15.

4. Uses.

This wood is used mostly for purposes in which durability is an important factor, canoes, indoor fittings, boxes, crates, and shingles.

4. Taxus baccata L.

Fam. Taxaceae

E. Yew-tree, Common yew, Chinwood,
Globe-berry

F. If, If commun

G. Eibe, Echte Eibe, Ifenbaum,
Eichenbaum

Origin and Distribution

In Europe at up to 6000 ft. altitude, North Africa, Northern and Western Asia including Iran, at up to 11,000 ft. altitude.

1. General characteristics and properties.

Sapwood yellowish-white; heartwood reddish brown. Wood hard and heavy, close-grained and irregular in its growth, resistant to insect damage, and very durable, untreated fence posts have shown long serviceability, without characteristic odor or taste, takes very good polish.

2. Macroscopic features.

Growth rings distinct, excentric and wavy, delineated by a band of darker summerwood, narrow to medium wide. Transition from springwood to summerwood gradual. Resin canals absent. Parenchyma not visible. Rays very fine, not distinct to the naked eye.

3. Microscopic features.

Tracheids up to 25 microns in diameter; bordered pits in one row on radial walls of tracheids, tangential pitting present in the last few rows of summerwood tracheids; close bands of spiral thickenings present. Resin canals wanting. Rays uniseriate (1 to 25 cells in height).

4. Uses.

For bows, carvings, canoes and poles.

5. Cupressus sempervirens L. var: horizontalis Mill. =
Cupressus horizontalis, (Mill.)

Fam. Cupressaceae

E. Cypress-tree

F. Cyprès

G. Gemein Zypresse, Millelmeerzypresse

Origin and Distribution

Cupressus sempervirens L. is reported in the Mediterranean region, Asia Minor, and Persia, up to 1000 meters altitudes.

1. General characteristics and properties.

Sapwood white; heartwood white to whitish-yellow and reddish.

Wood medium coarse-textured, very fine and close-grained, fragrant, moderately hard, and durable.

2. Macroscopic features.

Growth rings distinct, transition from springwood to summerwood gradual. Parenchyma present, and visible. Rays fine, and visible.

3. Microscopic features.

Transition in diameter of tracheids from springwood to summerwood gradual. Bordered pits on radial walls of tracheids. Tangential pitting present in the last few rows of summerwood tracheids. Parenchyma, in tangential rows. Rays mostly uniseriate; average height of rays 320 microns; average width of rays 18 microns, average number of rays per one millimeter 7.

4. Uses.

This wood was used by the ancient Egyptians for mummy cases, in

Crete for shipbuilding and in Assyria for coffins of the Popes. It was used by Alexander the Great for his Babylonian fleet and Semiramis bridge over the Euphrate. In the past it was used for harps and organ-pipes, and also for vineprops, but now seldom so employed. Owing to its durability it is used for clothe-chests, because of its resistance to moths. Certonia work, or inlaying of this wood with ivory is still famous as a Persian art.

6. Quercus castaneaefolia C. A. M.

Fam. Fagaceae

E. Oak-tree

F. Chêne

G. Eiche, Kastanienblättrige Afäre

Origin and Distribution

Northern Iran

1. General characteristics and properties.

Sapwood narrow, whitish to grayish; heartwood reddish-brown to brown, darkening on exposure. Wood without characteristic odor or taste, has average strength properties, young oak is tougher than older wood. Sapwood is subject to insect attacks, heartwood is durable, untreated ties of this species last at least 10 years in service.

2. Macroscopic features.

Wood ring porous. Growth rings very distinct and well-marked. Springwood pores large, visible to the naked eye; large vessels in springwood are usually in two rows; transition from springwood to

summerwood gradual to more or less abrupt. Summerwood pores are thick-walled, sometimes in flame-shaped groups. Rays of two types, broad and narrow, broad rays are visible to the naked eye; narrow rays are indistinct without magnification. Parenchyma forms part of the conjunctive tissue between springwood vessels and rays and is visible with a hand lens.

3. Microscopic features.

Vessels round to slightly oval; in the summerwood 10 per square millimeter, in the springwood 6 per square millimeter; average diameter of springwood vessels is 300 microns, average diameter of summerwood vessels is 80 microns, average length of vessel segments 300 microns; perforation plates simple; pits are small and mostly orbicular to oval; tyloses abundant. Fibers thick-walled, regularly arranged in radial rows. Rays unstoried, homogeneous; broad rays average 3200 microns in height; narrow rays 140 microns in height, average width of broad rays 200 microns; broad (compound) rays 15-20 plus seriate; the average number of rays per one millimeter is 9. Parenchyma abundant, metatracheal diffuse, restricted mostly to the outer margins of wide rings.

4. Uses.

Largely for mine timbers, tight-cooperage, railroad ties, fence posts, constructional purposes, furniture, firewood, boxes and crates and agricultural implements. Owing to its hardness and durability it is widely used for railroad ties, and because of its impermeability to liquids, durability and strength, it is used for tight-cooperate, mainly for export.

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7. Quercus persica J. et sp.

Fam. Fagaceae

E. Oak-tree

F. Chêne

G. Eiche

Origin and Distribution

Western Iran

1. General characteristics and properties.

Sapwood very wide, whitish to light grayish; heartwood light brown to pinkish-brown. Wood without characteristic odor or taste, close-grained, firm in texture and fairly hard, but softer than other species of oak, of average durability. Owing to large proportion of sapwood, wood is not extensively used. It is slow growing species, mostly due to climatic conditions and poor site on which it grows. The ancient Persians are said to have used this wood in construction of palaces.

2. Macroscopic features.

Wood ring porous. Growth rings distinct and narrow. Springwood pores are large, visible to the naked eye, usually in two to three rows; transition from springwood to summerwood gradual to more or less abrupt; summerwood pores in flame-shaped groups. Rays of two types broad and narrow, broad rays are visible to the naked eye; narrow rays are indistinct without magnification. Parenchyma forms part of the conjunctive tissue between springwood vessels and rays. Rays are visible without a hand lens.

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3. Microscopic features.

Vessels round to slightly oval; perforation plates simple; pits are small and are mostly orbicular to oval. Fibers thick-walled. Rays unstoried, homogeneous, 10-18 seriate. Parenchyma abundant, Metatracheal diffuse.

4. Uses.

Locally for fuel; excellent for charcoal; occasionally used for furniture and mine timbers.

8. Quercus iberica Stev. = Quercus sessiliflora, Sm.

Fam. Fagaceae

Origin and Distribution

Northern Iran, from 850-1600 to 2000 meters altitude.

1. General characteristics and properties.

Sapwood whitish; heartwood whitish-brown. Wood without characteristic odor or taste, has average strength properties, finely grained and moderately hard. Owing to growth at higher elevations, this species is slow-growing and produces fine-grained wood with narrower rings than those of Quercus castaneaefolia C. A. M.

2. Macroscopic features

Wood ring porous. Growth rings distinct, narrow. Springwood pores are large, usually in 2-4 rows, visible to the naked eye, transition from springwood to summerwood gradual to more or less abrupt; summerwood pores are thick-walled, in flame-shaped groups. Rays of two types, broad and narrow. Parenchyma forms part of the conjunctive tissue between springwood vessels and rays.

3. Microscopic features.

Vessels round to slightly oval; perforation plates simple; pits are small and are mostly orbicular to oval. Fibers thick-walled.

Rays 15-20 seriate. Parenchyma abundant, metatracheal-diffuse.

4. Uses.

For constructional purposes, fuel and charcoal.

9. Elaeagnus angustifolia L. = E. hortensis M. B. =
E. incanus Lam. = E. Orientalis L.

Fam. Elaeagnaceae

E. Oiltree, oleaster, Russian olive, Bohemian oleaster

F. Olivier de Bohême, Chalef, Chalef à feuilles étroites, Eléagne, Olinet, Arbre de paradis, Arbre d'argent

G. Oleaster, Ölweide, silberbaum, Schmale Ölweide Böhmischer Ölbaum, Paradisbaum

Distribution

In dry regions of Iran, wild in eastern Iran.

1. General characteristics and properties.

Sapwood white; heartwood brown to orange-brown. Wood without characteristic odor or taste (sometimes with a very slight odor), generally straight-grained, soft to moderately hard.

2. Macroscopic features.

Wood ring porous. Growth rings distinctly marked by a belt of large pores. Springwood pores moderately-sized, and numerous; transition from springwood to summerwood gradual to more or less abrupt. The autumn wood contains fewer and smaller pores. Pores often oval.

Rays, short and fine, sometimes showing as silver grain on radial surface.

3. Uses.

The wood is used for fuel.

10. Albizzia julibrissin (DC.) Willd. =
Acacia julibrissin. DC.

Fam. Mimosaceae

E. Bastard tamarind, Silk-tree; Silk rose

F. Arbre à la soie, Arbre de Constantinople,

G. Orientalische Akazie, Schirmakazie

Origin and Distribution

Africa, Asia (from Iran, to China and Japan), Northern Iran up to 400 meters altitude.

1. General characteristics and properties.

Sapwood whitish-brown; heartwood brown, almost yellow golden, tinged with yellow and marked with lighter and darker streaks. Wood shallowly interlocked-grained, straight-grained, heavy and hard, high in toughness; heartwood said to be very durable, lustrous, even and medium to coarse-textured, moderately strong; seasons well, capable of a good polish, when polished it is extremely attractive.

2. Macroscopic features.

Wood ring porous. Growth rings distinct, springwood pores are large and open, irregular in distribution, often surrounded by a patch of loose tissue; transition from springwood to summerwood abrupt to more or less gradual. Parenchyma not visible. Rays exceedingly

fine, wide apart and irregular, not visible to the naked eye in cross section, visible on radial.

3. Microscopic features.

Vessels more or less oval, average 6 per square millimeter, average diameter of vessels 160 microns, average length of vessel segments 250 microns; perforation plates simple; intervessel pits oval to angular.

Parenchyma, present, paratracheal and scarce. Fibers, thin-walled. Rays unstoried, homogeneous to heterogeneous; average length of rays 220 microns; average width of rays (1-2 seriate) 20 microns; average number of rays per square millimeter 6.

4. Uses.

A very attractive wood, suitable for decorative wood-work, furniture, building, scaffold, and axles of carts, rafters, scantlings, cabinetmaking and chairmaking.

11. Ailanthus glandulosa Desf = Ailantus altissima. Swingle.

Fam. Simarubaceae.

E. Tree of Heaven, Tree of the Gods, Chinese Ash, Japan Varnish Tree, False Varnish Tree, Chinese Sumach, Tallow Tree.

F. Arbre de ciel, Vernish du Japan, Frêne puant, Ailante glanduleux

G. Götterbaum, Echter Götterbaum, Japanischer Firnisbaum

Origin and Distribution

Grows wild in the mountains of Chili, Northern China, Japan; introduced into India, Iran, England, France, Germany, Italy and the eastern United States of America.

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1. General characteristics and properties.

Sapwood yellowish and broad; heartwood, grayish orange. Wood without characteristic odor, moderately heavy, moderately hard, high in elasticity and resistance to crushing, difficult to split, with a beautiful satin-like luster, moderately durable, susceptible of a high polish, makes handsome furniture, easy to work.

2. Macroscopic features.

Wood ring porous. Growth rings distinct because of rows of large springwood, open pores. Pores in the springwood large, in the summerwood small or moderately-sized; transition from springwood to summerwood gradual to more or less abrupt. Rays distinctly visible to the naked eyes, with a satin-like luster, few and moderately broad. This wood is easily distinguished from that of ash by the greater width of annual rings, and by the rays which are clearly visible in cross section with the naked eye.

3. Uses.

In cabinet-making, general carpentry and for fuel.

12. Juglans regia L.

Fam. Juglandaceae

E. Walnut-tree, Circassian Walnut,
Jupiter's Nut, Maderia Nut,
French Nut

F. Noyer, Noyer royal, Calottier,
Goguier, Noguier

F. Walnussbaum, Walnusse, Echte Walnuss,
Nussbaum, Welcher Nussbaum

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Origin and Distribution

A native tree of northern China and Persia, introduced into Greece and Italy in early times from Persia (Iran), and thence into the rest of Europe. Up to 1500 meters in north of Iran.

1. General characteristics and properties.

Sapwood broad, grayish to yellowish-brown, subject to insect attack; heartwood, light-brown to brown, moderately heavy, takes a beautiful polish. Wood moderately heavy, tasteless, irregular or straight-grained, generally beautifully mottled, shrinks moderately.

2. Macroscopic picture.

Wood semi-diffuse porous. Growth rings distinct, delineated through an abrupt difference in size between pores of the late summer-wood and those in the springwood of succeeding rings; tyloses present. Parenchyma present, visible in broken tangential lines. Rays fine, indistinct without a land lens.

3. Microscopic features.

Vessels average 8 per square millimeter; the average diameter of vessels 130 microns, the average length of vessel segments 300 microns; perforation plates simple; intervessel pits mostly angular. Parenchyma metatracheal, fairly abundant. Fibers thin to moderately thick-walled. Rays, 1-5 seriate, homogeneous to heterogeneous; average length of rays 200 microns; average width of rays 50 microns; average number of rays per square millimeter 6.

4. Uses.

Mostly veneer, largely sliced; railway ties, fence posts, millwork

and furniture. The color, general appearance, and carving qualities of this wood appeal particularly to decorative artists, in cabinet making and furniture.

13. Pterocarya fraxinifolia, Lam. = Juglans
pterocarya Willd = P. caucasica C.A.M.

Fam. Juglandaceae

- E. Winged fruited walnut-tree, Caucasian
walnut, False walnut, Wing-nut
- F. Pterocaryer à feuille de frêne,
Noyer de caucase
- G. Flügelnuss

Origin and Distribution

The Caucasus, Armenia, Persia (Iran), Northern Iran up to 1000 meters altitude.

1. General characteristics and properties.

Sapwood; heartwood pinkish-white. Wood light and moderately weak, without characteristic odor or taste, not very durable.

2. Macroscopic features.

Wood semi-diffuse porous. Growth rings distinct, mostly due to the abrupt transition in size of pores in the late summerwood and those in the springwood, of the succeeding ring. Parenchyma present, visible in broken tangential lines. Rays fine, indistinct without a hand lens.

3. Microscopic features.

Vessels average 7 per square millimeter; average length of vessel segments 450 microns; average diameter of vessels 140 microns; perforation plates simple; intervessel pits mostly angular.

Parenchyma metatracheal, medium abundant. Fibers, thin to moderately thick-walled. Rays, unstoried, 1-4 seriate, homogeneous to heterogeneous; average length of rays 400 microns; average width of rays 25 microns; average number of rays per square millimeter 7.

4. Uses.

Chiefly used for making boxes and packaging cases, furniture, cabinet work, and millwork.

14. Diospyros lotus L.

Fam. Ebenaceae

E. False lote-tree, Date plum, Sour jujube, Persimmon-tree

F. Faux lotier

G. Dattelpflaum, Italienische Dattelpflaum, Afrikanische Lotusbaum.

Origin and Distribution

Iran, Afghanistan, extending to Kashmir and Himalaya to southern Europe, northern Iran up to 1100 meters altitude.

1. General characteristics and properties.

Sapwood broad and creamy-white; heartwood, gray to dark-brown; some with black, brown and light yellow streaks. Wood without characteristic odor or taste, close-grained, strong, tough, heavy, hard, high in nail holding ability, susceptible to high polish, wears smoothly with use, difficult to season, not very durable.

2. Macroscopic features.

Wood semi-ring porous. Growth rings distinct but not conspicuous.

Springwood pores visible to the naked eyes; summerwood pores small, in short radial groups, somewhat irregular in size. Parenchyma visible with a hand lens, appearing evenly punctate. Rays fine, distinct with a hand lens, parallel, numerous, and almost equidistantly spaced.

3. Microscopic features.

Vessels slightly oval, in short radial groups; perforation plates simple; intervessel pits orbicular to oval. Parenchyma paratracheal, and terminal. Fibers relatively thin-walled to thick-walled. Rays homogeneous to heterogeneous.

4. Uses.

It is suitable for shuttles in textile industries, because it is tough, of proper weight, and wears smoothly. Used for sport articles, such as golf heads, wood has a great value for veneer (it resembles narrow-striped ebony), is used also for shoe-last, plane-stocks, boxes and crates.

15. Prunus divaricata Ledeb. = Prunus cerasifera Ehrh.

Fam. Rosaceae

E. Sloe-tree, Black-thorne, Bullace

F. Prunellier, Prunier épineux

G. Schlehenpflaum

Distribution

Northern Iran.

1. General characteristics and properties.

Sapwood whitish to light reddish-brown; heartwood light blackish-brown. Wood close and even grained, hard, heavy, not very durable,

moderately strong, finishes smoothly, free from checking and warp, seasons well, capable of a very smooth surface.

2. Macroscopic features.

Wood semi-ring porous. Growth rings are clearly marked by dark-colored zones, delineated by a narrow inconspicuous bands of porous tissue in the early springwood. Pores, very numerous, small, somewhat plugged, at the beginning of the ring somewhat larger, but not visible with the naked eye, evenly distributed. Parenchyma not visible. Rays visible, forming numerous small flecks on radial surface.

3. Microscopic features.

Perforation plates simple. Parenchyma very sparse. Fibers thin to ~~thick-walled~~. Rays unstoried, homogeneous to heterogeneous.

4. Uses.

For decorative purposes, pipes, valued by turners for inlaying, used for walking sticks and cabinet work.

Prunus mahaleb L. = Cerasus mahaleb. (1). Mill =
Padus mahaleb Borkh.

E. Perfumed cherry, Rock cherry

F. Cerisier odorant, Cerisier mahaleb

F. Weichsel, Mahalebkirsche

Wood perfumed, brown or green-streaked, moderately hard. Growth layers are marked by thin dark lines, pores are very small, hardly discernible under the lens. Rays defined. Used for pipe-stems and walking sticks.

Prunus armeniaca Linn

Sapwood white; heartwood grayish-brown to light-brown. Wood moderately hard, close-grained. Pores very numerous and small, uniformly distributed. Rays numerous and regular. Wood is used chiefly for firewood, mottled with streaks and handsome.

Prunus avium Moench = *Cerasus avium* Moench =
C. dulcis Gaertn = *C. nigra* Mill.

