

## SOME MORE PLANT COMMUNITIES AND THE FUTURE OF DRY OAK FOREST ZONE IN SWAT VALLEY

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### Abstract

Additional investigations on the dry oak forest zone in Swat Valley revealed that three more plant communities, viz *Diospyros lotus*, *Cotoneaster nummularia* – *Sophora mollis* and *Quercus baloot*-*Impatiens bicolor* occur in the area. Prospects of renewable resource development have also been indicated.

### Introduction-

Ecological studies on dry oak forest zone (*Quercus baloot* Griffith) in Swat Valley were initiated by the present authors during 1979–80 and were continued also in 1980-81. Results of the first year study, together with the materials and methods, were presented in an interim paper (1980), entitled, "The present situation and the future of dry oak forest zone in Pakistan." The paper contained an account of the climate, the biogeographic limits and the nature of dry oak forests in Pakistan and four plant communities, namely, *Quercus baloot* – *Viola serpens*, *Prunus prostrata* – *Quercus baloot*, *Indigofera heterantha* – *Prunus prostrata* and *Plectranthus rugosus* as well as discussed the prospects of development of the zone. The results of the second year study are given in this paper.

### Results

On analysis of vegetation data of sample plots, the following three plant communities were recognized.

#### 1. *Diospyros lotus* community

Found as a patchy growth throughout the dry oak forest zone, the plant community occupies cool moist aspects and lower parts of cool moist slopes with light gradient, often lower parts of the lateral streams, and invariably at connection points with the main streams, receiving aestivally flowing and seeping cold water. The soils are wet, well-drained, deep, dark brown, clay loams rich in humus.

The community is rich in species with well-developed tree and shade-bearing herb layers and a poorly developed shrub layer. (Table I) Grasses are poorly represented. The following is

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the biological spectrum:-

MM	6.9 %	H	27.58 %
M	3.45 %	G	0 %
N	17.24 %	Th	37.93 %
Ch	6.9 %		

Table 1: *Diospyros lotus* community

No. of Quadrat	18	20	13	14	Pre- sence	Frequ- ency (%)	Cons- tancy class
Area (m <sup>2</sup> )	200	200	200	200			
Altitude (m)	1500	1540	1560	1580			
Aspect	N	S	NE	NW			
Slope (%)	5	8	6	5			
Parent rock	granite	granite	granite	granite			
HCL reaction	Nil	Nil	Nil	Nil			
Soil pH	6.0	6.0	6.5	7.0			
Vegetation coverage (%)	90	80	80	80			
Total No. of species	25	19	17	21			

#### 1st Layer

<i>Diospyros lotus</i>	3	3	3	3	4	100	V	MM
<i>Quercus baloot</i>	2	+	+	—	3	75	IV	MM
<i>Parrotia jacquemontiana</i>	1	—	—	1	2	50	III	M

#### 2nd Layer

<i>Indigofera heterantha</i>	1	1	+	+	4	100	V	N
<i>Daphne oleoides</i>	+	1	—	1	3	75	IV	N
<i>Prunus prostrata</i>	—	1	+	1	3	75	IV	N



