



## Species Diversity (Flora and Usage Plants) of Machakhel National Park

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### Abstract:

There were identified 548 species belonging to 293 genera and 104 families in the Machakhel National Park (Georgia, Adjara) under review. 19 Pteridophytes and 529 Spermatophytes were detected out of this 548 species, Spermatophytes also contained 5 Gymnospermae and 524 Angiospermae species. The life form spectrum of the species was as follows: trees 30 (5,5%), shrubs 31 (5,7%), tree-shrubs 18 (3,3%), Perennial herbs 278 (50,7%), Biennial herbs 53 (9,7%), Annual herbs 90 (16,4%), Annual-Biennial herbs 19 (3,5%), Biennial-Perennial herbs 5 (0,9%). There are 55 endemic species (10,0%) in the flora of Machakhela National Park area, including Caucasian – 21 (3,8%), Georgian – 3 (0,5%), Colchic – 25 (4,6%), Adjara-Lazetian – 4 (0,7%), Ajarian – 2 (0,4%) species. 10 species (1,8%) included in “Red List” of Georgia, 60 (11,0%) are recommended for the “Red List” of Caucasus and 5 (0,9%) included in IUCN “Red List”. The alien flora is presented by 44 species – 8,0% (adventive-6, invasive-4, subspontaneous-4, naturalized-25, unknown-5). The area is a very important relictual refuge for many plant species. The region is also rich with usage plants (265 species, 48,4%): ornamental – 83 (15,1%), traditional medicine – 116 (21,2%), traditional culinary – 66 (12,0%).

*Key Terms: Machakhel National Park, Species, Genera, Families.*

### Introduction:

As it is known Caucasus is distinguished by the originality and high quality of its biodiversity; herewith, nature of the region is under the strong impact of human activities which threatens both single species and ecosystems and ecological balance in general. All that can be proved by the fact that Caucasus is recognized to be the distinguished region due to its biodiversity; moreover, it is included in the World Lists (WWF (1997), (2000) of priority regions with level of biodiversity to be unique and needs to be conserved.

From its part, Colchic biogeographical region is eminent within Caucasus with the richness of relict and endemic species. It is stipulated by the fact that during Ice Age Colchi became the shelter for the species tend to heat. Forests of temperate zone have been continuously growing here since the Tertiary Period: Due to its biodiversity it is absolutely prominent, unique section in the East Eurasia (with biogeographical region of Hirkani).

Within Colchi, the south Colchi is outstanding (Adjara and bordering territory of Turkey) with the peculiar abundance of the oldest endemic species; therefore, in this original region, where like everywhere in Caucasus, problems

of wild nature protection are very actual, foundation of modern protected areas is very important task from nature protection point of view. Territorial protection of Nature and tourism development related to it should be considered as one of the priorities in Adjara taking into account its biological diversity and tourism-recreational resources. In order to manage this activity successfully, the process of spatial arrangement should be regulated (taking into account infrastructure development, cultural hereditary and requirements for environment protection), as well as the establishment of efficiently protected areas and their net.

In order to ensure sustainable development in Adjara and provide the population with healthy and sound living and working environment in the context of improved functioning of the protected areas and nearest perspectives of establishment of the protected areas net and opportunities of development of Transboundary cooperation was created spatial-territorial planning document - Spatial-Territorial Planning Document “- The Management Plan of Natural - Landscape Territory of Machakhela” (Spatial-Territorial Planning Document. . . , 2008).

The research area, Planned Natural-Landscape area Machakhela, is located in the South-West part of Caucasus, namely, in the remote Shavsheti range and its branching - near the Black Sea; distance to the nearest Black Sea point is less than 10 km. Planned Natural-Landscape area Machakhela includes the basin of the river Machakhela (right flow of the river Chorokhi and covers bordering areas of the Autonomous Republic of Adjara (Georgia) and the Artvin Province (Turkey).

Total area of Machakhela NP is 12,739 ha; the forest area comprises the major part– 86.2% (10,993 ha).