Fam. Rosaceae

- E. Cherry tree, Head cherry, Merry-tree, Wild gean, Bird cherry, Gean, Gean Cherry, Sour cherry, Gaskins, Wild cherry tree, Hedgeberry, Sweet cherry, Mazards
- F. Guigner sauvage, Cerisier, Merisier, Cerisier de bois, Cerisier des oiseaux
- G. Bach-kirsche, vogelkirsche, süsskirsche, Wilder kirschbaum

Origin and Distribution

Northern Iran, up to 2600 meters altitude.

Macroscopic features

Sapwood yellowish-white to reddish; heartwood light yellowish-brown to light-yellowish red. Wood close, even-grained, hard, heavy, firm, wood not durable. Annual rings distinct, delineated by a narrow inconspicuous band of porous tissue in the early springwood. Rays distinct and fine. The wood is valued and used by turners and for inlaying.

Prunus laurocerasus L. = Cerasus laurocerasus Lois =
Padus laurocerasus Mill. = Laurocerasus officinalis Roem

Fam. Rosaceae

E. Cherry-Laurel

F. Laurier-cerise

G. Lorbeerkirsche, Kirschelorbeer

Native of southern Europe, Asia, and Caspian forest belt. Heartwood is pinkish-white; wood rough-grained, hard and moderately heavy. Annual rings distinct. Pores small and numerous. Rays very fine. Wood used by turners and for inlaying.

16. Catalpa cordifolia. Moench = Catalpa bignonioides Walt.

Fam. Bignoniaceae

E. Catalpa

F. Bois shavanon

Origin and Distribution

South Central America, the origin of the name is Catawba, the name of Indian tribes of Georgia and the Carolinas.

1. General characteristics and properties.

Sapwood pale gray and narrow; heartwood brown to grayish-brown, somehow lustrous. Wood without characteristic taste, but with a faint aromatic odor, straight and coarse-grained, light, soft, weak, brittle, durable, especially in contact with the soil.

2. Macroscopic features.

Wood ring porous. Growth rings distinct. Springwood pores large and visible to naked eye; summerwood pores small; transition from

springwood to summerwood more or less gradual to abrupt. Parenchyma not distinct. Rays visible with a hand lens, usually indistinct to the naked eye.

3. Microscopic features.

Vessels round to slightly oval, 8-20 per square millimeter; perforation plates simple; spiral thickenings present in the summerwood vessels; intervessel pits orbicular to oval. Parenchyma, paratracheal and paratracheal-zonate. Fibers, thin-walled. Rays, unstoried (1-6 seriate), homogeneous to heterogeneous.

4. Uses.

For posts, railroad ties; fences, cabinets, fuel, and construction purposes.

17. Catalpa speciosa. Ward.

Fam. Bignoniaceae

E. Catalpa

F. Bois shavanon

Origin and Distribution

South Central United States. The origin of the name is Catawba, the name of Indian tribes of Georgia and the Carolinas. This tree was introduced to European and Asian countries (Iran) as an ornamental tree.

1. General characteristics and properties.

Sapwood grayish-white; heartwood brown. Wood with a faint aromatic odor, light, soft, not strong, straight and coarse-grained, brittle, durable especially in contact with the soil.

2. Macroscopic features.

Wood ring porous. Growth rings distinct. Springwood pores large

and visible to the naked eye; transition from springwood to summerwood abrupt, or more or less gradual; summerwood vessels small. Parenchyma not distinct. Rays visible with a hand lens, usually indistinct to the naked eye.

3. Microscopic features.

Vessels round to oval, 8-20 per square millimeter; perforation plates simple; spiral thickenings present in the summerwood vessels; intervessel pits orbicular to oval. Parenchyma paratracheal and paratracheal-zonate. Fibers thin-walled. Rays unstoried (1-6 seriate), homogeneous to heterogeneous.

4. Uses.

For posts and fencing, fuel and cabinet-work.

18. Ulmus montana Sm. = U. glabra, Huds. (non Mill) =
U. Major, Smith = U. Scabra, Mill = U. latifolia
 Moench. = U. corylifolia, Boreau

Fam. Ulmaceae

E. Wych elm, Broadleaved elm,
 Wych-hazel, Scotch elm, Mountain elm

F. Orme de montagne, Orme blanc

G. Bergrüster, Bergulme

Origin and Distribution

Europe, western Asia (Iran), northern Iran.

1. General characteristics and properties.

Sapwood narrow, whitish-yellow; heartwood brown or brownish-red. Wood usually without characteristic taste and odor, sometimes sapwood with a faint characteristic odor; wood straight-grained, moderately heavy, fairly hard, easier to split than U. campestris L., high in

static and impact bending, shrinks considerably, has tendency to warp in seasoning, moderately durable.

2. Macroscopic features.

Wood ring porous. Growth rings distinct. Springwood pores large, distinctly visible with naked eye; transition from springwood to summerwood abrupt; summerwood pores are small and numerous, arranged in more or less continuous, wavy, concentric bands. Parenchyma not visible. Rays strongly defined on the radial section, in pronounced flecks, indistinct to the naked eye in the cross section.

3. Microscopic features.

Vessels average 120 per square millimetre; average diameter of springwood vessels 250 microns; average length of vessel segments 200 microns; perforation plates simple; spiral thickenings present in the smaller vessels; intervessel pits orbicular to angular; tyloses present. Parenchyma, paratracheal and metatracheal; paratracheal parenchyma abundant, contiguous, metatracheal parenchyma sparse. Fibers medium thick to thick-walled. Rays unstoried, homogeneous; average width of rays 40 microns; average length of rays 280 microns; average number of rays per square millimeter 4.

4. Uses.

For panelling, staircases or other joinery, furniture and chair making (although it is not really satisfactory, because it is attacked by beetles), boat building, millwork, cart building, boxes and crates. Because of its attractive color and grain it is used for sporting and athletic goods.

19. Ulmus procera, Salish. = *U. nuda* Ehrh = *U. campestris*, L. =
U. tetrandra, Schk. = *U. vulgaris* Pall. = *U. glabra*, Mill
 (non Hunds) = *U. suberosa* Ehrh. = *U. elliptica*, C. Koch

Fam. Ulmaceae

- E. Common elm, Red elm, English elm, Alm,
 Aulm-tree, Small leaved elm, European elm.
- F. Orme, Orme rouge, Ormeau, Orme champête
 Ipreau
- G. Ruster, Feldulme, Feldruster, Rotruster,
 Schwarze Ruster

Origin and Distribution

Europe (United Kingdom), western Asia (Iran), northern Iran.

1. General characteristics and properties.

Sapwood narrow, yellowish-white; heartwood dark-brown to brownish-red; usually without characteristic odor or taste. Wood, hard, heavy, tough, very difficult to split, apt to warp and twist, susceptible to high polish.

2. Macroscopic features.

Wood ring porous. Growth rings distinct. Springwood pores large, distinctly visible to the naked eye, transition from springwood to summerwood abrupt; springwood consists of single interrupted row of pores; pores in the summerwood in wavy bands, which are conspicuous enough to be visible without the aid of a hand lens. Parenchyma not visible. Rays not distinguishable with the naked eye.

3. Microscopic features.

Perforation plates simple; spiral thickenings present in the smaller vessels; intervessel pits orbicular to angular; tyloses present.

Parenchyma paratracheal and metatracheal, paratracheal parenchyma

abundant, metatracheal parenchyma sparse. Fibers medium-thick to thick-walled. Rays unstoried, homogeneous.

4. Uses.

As this wood is very durable under water, and fairly so underground, it is very useful for different constructional purposes. It was used formerly for waterpipes and ship keels in England. This elm and U. montana Smith are largely used for panelling, furniture, millwork and chair-making.

Note.

Complete bands of pores of summerwood are narrower in Ulmus campestris L. than in Ulmus montana Smith.

20. Zelkova crenata, Desf. = Planera Richardi, Michaux =
Ulmus polygama Rich = Rhamnus carpinifolia, Pall =
Planera crenata Desf.

Fam. Ulmaceae

E. Elm of Siberia, Siberian elm, Planer tree

F. Orme de Siberie, Zelkova à feuille crénelée, Planère

G. Zelkowe, Wasserulme

Origin and Distribution

Southern Russia (Caucasus), northern Iran, besides above species, two other species are known, the largest of which is Z. acuminata in Japan and China, and Z. cretica, a shrub of Crete and Cypress. Zelkova crenata was introduced into England and Europe in 1770. In northern Iran from 900 to 1300 meters altitude.

1. General characteristics and properties.

Sapwood broad, whitish-yellow; heartwood reddish-brown. Wood without characteristic taste and odor, hard, heavy, tough, much like American or Canadian elm, moderately durable, does not crack and warp, takes a good polish.

2. Macroscopic features.

Wood ring porous. Growth rings distinct. Springwood pores large, visible with naked eye; transition from springwood to summerwood abrupt; summerwood pores are small and numerous, forming more or less continuous wavy, concentric bands, marked by light-colored lines. Parenchyma not visible. Rays not distinct to the naked eye.

3. Microscopic features.

Vessels round, average 110 per square millimeter; average diameter of springwood vessels 140 microns; average diameter of summerwood vessels 80 microns; average height of vessel segments 300 microns. Parenchyma, paratracheal and metatracheal; paratracheal parenchyma abundant. Fibers medium thick to thick-walled, length of fibers short. Rays, unstoried, homogeneous to heterogenous, average length of rays 270 microns; average width of rays 50 microns; average number of rays per square millimeter 6.

4. Uses.

Furniture, boat building and millwork. As it is a strong and durable wood it was used as pillars to the temples in the past.

Note.

The likeness of this species to that of Ulmus is so marked, that it is possible to confuse this wood with Ulmus spp.

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21. Maclura aurantiaca Nutt = Maclura pomifera (Raf.) Schneid

Fam. Moraceae

E. Osage-orange, bow-wood

F. Bois d'arc

Origin and Distribution

Arkansas and Texas, North America, tree was introduced to European and Asian countries (Iran).

1. General characteristics and properties.

Sapwood, light yellow, and narrow; heartwood, bright orange to golden yellow longitudinally, brown transversely; darkens with exposure to air and light and turns greyish. Wood without characteristic odor or taste, very heavy, hard, strong, not tough, straight-grained, coarse textured, lustrous, shrinks moderately, very durable especially in contact with the soil.

2. Macroscopic features.

Wood ring porous, Growth rings distinct. Springwood pores, large, occluded with tyloses, springwood zone appears as a light colored band, 2-3 pores in width; summerwood pores small, forming interrupted concentric bands. Parenchyma not distinct. Rays visible without a hand lens, rather irregular.

3. Microscopic features.

Vessels round, 10-60 per square millimeter; perforation plates simple; spiral thickenings present in the small vessels of summerwood; intervessel pits orbicular to oval or angular. Parenchyma, paratracheal, paratracheal-confluent, and terminal, abundant. Fibers 10-16 microns

in diameter and moderately thick-to thick-walled. Rays unstoried, and homogeneous for the most part.

4. Uses.

In southern United States it is largely used for post and agricultural implements and wagons. It was used in the past by the Osage and other Indian tribes, west of the Mississippi river, for bows and war clubs (name of bow-wood). Suitable for carving, turnery, railway ties, and machinery parts.

22. Robinia pseudoacacia L.

Fam. Papilionaceae

E. Locust-tree, Black locust, Yellow locust, American locust, False acacia

F. Robinier Faux-Acacia, Acacia, Faux acacia

G. Schotendorn, Gemeiner Schotendorn, Falsche Akazie, Gemeine Robinie, Courbarill

Origin and Distribution

A native of southern United States, it is believed that Cobbett introduced this tree into England in 1812 from North America. It is now widely grown in Europe and Asia, especially in Japan, Himalayas and Iran.

1. General characteristics and properties.

Sapwood yellowish-white, very narrow; heartwood greenish-yellow to yellowish-brown; when fresh light greenish yellow, with a glossy lustre, but darkens to a dull greenish brown. Wood without characteristic odor or taste, very heavy, hard, exceedingly strong, tough, strong in compression parallel to grain, very durable, shrinks

considerably in seasoning, high in nail holding ability, difficult to work with tools.

2. Macroscopic features.

Wood ring porous. Growth rings distinct. Springwood pores large, comprising a light colored band, 2-3 pores in width; summerwood pores small, forming interrupted concentric bands.

Vessels all plugged with tyloses and appear as clear yellow spots. Parenchyma indistinct. Rays visible to the naked eye.

3. Microscopic features.

Vessels are oval, solitary, or in radial groups of two to ten together, 3-35 per square millimeter; perforation plates simple; spiral thickenings present in the small vessels in summerwood; intervessel pits orbicular to oval or angular. Parenchyma, paratracheal paratracheal-confluent, and terminal. Fibers moderately thick to thick-walled. Rays 1-7 seriate, unstoried homogeneous to somewhat heterogeneous.

4. Uses

Used for sleepers, piles, railway ties, turnery and cabinet work. As the wood is very elastic and strong, it is used for wheel spokes and in vehicle construction, machine parts, wagon hubs, mine equipment and planing-mill products.

23. Fraxinus excelsior L.

Fam. Oleaceae

E. Ash tree, Taller, Bird's Tongue

F. Frêne

G. Esche

Origin and Distribution

Europe (England, France, and Hungary), Turkey and northern Iran, a native of Europe, northern Africa and western Asia.

1. General characteristics and properties.

Sapwood, very broad, yellowish-white to greyish-white; heartwood grayish-white to light-brown somewhat lustrous. Wood without characteristic odor or taste; moderately hard and heavy, even textured, straight-grained, easily worked, tough, elastic, highly flexible, susceptible of a good polish, moderately durable, high in withstanding sudden shock, and impact bending, warps little, slower-grown wood is apt to become black-hearted which lessens the strength properties of wood.

2. Macroscopic features.

Wood ring porous. Growth rings distinct. Springwood pores large, visible to the naked eye, forming a band 2-4 pores in width; summerwood pores small, visible to the naked eye, solitary and in 2-3 multiples; transition from springwood to summerwood abrupt; summerwood pores form a ripple-pattern on tangential surface. Parenchyma visible with a hand lens in summerwood. Rays are fine and numerous, not distinct without a hand lens.

3. Microscopic features.

Vessels round, very slightly oval; vessels average 12 per square millimeter; average diameter of springwood vessels 160 microns; average diameter of summerwood vessels 50 microns, average length of vessel segments 220 microns; perforation plates simple; intervessel pits orbicular to oval or angular. Parenchyma, irregularly distributed,

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paratracheal, paratracheal-confluent. Fibers thin to medium thick-walled. Rays 1-4 seriate, homogeneous occasionally heterogeneous, average length of rays 50 microns, average width of rays 25 microns.

4. Uses.

Used in violin manufacturing (backs of violins), for gymnasium poles, athletic appliances, tennis-racquets, hockey sticks, for construction of motor vehicles, handles, furniture, agricultural implements, ship and boatbuilding, cooperage, sewing machines, cabinet work.

For veneer and decorative panel-work, the wood is selected chiefly in the form of burrs which give curly, wavy, and handsome figures.

24. Fraxinus oxycarpa Willd. = F. oxyphylla M. B. =
F. rostrata Juss. = F. ornus Pall. (non L.)

Fam. Oleaceae

E. Ash-tree, Taller, Bird's Tongue

F. Frêne

G. Esche

Origin and Distribution

Planted on the southern slopes of Elburz mountain chain - Iran.

1. General characteristics and properties.

Sapwood yellowish-white; heartwood light greyish-brown. Wood without characteristic odor or taste, hard, close-grained, somewhat lustrous, easily worked.

2. Macroscopic features.

Wood ring porous. Growth rings distinct. Spring wood pores large forming a band with 2-3 pores in width; summerwood pores small, solitary

or in 2-3 multiples; summerwood pores form a ripple pattern less conspicuous than in F. excelsior L. Parenchyma visible with a hand lens in the summerwood. Rays fine, not distinct to the naked eye.

3. Microscopic features.

Vessels round, very slightly oval; perforation plates simple; intervessel pits orbicular to oval or angular. Parenchyma, paratracheal-confluent and terminal. Fibers thin to medium thick-walled. Rays 1-3 seriate, homogeneous.

4. Uses.

For cabinet work, sporting goods, boxes, baskets, crates and agricultural implements.

25. Gleditschia caspica Desf.

Fam. Papilionaceae

E. Honey-locust, Sweet locust-tree,
Thorny locust

F. Févier, caroug à miel

G. Christusdorn, Honigdorn, Dornbaum,
Dornige christusakazie

Origin and Distribution

Northern Iran up to 500 meters altitude.

1. General characteristics and properties.

Sapwood yellowish to greenish-white, broad; heartwood, rose or light brownish-red. Wood without characteristic odor or taste, fine and close-grained, moderately heavy, hard, strong, high in compression parallel to grain, impact and static bending, difficult to work with

tools, moderately durable, especially in contact with the soil, similar to Robinia pseudoacacia L. in general properties and use, but without tyloses in vessels.

2. Macroscopic features.

Wood ring porous. Growth rings distinct. Springwood pores large, visible to the naked eye, forming a band 3-5 pores in width; summerwood pores small, solitary or in short radial rows and groups; transition from springwood to summerwood abrupt. Parenchyma, in tangential bands in summerwood, the whitish band visible with a hand lens. Rays visible to the naked eye.

3. Microscopic features.

Vessels round; perforation plates simple; spiral thickenings present in summerwood; intervessel pits orbicular to oval or angular. Parenchyma abundant, paratracheal, paratracheal-confluent, and terminal. Fibers moderately thick to thick-walled. Rays 6-10 seriate, homogeneous.

4. Uses.

For sleepers, posts, fences and furniture.

26. Morus alba L. = M. indica, L. = M. candida, Dod.

Fam. Moraceae

E. Mulberry, White mulberry, Sycamine

F. Mûrier blanc

G. Maulbeerbaum, Weissmaulbeerbaum

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Origin and Distribution

It is believed to be a native of Asia (China), introduced into Europe in the fifteenth century, north of Iran.

1. General characteristics and properties.

Sapwood, yellowish-white, narrow; heartwood yellowish-brown to a brilliant gamboge yellow, turning reddish and russet-brown on exposure. Wood without characteristic odor or taste, hard, heavy, straight-grained and lustrous, durable, especially in contact with the soil, difficult to split.