*3rd Layer*

<i>Fragaria indica</i>	1	1	—	1	3	75	IV	H
<i>Sarcococca saligna</i>	1	+	+	—	3	75	IV	N
<i>Viola serpens</i>	+	1	—	+	3	75	IV	H
<i>Trifolium serpens</i>	+	1	+	—	3	75	IV	H
<i>Galium asperifolium</i>	+	+	—	+	3	75	IV	Th
<i>Astragalus grahamianus</i>	+	1	+	—	3	75	IV	N
<i>Geranium sp.</i>	1	—	+	+	3	75	IV	Th
<i>Plectranthus rugosus</i>	+	1	+	—	3	75	IV	Ch
<i>Stellaria media</i>	1	—	+	+	3	75	IV	Th
<i>Rumex nepalensis</i>	—	1	+	+	3	75	IV	Th
<i>Impatiens bicolor</i>	+	+	—	+	3	75	IV	Th
<i>Oxalis corniculata</i>	+	+	—	+	3	75	IV	H
<i>Pteris cretica</i>	—	+	+	+	3	75	IV	H
<i>Asplenium sp.</i>	+	—	+	+	3	75	IV	H
<i>Myosotis sp.</i>	+	—	+	+	3	75	IV	Th
<i>Calamintha vulgare</i>	+	—	+	+	3	75	IV	Th
<i>Andrachne cordifolia</i>	+	+	—	+	3	75	IV	Ch
<i>Lamium album</i>	+	—	—	+	2	50	III	Th
<i>Plantago major</i>	+	—	+	—	2	50	III	Th
<i>Poa annua</i>	+	—	—	+	2	50	III	Th
<i>Cerastium sp.</i>	+	+	—	—	2	50	III	Th
<i>Ranunculus laetus</i>	+	—	—	+	2	50	III	H
<i>Taraxacum officinale</i>	—	+	+	—	2	50	III	H

- 1) MM = Meso-and megaphanerophyte      H = Hemicryptophyte  
M = Microphanerophyte      G = Geophyte  
N = Nanophanerophyte      Th = Therophyte  
Ch = Chamaephyte

The community provides summer grazing to livestock, sheep and goats. The herbaceous layer typically consists of shade bearing/shade demanding plants indicating cool moist sites. *Rumex nepalensis* indicates grazing. While *Viola serpens* is the only medicinal plant, three poisonous shrubs, namely, *Sarcococca saligna*, *Daphne oleoides* and *Andrachne cordifolia* and one unpalatable under-shrub, *Plectranthus rugosus* are found in the habitat.

Growing on wet sites, *Diospyros lotus* forms a subclimax community, which is so maintained with plentiful amlak regeneration as long as these ecological conditions persist. The community is, however, sometimes soon also joined by *Quercus baloot* in the earlier stages of its succession.

## 2. *Cotoneaster nummularia-Sophora mollis* community

This plant community grows on degraded sites at medium-high altitudes on moderate to steep slopes and rather warm aspects on granites. Soils, which have a well-developed profile

but with top-eroded B horizon, are moderately deep, moist, non-calcareous, sandy clay loams with a pH of 6–6.5. Being found on animal resting places, away from water points, the community occurs only in patches here and there and, therefore, occupies a small surface area.

The community is rich in species with a well-developed shrub layer and poorly-developed tree and herb layers. (Table II) Grasses are poorly represented. The following is the biological spectrum:-

MM	3.45 %	H	27.57 %
M	3.45 %	G	0 %
N	20.69 %	Th	41.39 %
Ch	3.45 %		

As a result of cutting and browsing, the dry oak is kept bushy and the shrub layer low. Being rich in forbs and browse species, the community provides some summer grazing to livestock, sheep and goats. Degree of overgrazing is severe as is indicated by the presence of poisonous, unpalatable and nitrophilous species as well as of innumerable annuals. The poisonous species include *Daphne oleoides* and *Andrachne cordifolia* while nitrophilous species *Malva neglecta* and *Plantago lanceolata*. *Thymus serpyllum* indicates degradation of the habitat by erosion.

*Viola serpens* is the only medicinal plant and that, too, feebly represented. Heavy grazing seems the cause of its scarcity. Also as a consequence of heavy grazing, regeneration, particularly of climax species and more specifically of *Quercus baloot*, is totally lacking.

Table 2: *Cotoneaster nummularia* — *Sophras mollis* community

No. of Quadrat	6	8	23	29	Pres- ence	Frequ- ency (%)	Cons- tancy class
Area (m <sup>2</sup> )	200	200	200	200			
Altitude (m)	1760	1740	1720	1600			
Aspect	SW	SW	SE	SE			
Slope (%)	25	30	60	25			
Parent rock	granite	granite	granite	granite			
HCL reaction	Nil	Nil	Nil	Nil			
Soil pH	6	6	6.5	6.5			
Vegetation coverage (%)	80	80	70	70			
Total No. of species	17	16	22	14			

L.F.



