



Floristic composition of Machiara National Park, District Muzaffarabad Azad Kashmir, Pakistan

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Abstract

A total of 409 species were recorded with 103 families and 225 genera. The dominant families of plants in the study area were Asclepiadaceae, Balsaminaceae, Boraginaceae, Caryophyllaceae, Compositeae, Cyperaceae, Dryopteridaceae, Euphorbiaceae, Gentianaceae, Labiatae, Moraceae, Papilionaceae, Poaceae, Polygonaceae, Primulaceae, Pteridaceae, Ranunculaceae, Rosaceae, Scrophulariaceae and Umbelliferae. This research study was aimed to provide a detailed account for Botanical inventory of study area which will help Taxonomists and Park management to better manage Plant resources of the National Park such as medicinal plants, Timber wood species, Fuel wood and fodder plants. Grazing and illegal extraction of plant resources within study area is common practice, which leads to the destruction of floral wealth of this area, which is part of Himalayan Biodiversity hotspot.

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Introduction

Floral species inventory is considered a common practice among the taxonomists worldwide that provides a handful of information about plant species of the specific area. This practice of compiling floristic list could be used in future vegetation studies for reference (Qureshi *et al.*, 2011). Machiara National Park is located within a Himalayan biodiversity “hotspot” (Myers *et al.*, 2000) with it being an important bird area itself (BirdLife International, 2012). As an important area for biodiversity conservation, no studies on floral composition are done so far. There are some studies on the wildlife in Machiara National Park (Awan *et al.*, 2004; Baig, 2004; Baig and Rafique, 2005; Dar and Malik, 2009; Dar *et al.*, 2009; Minhas *et al.*, 2010; Qamar *et al.*, 2008) but a very few studies on forest vegetation as well as documentation (Awan and Awan, 2007; Dar, 2003; Government of Azad Jammu & Kashmir, 2003.; Khan, 1996; Khurshid, 2005; Saeed *et al.*, 2009). The uncontrolled extraction of resources from forest areas is not only factor responsible for the loss of biodiversity in the area but the State government grabs about 50% revenue from forest resources and out of these 94% revenue is generated from timber sale through Azad Jammu and Kashmir Logging and Sawmills Corporation (AKLASC) and other 6% are from other Non Timber forest products. This uncontrolled exploitation has caused the reduction of forest area from 42% in 1948 to 11% (Butt, 2006).

The Machiara National Park (MNP) lies at 34°-31' N Latitude and 73°-37' E Longitude between 2000 and 4700 meters elevation above mean sea level. The park is located on the right bank of the River Neelum at a distance of about 35 km from the capital city Muzaffarabad (Fig 1).

Machiara National park was notified as National park on March 14, 1996 realizing the need for sustainable conservation of natural resources in the area. Machiara National Park (MNP) represents a temperate

Himalayan forests/alpine scrub rangeland ecosystem with a rich ecosystem (Government of Azad Jammu & Kashmir, 2003) and covers 13,532 hectares (IUCN, 1996) and 28 villages with an estimated population of 35,497 persons (at the end of 2004). It is situated at 35 kilometers distance to the north of the capital city Muzaffarabad within District Muzaffarabad (Government of Azad Jammu & Kashmir, 2004). The overall goal is to set up sustainable management and resource utilization models demonstrating effective natural resource conservation. The sustainable management model of the National Park is based on the conservation of forest use area, biodiversity and grazing grounds with the participation of local communities by offering them ownership and legal benefits from the park area coupled with activities aimed at the social mobilization, environmental awareness campaigns and capacity building of local stakeholders and village conservation committees. This is the first National Park in Azad Jammu and Kashmir State (IUCN, 1996) and one of three globally significant national parks selected for World Bank funding (World Wide Fund for Nature Pakistan, 2012).

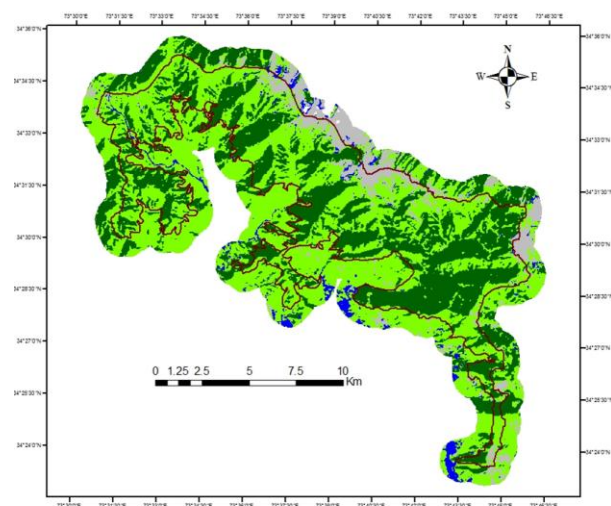


Fig 1. Map of Machiara National Park.

The climate of the area varies with altitude, but generally the forest areas of Machiara National Park fall in the moist temperate zone. Winters are extremely

cold with heavy snowfalls. High peaks remain ice clad till June or even longer, giving a splendid background to the lush green forest vegetation of Machiara and the villages around. Summers are pleasant and cool. The nearest meteorological station to Machiara National Park is in the capital city Muzaffarabad, which is at an elevation of 650 meters above the mean sea level and at a distance of 35 km from the MNP. Therefore, the meteorological data available does not give a true picture of the climatic conditions in the MNP, because

of the higher elevation of the park i.e. 2000 meters to 4700 meters above the mean sea level. The mean of monthly daily minimum temperatures ranges from 3.1° C in January to 22.8° C in July, whereas the mean of monthly daily maximum temperatures ranges from 15.9° C in January to 37.6° C in June (Government of Azad Jammu & Kashmir, 2005a). The mean annual rainfall is 1526.7 millimeters, with a total of 84.5 rainy days per year (Table 1).

Table 1. Climatic Data Muzaffarabad from 1961-2009. (Source: Pakistan Meteorological Department).