2. Macroscopic features.

Wood ring porous. Growth rings distinct. Springwood pores large, forming a broad and recognizable band 2-8 pores in width; most of the pores are open, occasionally a few filled with white deposits; transition from springwood to summerwood abrupt, summerwood pores small, with a tendency to arrangement in wavy interrupted bands. Parenchyma not visible. Rays fine, but very distinct.

3. Microscopic features.

Vessels round to oval; perforation plates simple; spiral thickenings present in summerwood vessels; intervessel pits orbicular to oval or angular; springwood vessels mostly open, occasionally occluded with white deposits. Parenchyma paratracheal and metatracheal-diffuse. Fibers thin to thick-walled. Rays 5-8 seriate, homogeneous to heterogeneous.

4. Uses.

Chiefly for furniture, veneer and inlaying; also used for fence posts, cooperage and agricultural implements.

27. Lonicera iberica M. B. = L. chlamydophora C. Koch.

Fam. Caprifoliaceae

E. Honeysuckle

F. Chèvrefeuille

G. Heckenkirsche, Geissblatt

Origin and Distribution

A large genus (Lonicera, Linn) containing more than 28 species, small shrubs, or climbers growing for the most part in western Asia and Himalayas.

1. General characteristics and properties.

Sapwood white; heartwood yellowish to grayish-brown, with darker streaks. Wood close and even-grained, soft to moderately hard.

2. Macroscopic features.

Wood ring porous. Growth rings distinct; marked by a narrow continuous belt of small pores. Pores in the rest of the wood very small; transition from springwood to summerwood abrupt to more or less gradual. Rays fine and numerous.

3. Uses.

The wood is handsome. It might be used for carving, turning and other ornamental purposes.

28. Pistacia mutica F. et M. = P. terebinthus L. =
P. atlantica Var. Latifolia D. C.

Fam. Anacardiaceae

E. Pistachio-tree

F. Pistachier

G. Pistazienbaum

Origin and Distribution

A tree of western Asia, southern and eastern Iran.

1. General characteristics and properties.

Sapwood white to yellowish-white; heartwood grayish-brown, to yellowish-brown, beautifully mottled with yellow and gray-dark veins.

Wood is very hard, and finely grained.

2. Macroscopic features.

Wood ring porous. Annual rings marked by lines of more numerous and larger pores. Springwood pores large; summerwood pores small, surrounded by loose tissue, tend to be arranged in interrupted, wavy bands. Parenchyma not visible. Rays fine and numerous.

3. Uses.

Wood of no commercial importance, suitable for carving, furniture, inlaying and ornamental work.

29. Cercis siliquastrum L. = Cercic. siliquosa St. Lager.

Fam. Papilionaceae

E. Love Tree, Red bud, Judas tree

F. Arbre de Judée, Gaïnier, Arbre d'amour
siliquastre, Bouton rouge, Arbre de feu

G. Griffelbaum, Judasbaum, Echter Judasbaum
Früher salatbaum.

Origin and Distribution

Southern Europe and warmer temperate Asia, northern Iran, from 180 to 900 meters altitude.

1. General characteristics and properties.

Sapwood white; heartwood yellowish-brown to brownish-yellow.

Wood handsome, with black veins, moderately heavy, hard, capable of taking an excellent polish, straight-grained.

2. Macroscopic features.

Wood ring porous. Growth rings distinct. Springwood vessels large, forming a band, with 4-6 pores in width; transition from springwood to summerwood abrupt to more or less gradual; summerwood pores small (1-8), forming wavy, interrupted bands. Parenchyma not visible. Rays fine and numerous.

3. Uses.

Wood of no commercial importance, suitable for ornamental work.

30. Paulownia tomentosa Koch.

Paulownia imperialis Siebold and Zuccarini

Fam. Scrophulariaceae

E. Paulownia

Origin and Distribution

Native of central and western China, introduced into Europe, America, Japan and Western Asia (Iran).

1. General characteristics and properties.

Heartwood reddish-brown to light nut-brown. Wood extremely light and low in density (1/2 of poplar), very soft, very fine-grained and lustrous.

2. Macroscopic features.

Wood ring porous to semi-ring porous. Growth rings marked by a springwood zone of numerous large pores; summerwood pores are small and grouped in short, peripheral lines, producing a conspicuous pattern reminiscent of plum. Parenchyma not visible. Rays fine, form light shallow bands in radial surfaces.

3. Uses.

It is largely cut and sliced into very fine veneers, used for visiting cards, solid wood work for clock cases and ink-stands, musical instruments, lacquer ware, and cabinetmaking, sandals, boxes, clogs, furniture. In Japan it produces good charcoal used for polishing, and gunpowder.

31. Sambucus nigra L.

Fam. Caprifoliaceae

E. Elder

F. Sureau noir

G. Schwarze Holder

Origin and Distribution

Europe, north Africa and west Asia.

1. General characteristics and properties.

Sapwood white, heartwood yellowish to straw-yellow. Wood when dried, exceedingly hard and attractive; close-grained, difficult to dry, warps in seasoning.

2. Macroscopic features.

Wood diffuse porous. Annual rings marked by a circle of moderately

sized pores. Vessels more numerous in springwood, usually less numerous in summerwood, minute and plugged. Rays well defined, not parallel, clearly visible on radial surface.

3. Uses.

Wood when dried very attractive. It would make an attractive wood for ornamental purposes, inlay, carving, and cabinetwork. It is used for turnery.

32. Ligustrum vulgare L.

Fam. Oleaceae

E. Prim, Privy, Privet, Primwort

F. Troène, Pruène, Bois noir

G. Rainweide, Gewöhnliche Rainweide, Beinholz, Dintenbeere, Gemeiner Liguster, Liguster

Origin and Distribution

Europe, western Asia.

1. General characteristics and properties.

Heartwood white, close and even-grained, moderately hard, with a satiny lustre. Annual rings marked by a continuous belt of small pores of summerwood and continuous line of larger pores of springwood pores. Summerwood pores are small, often in radial lines, or groups of three, regularly distributed and scanty. Rays fine and numerous.

2. Uses.

Wood of no commercial importance. .

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33. Rhus coriaria L.

Fam. Anacardiaceae

- E. Sumach, Tanner's sumach, Redoul
- F. Corroyer, Corroyère, Rouvre-des-corroyeurs sumac des corroyeurs, Sumac des provinces, sumac de tanneurs, Rhou, Change
- G. Sumach, Gerbersumach, Hirschbaum, Hirschkofenbaum

Origin and Distribution

Northern Iran

1. General characteristics and properties.

Sapwood, white, heartwood yellowish-green, to greyish-green, mottled with yellow color, streaked with brownish-grey. Wood moderately light, hard, medium-textured, with a lustrous sheen.

2. Macroscopic features.

Wood ring porous. Growth rings distinct, transition from springwood to summerwood abrupt to more or less gradual. Springwood pores moderately-sized, and numerous; summerwood with fewer and smaller pores; pores round to oval. Rays fine and numerous.

3. Microscopic features.

Perforation plates simple; parenchyma, paratracheal, metatracheal and terminal. Fibers thin-walled. Rays unstoried and heterogeneous.

4. Uses.

For carving, inlay and ornamental works.

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34. Platanus orientalis L. = P. acerifolia. Willd. =
P. cuneata Willd. = P. digitatata, Hort = P. laciniata.
 Hort. = P. elongata, Steud = P. Vulgaris. Spach.

Fam. Platanaceae

E. Sycamore, Button-wood, Plane-tree,
 Oriental Plane tree

F. Platane

G. Platane, Orientalische Platane

Origin and Distribution

From Kashmir to Greece, Plateau of Iran.

1. General characteristics and properties.

Sapwood yellowish-white; heartwood variable in color from a very pale yellow to a light reddish-brown or a grayish-blue, and of a mixture of all these tints, in very old trees becoming brown and then resembling beech. The color is affected by the time of year when the tree is cut, and by the type of soil from which the tree is taken. Wood without characteristic odor or taste, resembles beech, but is softer, moderately hard, close and smooth-grained, has tendency to warp and split, subject to insect attack, and not durable, intermediate in nail holding.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct, delineated by a dark line or band of denser summerwood. Pores small, indistinct or barely visible to the naked eye. Parenchyma not visible. Rays numerous and broad, occupying nearly half the surface in cross section, forming a reddish-brown or silvery fleck on the radial surface, which produce a characteristic pattern on the tangential surface.

3. Microscopic features.

Vessels more or less round; average 110 per square millimeter;

[illegible]

average diameter of vessels 65 microns; average length of vessel segments 400 microns; perforation plates simple or occasionally scalariform; intervessel pits oval to orbicular. Parenchyma, paratracheal-diffuse, abundant. Fibers medium to moderately thick-walled. Rays unstoried, homogeneous, average height of broad rays 2000 microns; average width of rays (1-9 seriate) 100 microns; average number of rays per square millimeter 4.

4. Uses.

In Iran it is used for furniture, doors, windows, and cabinet work, turnery, carpentry, veneer, slack cooperage, boxes and crates.

35. Fagus sylvatica L. = F. echinata Gilibert =
F. silvestris. Gaertn. = Castanea Fagus Scop.

Fam. Fagaceae

- E. Beech, Buck, European White Beech, White Beech.
- F. Hêtre, Foyard, Fayard, Fauce, Fouteau, Favinier, Fau, Fouillard
- G. Buche, Rothbuch, Bucheboom, Echte Buche

Origin and Distribution

This species is widely distributed in Europe, Asia minor, and Iran from 650 to 2000 meters altitude.

1. General characteristics and properties.

Sapwood whitish; heartwood light yellowish-white to reddish-brown. Wood close and even-grained, without characteristic odor or taste, moderately hard and heavy, lacking in durability when exposed to

alternate dryness and wetness, high in nail holding, has tendency to split along the rays, strong in static and impact bending, takes good polish.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct, delineated by a dark line or band of denser summerwood. Vessels small and numerous, indistinct without a hand lens. Parenchyma not visible with a hand lens. Rays of two types, broad and narrow, former group visible with the naked eye, latter with a hand lens magnification, forming pronounced fleck on radial face.

3. Microscopic features.

Vessels average 130 per square millimeter; average diameter of vessels 60 microns; average length of vessel segments 500 microns; tyloses present in the heartwood; perforation plates simple or occasionally scalariform; intervessel pits oval to long-elliptical, with horizontal or nearly horizontal orifice. Parenchyma abundant, metatracheal and metatracheal-diffuse. Fibers thick-walled, medium in height. Rays, unstoried, homogeneous; narrow rays much more numerous than broad ray; average height of broad rays 3000 microns; average height of simple rays 150 microns; average width of broad rays 180 microns; average width of simple rays 15 microns; broad (oak-type) rays 15-25 plus seriate; simple rays uniseriate to 1-5 seriate; average number of rays per square millimeter 6.

4. Uses.

Railroad ties, slack cooperate, widely used in chair making, boat

building, for veneer, boxes, crates, excellent for firewood, and charcoal for gunpowder.

36. Carpinus betulus L. = C. vulgaris Mill. =
C. sepium Lam. = C. ulmifolia, Salish.

Fam. Betulaceae

E. Hornebeam, Hardbeam, White beech,
Yoke elm, Hornbeech.

F. Charme, Charmille, Charme-faux bouleau

G. Hornbaum, Hainbuche, Weissbuche,
Hagebuche, (Heckenbuche)

Origin and Distribution

Central Europe, western Asia, including Iran, from 200 to 1000 meters altitude in northern Iran.

1. General characteristics and properties.

Sapwood white, merging gradually into heartwood, sometimes not distinguishable from heartwood, when distinguishable, heartwood pale yellowish. Wood without characteristic odor or taste, close-grained, hard, tough, moderately strong in static and impact bending, somewhat lustrous, difficult to split.

2. Macroscopic features.

Wood diffuse porous. Growth rings usually distinct, sometimes not clearly marked in cross section, but on tangential face marked by uneven dark lines, very sinuous, delineated by a narrow, whitish band at the outer margin. Pores are very small and rather obscure and indistinct without a hand lens. Parenchyma, present, sometimes distinct with a hand lens. Rays, of two types; aggregate rays visible to the naked eye;

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narrow (simple) rays are visible with a hand lens; rays are numerous, more or less irregularly distributed.

3. Microscopic features.

Vessels oval; average number of vessels per square millimeter 80; average diameter of vessels 55 microns; average length of vessel segments 460 microns; perforation plates simple, intervessel pits or bicular to oval or angular. Parenchyma, metatracheal, metatracheal-diffuse, and terminal; metatracheal parenchyma very abundant, the others sparse. Fiber thin- to moderately thick-walled. Rays heterogeneous; average length of rays 200 microns; average width of rays 20 microns; average number of rays per square millimeter 150. Rays of two types, aggregate and simple, aggregate rays consist of simple rays, fibers and vessels.

4. Uses.

Excellent for mine timbers, fuel, handles, mallets, lasts and skittles.

37. Alnus glutinosa, Willd. = Betula Alnus glutinosa L. =
A. denticulata C. A. M. = A. barbata C. A. M. =
A. nitens C. Kock. = A. rotundifolia Mill. =
A. communis, Desf. = A. nigra, Gilibert

Fam. Betulaceae

- E. Howler, Owler, Black alder, Aller,
 Eller, European alder
 F. Vergne, Verne
 G. Eller, Bach Erle, Schwarz Erle

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Origin and Distribution

This species is widely distributed in temperate Europe, north Africa, Asia, including Japan and Iran, up to 1000 meters altitude.

1. General characteristics and properties.

Heartwood indistinct without characteristic odor. Wood is white, when cut, becoming reddish-white, subject to oxidative sap stain, soft, light, smooth-grained, fine-textured, and lustrous, not durable, easy to work with tools, takes paint well and easily splits.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct in cross section, delineated by a whitish or brownish line at the outer margin. Pores numerous and small, but distinct with a hand lens. Parenchyma indistinct. Rays are clearly defined, of two types broad (aggregate), and narrow (simple); simple rays not visible without a hand lens; aggregate rays not sharply delineated.

3. Microscopic features.

Wood diffuse porous. Vessels oval, average 70-110 (100) per square millimeter; average diameter of vessels 55 microns; average height of vessels 800 microns; perforation plates scalariform with 25 plus thin bars; intervessel pits orbicular to oval (perforation plates simple in Populus and Salix). Parenchyma, paratracheal, metatracheal-diffuse, fairly abundant. Fibers thin to moderately thick-walled. Rays unstoried, homogeneous; simple rays uniseriate; aggregate rays consist of simple rays and of included fibers and vessels; average length of rays 250 microns; average width of rays 18 microns; average

100

number of rays per square millimeter 16.

4. Uses.

It is used mainly for charcoal production, furniture, millwork, canoe making, small articles, cabinet-making and plywood manufacturing.

38. Alnus subcordata C. A. M. = A. cordifolia Ten. Var. subcordata Regel

Fam. Betulaceae

E. Alder

F. Aune

G. Erle

Distribution

Northern Iran, up to 1600-2000 meters altitude.

1. General characteristics and properties.

Wood white to reddish-white, similar in general characteristics to Alnus glutinosa Willd.; except in some minor macroscopic and microscopic features. The maximum of thin bars in scalariform perforation plates of Alnus glutinosa Willd. is 25, and 20 for Alnus subcordata C. A. M. The summerwood delineation tends to show small curvature in contact with broad rays, in Alnus glutinosa Willd. Delineation line tends to show a conspicuous curvature (U-shaped) in contact with broad rays in Alnus subcordata C. A. M. This species has the same principal uses as Alnus glutinosa Willd.

39. Liquidambar orientalis L.

Fam. Hamamelidaceae

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Origin and Distribution

A genus of about four species in central and western Asia and northern and central America and China.

1. General characteristics and properties.

Sapwood white; heartwood gray to grayish-brown. Wood without characteristic odor or taste, heavy, fairly hard, moderately strong in compression parallel to the grain, static and impact bending, frequently interlocked but mostly straight-grained, average in nail holding ability, has a tendency to warp and twist, shrinks considerably and moderately durable, takes a satiny polish.

2. Macroscopic features.

Wood diffuse porous. Growth ring inconspicuous. Pores small, uniform in size, solitary or in multiples of 2-3, numerous and not visible to the naked eye. Parenchyma not visible. Rays not distinct to the naked eye, very close, occupying half of the area on the transverse surface of the wood.

3. Microscopic features.

Vessels round to oval; perforation plates scalariform; spiral thickenings present, restricted to the tapering ends of vessel segments; intervessel pits orbicular to oval or linear. Parenchyma paratracheal and metatracheal-diffuse; and sparse. Fiber tracheids moderately thick-walled. Rays of two types and unstoried.

4. Uses.

Liquid storax, a gray-brown resin, is obtained from L. orientalis, used in the orient for medicine, perfumery and for the preparation of

incense. Wood is used for furniture, veneer, turnery, slack, cooperage, railroad ties, cabinet work, boxes and crates.

40. Aesculus Hippocastanum, Linn.

Fam. Sapinaceae

E. Horse-chestnut

F. Marronnier d'Inde

G. Roszkastanie

Origin and Distribution

Indigenous to Turkey and Greece, and commonly distributed throughout Europe and completely naturalized there.

1. General characteristics and properties.

Sapwood white to grayish-white; heartwood slightly yellowish or reddish. Wood without characteristic taste, odorless or with a slight characteristic odor, soft, fine-grained, weak in compression parallel to the grain, static and impact bending properties, shrinks moderately, low in durability.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct and delineated by a line of darker summerwood. Pores numerous, minute, not visible without a hand lens. Parenchyma visible or indistinct without a hand lens. Rays very fine, scarcely visible with a hand lens, occupying half of the area on the transverse section.

3. Microscopic features.

Vessels round or mostly oval; perforation plates simple; inter-vessel pits orbicular to oval or angular. Parenchyma terminal and

paratracheal. Fibers thin-walled. Rays storied to unstoried, homogeneous to heterogeneous.

4. Uses.

For cart linings, packing cases, boxes and crates. (Wood similar in character to Willow and Poplar.)