*1st Layer*

Absent

*2nd Layer*

<i>Quercus baloot</i>	1	1	2	+	4	100	V	MM
<i>Fraxinus xanthoxyloides</i>	1	1	+	1	4	100	V	M
<i>Cotoneaster nummularia</i>	1	2	1	1	4	100	V	N
<i>Sophora mollis</i>	1	2	1	1	4	100	V	N
<i>Daphne oleoides</i>	+	1	1	1	4	100	V	N
<i>Astragalus grahamianus</i>	1	1	+	+	4	100	V	N
<i>Prunus prostrata</i>	—	+	1	+	3	75	IV	N

*3rd Layer*

<i>Thymus serpyllum</i>	1	2	+	+	4	100	V	H
<i>Plantago lanceolata</i>	+	+	+	+	3	75	IV	Th
<i>Malva neglecta</i>	+	+	—	—	2	50	III	Th
<i>Oxalis corniculata</i>	+	+	—	—	2	50	III	H
<i>Calamintha vulgare</i>	+	+	—	—	2	50	III	Th
<i>Andrachne cordifolia</i>	+	—	+	—	2	50	III	Ch
<i>Origanum vulgare</i>	+	—	+	—	2	50	III	Th
<i>Arenaria sp.</i>	+	—	—	+	2	50	III	Th
<i>Youngia japonica</i>	+	—	+	—	2	50	III	Th
<i>Bupleurum tenue</i>	+	—	+	—	2	50	III	H
<i>Viola serpens</i>	+	—	+	—	2	50	III	H
<i>Cynodon dactylon</i>	—	+	+	—	2	50	III	H
<i>Androsace rotundifolia</i>	—	+	+	—	2	50	III	Th
<i>Lespedeza juncea</i>	—	+	—	+	2	50	III	Th
<i>Galium asperifolium</i>	—	+	+	—	2	50	III	Th
<i>Ajuga bracteosa</i>	—	—	+	+	2	50	III	Th
<i>Scrophularia sp.</i>	—	—	+	+	2	50	III	H
<i>Medicago lupulina</i>	—	—	+	—	1	25	II	Th
<i>Microstegium nudum</i>	—	—	+	—	1	25	II	H
<i>Solanum nigrum</i>	—	—	+	—	1	25	II	Th
<i>Myrsine africana</i>	—	—	—	+	1	25	II	N
<i>Oxytropis mollis</i>	—	—	—	+	1	25	II	H

3. *Quercus baloot* — *Impatiens bicolor* community

The plant community is found at high altitudes on very steep slopes on limestones. The soils which have a well — developed profile and in tact B horizon are deep brown moist fertile (humus rich) acidic sandy clay loams with a pH of 4.

The community is moderately rich in species with a well-developed tree layer and poorly developed herb and shrub layers. (Table III) Grasses are typically absent. The following is the biological spectrum:-

MM	4 %	H	16 %
M	4 %	G	20 %
N	12 %	Th	40 %
Ch	4 %		

The community is moderately rich in forbs, but without appreciable cover, and so provide little grazing to livestock, sheep and goats. Fallen leaves of oak, however, do provide some forage. The over-grazing has badly trampled the vegetation and compacted the soil as is indicated by the presence of *Indigofera heterantha*. It has also eliminated palatable species, reduced density of some others and introduced poisonous plants like *Daphne oleoides*. *Thymus serpyllum* indicates degradation of the habitat by erosion. There are two medicinal plants, viz. *Viola serpens* and *Dioscorea deltoidea* but they are both feebly represented. Because of heavy grazing and trampling, regeneration of the climax species is typically missing.

Taking advantage of deep fertile soils, the habitat at places is used for growing potatoes and elsewhere cereal crops. Such seasonal cultivation on steep mountainous slopes is harmful rather than useful. Being unstable, soils thereon are gradually lost through erosion only to cause siltation of rivers and dams.