Months	Rainfall (mm)	Temperature (C°)		Humidity (%)	
		Maximum	Minimum	5:00 AM	5:00 PM
JanuaryS	101.3	27.0	3.1	82.4	50.3
February	137.4	29.0	5.4	79.6	46.3
March	157.3	37.0	9.7	74.7	40.9
April	109.0	40.5	14.2	72.8	38.0
May	78.5	46.5	18.4	65.0	33.2
Jun	113.6	46.2	21.9	65.0	34.0
July	328.7	45.0	22.8	82.6	52.2
August	229.9	40.2	22.6	87.0	57.6
September	112.6	39.0	19.4	83.1	48.1
October	45.9	38.3	13.5	79.8	42.4
November	37.2	33.0	7.8	81.9	48.4
December	69.0	27.0	4.1	83.4	54.0

Table 2. Plant floristic composition of Machiara National Park.

(Abbreviations: S= Shrub, T= Tree, H= Herb, C= Climber, F=Fern, LC= Life Cycle, P= Perennial, A= Annual).

Ref	Family	Name of Plant species	Status	L C	Flowering
590	Acanthaceae	<i>Strobilanthes urticifolia</i> Wall. ex Kuntze.	s	p	Jun-Oct
591		<i>Strobilanthes glutinosus</i> Nees	s	p	Nov-Mar
46	Aceraceae	<i>Acer caesium</i> Wall. Ex Brandis.	T	P	Mar-May
66	Alliaceae	<i>Allium humile</i> Kunth.	h	p	Jun -Jul
67		<i>Allium victorialis</i> Linn.	h	p	Jun-Aug
68		<i>Allium victoria lis</i> Linn.	h	p	May-Jun
48	Amaranthaceae	<i>Achyranthus aspera</i> var. <i>Aspera</i> Linn.	h	p	May-Jun
49		<i>Achyranthus aspera</i> var. <i>Aspera</i> Linn.	h	p	May-Jun
531	Anacardiaceae	<i>Rhus cotinus</i> L.	T	P	May-Jun

532		<i>Rhus javanica</i> L.	T	P	Jun-Aug
533		<i>Rhus punjabensis</i> Stewart ex Bran.	T	P	Jun-Aug
228	Apiaceae	<i>Carum carvi</i> L.	H	P	Jul-Aug
486		<i>Pleurospermum candollei</i> (DC.) Clarke.	H	A	Jul-Aug
565		<i>Selinum tenuifolium</i> Wall.	T	P	May-Jun
613	Apocyanaceae	<i>Nerium oleander</i> Mill.	s	p	Apr-Oct.
419		<i>Vinca grandiflora</i> Salisb.	H	P	Sep-Oct
229		<i>Cataranthus roseus</i> (L) G.Don.	s	p	WY
39	Papilionaceae	<i>Lespedeza juncea</i> (Lf.) Person.	S	P	Jul-Aug
84	araceae	<i>Arisaema flavum</i> (Forsk.) Schott, Prodr.	H	A	Jul
366		<i>Arisaema jacquemontii</i> Blume	H	A	Jul
36	Araliaceae	<i>Aralia cachmirica</i> Dcne.	H	P	Jun-Jul
602		<i>Hedera nepalensis</i> K.Koch.	C	P	Apr-Aug
91	Asclepiadaceae	<i>Tylophora tenerrima</i> Wall ex Wight	H	A	Jun-Jul
89		<i>Asplenium ceterach</i> L.	F	A	Jul-Aug
90		<i>Asplenium dalhousiae</i> Hook.	F	A	Jul-Aug
294	Balsaminaceae	<i>Impatiens bicolor</i> Royle.	H	A	Jun-Jul
92		<i>Impatiens brachycentra</i> Kar. & Kir.	H	A	Jun-Jul
93		<i>Impatiens flemingii</i> Hook. f.	H	A	Jun-Jul
373		<i>Impatiens glandulifera</i> Royle.	H	A	Jun-Jul
374		<i>Impatiens scabrida</i> DC.	H	A	Jun-Jul
375		<i>Impatiens thomsonii</i> Hook. f.	H	A	Jun-Jul
376		<i>Berberis kunawurensis</i> Royle.	S	P	May-Jun
377	Berberidaceae	<i>Berberis lycium</i> Royle.	S	P	Jun-Aug
378		<i>Berberis orthobotrys</i> Bien.	S	P	Jun-Aug
103	Betulaceae	<i>Betula utilis</i> D.Don.	T	P	Jun-Jul
104		<i>Corylus colurna</i> Linn.	T	P	Apr
105	Boraginaceae	<i>Cynoglossum glochidiatum</i> Wall. ex Berth.	H	A	Jul-Aug
107		<i>Cynoglossum lanceolatum</i> Forssk.	H	A	Jun-Jul
254		<i>Cynoglossum microglochin</i> Benth.	H	A	Jun-Jul
264		<i>Lindelofia anchusoides</i> (Lindl.) Lehm.	H	P	Jun-Aug
265		<i>Lindelofia longiflora</i> (Benth.) Baill.	H	P	Jun-Aug
266		<i>Lithospermum tenuiflorum</i> L.	H	P	Jun-Jul
400		<i>Myosotis plaustris</i> (L) Nath.	H	P	Jul-Aug
401		<i>Onosma hispidum</i> Wall. ex G.Don.	H	P	Apr-May
403		<i>Pseudomertensia parvifolia</i> (Dene.) Reidl.	H	P	May-Jun
416	Brassicaceae	<i>Cardamine impatiens</i> L.	H	P	Jun
457	Buddlejaceae	<i>Buddleja crispa</i> Benth.	S	P	May-Jun
515	Buxaceae	<i>Sarcococca saligna</i> (D.Don) Muell.	S	P	Sep-Oct