41. Castanea sativa Mill. = castanea vesca Gaert. =
 C. vulgaris Lam. = Fagus castanea L.

Fam. Fagaceae

E. Chestnut, Sweet Chestnut tree,
 Meat-nut, Spanish chestnut.

F. Châtaignier, Castagné

G. Kastanienbaum, Echte Kastanie,
 Edel Kastanie, Gottereichel

Origin and Distribution

About 10 species known in Europe, North America, north Africa and Asia. Castanea sativa Mill. has been ascribed to northern Iran, but is not a native of this country; indigenous to the continental Europe.

1. General characteristics and properties.

Sapwood yellowish-white or light-brown; heartwood darker brown. Wood without characteristic odor, with a slight tannin taste, moderately light, hard, weak in compression parallel to the grain, static and impact bending, straight and coarse-grained, tendency to warp, subject to ring-shakes, shrinks moderately, average in nail holding ability, and durable.

2. Macroscopic features.

Wood ring porous. Growth rings distinct. Springwood pores large,

visible to the naked eye; forming a broad circle in the springwood and bifurcating lines beyond; transition from springwood to summerwood abrupt; summerwood pores small. Parenchyma indistinct. Rays fine hardly distinguishable with a lens.

3. Microscopic features.

Perforation plates simple, occasionally scalariform in the summerwood vessels. Parenchyma paratracheal to metatracheal-diffuse. Fibers thin-walled. Rays unstoried, homogeneous.

4. Uses.

For fenceposts, rails, staves, cabinet-work and charcoal.

41. Betula alba L. = B. verrucosa, Ehrh = B. alba Ssp.
verrucosa, Regel = B. ovata, C. Kock.

Fam. Betulaceae

- E. Birch, Silver birch, Silver white birch,
Lady birch tree, American white birch,
Paper birch, European birch, Black birch,
White birch.
- F. Bouleau, Bouillard, Bois à balais,
Arbre de la sagesse
- G. Birke, Weissbirke, Warzige Birke,
Hexenbesen

Origin and Distribution

Northern Europe and Asia, in extreme boarder of northern forest of Iran.

1. General characteristics and properties.

Sapwood white to yellowish pale; heartwood light, reddish-white to light brown. Wood without characteristic odor or taste, straight and even-grained, moderately hard and heavy, difficult to split, easily

worked, not strong, capable of finishing very smoothly, possess good nail-holding ability, not durable liable to the attack of insects.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct (with a lens), delineated by a fine line of denser fibrous tissue and by smaller pores of the summerwood. Pores are exceedingly small, plugged. Parenchyma not visible. Rays fine, generally not distinct to the naked eye, narrower than the larger pores.

3. Microscopic features.

Vessels oval, 50-100 per square millimeter; perforation plates scalariform; intervessel pits orbicular to oval or angular. Parenchyma metatracheal-diffuse, paratracheal and terminal. Fibers thin- to thick-walled. Rays unstoried, 1-5 seriate, homogeneous.

4. Uses.

Wood valued by turners for cups and bowls; and for felloes of wheels, cooperage, fuel, broom handles, hoops, crates, boxes, baskets, boats, building, furniture, agricultural implements and general wood-work, valued for veneer; produces excellent crayon charcoal.

42. Tilia rubra D. C. = Tilia begonifolia Stev.

Fam. Tiliaceae

E. Lime-tree, Linden, Teil-tree,
Basswood

F. Tilleul, Tillot

G. Lindenbaum, Linde

Origin and Distribution

Northern Iran, up to 2300 meters altitude.

1. General characteristics and properties.

Sapwood whitish, merging gradually into heartwood; heartwood brownish-white to pale brown. Wood tasteless with a faint odor on fresh-cut wet surface, slightly lustrous, soft, tough, close-grained, easily worked, but not strong, finishes smoothly, has poor nail-holding ability, shrinks considerably, not durable.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct, delineated by difference in the size of pores in the springwood and summerwood. Pores small, numerous, visible with a hand lens. Rays not distinct without a hand lens.

3. Microscopic features.

Vessels round, average 75 per square millimeter; average diameter of vessels 65 microns; average length of vessel segments 320 microns; perforation plates simple; spiral thickenings present; intervessel pits polygonal through crowding, orbicular to oval. Parenchyma abundant, terminal and metatracheal. Fibers thin-walled, medium short to medium long. Rays unstoried, or somewhat storied, homogeneous, average height of rays 250 microns, average width of rays (1-5) seriate 25 microns, average number of rays per square millimeter 7.

4. Uses.

For cheap furniture, chair-seats, carpentry, turnery, charcoal, cooperage, boxes, crates, millwork. Veneer used in manufacture of plywood. Can be used to some extent for pulp.

43. Rhamnus cathartica L.

Fam. Rhamnaceae

E. Buckthorn

F. Nerprun, Bourdaine

G. Faulbaum, Kreuzdorn

Origin and Distribution

Europe, north Africa, Asia (Rhamnus cathartica L.), Northern Iran from 800 to 2400 meters altitude.

1. General characteristics and properties.

Sapwood greenish-yellow, narrow; heartwood orange-red. Wood without characteristic odor or taste, hard and heavy, shrinks little.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct delineated by distinct zone of pores in the springwood, and remarkably flamboyant groups of vessels in the summerwood. Pores small, indistinct without a hand lens, numerous; pores in springwood larger than summerwood forming a continuous uniseriate row at the beginning of the ring. Parenchyma not visible. Rays indistinguishable.

3. Microscopic features.

Vessels round to oval; perforation plates simple; spiral thickenings present; intervessel pits orbicular to oval. Parenchyma, paratracheal and metatracheal-diffuse. Fibers thin-walled. Rays homogeneous.

4. Uses.

Wood used as firewood and turnery articles.

44. Populus nigra, L. var. pyramidalis Roz. = P. pyramidalis,
 Rozier = P. dilatata. Ait. = P. Italica, Auct. =
P. fastigiata, Poir.

Fam. Salicaceae

E. Lombardy poplar

F. Peuplier pyramidale, P. d'Italie

G. Pyramidenspappel

Origin and Distribution

Populus nigra L. is widely distributed in Europe, northern Asia, including Iran.

1. General characteristics and properties.

Sapwood white, nearly white to whitish-yellow merging gradually into heartwood; heartwood whitish yellow to light grayish-brown. Wood without characteristic odor or taste, not strong, not durable, easy to work with tools, moderately soft, high in resistance to splitting, has tendency to warp when seasoned.

2. Macroscopic features.

Wood diffuse porous. Growth rings not conspicuous. Pores small, numerous, not visible without 10-X magnification. Parenchyma terminal indistinct. Rays very fine, scarcely visible with a hand lens.

3. Microscopic features.

Vessels round and oval; average 80 per square millimeter; average diameter of vessels 70 microns; average length of vessels segments 300 microns; perforation plates simple; intervessel pits orbicular to oval, mostly angular. Parenchyma terminal, forming a narrow, continuous or interrupted line. Fibers, thin-walled, 20-35 microns in diameter.

Rays, unstoried, uniseriate, homogeneous; average length of rays 220 microns; average width of rays 15 microns; average number of rays per square millimeter 12.

4. Uses.

Because it does not split readily it is useful for the bottoms of waggon; it is used for tool handles, furniture, agricultural implements, roof construction and fuel in dry region of Iran.

45. Populus nigra L., Var. pubescens L.

Fam. Salicaceae

E. Italian poplar, Black poplar,
Willow poplar, Water poplar

F. Peuplier noir, P. franc,
P. suisse, Liard, Liardier

G. Schwarzpappel, pappel Weide,
Deutsch Pappel, Wollenbaum

Wood whitish to light grayish-brown, similar in general macroscopic features to that of Populus nigra L., Var. pyramidalis L.

46. Populus alba L. = P. nivea, Willd.

Fam. Salicaceae

E. Aspen-tree, White asp, Abele-tree,
White poplar

F. Peuplier blanc, P. grisard,
P. de Hollande, Bouillard,
Blanc de Hollande, Ypreau,
Franc picard

G. Silberpappel, Abele, Weisspappel,
Weisseaspe, Albe

1

Origin and Distribution

Northern Africa, northern and western Asia, including Iran. North and other parts of plateau of Iran.

1. General characteristics and properties.

Sapwood white, heartwood whitish-yellow to light-brown. Wood moderately soft, similar in general macroscopic features to that of Populus nigra, var. pyramidalis L., used extensively in match manufacturing, boxes, crates and etc.

Populus euphratica Oliv. = P. diversifolia, Shrenk.

Fam. Salicaceae

E. Sind poplar

F. Peuplier

G. Pappel, pappelbaum

Origin and Distribution

Southern Asia, including Iran.

1. General characteristics and properties.

Heartwood light-reddish to reddish-brown in color. Wood straight to more or less interlocked grained, moderately durable in contact with water, subject to insect attack, medium fine to uneven-textured, rather lustrous. It seems to be suitable for plywood manufacturing.

47. Salix aegyptiaca L. = S. nitida Gmel = S. phlomoides M. B. = S. Medemi Boiss. = S. cinerea L. Var. Medemi Boiss.

Fam. Salicaceae

E. Egyptian Willow (Calaf, Ban)

F. Saule d'Egypte, Saule d'orient

G. Ägyptischer Weide

Origin and Distribution

Northern and western Iran, up to 200 meters altitude.

1. General characteristics and properties.

Sapwood whitish; heartwood light brown to grayish-brown. Wood without characteristic odor, light, moderately soft, and weak, straight-grained, not durable.

2. Macroscopic features.

Wood diffuse-porous. Growth rings distinct, but not conspicuous. Pores numerous and uniformly distributed. Parenchyma terminal, indistinct. Rays very fine, scarcely visible at low magnification.

3. Microscopic features.

Vessels round to oval; average 90 per square millimeter; average diameter of vessels 60 microns; average length of vessel segments 300 microns; perforation plates simple; intervessel pits mostly angular. Parenchyma, terminal, forming a narrow, continuous interrupted line. Fibers, thin to moderately thick-walled, 16-32 microns in diameter. Rays unstoried, uniseriate, and heterogeneous, average length of rays 200 microns, average number per square millimeter 12.

4. Uses.

Used for fuel, charcoal, boxes, boomerangs and furniture.

48. Salix australior And.

Fam. Salicaceae

E. Willow, Withy, Sally

F. Saule

G. Weide

Distribution

Dry region of Iran.

1. General characteristics and properties.

Wood light grayish-brown, similar in general macroscopic features to that of Salix aegyptiaca L.

Note: The most important Salix species as timber-trees are Salix aegyptiaca L. and Salix fragilis L. Species of Salix purpurea L. with red or purple bark; Salix acmophyll. Boiss, or golden willow, with yellow bark, and Salix australior And (Black-willow), Salix persica Boiss, Salix micans And, and Salix carmanica Boiss, are steppic and mere prostrate of no important value as timber-tree. In all these species numerous pores are small, and the rays cannot be distinguished with lens.

49. Salix babylonica L.

Fam. Salicaceae

- E. Weeping willow,
Mourning willow (Garb)
- F. Saule pleureur, S. de Babylone,
S. parasole, S. du Levant,
Paradis des Jârdiniers
- G. Hangeweide, Traverweide,
Babylonische Weide

This species is an ornamental tree; wood is similar in general macroscopic features to that of Salix aegyptiaca L.

50. Buxus sempervirens L.

Fam. Buxaceae

E. Box, Boxtree, Garden Edging Box

F. Buis, Buis toujours vert

G. Bux, Buchsbaum, Buxbaum, Echter
BuxbaumOrigin and Distribution

Northern and western Asia, including Iran, Japan, Himalayas (India), Africa, and southern Europe, from Norway to the Mediterranean, is known under the commercial name of "boxwood" (Persian, Abasian, Mediterranean, Turkish and Himalayan).

1. General characteristics and properties.

Sapwood white; heartwood light yellow, to whitish-yellow in color. Wood very close and even-grained, hard and heavy, firm, free from heart shakes, possessing what might be termed "boxwood" qualities, difficult to split, but very apt to split in drying, works smoothly, durable, slightly lustrous, dense and very strong. Wood very homogeneous in texture, compared for closeness and evenness of grain to Ebony.

2. Macroscopic features.

Wood diffuse porous. Growth rings narrow, more or less distinct, delineated by a line of denser summerwood. Pores are exceedingly small and are not distinct without a hand lens. Rays very fine and numerous. Growth rings, rays and vessels are indistinct with the naked eye. Parenchyma not visible.

3. Microscopic features.

Vessels round, average 130 per square millimeter; average diameter

of vessels 35 microns; average length of vessel segments 300 microns; perforation plates scalariform; intervessel pits very small, average 4 microns in diameter. Parenchyma present, fairly abundant. Rays homogeneous to heterogeneous; average length of rays 200 microns; average width of rays 18 microns (1-2 seriate); average number of rays per square millimeter 10.

4. Uses.

Chief use of this wood is for engravings, chiefly exported from Iran and Abasia in Circassia to European countries. Is also turned into spoons, forks, small boxes and boards. For most delicate articles, wood is soaked for 24 hours in water, and then boiled. It is then wiped perfectly dry and buried until wanted for use. The manner in which wood is harvested has effect on its quality. It should be cut in month of January only, then it should be placed in a dry pit below level of ground, and covered with dry straw, remaining in such a position for two years, and then steamed: Boxwood is demanded for engraving blocks, for printing in cheap papers, woodcuts for printing and fine engraving, rulers, mathematical instruments, shuttles, combs, inlay work and tool handles.

51. Parrotia persica D. C.

Fam. . Hamamelidaceae

E. Iron-wood, Moroco Iron-wood,
Iron-tree

F. Parrotie de la perse

G. Parrotie, Eisenholz, Transkaukasiches
Eisenholz, Umbürtel

Origin and Distribution.

From 1400 up to more than 2000 meters altitude in northern Iran.

1. General characteristics and properties.

Heartwood light pinkish-white, very close and even-grained, without characteristic odor or taste, hard, moderately heavy, durable.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct, delineated by a dark line of denser summerwood. Pores extremely small, rather scanty, indistinct without a hand lens. Parenchyma not visible. Rays very fine, numerous and regular.

3. Microscopic features.

Vessels round and slightly oval, average 120 per square millimeter; average diameter of vessels 40 microns, average length of vessel segments 360 microns; perforation plates scalariform with 8-18 plus thin bars; intervessel pits orbicular to oval. Parenchyma present, forming uniseriate lines, fairly abundant. Fibers, moderately thick-walled. Rays unstoried, homogeneous; average length of rays 450 microns; average number of rays per square millimeter 12.

4. Uses.

For millwork, charcoal, handles, sleepers, fences, turnery, agricultural implements, wagon-frames and building.

52. Pirus cordata Desv. = P. Boissieriana Bh.

Fam. Rosaceae

E. Pear-tree

F. Poirier

G. Birne, Beere, Echter Birnbaum

Origin and Distribution

Northern Iran up to 2000 meters altitudes.

1. General characteristics and properties.

Sapwood reddish-white; heartwood light, reddish brown, sometimes no true heart present, but wood is darker, light chocolate-brown in the center. Wood remarkable for its extraordinary evenness of texture, which makes it desirable for carving, moderately heavy, hard, tough, difficult to split, fine and close-grained, takes good polish, very durable if kept dry, without characteristic odor or taste, easily cut in any direction.

2. Macroscopic features.

Wood diffuse porous. Growth rings recognizable, delineated by a dark line of denser summerwood. Pores exceedingly fine and numerous, indistinct to the naked eye. Parenchyma not visible. Rays indistinct to the naked eye, and are hardly discernible with the aid of a lens, rays uniform, very fine, and numerous and spread more or less equidistantly.

3. Microscopic features.

Vessels average 220 per square millimeter; average diameter of vessels 30 microns; average length of vessel segments 280 microns; perforation plates simple. Parenchyma metatracheal, and abundant. Fibers, thick-walled, medium short to medium long. Average height of rays 200 microns; average width of rays (1-2 seriate) 15 microns; average number of rays per square millimeter 17.

4. Uses.

Owing to its extraordinary smoothness, it is used for mathematical and drawing instruments and rulers, calico-printing blocks, cabinet work, carving and wood engraving, turnery, picture frames, T-squares and set squares.

53. Cydonia oblonga Mill. = Pyrus cydonia L. =
Cydonia cydonia. Pers. = Cydonia Vulgaris. Pers.

Fam. Rosaceae

E. Quince tree, Golden Apple

F. Cognassier, Coignassier, Coignier,
 Coign

G. Quitte, Echte Quitte, Birnquitte,
 Chuttenbaum

Distribution

Northern Iran.

1. General characteristics and properties.

Sapwood white; heartwood light brown. Wood fine and close-grained, without characteristic odor or taste, medium hard and heavy, warps and cracks in seasoning, similar in its properties to that of Pyrus L.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct, delineated by a dark line of denser summerwood. Pores exceedingly small, numerous and evenly distributed. Parenchyma not visible. Rays uniform, regularly spaced, fine and numerous.

3. Uses.

No important uses.

54. Mespilus germanica L. = M. vulgaris Rchb. =
M. communis Gldenst. = Ostinia mespilus Clairv.

Fam. Rosaceae

E. Medlar-tree, Dutch medlar, English
medlar, Hosedoup

F. Nflier, Nle Mlier, Nesplier

G. Mispel, Deutsche Mispel, Mespelboom,
Nispel

Distribution

Northern Iran up to 2000 meters altitude.

1. General characteristics and properties.

Sapwood white; heartwood, light brown. Wood moderately close-grained, hard and heavy, without characteristic odor or taste, warps and cracks.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct, delineated by a dark line of denser summerwood. Pores exceedingly fine and numerous. Parenchyma not visible. Rays uniform, very fine and numerous.

3. Microscopic features.

Perforation plates simple. Parenchyma metatracheal and abundant. Fibers thin-walled.

4. Uses.

Turnery, fuel, and walking-sticks.

55. Crataegus monogyna (Willd.) Jacq. = C. Azarella Griseb =
C. heterophylla Stev. = Mespilus oxyacantha D. C. =
Mespilus monogyna. Willd.

Fam. Rosaceae

E. May tree, Hawthorn, Thornapple-tree,
Quickest White Thorne

F. Aubépine, Noble épine, Aubespine, Bois de Mais,
Poire d'oiseau, Mais

G. Spitzdorn, Weissdorn, Rotdorn,
Christdorn Heckdorn

Distribution

Northern Iran up to 2200 meters altitudes.

