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Understory plant species diversity of Asalem's forests, northern Iran

Abstract

The diversity of plants in forests understory is important from different perspectives. Thus, present research was carried out to find the chorology, origin and diversity of the understory plants species in Asalem's forests, northern Iran. Basic studies were conducted on the geographic characteristics of the region. The direct visiting forests method were selected for investigation of tree and understory plants species (herbs) which lasted of the year 2017 to 2018. Sampling of understory vegetation were done, recorded and identified based on available scientific references. The results showed that there are more than 152 species belonging to 124 genera and 61 families existed in forest understory. The largest families were Asteraceae, Rosaceae, Poaceae and Apiaceae with 17, 13, 11 and 10 species, respectively. Investigation of the geographical distribution of plant species indicated that there is a composition of Europe–Siberian, Iran-Turan, Mediterranean (and Polyregional and cosmo) plant elements. Plant life forms by Raunkiaer method showed that phanerophytes with 28 % and Chameophytes = Therophytes with 26 % are the most frequent life forms in this area. Also, plant diversity was higher in areas with sparse tree cover, but in degraded areas or areas with high tree vegetation understory plants diversity was low.

Keywords: Flora composition, Life form, Diversity, Asalem forest area

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Introduction

One of our greatest natural assets around the world, forests provide different ecological, social and economic services.[1] Plant vegetation in forest areas has importance in different aspects not only in term of wood production, but also in other non-woody production such as forage, medicine, beauty and etc. This productivity and diversity of forest is one of the best guide judgments about the ecological condition of the region. Because the plants are resistant organisms have endured in the long term conditions[2] and have adapted with own environmental factors. Beside the forest utilization, investigation of the plant diversity is important and it will show like a document history for the any region. In this regards, the most effective method, floristicall study investigates the geographical and floristically origin of each region for genetic resources managing.[3] Identification and conserving forest biodiversity, especially understory herbs is therefore a valuable national and international work which focused on the creation of protected areas.[4] However natural forest reserves are a critical part for conserving biodiversity in forests but are not sufficient and about 92% of the forests are outside formally protected around the world.

From the global, to regional there is many different forest ecosystem in term of diversity which determined by the combination of natural factors.[4] It is therefore vital to adopt appropriate methodology to help ensure the long-term sustainability[1] especially for forest reservoirs in a changing world. To this end, the study of the plants diversity in forests understory around the word will be important in order to achieve conservation objectives and various exploit aspects. Therefore, the aim of this study was to determine florist list, chorology and diversity of the forest understory plant species in Asalem's forests (belong to Shafarood company) in northern region of Iran.

Materials and methods

Study area

Asalem's forests area is located in southern Iran, in the Guilan province. The climate of the study area is very humid and the mean annual precipitation is 1365 mm and the mean annual temperature is 13.7 centigrade.[4] Study area consists of different series as below: Nave1, Nave2, Nave3, Gilesara and lomir1 which are located at Geographical location (u.t.m) 51° 37′ 37″-16° 41′ 37″ and 51° 48′ 48″-27° 52′ 48″ in a range of 250- 2150 m abs (Figure 1).

Figure 1 Geographical location of Asalem basin (Shafarood forest), Iran.

Methodology

In order to plant study, the field visiting was performed favorably and also herbarium task were done to identify the left species. Therefore, different plant species samples were gathered during 2017-2018 and were identified. Identification was performed in two ways; using scientific references and local people's knowledge. Also, those species which were not identified based on field observation,

were identified in herbarium of the Tehran University. Along the field sampling, photos were also taken from the different species, which were used for laboratory for identification. Plant species identification was done based on different scientific reference and flora. Also, plant specimens were identified, named based on the different classification included Flora Iranica,[5] Flora of Iraq,[6] Flora of Iran (Assadi), and Flora of Ghahreman.[7]

Results

Despite the low area and the presence of shadows in the Asalem forests, the diversity of plants was highly evaluated. The obtained results on the floristic diversity of Asalem forests were categorized in Table 2 in taxon in family groups. Totally 152 species belonged to 124 genus and 61 families of plant species plants species were identified in the in Asalem basin (Shafarood forest) mentioned region. Except of some families which contain only one species and genus in this area, the others of families have several species. The percent of species in this area with plant family has been demonstrated in the below Figure 2. The results of the flora Study showed that, there is a wide variety of herb plants in the region. Although the area is not vast, but herb plants have high percentage -more than 90 percent- of the total plants with diverse life forms due to the location of the area in hyrcanian zone. The total life forms of plant speciess plants are revealed in Figure 3 that, are classified based on Raunkiaer (1943).

Also, plant diversity for each of the series is presented in the following table. It seems that understory plants are much more diverse compared to existing wood species, which are mostly a species of trees. The results of diversity indices in each the seri shown in Table 1 which showed a variation between species in different series. In this area plant diversity indices (Shannon, Simpson, Menhinick, Margalef, and Fisher alpha Index) is different in each region. This is mainly due to the predominance of tree species or the effects of external factors like humans in the region.