The dominating ligneous species (the bulk component of the forest) in forest covered area are represented by: *Fagus orientalis*, *Castanea sativa*, , *Alnus barbata*, *Picea orientalis*. The smaller share of forest stands are represented by the domineering beech (*Carpinus*) and pine (*Pinus*). Forest stands are mainly of the natural origin. Other ligneous species common for the region are also presented in scattered mode mainly of natural genesis. In small fragments and units are presented other ligneous species characteristic for the region.

The relief is very severely crushed. It is characterized by dissected terrain, high altitudinal amplitude and deep gorges. Over 80 % of the area is comprised of slopes of 20° and more inclination; hypsometric highest point are: Mounts Khedi (2151 m), Kvakibe (1937 m), Bashturk (1712 m), Muratkala (1794 m) and others.

Average annual precipitation is more than 2000 mm; air humidity is 80-85%. Often foggy days. Average annual temperature varies depending on the Height of 12-14°C (500-600 m a.s.l) up to 5-6°C (1000-1200 m a.s.l). In the lower mountain average temperature of the hottest month (August) is 20°C, temperature of the coldest month (January) - 2°C. Quantity of days with air temperature of 0°C is more than 274. The height of snow cover in the upper and lower zones is 3-4 meters.

Hypsometrically, forests vegetation is arranged in the following way:

< 500-600 m: mixed broad-leaved Colchic forests

500(600)-1000(1200) m: chestnut tree belt

1000(1200)-1600(1800) m: beech belt

1600(1800) m. > dark coniferous forest belt

#### Materials and Methods:

A major method of investigation is a traditional route expedition-excursion, method-collecting plant specimen for herbarium and camera processing. In compiling the list of wildgrowing plant species it was used herbarium specimens collected directly by us, between 1990 - 20012 years, as well as samples from the herbarium of Batumi Botanical Garden (BAT) and N. Ketskhoveli Tbilisi Institute of Botany. We identified plants according to the plant indexes of Adjara (Georgia) and Turkey; Variety taxonomy is specified according to the temporary nomenclature (Ketskhoveli, Kharadze, Gagnidze R, 1971-2007; Davis,1965-1982; Czerepanov,1995). Herbarium samples, digital pictures of species and habitats are kept at Batumi Botanical Garden (BAT). Conservation status are given according Red List of Georgia, Red List species of Caucasus Ecoregion and IUCN Red list (<http://www.garemo.itdc.ge>; [www.iucn.org/redlist](http://www.iucn.org/redlist); [http://www.cepf.net/Documents/final\\_IUCNNR\\_caucasusplants.pdf](http://www.cepf.net/Documents/final_IUCNNR_caucasusplants.pdf); <http://www.mobot.org/MOBOT/Research/caucasus/caucasus.shtml>).

The terminology of alien status presented below has been adopted from Kikodze et al (2009).

#### Results and Discussion:

There were identified 548 species belonging to 293 genera and 104 families in the Machakhela National Park (Georgia, Adjara) under review. 19 Pteridophytes and 529 Spermatophytes were detected out of this 548 species, Spermatophytes also contained 5 Gymnospermae and 524 Angiospermae species. The life form spectrum of the species

was as follows: trees 30 (5,5%), shrubs 31 (5,7%), tree-shrubs 18 (3,3%), Perennial herbs 278 (50,7%), Biennial herbs 53 (9,7%), Annual

herbs 90 (16,4%), Annual-Biennial herbs 19 (3,5%), Biennial-Perennial herbs 5 (0,9%) (Figure 1).