222	Campanulaceae	<i>Campanula aristata</i> Wall.	H	A	May-Jun
212		<i>Campanula cashmeriana</i> Royle.	H	A	Jun-Aug
555		<i>Codonopsis obtusa</i> (Chipp) Nannf.	H	A	Jun-Jul
219		<i>Codonopsis rotundifolia</i> Benth.	H	A	Jun-Jul
220	Ulmaceae	<i>Celtis australis</i> L.	T	P	Apr-May
246	Cannabaceae	<i>Cannabis sativa</i> L.	H	A	Jul-Aug
247	Caprifoliaceae	<i>Abelia triflora</i> RBr.	H	A	Jun-Jul
221		<i>Lonicera quinquelocularis</i> Hardw.	S	P	May-Jun
43		<i>Lonicera vaccinioides</i> Rehder.	S	P	Jun-Jul
404		<i>Viburnum grandiflorum</i> Decne.	S	P	Jun-Jul
405	Caryophyllaceae	<i>Arenaria festucoides</i> Bth.	H	P	Jul-Aug
612		<i>Cerastium cerastioides</i> Gilib.	H	A	Mar-Apr
83		<i>Cerastium fontanum</i> Baung.	H	A	Mar-May
233		<i>Gypsophila cerastioides</i> D. Don.	H	P	May-Jun
234		<i>Silene indica</i> var. <i>cashmeriana</i> (Majumdar) Y. Nasir.	H	A	Jul-Aug
363		<i>Silene conoidea</i> L.	H	A	Jul-Aug
567		<i>Silene indica</i> var. <i>edgeworthii</i> (Bocquet) Y. Nasir.	H	A	Jul-Aug
568		<i>Silene laxantha</i> Majumdar.	H	A	Jul-Aug
569		<i>Silene tenuis</i> Willd.	H	A	Jul-Aug
570		<i>Silene vulgaris</i> (Moench) Garcke.	H	A	Jul-Aug
571		<i>Spergula arvensis</i> L.	H	A	Apr-May
572		<i>Stellaria monosperma</i> Buch. -Ham. ex D. Don.	H	A	Jun-Aug
580	Compositae	<i>Chondrilla graminea</i> MBieb.	T	P	Aug-Sep
589		<i>Aster himalaicus</i> C.B Clarke.	H	P	May-Jun
237		<i>Centaurea iberica</i> Trey. Ex Spemg.	H	A	May-Jun
40		<i>Achillea millefolium</i> L.	H	P	Jul-Aug
47		<i>Anaphalis arvensis</i> L.	H	P	Aug
70		<i>Anthemis nobilis</i> L.	H	A	May-Jun
80		<i>Artemisia dubia</i> Wall.	H	A	Aug-Sep
86		<i>Artemisia laciniata</i> Willd.	H	A	Aug-Sep
87		<i>Artemisia macrocephala</i> Jacquem. ex Besser.	H	A	Aug-Sep
88		<i>Artemisia parviflora</i> Roxb.	H	A	Aug-Sep
94		<i>Aster albescens</i> Dc.	H	A	Aug
95		<i>Aster falconeri</i> (Clarke) Hutch.	H	P	Jun-Jul
96		<i>Cichorium intybus</i> L.	H	P	Jul-Sep

232		<i>Conyza bonariensis</i> (L.) Cronquist.	H	A	May-Jun
238		<i>Crepis flexuosa</i> (DC.) Benth.	H	A	Mar-Apr
249		<i>Erigeron multiradiatus</i> Benth.	H	A	Mar-Apr
260		<i>Gerbera gossypina</i> (Royle) Beauv.	H	A	May-Jun
295		<i>Inula cuspidata</i> (DC.) Clarke.	H	P	Aug-Sep
360		<i>Inula royleana</i> D.C.	H	P	Aug-Sep
381		<i>Leontopodium himalayanum</i> DC.	H	A	May-Jun
382		<i>Saussurea jacea</i> (Klotzsch) CB Clarke.	H	P	Aug-Sep
396		<i>Solidago virga aurea</i> L.	H	A	Aug-Sep
556		<i>Teraxacum officinale</i> F.H. Wigg.	H	A	Apr-May
576	Convolvulaceae	<i>Ipomoea eriocarpa</i> R.Br.	H	A	Sep-Oct
594	Coriariaceae	<i>Coriaria nepalensis</i> Wall.	S	P	Apr-May
383	Cornaceae	<i>Cornus macrophylla</i> Wall.	T	P	May-Jun
250	Crassulaceae	<i>Sedum adenotrichum</i> Wall ex Edgew.	H	P	May-Jun
251		<i>Sedum awersii</i> Ledeb.	H	P	Apr-Jun
563	Cupressaceae	<i>Juniperus communis</i> L.	S	P	Aug-Sep
564	Cyperaceae	<i>Carex filicina</i> Nees.	H	P	Aug-Sep
391		<i>Carex foliosa</i> D. Don.	H	P	Jun-Jul
223		<i>Carex ligulata</i> Nees.	H	P	Jun-Jul
224		<i>Carex nubigena</i> D. Don.	H	P	Aug-Sep
225		<i>Carex setigera</i> D. Don.	H	P	Jun-Jul
226		<i>Cyperus difformis</i> L.	H	P	Jul-Aug
227		<i>Cyperus squarrosus</i> L.	H	P	Jun-Jul
267		<i>Eriophorum comosum</i> (Wall. ex Roxb.) Nees.	H	P	Jul-Aug
268		<i>Fimbristylis dichotoma</i> (L.) Vahl.	H	P	May-Jun
296		<i>Fimbristylis falcata</i> (Vahl.) Kunth.	H	P	May-Aug
304		<i>Kobresia sanguinea</i> (Bott) Raymond.	H	P	Jul-Aug
305		<i>Scirpus holoschoenus</i> L.	H	P	May-Jun
392	Dioscoriaceae	<i>Dioscorea deltoidea</i> Wall. ex Kunth.	H	P	Jun-Jul
559	Dryopteridaceae	<i>Athyrium microphyllum</i> (J. Sm.) Alston.	F	A	Jun-Aug
283		<i>Cystopteris fragilis</i> (L.) Bernh.	F	A	Jun-Aug
99		<i>Cyrtomium falcatum</i> (L. f.) C. Presl.	F	A	Jun-Aug
269		<i>Dryopteris ramosa</i> (Hope) C. Chr.	F	A	Jun-Aug
270		<i>Dryopteris stewartii</i> Fras. Jenk.	F	A	Jun-Aug
285		<i>Polystichum piceo-paleaceum</i> Tag.	F	A	Jun-Aug
286		<i>Polystichum squarrosum</i> (D. Don) 1. Smith.	F	A	Jun-Aug
501	Ebenaceae	<i>Diospyros lotus</i> L.	T	P	Sep-Oct