### Discussion and conclusions

As was earlier reported by the present authors (1980), due to heavy biotic pressure, the hitherto patchy seriously degraded, slowly growing and non-regenerating dry oak forests and the associated vegetation, covering the steep mountainous watersheds in Swat, are not contributing appreciably towards uplift of the tract.

Table 3. *Quercus baloot* – *Impatiens bicolor* community

No. of Quadrat	31	33	36	38	Pres- ence	Frequ- ency (%)	Constancy class
Area(m) <sup>2</sup>	200	200	200	200			
Altitude(m)	2000	2100	2240	2275			
Aspect	NW	NE	SW	SE			
Slope (%)	90	85	85	80			
Parent rock	Lime- stone	Lime- stone	Lime- stone	Lime- stone			
HCL reaction	+++	+++	+++	+++			
Soil pH	4	4	4	4			
Vegetation coverage (%)	90	90	85	90			
Total No. of species	18	18	17	15			

L.F.



<i>Quercus baloot</i>	3	2	3	3	4	100	V	MM
<i>Fraxinus xanthoxyloids</i>	+	+	+	—	3	75	IV	M

**2nd Layer**

<i>Indigofera heterantha</i>	—	+	1	1	3	75	IV	N
<i>Daphne oleoides</i>	+	—	+	1	3	75	IV	N
<i>Berberis lycium</i>	+	+	+	—	3	75	IV	N

**3rd Layer**

<i>Impatiens bicolor</i>	2	2	2	3	4	100	IV	Th
<i>Youngia japonica</i>	+	1	+	—	3	75	IV	Th
<i>Fragaria indica</i>	+	+	—	+	3	75	IV	H
<i>Carum sp.</i>	+	+	—	1	3	75	IV	G
<i>Scrophularia sp.</i>	+	—	+	+	3	75	IV	H
<i>Origanum vulgare</i>	+	—	+	+	3	75	IV	Ch
<i>Galium asperifolium</i>	+	+	—	+	3	75	IV	Th
<i>Herniaria sp.</i>	+	+	+	—	3	75	IV	Th
<i>Calamintha vulgare</i>	+	+	—	+	3	75	IV	Th
<i>Amaranthus sp.</i>	+	+	+	—	3	75	IV	Th
<i>Lespedeza juncea</i>	+	—	+	+	3	75	IV	Th
<i>Dioscorea deltoidea</i>	—	+	+	—	2	50	III	G
<i>Convolvulus arvensis</i>	—	+	+	—	2	50	III	G
<i>Polygonatum multiflorum</i>	+	—	+	—	2	50	III	G
<i>Viola serpens</i>	—	+	—	+	2	50	III	H
<i>Arabidopsis thaliana</i>	+	—	—	+	2	50	III	Th
<i>Ajuga bracteosa</i>	—	+	+	—	2	50	III	Th
<i>Adiantum venustum</i>	—	+	—	+	2	50	III	G
<i>Thymus serpyllum</i>	+	—	—	+	2	50	III	H
<i>Lotus corniculatus</i>	—	+	+	—	2	50	III	Th

The biotic pressure has not only ousted the wildlife, the dry oak itself and the medicinal plants, like *Viola serpens* and *Dioscorea deltoidea*, and greatly reduced the production of black mushrooms, but has also increased the poisonous plants such as *Sarcococca saligna*, *Daphne oleoides* and *Andrachne cordifolia*. The *Diospyros lotus* and *Contoneaster nummularia* — *Sophora mollis* communities which are highly degraded, include two to three poisonous plants but only one medicinal plant, while the less so degraded *Quercus baloot*-*Impatiens bicolor* community has only one poisonous plant but two medicinal plants. The more degraded a habitat, the more numerous poisonous and fewer medicinal plants there are in a community.

The existing forest and the associated vegetation are only able to provide some fuel-wood, browsing and grazing but no timber whatsoever. They are also not in a position to provide shelter and breeding refuge, the winter habitat for the markhor. They also equally do not

provide cover on steep mountainous watersheds against soil erosion and so can-not prevent flow of silt load and ensure supply of regulated flow of water into the Tarbela dam.