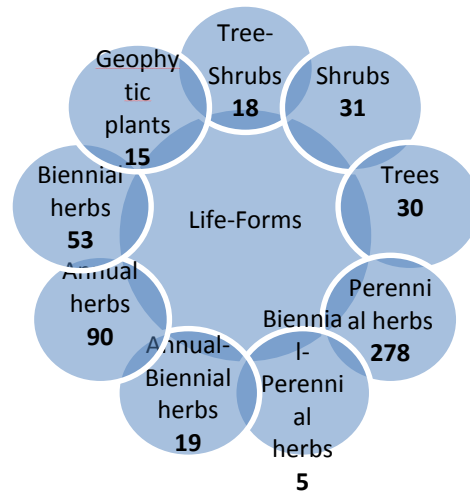


Figure 1. The vascular flora life-form of Machakhel National Park

In the study area Six ecological groups have been defined to reflect habitats: Forest -141, Grassland, scrub and rock plant -87, Forest, Grassland, scrub and rock plant -109, Marsh and wet meadow plant -24, Ruderal and segetal plant -111, lowland and Pioneer plant -2 ( Figure 2).

The alien flora is presented by 44 species – 8,0% (adventive-6, invasive-4, subspontaneous-4, naturalized-25, unknown-5). (Figure 3, Table 1).

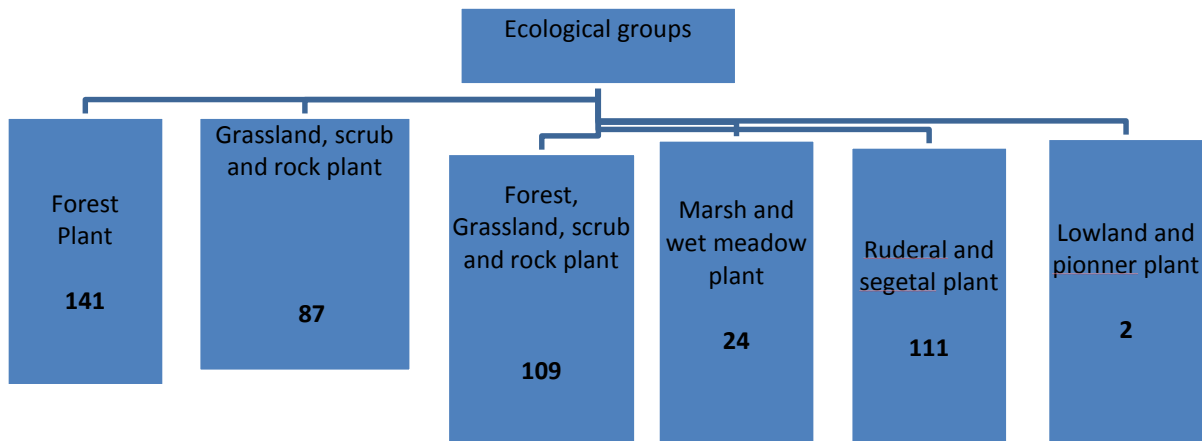
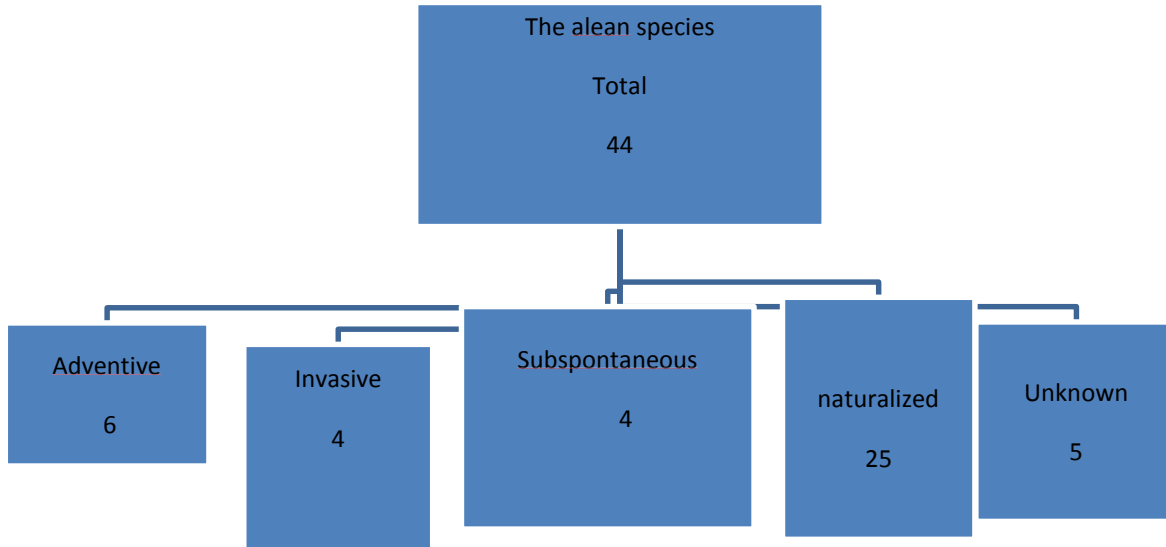