502	Elaeagnaceae	<i>Elaeagnus orientalis</i> L.	S	P	Jul-Aug
284	Equisetaceae	<i>Equisetum ramosissimum</i> Desf.	F	P	Jul
289	Ericaceae	<i>Gaultheria trichophylla</i> Royle.	S	P	Aug-Sep
292		<i>Rhodendron hypenanthum</i> Balf.f.	S	P	Aug-Sep
355		<i>Vaccinium vacciniaceum</i> (Roxb). Sleumer.	S	P	Jul-Aug
530	Euphorbiaceae	<i>Acalypha brachystachya</i> Hhomen.	H	A	Sep
606		<i>Andrachne cordifolia</i> (Dcne) Muell.	S	P	Sep-Oct
45		<i>Euphorbia helioscopia</i> L.	H	A	Aug-Sep
298		<i>Euphorbia wallichii</i> Hook.f.	H	A	Aug-Sep
299		<i>Phyllanthus niruri</i> L.	H	A	Sep-Oct
477		<i>Ricinus communis</i> L.	S	P	WY
71	Fabaceae	<i>Dumasia villosa</i> DC.	H	A	Sep-Oct
535		<i>Melilotus officinalis</i> (L) Lam.	T	A	Aug-Sep
288	Fagaceae	<i>Quercus baloot</i> Griffith.	T	P	May-Jun
409		<i>Quercus floribunda</i> (Q. dilatata) Lindl. Ex Royle.	T	P	May-Jun
521	Flacourtiaceae	<i>Xylosma longifolium</i> Clos.	T	P	Oct-Nov
522	Fumariaceae	<i>Corydalis diphylla</i> Wall.	H	P	Jun-Jul
620		<i>Corydalis govaniiana</i> Wall.	H	P	May-Jun
41		<i>Fumaria indica</i> (Hausskn.) Pugsley.	H	A	Apr-Jun
253	Gentianaceae	<i>Gentiana kurroo</i> Royle.	H	A	Sep-Oct
352		<i>Swertia petiolata</i> D.Don.	H	P	Jul-Sep
356		<i>Geranium himalayense</i> Klotzsch.	H	P	Aug-Sep
592		<i>Geranium nepalense</i> Sweet.	H	A	May-Sep
297		<i>Geranium rotundifolium</i> L.	H	A	Apr-May
357		<i>Erodium cicutarum</i> (L.) LHerit. ex Aiton	H	A	Mar-Apr
358	Grossulariaceae	<i>Ribes alpestre</i> Dene ex Jaeg.	S	P	Apr-May
359	Guttiferae	<i>Hypericum dyeri</i> Rehder.	S	P	Sep-Oct
534		<i>Hypericum oblongifolium</i> Choisy.	S	P	May-Jun
372		<i>Hypericum perforatum</i> L.	H	P	Jun-Aug
370	Hammamelidaceae	<i>Parrotiopsis jacquemontiana</i> (Dene.) Rehder.	S	P	Aug-Sep
371	Hippocastanaceae	<i>Aesculus indica</i> (Wall. Ex Camb) H.k.f.	T	P	Jun-Jul
469	Iridaceae	<i>Iris kashmiriana</i> Baker.	H	P	May-Jun
34		<i>Iris hookeriana</i> Foster.	H	P	Jun-Jul
384	Juglandaceae	<i>Juglans regia</i> Linn.	T	P	Mar-Apr
385	Juncaceae	<i>Juncus articulatus</i> Linn.	H	A	May

387		<i>Juncus bufonius</i> Linn.	H	A	May-Jun
388		<i>Juncus mem_naceous</i> Royle.	H	A	May-Jun
389	Labiatae	<i>Salvia parviflora</i> Salisb.	H	A	May-Jun
390		<i>Salvia virgata</i> Jacq.	H	A	Jul-Aug
65		<i>Ajuga bracteosa</i> Wall.ex Bth.	H	A	WY
79		<i>Anisomeles indica</i> (L) o. Ktze.	H	A	Jun-Aug
394		<i>Lamium album</i> L.	H	P	Aug-Sep
398		<i>Leucas cephalotes</i> Spreng.	H	A	Sep-Oct
410		<i>Mentha arvensis</i> L.	H	P	Jun-Jul
417		<i>Nepeta erecta</i> (Boyle ex Benth.) Berth.	H	P	Jul-Aug
418		<i>Nepeta laevigata</i> (D.Don) Hamd-Mazz.	H	P	Jul-Aug
461		<i>Origanum vulgare</i> L.	H	P	Sep-Oct
474		<i>Phlomis bracteosa</i> Royle ex Benth.	H	P	Sep-Oct
475		<i>Phlomis spectabilis</i> Falc. Ex Bth.	H	P	Sep-Oct
485		<i>Plectranthus rugosus</i> Wall. ex Bth.	H	P	Jul-Aug
510		<i>Prunella vulgaris</i> L.	H	P	Jul-Aug
552		<i>Scutellaria linearis</i> Bth.	H	P	Jul
553		<i>Scutellaria scandens</i> Buch.-Ham. ex D. Don.	H	P	Jul-Aug
561		<i>Stachys floccosa</i> Bth.	H	P	Jul-Aug
562		<i>Thymus serpyllum</i> L.	H	P	Apr-May
587	Asparagaceae	<i>Asparagus adscendens</i> Roxb.	H	P	Oct
599		<i>Asparagus filicinus</i> Ham.	H	P	Jun-Jul
307		<i>Asparagus racemosus</i> Willd.	C	P	Oct-Nov
353	Asphodelaceae	<i>Eremurus persicus</i> (Jaub. & Spach) Boiss.	H	P	May-Jun
399	Liliaceae	<i>Fritillaria roylei</i> Hook.f.	H	P	Jun-Jul
495		<i>Gagea elegans</i> Wall.	H	P	May-Jun
402		<i>Lilium polyphyllum</i> D.Don.	H	P	Jul-Aug
37		<i>Polygonatum verticellatum</i> L.	H	P	Jun
617		<i>Linum corymbulosum</i> Reichenb.	H	A	Mar-Apr
406	Loranthaceae	<i>Arceuthobium minutissimum</i> Hook.	P	P	Aug-Sep
301		<i>Viscum album</i> Linn.	P	P	Apr-May
302	Malvaceae	<i>Malva parviflora</i> L.	H	A	Jun-Jul
303	Moraceae	<i>Ficus carica</i> L.	T	P	Apr-May
413		<i>Ficus foveolata</i> Wall. ex Miq.	T	P	Jun-Jul
414		<i>Ficus virgata</i> (F. palmata) Forssk.	T	P	Jul-Aug
415		<i>Morus alba</i> L.	T	P	Apr-May
412		<i>Morus nigra</i> .	T	P	Apr-May