The removal of humus, an excellent medium, alike for natural regeneration of dry oak and growth and production of black mushrooms, from the forest floor for manuring the cereal and potato fields has almost universally put an end to natural regeneration of the former and hampered growth and production of the latter. While the old trees are gradually being removed, the young growth is not being established at all.

As the timber requirements of the ever-growing population cannot be met with from the dry oak forest zone, the pressure is naturally shifted to the deodar forest zone above. As a consequence, the latter forest zone, too, is involved in the process of degradation.

To sum up, deforestation and otherwise degradation of the dry oak forest zone in the area have harmed the renewable natural resources as under:-

1. Dry oak forests are fast-diminishing for want of natural regeneration,
2. Markhor, deprived of its winter home, is not able to breed normally,
3. Production of medicinal plants has greatly reduced,
4. Production of black mushrooms, too, has largely dropped,
5. Watersheds are not enough protected for water percolation and against soil erosion, to provide regulated flow of water in the rivers and to prevent downflow of heavy silt load finally into the Tarbela Dam.

### Recommendations

Keeping in view the problems, discussed above, and the climatic potential of the dry oak forest zone earlier pointed out by the present authors (1980), the following recommendations are made for uplift of the area.

In the first instance, seasonal steep-slope cultivation may be stopped forthwith and hitherto existing natural vegetation preserved whatever and wherever present. Land may then be put under faster-growing and more economic tree species, but always without much disturbing the root zone of the natural vegetation. Not only will this provide a stable plant cover on the fragile watersheds and hold soil in position but also provide timber, pole, fuelwood, winter fodder and fruits to the local population. This will also desirably release the enormous pressure on the deodar forests in the area.

A number of tree species, including exotics, which can successfully be grown in the area and some of which were earlier too suggested by the present authors (1980), are proposed for



planting in different habitats as under:-

I. Upper subzone (1350-2550 m)

A. Plain/slopy terrain with good drainage

1. *Timber/fodder/fuelwood trees*

*Acer pentapomicum* (Tarkan, maple)  
*Fraxinus excelsior* (sum, ash)  
*Cedrus deodara* (deodar)  
*Pinus wallichiana* (Kail, blue pine)  
*Ulmus villosa*, (mannu, elm)  
*Buxus wallichiana* (Boxwood, shamshad)  
*Morus alba* (Tut, mulberry)  
*Ailanthus altissima* (Ailanthus, tree of heaven)  
*Parrotiopsis Jacquemontiana* (paser)

2. *Fruit/oil trees*

*Corylus jacquemontii* (Urni, hazelnut)  
*Malus pumila* (Seb, apple)  
*Cydonia oblonga* (Behi, Quince)  
*Morus Alba* (Tut, mulberry)  
*Pyrus communis* (Nashpati, pear)  
*P. lindleyi* (Nakh, sand pear)  
*P. pashia* (Batangi)  
*Prunus armeniaca* (Khubani, apricot)  
*P. bokhariensis* (Alucha, plum)  
*P. domestica* (Alucha, plum)  
*P. institia* (Alucha, plum)  
*P. persica* (Aru, peach)  
*Ficus carica* (Injir, fig)  
*Vitis vinifera* (Angur, grape-vine) — a vine

B. By water courses/flat gravelly river beds/river islands/under irrigation

1. *Timber/fodder/fuelwood trees*

*Populus alba* (safeda, poplar)  
*P. ciliata* (palach, poplar)  
*P. nigra* var. *italica* (safeda, poplar)  
*Alnus nitida* (Sharol, alder)  
*Platanus orientalis* (Plane Tree, Chinar)  
*Salix alba* var. *coerulea* (cricket bat willow)

2. *Fruit/oil trees*

*Juglans regia* (Akhrot, walnut)  
*Diospyros lotus* (Amlok)

II. Lower subzone (500 — 1350 m)

A. Plain/slopy terrain with good drainage

1. *Timber/fodder/fuelwood trees*

*Acer pentapomicum* (Tarkan, maple)  
*Robinia pseudo-acacia* (Robinia)  
*Acacia modesta* (Phulai)  
*Tecoma undulata* (Lahura)  
*Dalbergia sissoo* (Shisham, sissoo)  
*Zizyphus mauritiana* (ber, jujube)