Figure 2. The vascular flora ecological groups of Machakhel National Park.



**Figure 3.** The alean species vascular flora of Machakhel National Park.

**Table 1.** The alean species vascular flora of Machakhel National Park.

Alean status	List of Alean species
<b>Adventives</b>	<i>Amaranthus blitoides</i> S.Wats.; <i>Torilis arvensis</i> (Huds.) Link; <i>Cynoglossum creticum</i> Mill. ( <i>C.pictum</i> Soland ); <i>Aira elegans</i> Willd. ex Gaudin.( <i>A.capillaris</i> Host.); <i>Digitaria violascens</i> Link [ <i>D.chinensis</i> (Retz.) A.Camus ; <i>Paspalum chinense</i> Nees]; <i>Hemarthria altissima</i> (Poir.) Stapf. & C.E.Hubb.
<b>Naturalized</b>	<i>Amaranthus retroflexus</i> L.; <i>Hydrocotyle ramiflora</i> Maxim.; <i>Artemisia vulgaris</i> L; <i>Bidenis bipinnata</i> L.; <i>Conyza canadensis</i> (L.) Cronq. ( <i>Erigeron canadensis</i> L.); <i>Galinsoga ciliata</i> (Rafin) Blake; <i>Gnaphalium affine</i> D.Don; <i>Inula britannica</i> L.; <i>Sonchus asper</i> (L.) Hill; <i>Sonchus oleraceus</i> L; <i>Xanthium strumarium</i> L.; <i>Torilis procumbens</i> (Bess.) Reichnb.; <i>Vicia tetrasperma</i> (L.) Schreb ; <i>Geranium robertianum</i> L; <i>Malva neglecta</i> Wallr.; <i>Phytolacca americana</i> L.; <i>Robinia pseudacacia</i> L. ; <i>Ranunculus chius</i> DC.; <i>Commelina communis</i> L. ; <i>Aegilops cylindrica</i> Host; <i>Holcus lanatus</i> L.; <i>Oplismenus undilatifolium</i> (Ard.) Beauv. ; <i>Poa annua</i> L.
<b>Subspontaneous</b>	<i>Aster novae-angliae</i> L.; <i>Aster novi-belgii</i> L.; <i>Trigonella coerulea</i> (L.) Ser. ( <i>Trifolium caeruleum</i> L.); <i>Phytolacca ixocarpa</i> Brot.ex Hornem.
<b>Unknown</b>	<i>Berteroa incana</i> (L.) DC.; <i>Chenopodium album</i> L.; <i>Tordylium maximum</i> L.; <i>Vicia angustifolia</i> Reichard ( <i>V.sativa</i> L.subsp. <i>nigra</i> (L.) Ehrh.); <i>Veronica persica</i> Poir.; <i>Veronica polita</i> Fries. ( <i>V.didyma</i> auct. vix Ten..)
<b>Invasive</b>	<i>Ailanthus altissima</i> (Mill.)Swingle ; <i>Spiraea japonica</i> L.fil. ; <i>Datura stramonium</i> L. ; <i>Paspalum dilatatum</i> Poir.