1. General characteristics and properties.

Heartwood pale reddish-brown to yellowish-white. Wood moderately hard, close and even-grained. Wood without characteristic odor or taste.

2. Macroscopic features.

Wood ring porous. Growth rings distinct, delineated by darker-colored wood on the outer edge of each ring. Pores small and numerous, and fairly evenly distributed. Parenchyma not visible. Rays very fine and numerous.

3. Uses.

Good for walking-sticks.

56. Zizyphus spina-christi (L.) Willd. = Rhammus spina-christi L. =
Rhammus heterogenea Burm. = R. nabeca Forsk.

Fam. Rhamnaceae

E. Nabca-tree, Lote-tree, Christ's thorn

F. Jujubier épine du christe, Guindallier, Nabca,
Chicourlier, Epine du Christe

G. Christdorn, Christdornbrustbeere

Origin and Distribution

South of Iran (Baluchistan) (Lace); a tree characteristic of the arid regions of Iran.

1. General characteristics and properties.

Heartwood reddish-grey. Wood hard and close-grained, slightly brittle.

2. Macroscopic features.

Wood semi-ring porous. Growth rings distinct. Pores moderate in size, larger in springwood, pores more numerous in springwood than summerwood, round to oval. Rays fine.

3. Uses.

It coppices well and produces good charcoal, it might be used for saddletrees, oil-mills, agricultural implements, branches used for fences.

Zizyphus vulgaris Lam. = Rhamnus zizyphus L.

Fam. Rhamnaceae

Origin and Distribution

India, Kashmir, Baluchistan, plateau of Iran, northern Iran and Europe.

1. General characteristics and properties.

Sapwood pale yellow to yellowish-brown; heartwood dark brown. Wood moderately hard, and even-grained.

2. Macroscopic features.

Growth rings distinct, marked by a zone of numerous springwood pores. Rays are fine and short.

Zizyphus nummularia (Burm) Walk. = *Z. microphylla* Roxb. =
Rhamnus nummularia Burm. = *Z. rotundifolia* Lam.

Fam. Rhamnaceae

Origin and Distribution

A gergarious species of arid region of south of Iran, Baluchistan and central India.

1. General characteristics and properties.

Wood yellow to yellowish-gray, no heartwood evident, even-grained, moderately hard.

2. Macroscopic features.

Growth rings distinct, indistinct in specimens from the warmer regions. Pores moderately-sized, often round to oval and subdivided. Rays fine.

3. Uses.

Fuel.

57. Cotinus coggygia Scop. = *Rhus cotinus* L. =
Cotinus coccylgea C. Koch. = *Cotinus coriaria* du Hamel =
Cotinus cotinus (L.) Sarg.

Fam. Anacardiaceae

E. Wig tree, Smoke tree, Zantewood, Purple fringe
 Young Fustic, Feather tree, Aaron's Beard,
 Poison Ash, Venetian sumach, False fringe tree,
 Venice sumach, Smoke plant.

F. Arbra à perruque, Fustet, Sumac fustet, Pompon,
 Sumac des tinturiers, Barbre de Jupiter,
 Coquecigrue.

G. Perückenstrauch, Echter Perückenstrauch, Gemeiner
 Perückenstrauch, Ungarisches Gelbholz, Junger Fustik

Origin and Distribution

Southern Europe, western Asia, west Himalaya, northern Iran.

1. General characteristics and properties.

Sapwood narrow, and white; heartwood olive green, greenish to golden-yellow, mottled, with a rich dark yellow color, streaked with brownish-grey or greenish-grey, with a lustrous sheen. Wood moderately light, hard, medium-textured, and straight-grained.

2. Macroscopic features.

Wood semi-ring porous. Annual rings distinct, defined by denser summerwood and moderate-sized and large pores of springwood, summerwood pores very small, arranged in radial irregular groups. Rays fine and short, poorly visible with the naked eye.

3. Microscopic features.

Perforation plates simple; intervessel pits round. Parenchyma, paratracheal metatracheal and terminal. Fibers thin-walled. Rays unstoried and heterogeneous.

4. Uses.

Since it has a beautiful color, it can be used for inlay, carving, picture frames and fine cabinet work; it produces yellow dye for leather and wool; the bark and leaves are used for tanning.

58. Olea europea L. = Olea. oleaster Hoffm.

Fam. Oleaceae

E. Olive-tree

F. Olivier

G. "Ölbaum, Echter Ölbaum.

Origin and Distribution

Mediterranean regions, introduced into India, California, and other countries. It is indigenous in Syria, probably in northern Iran and southern Europe.

1. General characteristics and properties.

Sapwood whitish; heartwood yellowish-brown, with irregularly wavy dark-brown streaks and mottling, especially near the root. Wood rather brittle, not hard, takes excellent polish, resembling Buxus sempervirens L. in texture.

2. Macroscopic features.

Without wood diffuse porous. Growth rings distinct by a hand lens, delineated by a dark line of denser summerwood. Vessels small, evenly distributed, single or subdivided, or in small groups in patches of loose tissue. Parenchyma not visible. Rays fine, wavy, numerous and short.

3. Uses.

The wood is valuable in Iran, and used in turnings, for carving small articles, ink-stands, paper-knives, pots, fancy boxes, and for inlay and other small work of decorative nature.

59. Ficus carica L.

Fam. Moraceae

Ficus carica Var. *genuina*. Boiss.

E. Fig-tree, Common fig-tree

F. Figuier sauvage, Caprifiguiers,
Arbre à cariques

G. Feigenbaum, Zahnfeigenbaum

Origin and Distribution

Fig genus contains some of the giants of the vegetable kingdom, *F. carica* L. is cultivated in western Asia, from India to Kashmir, Afghanistan and Iran.

1. General characteristics and properties.

Wood dirty grey, soft, in regular concentric bands of soft tissues, light, and slightly lustrous.

2. Macroscopic features.

Growth rings not recognizable. Vessels moderately-sized and small, often oval and subdivided. Parenchyma, not visible. Rays fine. Wood characterized by alternate bands of soft and hard tissue.

3. Uses.

Wood is not suitable for general use; it might be employed for secondary cabinet.

Ficus bengalensis L. = *Urostigma bengalense*, Gasp.

Fam. Moraceae

E. Banyan, Bantan-tree

F. Figuier des Indes

G. Banyan

Origin and Distribution

A tree of south and sub-Himalayan forest of India, Ceylon, and southern Iran, growing near the Gombroon (Bandar, Abbas in the Persian Gulf), a large tree, throwing down aerial roots from the branches, banayan, is the name which was given to the tree growing near Gombroon.

1. General characteristics and properties.

Wood grey, no heartwood, moderately hard, consisting of narrow, wavy, concentric bands of soft tissue, alternating with broader bands of darker and firm tissue; on radial section has a characteristic grain not unlike Bombax malabaricum.

2. Macroscopic features.

Pores range from moderately-sized to large, scattered irregularly, often scanty and subdivided, transverse section shows narrow, and wavy concentric bands. Rays fine, equidistant, very distinct, not numerous.

3. Uses.

Used for well-curbs, as it has attractive grain. Can be made into furniture, cabinet work, and door panels.

60. Acer campestre L.

Fam. Aceraceae

E. Maple-tree, Bird's tongue, Dog Oak, Master tree, Maple-field, Field-maple, common maple

F. Erable champêtre, Petiterable, Auzerole, Aceraïlle

G. Feldahorn, Angerbinbaum, Massholder, Masseller Peitschenholz

Origin and Distribution

Central Europe, northern Asia, including Iran, northern Iran from 1100 to 2600 meters altitude.

1. General characteristics and properties.

Sapwood white; heartwood light-brown, or reddish-white. Wood without characteristic odor or taste, usually fine-grained, tough and

moderately hard, with a beautiful satiny lustre, shrinks moderately, moderately high in nail-holding ability, curly and mottled specimen present.

2. Macroscopic features.

Wood diffuse porous. Growth rings fairly distinct, delineated by a narrow, darker line of denser fibrous tissue, slightly wavy. Pores are small, minute and indistinct without a hand lens. Parenchyma not visible. Rays fine and distinct with a naked eye.

3. Microscopic features.

Microscopic features similar to those of Acer insigne Boiss. Vessels numerous; perforation plates simple; intervessels pits orbicular to oval or angular; spiral thickenings present. Parenchyma sparse, terminal, paratracheal, and metatracheal diffuse. Fibers thin to moderately thick-walled. Rays unstoried and homogeneous, 2-4 seriate.

4. Uses.

Turnery, cabinet making, excellent for fuel and charcoal, furniture, crates and boxes.

61. Acer pseudoplatanus L.

Fam. Aceraceae

E. Maple-tree

F. Erable

G. Ahorn

Origin and Distribution

Central Europe and western Asia.

1. General characteristics and properties.

Sapwood, white; heartwood, white to pale whitish-yellow when green, becoming yellowish with age. Wood fine and straight-grained, tough, medium heavy and hard, easily worked, splitting evenly, susceptible to cracking and warping in seasoning, without characteristic odor or taste, very durable if kept dry, taking a very smooth polish. Rays with a satiny lustre.

2. Macroscopic features.

Wood diffuse porous. Growth rings fairly marked by fine lines of denser figrous tissue. Pores small and indistinct, evenly distributed and irregularly spaced. Rays visible with a naked eye, with a satiny lustre on radial surface.

3. Microscopic features.

Microscopic features similar to those of Acer insigne Boiss. Vessels numerous; perforation plates simple; intervessels pits orbicular to oval or angular; spiral thickenings present. Parenchyma, sparse, terminal, paratracheal and metatracheal diffuse. Fibers thin to moderately thick-walled. Rays unstoried and homogeneous.

4. Uses.

For violin backs, table-tops, platters and spoons, cabinet work, reels, coach-panels, panels, railway cars, millwork, crates and boxes, charcoal (superior to beech).

62. Acer laetum C. A. M. = A. hederaefolia Tourn.

Fam. Aceraceae

E. Maple-tree

F. Erable

G. Ahorn

Distribution

Northern Iran from 150 to 2600 meters altitude.

1. General characteristics and properties.

Sapwood white; heartwood light-brown, to light grayish-brown.

Wood without characteristic odor or taste, usually straight and fine-grained, taking smooth polish, shrinks moderately, slightly lustrous, with handsome ray flecks.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct, delineated by a narrow, darker line of denser fibrous tissue. Pores are small and indistinct to the naked eye, uniform in size and regularly distributed. Parenchyma not visible. Rays of two widths, broader rays visible with a naked eye, forming a ray fleck on the quarter surface, narrow rays scarcely visible with a hand lens.

3. Microscopic features.

Microscopic features similar to those of Acer insigne Boiss.

Vessels numerous; perforation plates simple; intervessel pits orbicular to oval or angular; spiral thickenings present. Parenchyma, sparse, terminal, paratracheal, and metatracheal diffuse. Fibers thin to moderately thick-walled, length of fibers short. Rays unstoried and homogeneous, 1-3 seriate.

4. Uses.

For charcoal, fuel, millwork, turnery, crates, boxes, cheap furniture.

63. Acer insigne Boiss. et Bh.

Fam. Aceraceae

E. Maple-tree

F. Erable

G. Ahorn

Origin and Distribution

Northern Iran, up to 2000 meters altitude.

1. General characteristics and properties.

Sapwood white; heartwood greyish-white. Wood without characteristic odor or taste, usually straight-grained, fine-textured, moderately heavy and elastic, not very strong nor durable, takes a very smooth polish, shrinks moderately, works well with tools, moderately high in nail-holding ability, with a satiny lustre.

2. Macroscopic features.

Wood diffuse porous. Growth rings fairly distinct, delineated by a narrow, darker line of denser fibrous tissue. Pores are small and indistinct without a hand lens, uniform in size and regularly distributed. Parenchyma not visible. Rays of two widths, broader rays visible to the naked eye, forming a ray fleck on the quarter surface, narrow rays scarcely visible with a hand lens.

3. Microscopic features.

Vessels average 60 per square millimeter; the average diameter of

vessels 50 microns; average length of vessel segment 250 microns; perforation plates simple; intervessels pits orbicular to oval, or angular; spiral thickening present. Parenchyma sparse, terminal, paratracheal, and metatracheal-diffuse. Fibers, thin to moderately thick-walled. Rays, unstoried and homogeneous; average height of rays 400 microns; average width of rays (1-10 seriate) 80 microns; average number of rays per square millimeter 4.

4. Uses.

Cabinet making, cheap furniture, broom-handles, turnery, wooden dishes, shovels, house-frame, wooden bowls, shoe lasts, crates, boxes, millwork, wooden ware and novelties, musical instruments, charcoal and fuel.

Acer platanoides L.

Origin and Distribution

Norway to central Europe.

1. General characteristics and properties.

Heartwood white, but inclining to gray, when mature. Wood without characteristic odor or taste, hard, moderately heavy, tough, takes good polish, lacking in durability when exposed to wetness, has a tendency to warp and crack, close-grained, easy to work with tools.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct, delineated by a denser summerwood, slightly wavy. Vessels small and indistinct. Parenchyma not visible. Rays fine with a satiny luster on radial surface.

3. Microscopic features.

Microscopic features similar to those of Acer insigne. Boiss.
Vessels numerous; perforation plates simple; intervessel pits orbicular to oval or angular; spiral thickenings present. Parenchyma sparse, terminal, paratracheal, and metatracheal diffuse. Fibers thin to moderately thick-walled, length of fibers short. Rays unstoried and homogeneous, 6-9 seriate.

4. Uses.

For musical instruments, turnery.

64. Cornus australis C. A. M. = C. sanguinea Ledeb =
C. citrifolia Wahl.

Fam. Cornaceae

E. Dog-wood, Dog-berry, Cornel-tree

F. Cornouiller

G. Hartriegel

Origin and Distribution

Northern Iran up to 1000 meters altitudes.

1. General characteristics and properties.

Sapwood white to light reddish-brown; heartwood very pale brown.
Wood without characteristic odor or taste, heavy, hard to very hard, fine-grained, strong in compression parallel to the grain, static and impact bending, difficult to work with tools.

2. Macroscopic features.

Wood diffuse porous. Growth rings distinct but not sharply delineated. Pores small, not distinct without a hand lens, solitary

and in multiples of two to several. Parenchyma not distinct, or distinct with a hand lens. Rays of two widths, broader rays visible, but not sharply delineated against the background of pores and fibrous tissue; narrow rays scarcely visible with a hand lens.

3. Microscopic features.

Vessels round to oval; perforation plates scalariform; intervessel pits oval to linear. Parenchyma paratracheal, metatracheal-diffuse. Fibers moderately thick to thick-walled. Rays unstoried, heterogeneous.

4. Uses.

Used for wood-engraving, turnery, cogs, tool-handles, mallets and shuttles and formerly for charcoal.

CHAPTER V

FOREST PRODUCTS AND THEIR UTILIZATION
IN IRAN

FOREST PRODUCTS AND THEIR UTILIZATION IN IRAN

Timber Resources and Their Importance in Economy of Iran

Timber Resources in Iran in Comparison with the Other Middle East Countries

Forest resources constitute one of the most important and valuable assets of any nation. Iran is fortunate in having productive forests. According to the Iranian Forest Service, 136,883 cubic meters of roundwood were produced in 1951-52. The home grown lumber and wood products for domestic use and for export trade are of great importance in the national economy of Iran.

Comparative data of accessible forest areas of Asia indicate that Indonesia, India, China, Burma, Japan, Iran, Philippines, Thailand and Turkey, have large forest areas. In the Middle East, however, except for Iran, with nearly 20 million hectares, and Turkey, with 10 million hectares, the other countries do not have adequate forest resources to be self sufficient. A better management of Iranian forests can help the middle east countries with the necessary forest products.

The total amount of hardwoods harvested annually in Iran is 22 million cubic meters, of which 14 million are wasted and only 8 million utilized. According to available data for Asian countries, Japan produces the highest quantity equalling 25 million cubic meters.

More than 4 million cubic meters of roundwood in Iran are used for production of charcoal. This places Iran in the second place among the Asian countries in 1952, after Japan, where 14 million cubic

meters were utilized for charcoal production, and in third place, after Argentina and Japan, among all of the countries of the world.

Land and Forest Area of Asian Countries
Comparative Data on Accessible Forests
(1000 hectares)

	Accessible	Inaccessible	Total	Land Area
Indonesia	63,384	16,410	79,794	148,329
India	48,930	22,049	70,979	328,124
China	28,100	52,420	80,520	940,830
Burma	25,278	13,704	38,982	67,691
Japan	21,780	837	22,617	36,615
<u>Iran</u>	16,000	3,000	19,000	163,600
Thailand	15,715	16,414	32,129	41,629
Philippines	10,738	5,580	16,318	29,741
Turkey	10,284	300	10,584	76,781

Forest Area of Middle East Asia
Comparative Data on Total Forest Areas

	1000 Hectares
<u>Iran</u>	19,000
Turkey	10,584
Pakistan	2,700
Iraq	1,540
Afghanistan	1,000
Syria	449
Israel	89
Jordan	78
Lebanon	74

Total Harvest of Broadleaved Wood
Asia 1955

1000 m ³ Solid Volume of Roundwood	
Japan	26,910
<u>Iran</u>	8,000
Philippines	4,236
Turkey	3,628

Total Harvest of Coniferous and Broadleaved Wood
Asia 1955

1000 m ³ Solid Volume of Roundwood	
Japan	58,638
<u>Iran</u>	8,000
Turkey	5,771
Philippines	4,379

Charcoal Production in the World

1000 m ³ 1952	
Argentina	21,600
Japan	12,109
<u>Iran</u>	4,000
Italy	2,508

Total Utilization of Homegrown Roundwood
(Coniferous and Broadleaved)
Asia 1954

Wood for Charcoal
1000 m³ of Solid Volume of Roundwood

Japan	14,545
<u>Iran</u>	4,000
Indonesia	300
Burma	257
Turkey	205

Utilization of Broadleaved Homegrown Roundwood--1954

1000 m³ of Solid Volume of Roundwood
Wood for Charcoal Total Utilization

Japan	13,096	26,372
<u>Iran</u>	4,000	4,245
Indonesia	300	3,644
Burma	257	2,279
Turkey	205	4,267

Total Forest Products Balances
(In Roundwood Equivalents)
Asia 1954

	1000 m ³ (r) Roundwood Felling	Import	Export	Balance
Japan	56,240	2,530	1,200	57,570
India	15,830	550	50	16,330
<u>Iran</u>	8,450	---	---	8,450
Turkey	5,690	890	15	6,570
Indonesia	3,710	270	280	3,700

Total Forest Products Balances
(In Roundwood Equivalents)
Asia 1955

	1000 m ³ (r) Roundwood Felling	Import	Export	Balance
Japan	58,640	2,580	1,600	59,620
<u>Iran</u>	8,000	12	13	8,000
Turkey	5,770	510	20	6,260
Philippines	4,380	90	1,800	2,670

m³(r) Per 1000 Capita

Per Capita Consumption of Forest Products
Roundwood - Fuelwood
1954-1955

	Fuelwood	Industrial Wood	Average Consumption of Fuelwood
<u>Iran</u>	380	10	260
Japan	310	360	220
Hong-Kong	210	190	150
Turkey	200	80	140

Forest Resources of Iran and Their Products

Of the total of 163 million hectares in Iran, forests cover 19,500,000 hectares, or 12% of the total land area. Caspian forests, with 3,600,000 hectares, are composed of useful species similar to European (Mediterranean) species. Of these Persian walnut, oak, beech, ash, boxwood, elm, elder, are the most valuable. Parrotia persica D. C. and Zelkova crenata Desf. are also valuable for special purposes.