386		<i>Morus serrata</i> Roxb.	T	P	Mar-Apr
239	Morinaceae	<i>Morina coulteriana</i> Royle.	H	A	Jul-Aug
240	Oleaceae	<i>Jasminum humile</i> Linn.	S	P	Aug
290	Onagraceae	<i>Circaea alpina</i> Clarke	H	A	Jul-Aug
291		<i>Circaea cordata</i> Royle.	H	A	Jul-Aug
420		<i>Epilobium laxum</i> Royle.	H	P	Aug-Sep
460		<i>Epilobium parviflorum</i> Schreb.	H	P	Aug-Sep
271		<i>Oenothera rosea</i> LHer. ex Ait.	H	P	May-Jun
364	Ophioglossaceae	<i>Ophioglossum vulgatum</i> L.	H	A	May-Jun
365	Orchidaceae	<i>Dactylorhiza hatagirea</i> (D.Don).	H	A	Jun-Jul
584	Orchidaceae	<i>Habenaria aitchisoni</i> Reichb.f. apud Aitch.	H	P	Jul-Aug
585		<i>Habenaria marginata</i> Colebr.	H	P	Jul-Aug
462		<i>Spiranthes lancea</i> (Thunb.) Backer, Bakh. F & V. Steenis	H	A	Jun-Jul
463		<i>Spiranthes sinensis</i> (Pres.) Ames.,	H	A	Jun-Jul
465	Oxalidaceae	<i>Oxalis acetosella</i> L.	H	A	Apr-Sep
466		<i>Oxalis corniculata</i> L.	H	A	Apr-Sep
467	Paeoniaceae	<i>Paeonia emodi</i> Wall. ex Royle.	H	P	Jun
395	papaveraceae	<i>Papaver nudicaule</i> Linn.	H	P	Jun
98		<i>Papaver rhoeas</i> L.	H	A	Jun-Jul
600	Papilionacea	<i>Astragalus candolleanus</i> Royle ex Benth.	S	P	Jul-Aug
97		<i>Astragalus falconeri</i> Bunge.	H	A	Aug-Sep
38		<i>Lathyrus sativus</i> L.	C	A	Jun-Jul
380		<i>Trifolium repens</i> L.	H	P	Apr-May
407		<i>Argyrolobium flaccidum</i> Royle.	H	A	Jul
408		<i>Butea monosperma</i> (Lam.) Taubert.	T	P	Apr
248		<i>Colutea armata</i> Hemsley & Lace.	S	P	May-Jun
277		<i>Desmodium elegans</i> DC.	S	P	Jul-Aug
278		<i>Desmodium gangeticum</i> (L.) DC.	S	P	Jul-Aug
379		<i>Indigofera heterantha</i> Wall. Ex Brand.	S	P	Jun-Jul
397		<i>Indigofera linifolia</i> (L.f)Retz.	H	A	Aug-Sep
577		<i>Medicago denticulata</i> Willd.	H	A	Mar-Apr
216		<i>Medicago minima</i> (L) Groth.	H	A	May-Jun
468		<i>Sophora mollis</i> (Royle) Baker.	S	P	Jun-Jul
478	Parnassiaceae	<i>Parnassia nubicola</i> Wall.	H	A	May-Jun
44	Phytolaccaceae	<i>Phytolacca latbenia</i> Maxim.	H	A	Aug-Sep

230	Pinaceae	<i>Cedrus deodara</i> (Roxb. Ex Lamb) G. Don.	T	P	Apr
479	Pinaceae	<i>Abies pindrow</i> Royle.	T	P	May-Jul
481		<i>Picea smithiana</i> (Wall.) Boiss.	T	P	May-Jul
482		<i>Pinus wallichiana</i> A.B. Jackson.	T	P	May-Jul
483	Plantaginaceae	<i>Plantago lanceolata</i> Linn.	H	P	Jun-Jul
484		<i>Plantago major</i> Linn.	H	P	Aug-Sep
487	Plantanaceae	<i>Platanus orientalis</i> L.	T	P	May-Jun
61	Plumbaginaceae	<i>Plumbago zeylanica</i> Linn.	S	P	Aug-Sep
62	Poaceae	<i>Agropyron dentatum</i> Hook.	H	P	May-Jun
63		<i>Phleum alpinum</i> L.	H	P	Aug
81		<i>Agropyron dentatum</i> Hook.	H	P	Jun
85		<i>Agrostis stolonifera</i> Linn.	H	P	Aug
101		<i>Apluda mutica</i> Linn.	H	P	Aug-Sep
102		<i>Aristida cyanantha</i> Nees ex Steud.	H	P	Jul-Aug
209		<i>Avena barbata</i> Pott. ex Link.	H	A	Mar-Apr
210		<i>Avena fatua</i> Linn.	H	A	Mar-Apr
211		<i>Brachypodium sylvaticum</i> (Huds.) P. Beauv.	H	P	Aug-Sep
261		<i>Bromus pactinatus</i> Thunb.	H	A	Jul-Aug
262		<i>Bromus ramosus</i> Huds. Subalpine.	H	P	Jul-Aug
263		<i>Cynodon dactylon</i> (Linn.) Pers.	H	P	WY
280		<i>Cymbopogon distans</i> (Nees ex Steud.) Wats.	H	P	Aug-Sep
281		<i>Cymbopogon martini</i> (Roxb.) Wats.	H	P	Aug-Sep
282		<i>Digitaria citiaris</i> (Retz.) Koelr.	H	P	Sep-Oct
293		<i>Digitaria stricta</i> Roth. ex Roem.	H	A	Aug-Sep
368		<i>Digitaria violascens</i> L.	H	A	Jun-Jul
473		<i>Eragrostis curvula</i> (Schrad.) Nees	H	P	Aug
476		<i>Heteropogon contortus</i> (Linn.) P. Beauv.	H	P	Aug-Sep
488		<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	H	P	Jul-Aug
489		<i>Poa angustifolia</i> Linn.	H	A	Jun-Aug
490		<i>Poa annua</i> Linn.	H	A	WY
586		<i>Poa infirma</i> H. B. K.	H	A	Apr-May