There are 55 endemic species (10,0%) in the flora of Machakhel National Park, including Caucasian – 21 (3,8%), Georgian – 3 (0,5%),

Colchic – 25 (4,6%), Adjara-Lazetian – 4 (0,7%), Ajarian – 2 (0,4%) species (**Figure 4, Table 2**).

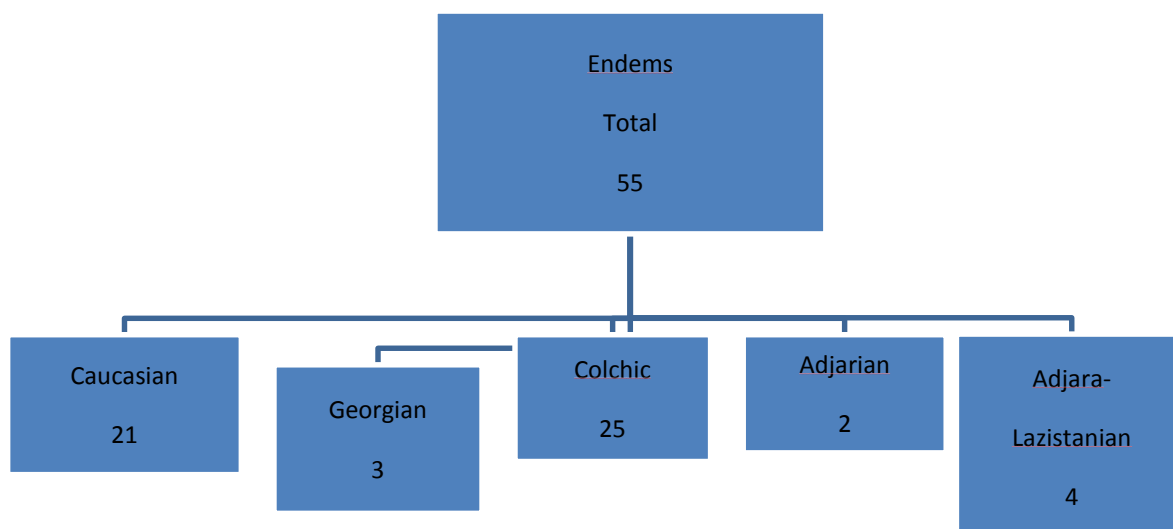


Figure 4. The endemic species vascular flora of Machakhel National Park.

Table 2. Endemic species of Machakhel National Park.

Endemism	List of endemic species
Ajarian and Adjara-Lazetian	<i>Campanula makaschwilii</i> , <i>Rhododendron ungeronii</i> , <i>Rhododendron smirnowii</i> , <i>Teucrium trapezunticum</i> , <i>Cyclamen adzharicum</i> , <i>Ficaria grandiflora</i> (F.popovii).
Colchic	<i>Heraclium cyclocarpum</i> , <i>Aristolochia pontica</i> , <i>Anthemis woronowii</i> , <i>Cirsium imereticum</i> , <i>Crepis pontica</i> , <i>Echinops colchicus</i> , <i>Hieracium adjarianum</i> , <i>Inula magnifica</i> , <i>Betula medwedewii</i> , <i>Myosotis lazica</i> , <i>Buxus colchica</i> , <i>Thelycrania koenigii</i> , <i>Euphorbia pontica</i> , <i>Vicia antiqua</i> , <i>Quercus pontica</i> , <i>Stachys trapezuntea</i> , <i>Ficus carica</i> , <i>Paeonia macrophylla</i> , <i>Rubus caucasicus</i> , <i>Muscari sosnowskyi</i> , <i>Ornithogalum woronowii</i> , <i>Iris lazica</i> , <i>Lilium szovitsianum</i> .
Georgian	<i>Symphytum grandiflorum</i> , <i>Symphytum asperum</i> , <i>Ranunculus bushei</i> .
Caucasian	<i>Heraclium sosnowskyi</i> , <i>Sonchus propinquus</i> , <i>Solidago virgaurea</i> , <i>Paracynoglossum glochidiatum</i> , <i>Arabis nordmanniana</i> , <i>Pachyphragma macrophyllum</i> , <i>Gadellia lactiflora</i> , <i>Euonymus leiophloea</i> , <i>Knautia involucrata</i> , <i>Chamaecytisus hirsutissimus</i> , <i>Alcea transcaucasica</i> , <i>Polygala caucasica</i> , <i>Helleborus caucasicus</i> , <i>Pulsatilla albana</i> , <i>Pulsatilla violacea</i> , <i>Ranunculus grandiflorus</i> , <i>Pyrus caucasica</i> , <i>Salix caucasica</i> , <i>Digitalis schischkini</i> , <i>Melampyrum caucasicum</i> , <i>Galanthus woronowii</i> .