Iran's most important timber resources are located in the Caspian area. It has been estimated that of 3,600,000 hectares of Caspian forests, 1,500,000 hectares support stands of high density, 1,200,000 of medium density, and 900,000 hectares are understocked. The first group supports 150 cubic meter of wood per hectare, the latter 75. The value of these forests is estimated at more than 400 million dollars.

The western forests with 11,300,000 hectares, scattered throughout the Zagros Range, comprise the largest forest area in Iran. These forests could be more productive with better protection and management. Pistacio forests in the region of low rainfall, composed mostly of Pistacio trees, are in poor condition. Limestone forests of the north-eastern part and forests of subtropical regions do not produce commercial timber.

Important Species

A discussion of the most important Iranian timber species for domestic industries and export trade follows.

Quercus castaneaefolia C. A. M., Oak. This species yields an excellent wood for veneer, plywood, general construction and barrel

staves. Large quantities of staves are exported.

Oak growing near the sea coast is characterized by wide growth rings. This is probably due to the effects of favorable climate and soil of high productivity. The rate of growth tends to decrease progressively at the higher elevation. The fast growing wood is best suited for construction purposes, while fine grained wood, because of the more uniform texture and lighter color, is considered more suitable for export trade.

There are other species of oak in the Caspian forest region, but quality of their wood for veneer and wood containers is not well known. It appears that the rate of growth of these oaks is generally slower than that of Q. castaneaefolia C. A. M.

Quercus persica Jetsp., Persian oak. This species is distributed widely through Zagros mountains in the western Iran. The wood of this species is not of the same quality as that of Q. castaneaefolia C. A. M. Since this species grows in drier regions than Q. castaneaefolia its wood is characterized by narrower growth rings and finer texture. However, it generally has wide sapwood which reduces its commercial value. Extensive use of Persian oak in the palaces of Persepolis testifies to the fact that in the past better quality of this timber was available.

Better management of the western forests should improve the growth and the quality of this species. At present average diameter growth of Persian oak is 2 to 3 centimeters a year, with trees 100 years of age reaching a diameter of about one-half meter.

Other valuable species of Iran are boxwood (Buxus sempervirens L.), Parrotia persica D. C., dogwood (Cornus australis C. A. M.), persimmon Diospyros lotus L., birch (Betula alba L.), maple Acer spp. and beech (Fagus silvatica L.); some of these are useful in shuttle and spindle making for textile industries.

Percentage of Important Species in the Caspian Region

Species	Percentage
<u>Carpinus betulus</u> L.	28
<u>Carpinus orientalis</u> Mill	
<u>Fagus silvatica</u> L.	16
Coniferous and Fruit Species	9
<u>Parrotia persica</u> D. C.	8
<u>Diospyros lotus</u> L.	7
<u>Quercus</u> spp.	7
<u>Alnus</u> spp.	6
<u>Acer</u> spp.	5
<u>Pterocarya fraximifolia</u> Lamb.	3
<u>Buxus sempervirens</u> L.	2
<u>Ulmus</u> spp.	2
<u>Zelkova crenata</u> Desf.	1
Shrubs	6

The Caspian forest belt is 1000 kilometers long and 20-30 kilometers wide. The average yield of wood per hectare is 150 cubic meters or a

total of 315,000,000 cubic meters. This should produce an income of 300,000,000,000 rials annually.

Based on the importance and value of different species to wood industries and to export trade they can be divided into three groups of species:

I - First Grade Species

1. Buxus sempervirens L.
2. Quercus castaneaefolia C. A. M.
3. Juglans regia L.
4. Zelkova crenata Desf.

II - Second Grade Species

1. Ulmus montana S. M.
2. Ulmus procera solisb
3. Tilia rubra D. C.
4. Alnus glutinosa Willd.
5. Alnus subcordata L.

III - Third Grade Species

1. Parrotia persica D. C.
2. Carpinus betulus L.
3. Populus spp.
4. Diospyros lotus L.
5. Pterocarya fraxinifolia Lam.
6. Acer spp.

WOOD INDUSTRIES IN IRAN

Iranian wood industries convert a large amount of raw material to useful commodities, however, there still exist many opportunities for further expansion in utilization of wood for domestic and export purposes. Wood using industries in Iran could be separated into three categories.

1. Wood using industries which convert raw material to rough or semi-manufactured commodities. These include sawmills, box and crate factories, barrel stave mills, and wood fuel, cross tie and mine timber producers.
2. Wood using industries, engaged in car construction, wood buildings, furniture factories, veneer and plywood, plants, and house and harbor construction.
3. Wood using industries which operate dry kilns, wood preservation plants, and cardboard and pulp and paper plants.

Modernization of these three groups of industries can increase production 2-5 times, with corresponding beneficial effect on the national economy.

Some industries, such as pulp and paper, are in their primary stage of development. Further development of this industry, installation of wood briquetting plants, and increased use of wood in textile industries can increase considerably utilization of forest products in Iran.

Introduction of new techniques in wood lamination, particle boards, manufacture and wood distillation industries, development and

modernization of plywood, pulp and paper, and other already existing industries, prevention of deterioration in wooden constructions, and use of better drying techniques, can all promote better utilization of wood products in Iran.

Export of Wood and Wood Products

There is annually a certain amount of wood export to European countries such as Ireland, Spain, Belgium, France, Italy and Holland. The major export products are oak, in the form of veneer logs and barrel staves, and walnut for veneer manufacture. The main method of transportation is the Trans-Iranian Railway connecting the forest area of the Caspian Zone to the harbor Khoramshahr in the Persian gulf coast.

Sawmill Industries

The wood requirements by other industries have stimulated private industry in establishing sawmills. The best equipped sawmill is at Tamishan in the Caspian Zone, but there are other well equipped sawmills operated by the government agencies and private industries. The installation of more sawmills is now under consideration by private enterprises.

Besides sawmills there is a group of lumber remanufacturing plants scattered throughout the country. The largest concentration center of these, with 36 mills, is in the capital of Iran.

The sawmilling industry is one of the best developed wood industries in Iran. Improved mechanization should increase the production capacity and the quality of product. Map No. 5 shows distribution of sawmills in Iran.

Use of Wood in Construction and in Production of Poles, Mine Timbers and Crossties

1. Use of wood in construction.

Wood is used for construction purposes mostly in home building in the forest regions. Even in the regions where buildings are not completely built of wood, considerable quantities of wood are consumed in construction.

It has been estimated that more than 300,000 cubic meters of wood are used in Iran for construction purposes annually. Use of wood in construction in the small cities is greater than in the large cities. In the latter, wood is usually used as round or square girders in the buildings. The main use of wood in the southern states, where there are no wood buildings, is for doors, frames, window sash, and similar items. Except for the northern provinces, where wood is used extensively in all parts of the house the use of wood in other provinces is mostly confined to framing.

The species which are used most, especially in non-forested provinces, are poplars, mostly P. nigra var. pyramidaeis Roz. The growth of this species is admirable, but its wood is not as durable as that of other Caspian forest tree species, such as oak, beech, and hornbeam.

Introduction of the Caspian species into door and sash manufacture is reasonable and improvement of the manufacturing facilities should have a beneficial effect on the entire homebuilding industry.

2. Poles.

There are more than 180,000 telephone and telegraph poles in use in Iran. Replacement needs for poles in the existing communication lines require a production of some 45,000 annually. A considerable number of poles is also required in the construction of new lines.

Since cost of replacement is high more attention should be paid to the selection of species and preservation of poles to improve their durability. At the present time some relatively weak species, such as poplar, are used in pole production, a practice which results in heavy damages to the communication lines, especially in the areas with high wind velocity and heavy snow. There is also need for establishing technical standards and specifications for the species, the diameter and length and the straightness of poles for the various uses.

3. Mine timbers.

The production of mine stulls, especially for coal mines in north of Iran, is carried on in the Caspian forest region.

Production of mine timbers in 1952 required more than 10,000 cubic meters of timber. The species used most are Carpinus betulus L. and Parrotia persica D. C.

Though square timbers have some advantages in framing, round timbers are used almost exclusively in all mines.

Strength properties, and the type of failure of the above mentioned species when used for mine timbers were determined by the Forest Products Laboratory, in Karaj, Iran. These two species were found to be the best suited for this purpose. No data on their durability,

however, are available. The decay problems are very critical, especially in the warm and damp air in certain mines and some attempts have been made to preserve these timbers.

Preservation Treatment. Even though for the semi-permanent construction some species possess sufficient durability, in some cases preservation is to be recommended. The average life of untreated timber is about 2-3 years, but treated timbers last 10-20 years. Therefore use of preserved timber is to be recommended. For treatment of the standing telegraph and telephone poles Cobra process has been recommended, in which a preservative is injected into the poles by a flat needle. The open tank system using hot and cold creosote, is adopted for preserving new poles. This system can be installed in different provinces with ease.

4. Railroad ties.

Nearly 4,600,000 railroad ties are in use in Iran, of which 600,000 are metal sleepers and the rest are wood ties. According to the new plans of expansion for the railways 300,000 crossties will be necessary annually for constructional purpose, and 200,000 for maintenance.

The railway administration endeavors to prolong the service of ties by more efficient preservation. An attempted change from creosote to Tanalith for this purpose was found unsatisfactory.

Deterioration of ties before preserving in storage can be remedied by better piling, in which there will be less wood-to-wood contact.

The species used most for ties are: oak, Quercus castaneaefolia C. A. M.,

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beech, Fagus sulvatica L. and elm, Ulmus montana S. M. Oak produces the most satisfactory ties. It is also possible to use untreated ties of such species as black locust Robinia pseudoacacia L., walnut Juglans regia L., and Catalpa speciosa Ward and Catalpa cordifolia.

5. Wood-match Industries.

Present day matches manufactured in Iran are safety type having either a wood or cardboard splint. The production of the first kind of matches is sufficient for domestic and export purposes.

There are more than 80 match factories in Iran, scattered in different provinces, according to distribution of poplar plantations, since this industry uses mostly poplar wood. The study of growth and properties of different species of poplar are continuing in the Forest Product Laboratory, Karaj, Iran. Publication No. 3 of this laboratory on growth and properties of one of the species of poplar may help owners of these factories with the necessary data. The availability of poplar species in many provinces of Iran, except southern states and Bahrain, stimulated the use of these species in the match industry.

Wood blocks for match boxes are usually produced by the sawmills. These blocks are cut into veneer and shaped into boxes. Some of these mills are not wholly mechanized. More extensive mechanization should result in a better quality of the product.

6. Furniture Industry.

This industry consisting of about 300 plants is widely scattered throughout most provinces of Iran. Wood is used as solid lumber, as core stock in panels, and as plywood and veneer. Wood consumption equals approximately 50,000 cubic meters annually.

Veneers of Persian walnut and oak are available, and principally used as face veneers. Stumps of Persian walnut (Juglans regia L.) produce highly figured veneer, for decorative furniture.

Technical assistance is required for further growth of this industry. In some parts of the country wood for parts is boiled in water and then dried in an oven. Recommendations of the Forest Products Laboratory, Madison, Wisconsin, for production of curved wood could be useful for private industry in Iran.

The furniture industry in Iran is growing rapidly. Elimination of seasoning defects in the raw materials, such as splitting and checking, and reduction of glue joint failures should improve quality.

7. Veneer and Plywood Industry.

As a decorative art manufacturing of veneers existed in Iran for many years. No doubt these veneers were hand-sawn from beautiful domestic and foreign species.

Many species of hardwoods produce good veneer and plywood. The output of the Iranian veneer and plywood mills is almost adequate to meet the domestic needs. Only small amounts of plywood are imported.

The main product of this industry is three-ply plywood panels. Panels with a higher number of plies are seldom seen on the market.

Some hand-sawn veneer is still available and is used by the furniture industry. Establishment of well-equipped veneer cutting plants is a necessity.

The glue used in Iran for edge-gluing and splicing is casein, while for the panel assembly blood-albumen is generally employed.

Suggestions and Recommendations. As there is no production of curved plywood in Iran for use in furniture manufacture, installation of a low pressure moulding plant is desirable.

Further improvements in this industry can be achieved by selection of better logs without split, spiral grain and other wood defects, by removing knots in veneer sheets and by introduction of the water-resistant glue, all of which should bring about improvement in quality of the final products. To eliminate importation of plywood new veneer and plywood plants should be established.

8. Use of Wood in Textile Industries.

A great number of wood products are in use in textile industries in Iran, therefore, establishment of plants for production of shuttles, picking-sticks and bobbins would be of great benefit to this industry. Species such as: Acer laetum C. A. M., Acer insigne Boiss, Bh, Fagus sylvatica L., and Betula alba L., could be used for bobbins. Fraxinus excelsior L., Fraxinus oxycarpa W. End, and Zelkova crenata Desf. could be used for picking-sticks, and Buxus sempervirens L., Parrotia persica D. C., Cornus australis C. A. M., and Diospyros lotus L. for shuttles.

9. Wood Seasoning.

There are several dry-kiln installations in Tehran, but further expansion of kiln drying capacity is thought to be essential. Installation of locally made kilns which can be built cheaper than imported kinds has been recommended. In many cases proper drying techniques are not practiced and as a result lumber is split and checked.

A practice of putting green-sawed wood in the direct sunlight should be discouraged. The use of stickers between layers of lumber and covering woodpiles against sunlight, will result in a better quality of lumber.

The choice of a particular kind of a kiln should be determined by the requirement of different industries, such as textile, furniture, etc. Building a large kiln would be cheaper than construction of several small kilns. An economical seasoning method for drying cross-ties in Iran has been recommended. By this method, crossties can be dried to 40 per cent moisture content in 12 hours, while air drying takes 15 months.

10. Wood Preservation Industry.

Crossties. This industry is engaged in helping the railway administration and the P. T. T. to preserve railroad ties and poles. A modern installation in Chirgah, in northern Iran, provides facilities for this purpose. In this plant crossties are preserved with creosote. Tanolith was tried as a preservative for crossties but was found to be unsatisfactory.

Usually the life of untreated ties is nearly five years; creosote treated ties last nearly 30 years. The ratio shows the effect of creosote treatment. The cost of preservative is much lower than the cost of several untreated ties. The data on the percentage of treated ties in the tracks are not available, but it is certain that a very high percentage are preserved. Some of the species which do not need any preservation, such as black locust and catalpa, have not yet been tried.

The most commonly used species are: oak, Quercus castaneaefolia C. A. M., elm, Ulmus montana, S. M., ash, Fraxinus excelsoir L., and beech, Fagus sylvatica L. Beech and oak are more durable than other species, however, some difficulties have been encountered in preserving beech ties. This may be due to the insufficient previous drying or the presence of red-heart in this species.

As preservation is of a great concern to the government agencies, the Forest Products Laboratory at Karaj tries its best to solve the problems of: 1) choice of preservatives, 2) choice of treating methods, and 3) evaluation of durability of different species.

Creosote produces best results in treating crossties in Iran. Other preservatives, such as Tanolith, and other water-soluble preservatives could be used for indoor items and dinitrophenol, copper naphthenate and pentachlorophenol could be used for other outdoor uses.

Telephone and Telegraph Poles. Open-tank immersion in hot and cold creosote is adopted for preserving poles by the P. T. T. The equipment is simple and such plants can be established in all the states and provinces of Iran. For standing poles the Cobra process has been recommended, and for mine-timber hot and cold creosote application in an open barrel is used.

11. Wood Container Industry.

Wooden barrels were in use for holding such liquids as vinegar and alcoholic beverages since 500 B. C. This industry, however, has remained in a primitive state and barrel staves are still produced by hand-hewing.

Barrel staves are made of oak, Quercus castaneaefolia C. A. M. in the Caspian region. A large number of these staves are exported to different European countries, especially Ireland. There are also several plants in the capital which produce 1,000 barrels a month for domestic use.

The development of this industry has been very slow. Though there exists some stave-cutting machinery, many are still made by hand, a process in which more than 70 per cent of raw material is destroyed. Changing hand-operated cooperage industry to a mechanical one, can increase the productivity as high as three times.

12. Pulp and Paper Industry.

Present Situation. The pulp and paper industry is not highly developed in Iran. It is necessary to import annually, for domestic requirements, a great amount of paper from the European countries, especially Sweden.

There are four paper mills in the country, two in the capital, one in the west and the other in the southeast. Plants located in the capital produce white wrapping paper and cardboard. The plant in the west of the capital produces cardboard, mostly for pastry boxes, trunks, etc. The southeastern plant is the largest paper mill in Iran. It produces writing paper.

The raw material used in these mills is old-paper stock and straw. There are no papermaking facilities that use wood as a source of pulp.