491		<i>Sporobolus arabicus</i> Boiss.	H	P	May-Jun
493	Podophyllaceae	<i>Podophyllum emodi</i> Wall.	H	A	Jun-Jul
494	Polygalaceae	<i>Polygala abyssinica</i> R.Br. ex Fresen.	H	P	Apr-May
42		<i>Polygala crotalarioides</i> DG., Prod.	H	P	Jun-Jul
464	Polygonaceae	<i>Oxyria digyna</i> L.	H	P	Jun-Jul
496		<i>Polygonum affinis</i> D. Don.	H	P	Jun-Jul
497		<i>Polygonum amplexicaulis</i> D. Don.	H	A	Jun-Jul
498		<i>Polygonum aviculare</i> L.	H	P	Jun-Jul
499		<i>Polygonum nepalense</i> Meissner.	H	P	Jun-Jul
500		<i>Polygonum pendulum</i> (M.B.) Laberstani.	H	A	Jul-Aug
529		<i>Rheum webbianum</i> Royle.	H	P	Aug-Sep
546		<i>Rheum emodi</i> Wall.	H	P	Jul-Aug
547		<i>Rumex dentatus</i> L.	H	P	Aug
492		<i>Rumex nepalensis</i> Spengler.	H	P	Jul-Aug
35		<i>Polemonium caeruleum</i> L.	H	A	Jul-Aug
69	Primulaceae	<i>Anagallis arvensis</i> L.	H	A	May-Jun
72		<i>Androsace foliosa</i> Dene. Ex Duby.	H	A	May-Jun
73		<i>Androsace himalaica</i> (Kunth) Hand- Mazz.	H	A	Jun-Jul
74		<i>Androsace rotundifolia</i> Hardw.	H	A	May-Jun
252		<i>Androsace himalaica</i> (Kunth) Hand- Mazz.	H	A	May-Jun
506		<i>Cortusa brotheri</i> Pax. Ex Lipsky.	H	A	Jun-Jul
507		<i>Primula denticulate</i> Sm.	H	P	May
508		<i>Primula duthieana</i> Baif. & W.W.Sm.	H	P	Jun-Jul
509		<i>Primula glomerata</i> Pax.	H	P	Jul
57		<i>Primula rosea</i> Royle.	H	P	Jun-Jul
58	Pteridaceae	<i>Adiantum incisum</i> Forssk.	F	A	Mar-Aug
59		<i>Adiantum capillus-veneris</i> L.	F	A	Mar-Aug
235		<i>Adiantum venustum</i> D. Don	F	A	Mar-Aug
236		<i>Cheilanthes dalhousiae</i> Hook.	F	A	Mar-Aug
458		<i>Cheilanthes subvillosa</i> Hook.	F	A	Mar-Aug
459		<i>Onychium contiguum</i> Wall. ex Hope.	F	A	Mar-Aug
516		<i>Onychium japonicum</i> (Thunb.) G. Kunze	F	A	Mar-Aug
517		<i>Pteris cretica</i> L.	F	A	Mar-Aug
518		<i>Pteris vittata</i> L.	F	A	Mar-Aug

242	Punicaceae	<i>Punica granatum</i> L.	T	P	Jun-Jul
243	Ranunculaceae	<i>Aconitum chashmanthum</i> Stapf ex Holmes.	H	P	Jul-Aug
244		<i>Aconitum ferox</i> Wall.	H	P	Jul-Aug
245		<i>Aconitum heterophyllum</i> wall.	H	P	Jul-Aug
50		<i>Aconitum Laeve</i> Royle.	H	P	Jul-Aug
51		<i>Aconitum rotundifolium</i> Kar&kir.	H	P	Jul-Aug
52		<i>Aconitum soongricum</i> (Stapf).	H	P	Jul-Aug
53		<i>Aconitum violaceum</i> Stapf.	H	P	Jul-Aug
54		<i>Adonis chrysocyathus</i>	H	P	Aug
55		<i>Anemone falconeri</i>	H	P	Jun-Jul
56		<i>Anemone obtusifolia</i> D.Don.	H	P	Jun-Jul
60		<i>Anemone polyanthes</i>	H	P	Jun-Jul
75		<i>Anemone tetrasepala</i> Royle,	H	P	Jun-Jul
76		<i>Aquilegia pubiflora</i> (Wallieh. Ex Royle)	H	P	May-Jun
77		<i>Caltha alba</i> Jacq. Ex Camb.	H	P	Jun-Jul
78		<i>Caltha palustris</i> L.	H	P	Aug-Sep
82		<i>Clematis barbellata</i> Edgew.	S	P	Aug
217		<i>Clematis connata</i> DC.	C	P	Jul-Aug
218		<i>Clematis gouriana</i> Roxb.	C	P	Jul-Aug
273		<i>Clematis grata</i> Wall.	C	P	Jul-Aug
274		<i>Clematis Montana</i> Buch. Home ex Royle.	C	P	Jul-Aug
275		<i>Delphinium cashmerianum</i> Royle.	H	P	Jul-Aug
276		<i>Delphinium denudatum</i> Wallich ex Hookf. & thoms.	H	P	Jun-Jul
523		<i>Delphinium uncinatum</i> H. & T.	H	P	Apr-May
524		<i>Delphinium vestitum</i> Wallich. Ex Royle	H	P	Jul-Aug
525		<i>Rannunculus adoxifolius</i> Hand Mazz.	H	A	Jun-Jul
526		<i>Rannunculus arvensis</i> L.	H	A	Apr-May
527		<i>Rannunculus hirtellus</i> Royle ex D.Don.	H	P	Jun-Jul
595		<i>Rannunculus laetus</i> Wallieh ex D.Don.	H	P	Jun-Jul
596		<i>Rannunculus muricatus</i> L.	H	A	Apr-May
597		<i>Thalictrum alpinum</i> L.	H	P	Jun-Jul