10 species (1,8%) included in “Red List” of Georgia, 60 (11,0%) are recommended for the “Red List” of Caucasus and 5 (0,9%) included in IUCN Red list of Threatened Species (2013.1.) (Table 3).

The region is also rich with usage plants (265 species, 48,4%): ornamental– 83 (15,1%), traditional medicine – 116 (21,2%), traditional culinary – 66 (12,0%) (Figure 5).

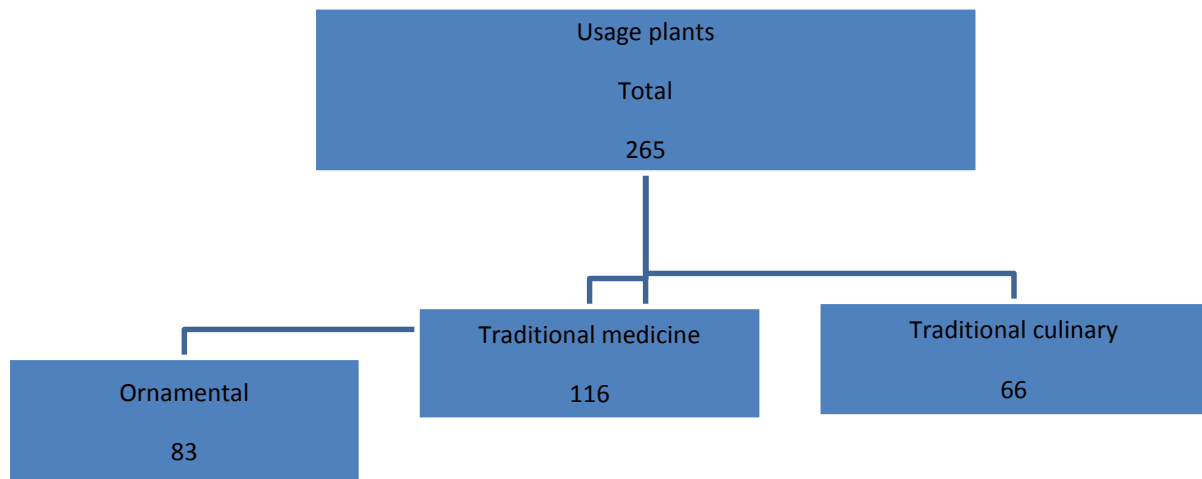
Table 3. Rare and endangered species of Machakhel National Park.