Since Iran is not self-supporting in pulp and paper products, there is always a shortage of these products on the market, especially

because domestic use is rapidly increasing. Imports of paper prevent development of the Iranian paper industry.

Suggestions and Recommendations for Future Development of the Pulp and Paper Industry. All the necessary factors for establishing pulp and paper plants, such as availability of raw material and power exist in the accessible forest areas of Iran. Quantities of old paper at a low cost are also available for conversion. The best grade of old paper should be used in production of writing paper, poorer grades for wrapping paper.

Expansion of the pulp industry for manufacture of container boxes, wallboard, wrapping paper and newsprint is highly desirable.

13. Wood Waste Industry.

Wood waste and wood residues can be utilized by numerous production units. Wood residue can be converted to useful products such as fuel briquettes, hogged wood, etc.

Wood residue and waste utilization plants do not exist in Iran. However, the availability of this raw material suggests the desirability of developing progressive plans for its utilization. Sources of the waste and residual wood are numerous. Some of these are: wood left in the forest after logging, and residues left in the manufacture of primary products such as lumber and veneer.

Hogged wood can be obtained by chipping coarse materials in sawmills. This type of material can be used for production of tars, acetic acid, methanol, and other chemicals.

Hydrolysis of wood cellulose, for production of industrial ethyl alcohol, and molasses for stock feeding, is another possibility.

Installation of several wood-briquetting plants, and of facilities for edge-gluing of sawmill residues for furniture is also desirable for development of wood using industries in Iran. Much wood now used as fuel, could be used in the box and crate industry and in the production of fiber products.

These proposals are aimed at bringing all forest lands in Iran into the highest possible state of productivity.

APPENDIX A

DISTRIBUTION OF HECTARAGE OF FORESTS BY
REGIONS, IRAN 1327 (1948-1949)

A Rough Estimate

Region	Area Hectares
1. Caspian Forests (Quercus-Fagus)	3,600,000
2. Oak Tree Forests	11,300,000
3. Limestone Mountain Forests	1,300,000
4. Pistachio Tree Forests	2,800,000
5. Subtropical Forests	500,000
Total	19,500,000
Approximately	20,000,000

AMOUNT OF PRECIPITATION IN CASPIAN REGION FOR
SPECIFIED STATIONS

(in millimeteres)

A reliable estimate showing increase in precipitation from eastern to western part of Caspian forests. This variation in precipitation may be a cause of fluctuation in forest communities.

Station	From East to West of Caspian Region				
	Gorgan	Babol	Ramsar	Lahi, jan	Astra
Total 12 months 1326(1947-48)	533	516	796	1,106	1,120
Total 12 months 1325(1946-47)	597	770	937	1,152	not available
Total 12 months 1324(1945-46)	463	735	1,340	1,142	not available

On the northern slopes of the Elburz mountains where there are rather typical forest communities of hardwoods, the increasing precipitation from east to west on the one hand, and the dropping of temperature and increasing rainfall in the Elburz mountains profile on the other have a great effect in creating many types of climax communities of trees, and in increasing the density of forests in the dominant communities.

ESTIMATED AVERAGE ANNUAL TIMBER UTILIZATION IN IRAN
1321-1325 (1942-1945 to 1947)
(In Metric Tons)

A Rough Estimate

Use	Domestic Utilization	
	Total	Proportion from Farm Woodlands
Fuelwood	4,500,000	1,500,000
Construction	300,000	200,000
Railroad ties	24,000	None
Matches	70,000	70,000
Boxes	60,000	48,000
Furniture	50,000	30,000
Veneer	4,000	None
Mining Timber	22,000	2,000
Minor Products	170,000	120,000
Total	5,200,000	1,970,000

IMPORTS AND EXPORTS OF WOOD, BY KINDS, PERSIA, 1910-1913

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<u>Imports (metric tons)</u>					<u>Exports (metric tons)</u>			
Country	1910-11	1911-12	1912-13	Country	1910-11	1911-12	1912-13	
				<u>Unclassified, Including Fuel</u>				
British Empire	183	100	144	British Empire	3,526	6,236	6,231	
British Indies	61	54	9	British Indies	9	43	--	
Russia	363	761	185	Russia	11,609	14,950	11,213	
Turkey	894	1,117	399	Turkey	44	18	4	
Oman(Muscat)	286	148	416	Oman(Muscat)	2,307	1,733	5,147	
Zanzibar	470	--	--					
Total	2,257	2,180	2,153		17,493	22,980	22,595	
				<u>Timber, Building and Cabinet Wood</u>				
British Empire	19	39	330	Afghanistan	1	--	--	
British Indies	811	887	1,744	British Empire	124	4	69	
Russia	7,366	9,891	13,430	Germany	--	--	--	
Turkey	431	309	369	Austria	--	--	--	
Oman(Muscat)	2	54	251	France	130	76	--	
Zanzibar	212	366	--	Russia	3,283	3,376	5,493	
Total	8,841	11,546	16,124	Turkey	86	47	175	
				Oman	5	315	153	
					3,679	3,818	5,890	
				<u>Manufactured Wood Other than Furniture and Vehicles</u>				
Germany	--	--	3	Afghanistan	3	5	9	
Austria	--	--	--	Austria	--	--	--	
British Empire	1	17	4	British Empire	2	1	3	
British Indies	48	13	6	British Indies	--	--	--	
United States	--	--	--	Russia	365	1,114	2,796	
France	--	--	--	Turkey	2	8	110	
Russia	342	1,352	407	Oman(Muscat)	121	11	98	
Turkey	5	9	1					
Oman	--	--	--					
Total	396	1,391	421		493	1,139	2,996	
Grand Total	11,494	15,117	18,708		21,665	27,937	31,481	
Excess of Exports over Imports					10,171	12,820	12,773	

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AMOUNT AND VALUE OF EXPORTS AND IMPORTS OF WOOD AND WOOD PRODUCTS, IRAN
1316 and 1317 (1937-1938 and 1938-1939)

Products	1316 (1937-1938)				1317 (1938-1939)			
	Exports		Imports		Exports		Imports	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
	Met. tons 1000 rls	Met. tons 1000 rls	Met. tons 1000 rls	Met. tons 1000 rls	Met. tons 1000 rls	Met. tons 1000 rls	Met. tons 1000 rls	Met. tons 1000 rls
Boards and other lumber	53	47	5,401	3,492	118	133	2,056	1,216
Logs and poles	--	--	2,560	1,201	14	19	728	184
Railroad ties	--	--	--	--	--	--	374	175
Barrel lumber	--	--	--	--	--	--	--	--
Veneer	--	--	593	859	--	--	399	834
Firewood	346	28	5	--	801	76	--	--
Charcoal	2	--	--	--	66	15	--	--
Galls	13	46	4	2	--	--	--	1
Bark for tannin	42	14	--	--	60	24	--	--
Total		135		5,554		267		2,410

AMOUNT AND VALUE OF EXPORTS AND IMPORTS OF WOOD AND WOOD PRODUCTS, IRAN
1323-1325 (1944-1947)

Product	1323 (1944-1945)				1324 (1945-1946)				1325 (1946-1947)			
	Exports		Imports		Exports		Imports		Exports		Imports	
	Volume MT*	Value ***	Volume MT*	Value **	Volume MT*	Value ***	Volume MT*	Value **	Volume MT*	Value ***	Volume MT*	Value **
Boards and other lumber	19	70	547	466	1,420	2,309	150	424	59	194	674	1,748
Logs and poles	520	240	293	328	546	1,089	1,339	1,508	1,303	3,840	495	505
Railroad ties	--	--	--	--	229	799	449	276	--	--	--	--
Barrel lumber	--	--	1	5	35	84	50	100	--	--	--	--
Veneer	--	--	7	540	--	--	165	2,595	--	--	397	6,331
Firewood	2,032	955	261	83	2,122	1,125	1,456	492	3,078	1,462	--	--
Charcoal	67	75	410	1,026	1,014	1,363	30	67	127	122	3	6
Galls	--	--	19	841	11	291	38	546	14	373	54	663
Bark for tannin	326	1,659	--	--	300	1,612	5	43	584	3,463	--	--
Total	2,999		3,289		8,672		6,051		2,524		9,253	

* Metric tons
** 1000 rls

SECRET

AMOUNT AND VALUE OF FOREIGN TRADE IN WOOD AND WOOD PRODUCTS COMMODITIES, IRAN
1325 and 1326 (1946-47 and 1947-1948)

	Imports		Exports	
	Amount	Value	Amount	Value
	1325	1326	1325	1326
Timber				
Wood and Wood				
Products				
	(1946-47) Met. tons	(1946-47) 1000 rls	(1946-47) Met. tons	(1946-47) 1000 rls
	1326 (1947-48)	1325 (1946-47)	1326 (1947-48)	1326 (1947-48)
	Met. tons	1000 rls	Met. tons	1000 rls
	1,623	9,253	5,165	9,524
	1,736	5,329	3,980	16,190

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APPENDIX B

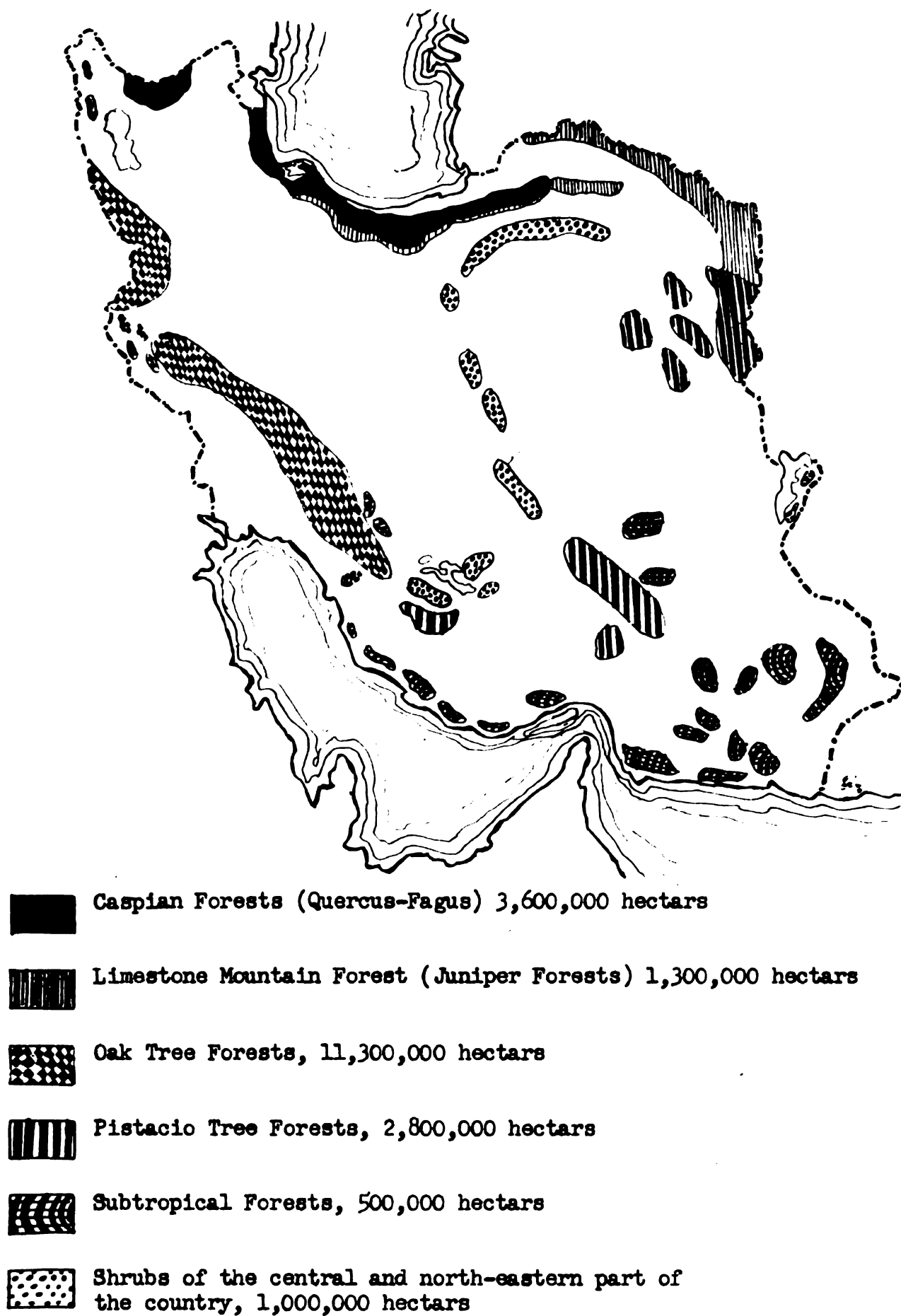


Figure 1. Distribution of Forests in IRAN

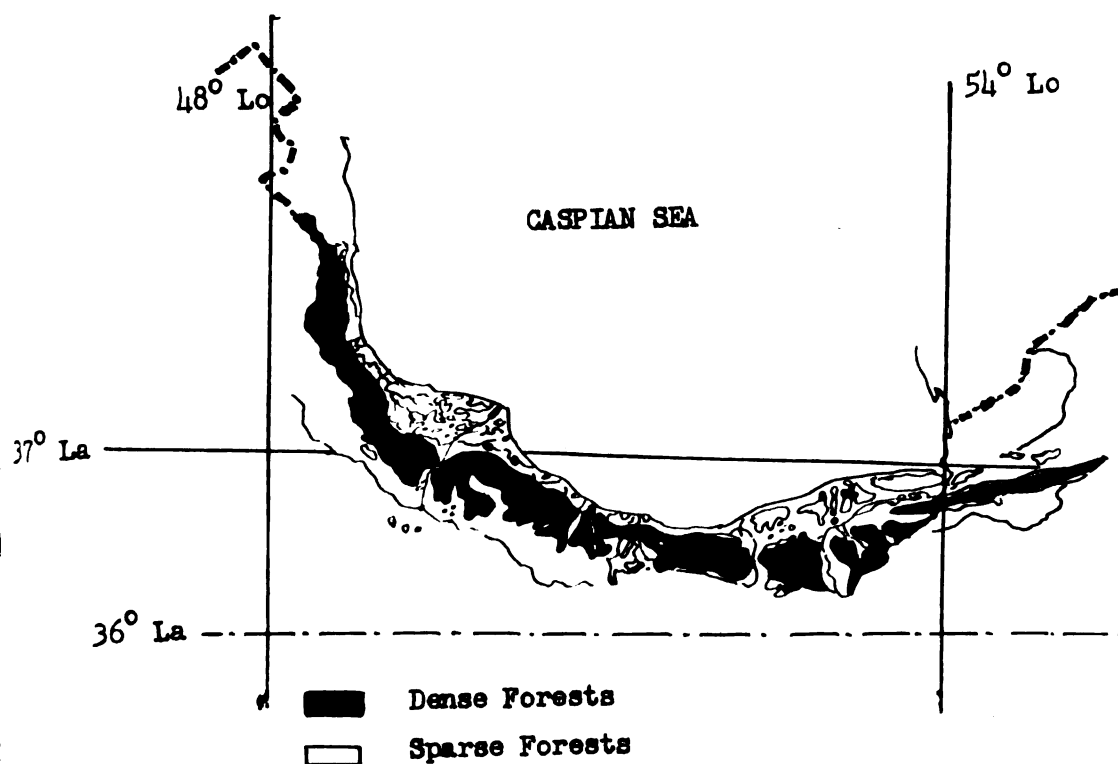


Figure 2. Distribution of Caspian Forests

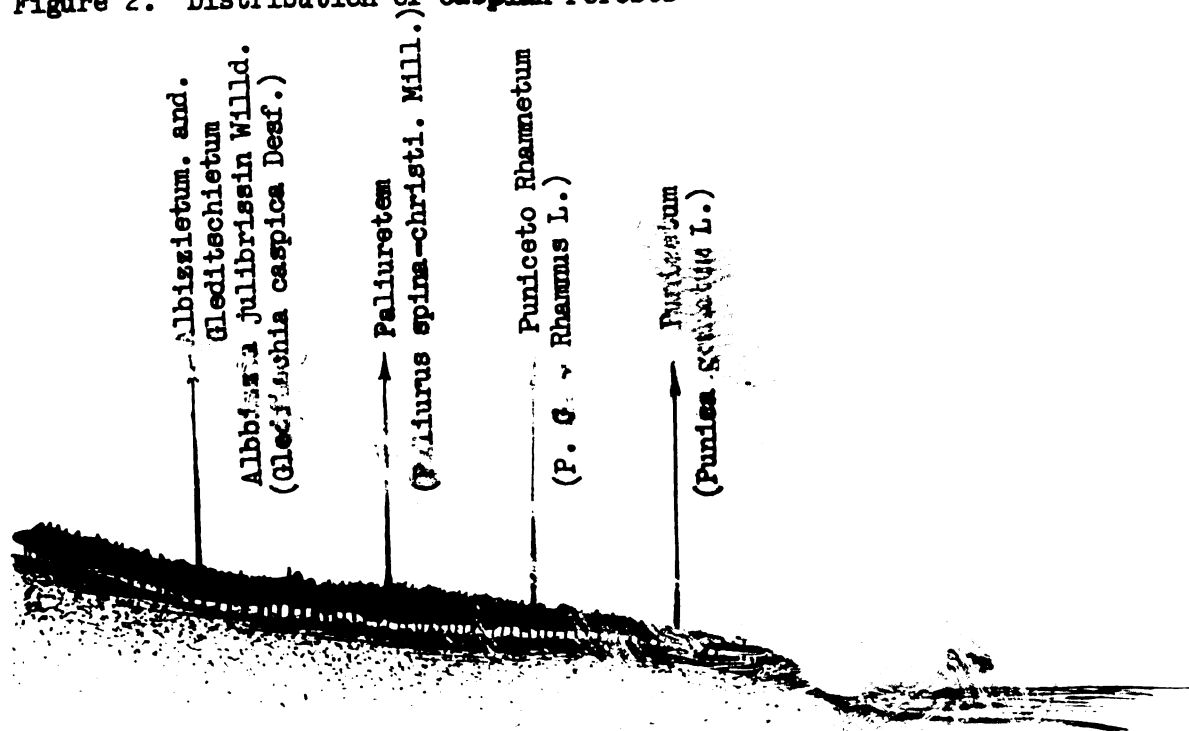


Figure 3. A profile of lower elevations near Caspian Sea Shore showing the major natural plant communities.