241		<i>Thalictrum cultratum</i> Wall.	H	P	Jun-Jul
528		<i>Thalictrum minus</i> L.	H	P	Jun
622	Rhamnaceae	<i>Rhamnus virgata</i> Roxb.	S	P	May-Jun
287		<i>Ziziphus nummularia</i> (Hunn.f) WightAm.	S	P	May-Jun
306	Rosaceae	<i>Cotoneaster accuminata</i> Lind.	S	P	Jun-Jul
504		<i>Cotoneaster affins</i> var. <i>bacillaris</i> (Lindl) Schneider.	S	P	Jun-Jul
505		<i>Cotoneaster microphylla</i> Wall.	S	P	Jun-Jul
566		<i>Cotoneaster rosea</i> Edgew.	S	P	Jun-Jul
583		<i>Cotoneaster nummularia</i> Fisch. & Mey.	S	P	Jun-Jul
255		<i>Duchesnea indica</i> (Andr.) Focke.	H	P	May-Jun
256		<i>Fragaria nubicola</i> Lindl. ex Lacaïta.	H	A	Apr-May
257		<i>Potentilla gerardiana</i> Lindley.	H	P	Jun-Jul
258		<i>Potentilla nepalensis</i> Hook.	H	P	Jun-Jul
259		<i>Prunus amygdalus</i> BailI.	T	P	Mar-Apr
536		<i>Prunus avium</i> L.	T	P	Mar-Apr
537		<i>Prunus bokhariensis</i> Royle ex. Ck. Sehn.	T	P	Mar-Apr
538		<i>Prunus cornuta</i> Wallieh ex Steud.	T	P	Mar-Apr
539		<i>Pyrus communis</i> L.	T	P	Mar-Apr
540		<i>Pyrus lindleyi</i> Rehder.	T	P	Mar-Apr
541		<i>Rosa brunonii</i> Lindl.	S	P	Jun-Jul
542		<i>Rosa indica</i> L.	S	P	Jun-Jul
543		<i>Rosa macrophylla</i> Lindl.	S	P	Jun-Jul
544		<i>Rosa webbiana</i> Wall ex Royle.	S	P	Jun-Jul
545		<i>Rubus biflorus</i> Buch.	S	P	Apr-May
578		<i>Rubus ellipticus</i> Smith.	S	P	Apr-May
579		<i>Rubus fruticosus</i> L.	S	P	Apr-May
581		<i>Rubus macilentus</i> Carob.	S	P	Apr-May
582		<i>Rubus niveus</i> Thunb non Wall.	S	P	Apr-May
511		<i>Rubus sanctus</i> (<i>Rubus ulmifolius</i>) Schott.	S	P	Apr-May
512		<i>Sibbaldia cuneata</i> Kunze.	H	A	Aug-Sep
513		<i>Sorbaria tomentosa</i> (Lindl.) Rehder.	S	P	May-Jul
514		<i>Sorbus cashmiriana</i> Hedlund.	S	P	Jul-Aug
519		<i>Spiraea affins</i> Parker.	S	P	Jul-Aug
520		<i>Spiraea canescens</i> D.Don.	S	P	Jun-Jul

354		<i>Spiraea vacciniifolia</i> D.Don.	H	A	Jun-Jul
279	Rubiaceae	<i>Galium elagans</i> L.	H	A	Aug-Sep
573	Rutaceae	<i>Dictamnus albus</i> L.	H	P	Jun-Jul
621		<i>Skimmia laureola</i> (DC.) Sieb. & Zucc. ex Walp.	S	P	May-Jun
549		<i>Zanthoxylum armatum</i> D.c.	S	P	Mar-Apr
550	Salicaceae	<i>Populus ciliata</i> Wall.ex Royle.	T	P	Mar-Apr
503		<i>Salix alba</i> L.	T	P	Apr-May
548		<i>Salix denticulate</i> N. J. Anders.	S	P	May-Jun
551		<i>Salix flabellaris</i> N.J .Andress.	S	P	Jul-Aug
554		<i>Salix tetrasperma</i> Roxb.	T	P	Jun-Jul
106	Sambucaceae	<i>Sambucus wightiana</i> Wall.ex Wight and Am.	S	P	Jun-Jul
557	Saxifragaceae	<i>Bergenia ciliata</i> (Haw.)Sternb.	H	P	Apr-May
393		<i>Saxifraga lilacina</i> Duthie.	H	A	Jul-Aug
411	Scrophulariaceae	<i>Lagotis cashmeriana</i> (Royle) Rupr.	H	A	Jun-Jul
470		<i>Mimulus strictus</i> Bth.	H	A	Apr-May
471		<i>Pedicularis pectinata</i> Wall.	H	A	Jun-Jul
472		<i>Pedicularis pyramidata</i> Royle ex Benth.	H	A	May-Jun
560		<i>Pedicularis roylei</i> Maxim.	H	A	May-Jun
609		<i>Scrophularia decomposita</i> Royle ex Bth.	H	A	Apr-May
610		<i>Verbascum erianthum</i> Bth.	H	A	Jun-Jul
611		<i>Veronica cachemirica</i> Gandoger.	H	A	May-Jun
619		<i>Veronica laxa</i> Simpson & J.S.Thomson .	H	A	May-Jun
64		<i>Wulfenia amherstiana</i> Benth.	H	A	Mar-Apr
574	Simaroubaceae	<i>Ailanthus altissima</i> (Mill.) Swingle.	T	P	Aug-Sep
100	Smilacaceae	<i>Smilax vaginata</i> L.	S	P	May-Jun
369	Solanaceae	<i>Atropa acuminata</i> Royle.	H	P	Jun-Jul
575		<i>Hyoscyamus niger</i> L.	H	A	Jun-Jul
618		<i>Solanum nigrum</i> L.	H	A	Apr-May
588		<i>Withania somnifera</i> (L) Dunal.	S	P	WY
593	Staphyleaceae	<i>Staphylea emodi</i> Brandis.	S	P	May-Jun
598	taxaceae	<i>Taxus wallichiana</i> Zucc.	T	P	Mar-Apr
272	Thelypteridaceae	<i>Thelypteris dentata</i> (Forssk.) St. Jhon.	F	P	Jun
362	Thymeleaceae	<i>Daphne oleoides</i> Schreb.	S	P	Jun