Conservation status	List of species
Georgian Red list (2006 data)	<i>Taxus baccata</i> (VU), <i>Betula medwedewii</i> (VU), <i>Buxus colchica</i> (VU), <i>Rhododendron ungeronii</i> (VU), <i>Rhododendron smirnowii</i> (VU), <i>Castanea sativa</i> (VU), <i>Quercus imeretina</i> (VU), <i>Quercus pontica</i> (VU), <i>Quercus hartwissiana</i> (VU), <i>Juglans regia</i> (VU), <i>Laurus nobilis</i> (VU), <i>Ulmus glabra</i> (VU).
Caucasus Red list (2012 data)	<i>Dryopteris oreades</i> (LC), <i>Heraclium cyclocarpum</i> (LC), <i>Heraclium sosnowskyi</i> (NE), <i>Peucedanum caucasicum</i> (NE), <i>Peucedanum longifolium</i> (NE), <i>Hedera helix</i> (NE), <i>Anthemis woronowii</i> (NE), <i>Arctium lappa</i> (NE), <i>Cirsium imereticum</i> (LC), <i>Inula magnifica</i> (NE), <i>Epimedium pubigerum</i> (NT), <i>Alnus barbata</i> (NE), <i>Alnus glutinosa</i> (NE), <i>Betula medwedewii</i> (VU), <i>Symphytum grandiflorum</i> (NE), <i>Hesperis adzharica</i> (NE), <i>Pachyphragma macrophyllum</i> (NE), <i>Campanula makaschwilii</i> (VU), <i>Gadellia lactiflora</i> (NE), <i>Melandrium balansae</i> (NE), <i>Euonymus leiophloea</i> (NE), <i>Swida koenigii</i> (VU), <i>Sedum caucasicum</i> (NE), <i>Cephalaria gigantea</i> (NE), <i>Rhododendron ungeronii</i> (VU), <i>Rhododendron smirnowii</i> (VU), <i>Euphorbia stricta</i> (NE), <i>Chamaecytisus hirsutissimus</i> (NE), <i>Psoralea acaulis</i> (NE), <i>Vicia antiqua</i> (NE), <i>Quercus pontica</i> (VU), <i>Quercus imeretina</i> (VU), <i>Lamium album</i> (NE), <i>Alcea transcaucasica</i> (NT), <i>Paeonia caucasica</i> (NE), <i>Paeonia macrophylla</i> (NE), <i>Fraxinus excelsior</i> (NE),

*Helleborus caucasicus* (NE), *Pulsatilla albana* (NE), *Pulsatilla aurea* (NE), *Pulsatilla violacea* (NE), *Rubus buschi* (NE), *Rubus caesius* (NE), *Digitalis schischkinii* (NE), *Scrophularia macrobotrys* (NE), *Daphne glomerata* (NE), *Tilia begoniifolia* (NE), *Galanthus woronowii* (NE), *Polygonatum glaberrimum* (NE), *Carex sylvatica* (NE), *Lilium szovtsianum* (NE), *Narthecium balansae* (NE).

#### IUCN Red list

*Picea orientalis* (Lower Risk/least concern ver 2.3 (needs updating)) *Abies nordmanniana* (Least Concern ver 3.1 Pop. trend: stable) *Taxus baccata* (Lower Risk/least concern ver 2.3 (needs updating)); *Alnus barbata* (Least Concern ver 3.1); *Corylus avellana* (Least Concern ver 3.1); *Buxus colchica* (Lower Risk/near threatened ver 2.3 (needs updating)); *Juglans regia* (Near Threatened ver 3.1 Pop. trend: decreasing).



**Figure 5.** The usage plants species vascular flora of Machakhel National Park.

Both conservation areas (The Machakhela planned conservation area in Georgia and Camili Biosphere Reserve in Turkey) are historically characterised by high population density, acute shortage of arable lands and predominance of livestock farming in traditional economy. Over the past decades the list of negative factors affecting biodiversity has been replenished by expansion of forest road networks, irrational use of forest resources, uncontrolled gathering of wild herbs, environmental pollution, construction of oil and gas pipelines, dams and other facilities, and unorganized tourism.

Disturbance of individual ecosystems resulting from increasing human impact on plant communities greatly threatens species diversity, and possibility of *in situ* conservation of relict and endemic plants with restricted ranges, which could lead to dramatic reduction in their population size and eventually to the threat of extinction (Manvelidze et al. 2009; Eminağaoğlu et al. 2010).

#### Acknowledgments:

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