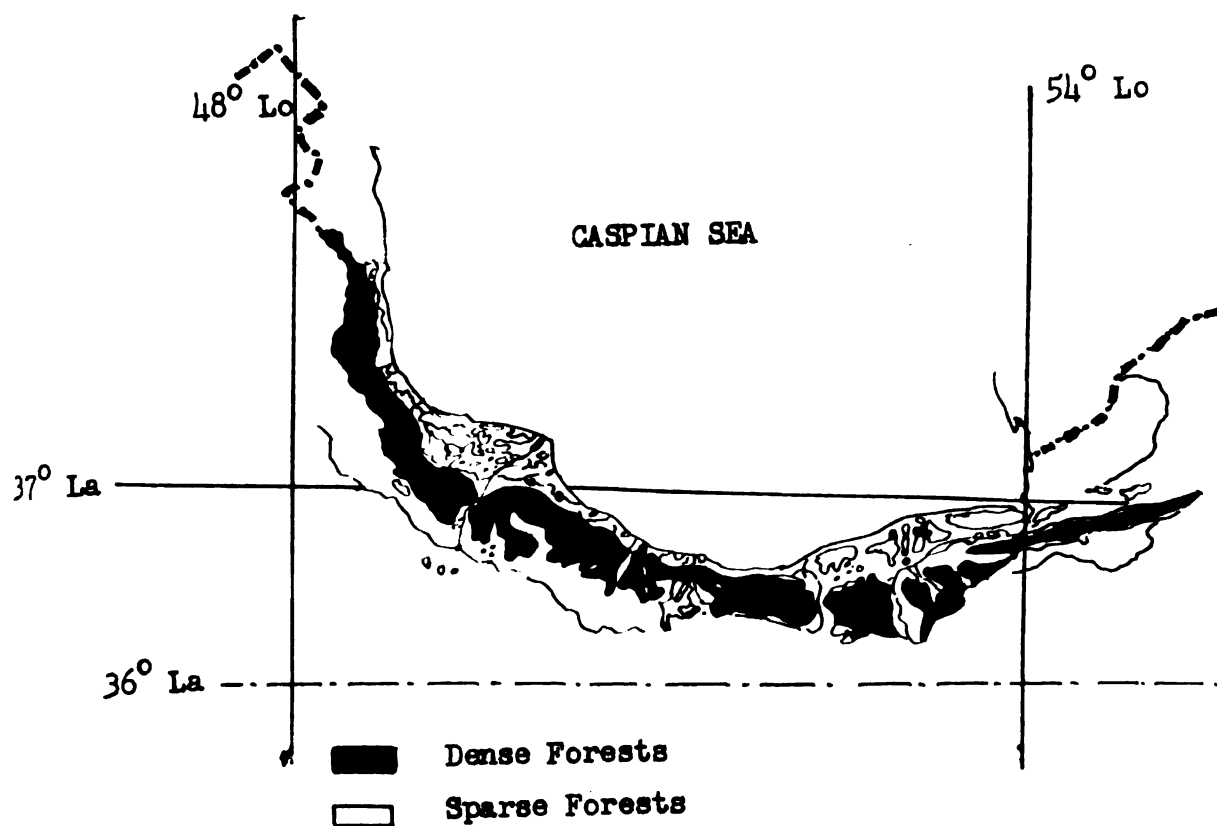


Figure 2. Distribution of Caspian Forests

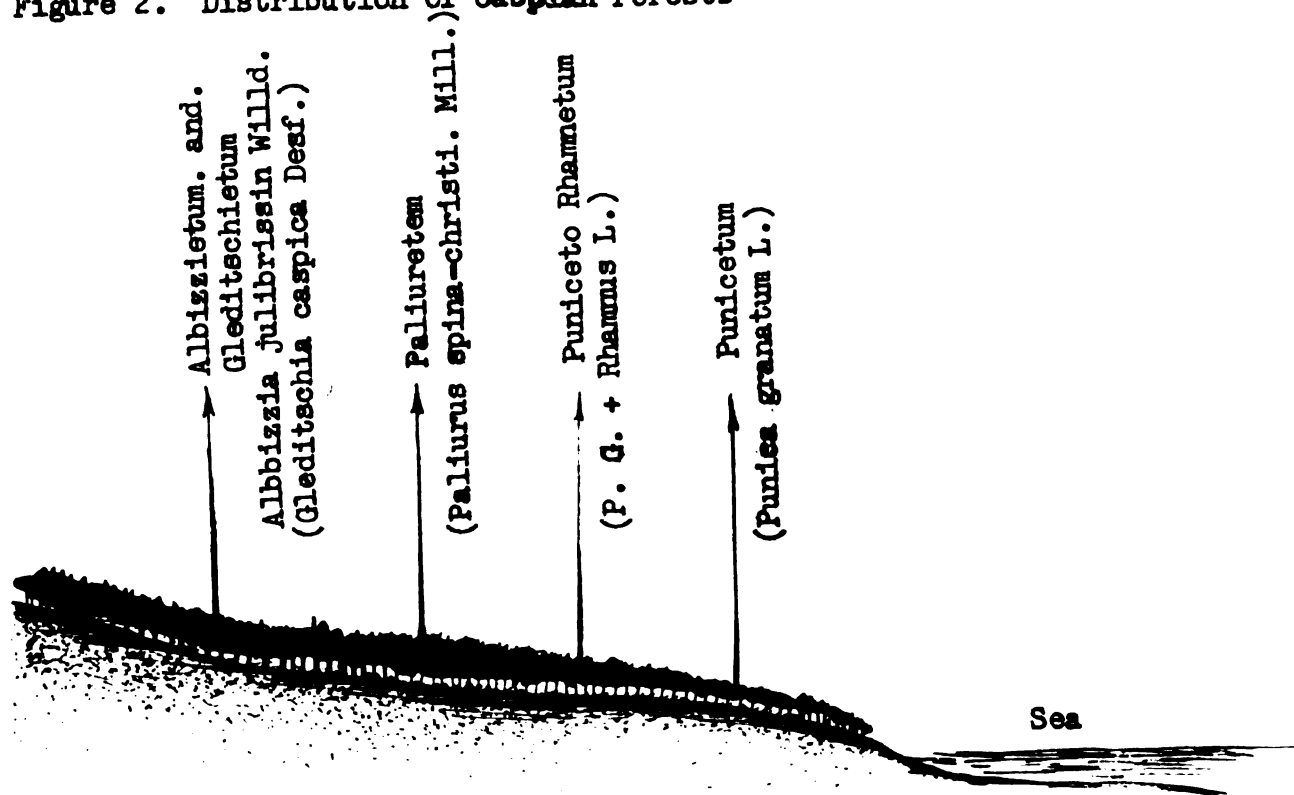


Figure 3. A profile of lower elevations near Caspian Sea Shore showing the major natural plant communities.

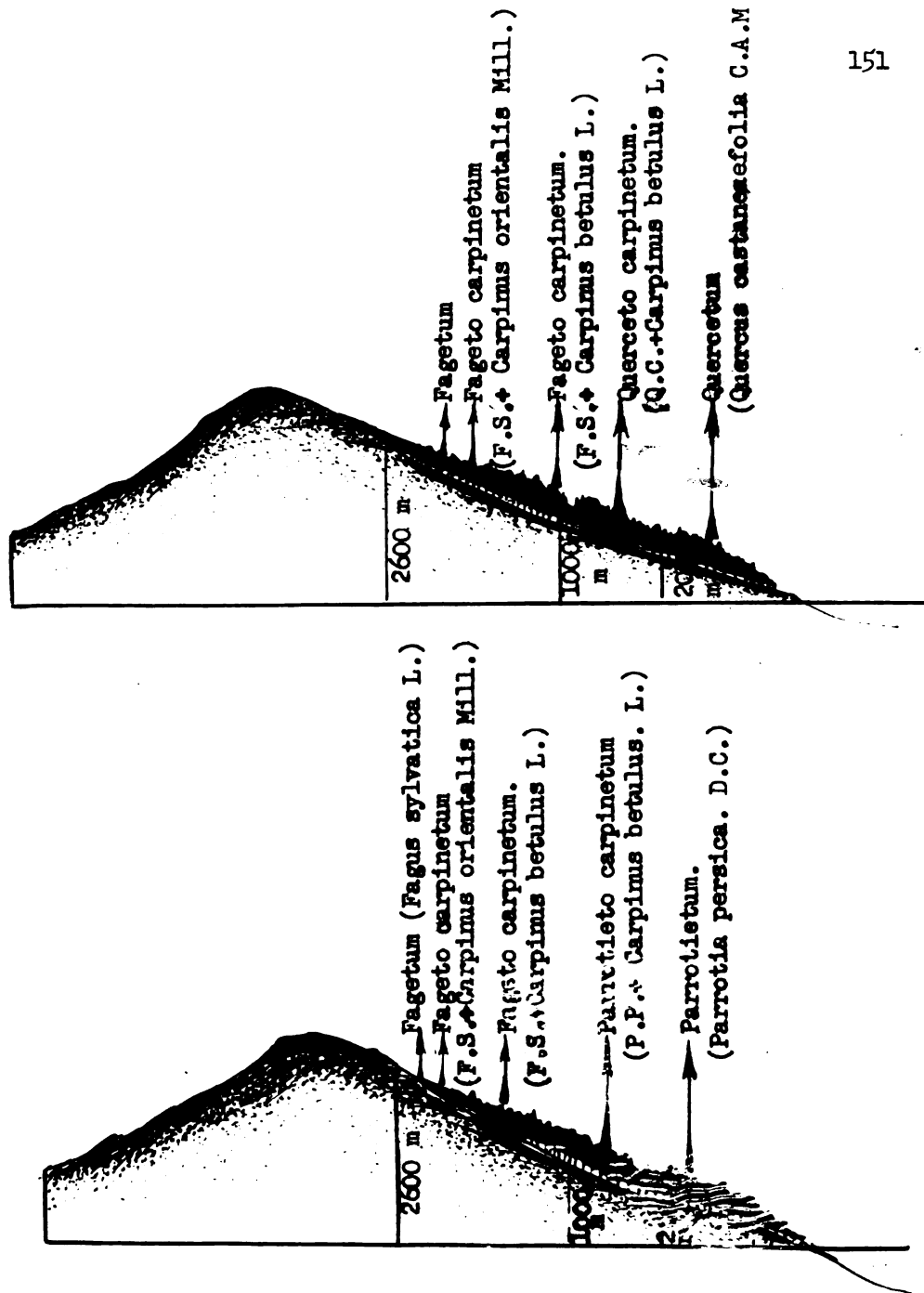


Figure 4. Profiles of the Elburz Mountains showing the two main forest zonnations at the higher elevation in the Caspian Region of IRAN.

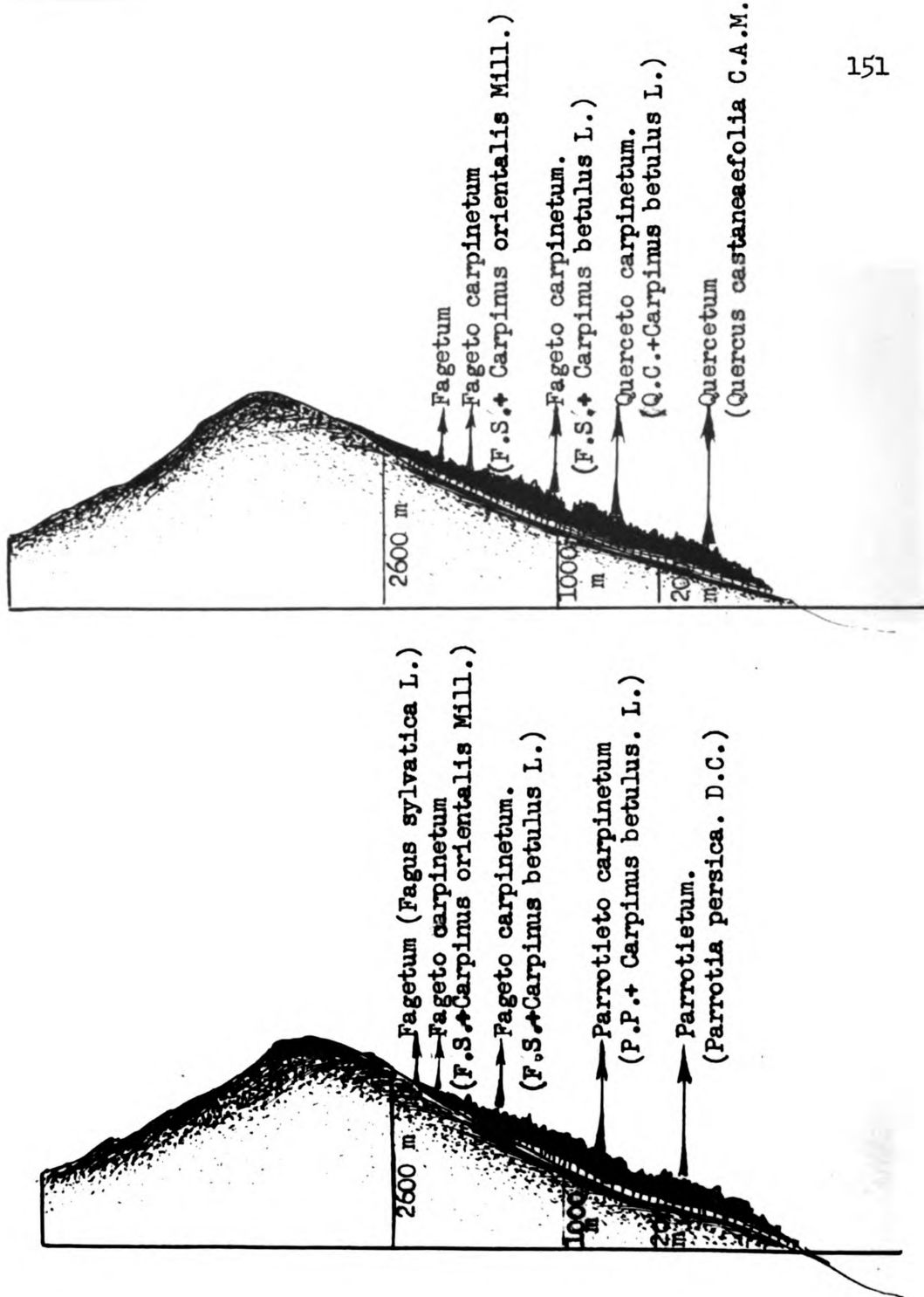


Figure 4. Profiles of the Elburz Mountains showing the two main forest zonnations at the higher elevation in the Caspian Region of IRAN.



-  - Crate Sawmills
-  - Production Capacity of Various Cities
-  - Carpenter Sawmills
-  - Furniture Sawmills

Figure 5. Distribution of Remanufacturing Mills in IRAN.



Figure 6. Distribution of Match Factories in IRAN.
(Twenty-nine match factories, with more
than 70,000 m³ consumption of wood annually.)



Figure 6. Distribution of Match Factories in IRAN.
(Twenty-nine match factories, with more than 70,000 m³ consumption of wood annually.)

APPENDIX C
TECHNIQUES FOR MICRO-SECTIONING

Techniques for Micro-sectioning

The following techniques were used by the writer for the softening, sectioning and mounting completed during the research project.

I. Softening

The softening method used was adopted from that described by G. L. Franklin, Forest Products Research Laboratory, Princes Risborough. This method partially delignifies the wood and, as a result, is relatively rapid. The method is not advisable for critical, microchemical investigation of the cell wall but is useful for more general anatomical studies. The softening technique is described in the following steps.

1. Samples were cut into one-half inch cubes.
2. The cubes were placed in a mixture of one part (by volume) of glacial acetic acid (CH_3COOH) and two parts (by volume) of hydrogen peroxide (H_2O_2). The mixture was contained in a glass flask fitted with a reflex condensor.
3. The mixture, and cubes, were heated for a period of one to four hours depending on the species of wood.
4. The cubes were removed from the flask and washed in running water several minutes. The blocks were then ready for sectioning on the microtome.

II. Sectioning

Sectioning was accomplished on a Spencer Lens Company sliding microtome. The mechanics of operating a microtome will not be reviewed in this paper. The section lubricant used was

twenty percent alcohol.

III. Staining

The staining procedure used for the sections is called the Iron Alum Hematoxylin with Safranin process. The process is described by Jeffrey (1917) as modified from Heidenhain (1892).

The following steps were used in the staining procedure.

1. The paraffin was removed from the sections by standard methods (unless embedded in celloidin). In case sections are not embedded in paraffin, this step is not necessary to follow.
2. The sections were immersed in a mordant ten to thirty minutes in the case of three percent aqueous iron alum (violet crystals) or for fifteen minutes in one percent ferric ammonium sulfate.
3. The sections were washed in water three times.
4. The sections were stained in dilute aqueous hematoxylin. The color development was controlled by removing the sections periodically and washing to avoid over-staining. (One drop of 1% aqueous haematoxylin is enough for one minute or less.)
5. The sections were stained in three percent alcoholic safranin (C.C.). An alternative was one percent safranin in fifteen percent alcohol for fifteen minutes or less.
6. The sections were washed with water with two changes.
7. The sections were dehydrated by allowing them to remain for varying periods of time in successive solutions of seventy percent, ninety-five percent and absolute alcohol. It may

be more advisable to differentiate in fifty percent alcohol, ninety-five percent alcohol and two changes of absolute alcohol.

8. Sections were transferred in xylol (or benzene).

The above staining process is recommended especially for woody tissues of vascular plants and is designed to show unlignified cell walls and the middle lamella clearly differentiated from lignified cell walls. Deeper staining with hematoxylin will darken the lignified walls and will make the tori of bordered pits and the middle lamella more prominent.

IV. Mounting

After staining, the sections were mounted in "Permout." Permout is a sixty percent solution of synthetic resin material and is very suitable for covering histological sections mounted on microscope slides. The sections may also be mounted in balsam dissolved in benzene or in Canada balsam, Tammar balsam, synthetic clarite or diaphane, but since the woody tissue sections are fairly thick, balsam solution is more satisfactory.

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