2. *Fruit/oil trees*

*Malus pumila* (Seb, apple)  
*Cydonia oblonga* (Behi, Quince)  
*Morus alba* (Tut, mulberry)  
*Pyrus lindleyi* (Nakh, sand pear)  
*P. pashia* (Batangi)  
*Prunus amygdalus* (Badam, almond)

<i>Pistacia integerrima</i> (Kangar)	<i>P. armeniach</i> (Khubani, apricot)
<i>Acer oblongum</i> (Long-leafed maple)	<i>P. bokhariensis</i> (Alucha, plum)
<i>Ceratonia siliqua</i> (carob tree)	<i>P. domestica</i> (Alucha, plum)
<i>Buxux papillosa</i> (Shamshad, Boxwood)	<i>P. institia</i> (Alucha, plum)
<i>Morus alba</i> (Tut, mulberry)	<i>P. persica</i> (Aru, peach)
<i>Eucalyptus camaldulensis</i> (Lachi, eucalypt)	<i>Ficus carica</i> (Injir, fig)
<i>E. tereticornis</i> (Lachi, eucalypt)	<i>Olea europaea</i> (Zaitoon, european olive)
<i>Pinus halepensis</i> (Aleppo pine)	<i>Diospyros kaki</i> (Amluk, persimon)
<i>Pinus roxburghii</i> (Chir)	<i>Citrus sinensis</i> (Malta, red blood orange)
<i>P. brutea</i>	<i>Eriobotrya japonica</i> (Loquat)
<i>Dodonaea viscosa</i> (Sanatha) — a shrub	<i>Psidium gayava</i> (Amrud, guava)
<i>Ailanthus altissima</i> (Ailanthus, tree of heaven)	<i>Reptonia buxifolia</i> (Gurgura)
<i>Olea ferruginea</i> (Kahu, olive)	<i>Zizyphus jujuba</i> (Unab)
<i>Grewia optiva</i> (Dhaman)	<i>Z. mauritiana</i> (Ber, jujube)
	<i>Punica granatum</i> (Anar, pomegranate)
	— A shrub
	<i>Vitis vinifera</i> (Angur, grapevine)

B. By water courses/flat gravelly river beds/river islands/under irrigation

1. *Timber/fodder/fuelwood trees*

*Salix acmophylla* (Bins, willow)  
*S. tetrasperma* (Bed, willow)  
*Populus euphratica* (Bhan, poplar)  
*P. nigra* var. *italica* (Safeda, poplar)  
*P. deltoides* (Poplar)  
*P. x euramericana* (hybrid poplar)  
*P. alba* (Safeda, poplar)  
*Platanus orientalis* (Chinar, plane)  
*Alnus nitida* (Sharol, alder)

2. *Fruit/oil trees*

*Juglans regia* (Akhrot, walnut)  
*Diospyros lotus* (Amluk)

While most of the species recommended require moderately deep to deep soils for their growth, *Robinia*, heaven tree and eucalypt can grow on shallow soil and almond and pomegranate on stony ones. Being good soil binders with their abundant root suckers, *Robinia* and heaven tree are highly suitable for growth on erosion sites, the latter particularly so as it is not browsed by the animals. *Ceratonia siliqua*, *Grewia optiva* and *Morus alba* are good fodder trees the first-named, being an evergreen, is particularly important as winter fodder. Medicinal plants, viz. *Dioscorea deltoidea*, a twiner and *Viola serpens*, a shade-bearer can also successfully be grown around and in between the trees, the former throughout the zone and the latter only in the upper subzone. Cultivation, on large scale, of black mushrooms, a gold earner of N.W.F.P., may also be tried in nature on litter of oak trees throughout its zone.

Provided with this effort, enough thick tree growth could be re-established on the steep mountains and human interference withdrawn or diminished, feeling secure, the markhor



would automatically return to its winter habitat.

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