361	Tiliaceae	<i>Grewia optiva</i> Drum ex Burret.	T	P	Aug-Sep
601		<i>Grewia tenax</i> (Forssk) Aschers and Schweinf.	S	P	Apr-May
231	Trilliaceae	<i>Trillidium govanianum</i> Wall. ex Royle.	H	A	Jul
603	Ulmaceae	<i>Ulmus wallichiana</i> Planch.	T	P	Apr-May
604		<i>Ulmus villosa</i> Brandis ex Gamble.	T	P	Apr-May
213	Umbelliferae	<i>Bupleurum falcatum</i> L.	H	P	Jun
214		<i>Bupleurum longicaule</i> Wall. ex DC.	H	P	May-Jun
215		<i>Bupleurum rotundifolium</i> L.	H	A	Jun-Jul
367		<i>Ferula jaeschkeana</i> Vatke.	S	P	May-Jun
558		<i>Heracleum thomsonii</i> Clarke.	H	A	Jul-Aug
300		<i>Scaligeria indica</i> W ex Clarke.	H	P	Jun-Jul
480	Urticaceae	<i>Boehmeria platyphylla</i> D.Don.	S	P	Aug-Sep
605		<i>Pilea umbrosa</i> Wedd.	H	P	Jun-Jul
208		<i>Urtica dioica</i> L.	H	A	May-Jun
607	Valerianaceae	<i>Valeriana pyrofolia</i> Deene.	H	P	May-Jun
608		<i>Valeriana jatamansi</i> Jones.	H	A	Apr-May
614	Violaceae	<i>Viola biflora</i> L.	H	A	Jun-Jul
615		<i>Viola canescens</i> Wall. Ex Roxb.	H	A	Mar-Apr
616		<i>Viola odorata</i> L.	H	A	Jun-Jul

Despite being at just 35 km from the capital city, the literacy rate in the area is alarmingly low. Local school teachers and the village elders maintained that the literacy rate for male and female population in the area is approximately 25% and 10% respectively with 17.5% overall literacy, against the average 60% literacy rate in the state (Government of Azad Jammu & Kashmir, 2004). The people practice subsistence agriculture on infertile steep slopes and mainly grow a single crop of maize and some vegetables. Because of small landholdings, crude practices and climate, the agricultural production is very low for sustaining the large human population. This is the main reason for the huge male out-migration to Muzaffarabad and the larger towns of Pakistan as a skilled and unskilled labor force. The aim of this study was to compile a list of plant species which will serve as reference for future Management of Plant resource wealth of the area.

Material and methods

The study area was thoroughly surveyed during March 2010-December 2010 for the purpose of collection of plant specimen. Plant Specimens were processed and dried using conventional drying and processing methods and mounted on herbarium sheets for further identification. All specimens were identified with the help of Flora of Pakistan (Ali and Qaiser, 1995-2006; Dar, 2003; Dar and Malik, 2009; Nasir and Ali, 1971-1994). The specimens identified were then matched with the herbarium sheets of University of Azad Jammu and Kashmir Muzaffarabad for further clarification.

Results and discussion

A total of 409 species were recorded with 103 families and 225 genera. Most dominant families with respect to species number in the study area were Ranunculaceae (32), Rosaceae (31), Poaceae (24), compositeae (23), Labiatae (18), Papilionaceae (15), Caryophyllaceae (12),

Cyperaceae (12), Polygonaceae (10), Primulaceae (10), Scrophulariaceae (10), Boraginaceae (9), pteridaceae (9), asclepiadaceae (7), Dryopteridaceae (7), Balsaminaceae (6), Euphorbiaceae (6), Gentianaceae (6), Moraceae (6), Umbelliferae (6) whereas other families have 5 or less than 5 species. Most of the families represent only one genus and species.

A detailed description of flora of the study area is give in table 2 which comprises of detailed account of Plant species with their families, Status (Herb, Shrub, Tree, Climber or Parasite on other tree species), Annual, Biennial or perennial, and Flowering period of each species. Among these 147 species were recorded as annuals whereas 262 species were perennials. Out of total records 269 species were herbs and grasses, 67 species of shrubs, 44 Tree species, Ferns were 20 in number, 2 species were Parasites on other species and 7 species were recorded as climbers (Fig. 2, 3).

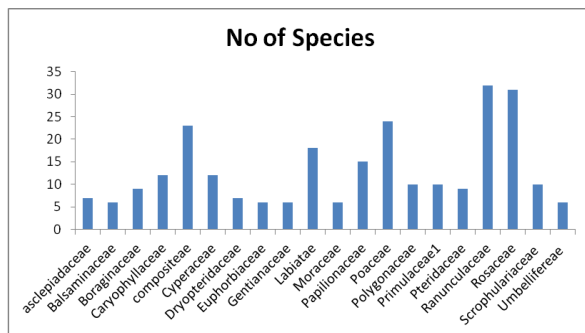


Fig. 2. Distribution of Species in each family.

Machiara National park lies in Himalayan Biodiversity hotspot and it is important to enlist floral wealth of this area which will ultimately help in future planning in the park resources management. Ecologically, this area lies in Temperate to Alpine and this is reflected in the floral species which are mostly indicating the ecological zonation (Dar, 2003; Dar and Malik, 2009). The vegetation of the area is under severe threat of grazing as a lot of herders cross this National Park every year to go to other areas of nearby District Neelum and during this passage the goats and sheep destroy vegetation and hence non palatable species increase in number which was also discussed by (Khan

et al., 2011) in another area of Pakistan. Medicinal, Timber and Fodder plant extraction at a huge level is also a threat to the biodiversity of the area as there are no strict rules and regulations which can stop this illegal extraction (Butt, 2006).

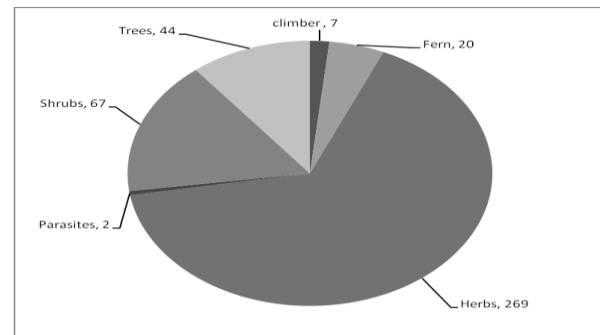


Fig. 3. Species categorized on the basis of status.

The area is extremely rich in floral diversity and it is call of time to preserve this wealth in time by keeping illegal resource poachers away and providing alternative of the resources in the form of better health facilities, cooking stoves etc. so people stop destroying natural vegetation. Another great threat is overgrazing by sheep and goats and authorities should ban entry of the herders in the Park area by providing another passage outside of the Park area.

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