Table 1 Diversity Indexes in different series in study forests

Diversity Indexes	Series name			
	Nave1	Nave2	Nave3	Gilesara and Lomir1
Shannon Index	1.51	1.45	1.74	1.66
Simpson Index	0.64	0.65	0.68	0.76
Menhinick	3.44	2.75	2.22	2.35
Margalef	4.95	4.54	4.56	4.59
Fisher alpha	26.78	21.73	15.34	18.58

Table 2 Plants species, life forms and chorotypes in Asalem forest (Shafarood forest), Iran

Families	Species	Life forms	Chorotypes
Spermatophytes/Angiospermae/Dicotyledonae			
Aceraceae	Acer cappadocicum Gled. Schrift	Ph	Euro.-Sib.(Eux.-Hyrc.)
	Acer velutinum Boiss.	Ph	Euro.-Sib.(Hyrc.)
Alismaceae	Alisma plantago-aquatica L.	Th	
	Acer insigne Boiss.	Ph	
Amaranthaceae	Amaranthus retroflexus L	Th	
Apiaceae)Umbelifera)	Turgenia latifolia	Th	IT-M
	Conium maculatum L.	He	ES-IT-M
	Vulpia myuros (L.) C. C.Gmelin	He	IT
	Eryngium caucasicum Trautv	Th	
	Heracleum persicum	He	Euro.-Sib.(Eux.-Hyrc.)
	Aegilops tauschii Cosson	He	ES-IT-M
	Eremopyrun distans (C.Koch) Nevski	He	IT
	Crypsis schoenoides (L.) Lam.	He	IT
	Phleum paniculatum Huds	He	ES, M, IT
	Setaria viridis (L.) P. Beauv.	Th	ES, M, IT
	Sanicula europaea L.	Th	IT
Araliaceae	Hedera pastuchovii Woron ex Grossh.	Ph	Euro.-Sib.
Aspleniaceae	Phylitis scolopendrium (L.) Newm	He	ES, M

	Dryopteris borrei Adens	He	Euro.-Sib
Aspidiaceae	Polysticum branunii (Spenner)Fee	He	Euro.-Sib
	Polysticum meyerii Roth	He	Euro.-Sib
	Artemisia annua L.	He	Euro.-Sib.
	Cichorium intybus L.	He	IT
	Xanthium strumarium L.	He	IT
	Calendula oficinalis L.	He	IT
	Senecio othonnae M. B. L.	Th	IT
	Dichrocephala integrifolia D.C.	Th	Cosmo.
Asteraceae (Compositae)	Conyza canadensis (L.) Cronq	Th	Cosmo.
	Carpesium cernuum L.	Th	Plure.
	Cirsium aduncum Fisch. & C.A.Mey.	He	IT
	Cirsium arvense (L.) Scop.	He	IT
	Lactuca orientalis	He	IT
	Lactuca serriola L.	He	IT-ES-M
	Scorzonera laciniata L.	Th	
	Silybum Marianum (L.) Gaertn.	He	IT, M
	Tanacetum parthenium(L.) Schultz – Bip.	He	IT
	Tripleurospermum disciforme L.	He	IT, M
	Tragopogon buphthalmoides (DC.) Boiss.	Th	IT, ES
Athyriaceae	Athyrium filix- femina (L.)Roth	He	Euro.-Sib.
Aquifoliaceae	Ilex spinigera (Loes) Loes	Ph	Euro.-Sib.(Hyrc.)
Betulaceae	Alnus glutinosa L. Gaerth. SSP. Barbata	Ph	Euro.-Sib.
	Alnus subcordata C. A. Mey.	Ph	Euro.-Sib.(Hyrc.)
Boraginaceae	Asperuo procumbens L.	Th	IT, M
	Echium amoenum Fisch et. Mey	Th	IT
Buxaceae	Buxus hyrcana Pojark.	Ph	Euro.-Sib.(Eux.-Hyrc.)
	Alyssum hirsutum M.B.	Th	IT
Brassicaceae	Capsella bursa-pastoris (L.) Medicus	Th	IT, M
	Descurainia sophia (L.) Webb & Berth in Engler & Prantl	Th	IT,M
	Cardamine uliginosa M.B.	Th	Euro.-Sib.(Pont.)-Ir.-Tur.
Cannabinaceae	Hunulus lupulus	Ph	
Caprifoliaceae	Lonicera nummulariifolia Jaub. & Spach	Ph	IT, M
	Viburnum opulus L.	Ph	
Caryophyllaceae	Buffonia calycina Boiss. & Hausskn. in Boiss	Th	IT
	Stellaria media (L.)Cyr.	Th	Cosmo.
Chenopodiaceae	Chenopodium album L.	Th	
Crassulaceae	Sedum album L.	Th	IT
Cupressaceae	Cupressus sempervirens L. var. horizontalis	Ph	Medi.
Corylaceae	Carpinus betulus L	Ph	Euro.-Sib.
	Carex acuta L.	He	Plure.
Cyperaceae	Carex stenophylla Wahlenb.	He	Plure.
	Carex sylvatica L	He	Plure.
Ebenaceae	Diospyrus lotus L.	Ph	Ir.-Tur.-Sino-Jap.
Equisetaceae	Equisetum arvense L.	Cr	Plure.

	Euphorbia helioscopia L	Th	Ir.-Tur.
	Euphorbia squamosa Willd.	Th	Euro.-Sib.(Hyrc.)
	Mercurialis perennis L.	Th	IT, ES
	Acalypha australis	Th	Cosmo.
	Gleditsia caspica Desf.	Ph	
Euphorbiaceae	Albizia julibrissin Durazz	Ph	Hyrc.
	Coronilla varia L	Th	Euro-Asi
	Trifolium mazanderanicum Rech. f.	Th, He	IT
	Trifolium pretense L.	Th	IT, M
	Fagus orientalis Lipsky.	Ph	
	Quercus castaneaefolia C.A.Mey.	Ph	Euro.-Sib.(Hyrc.)
Juglandaceae	Pterocarya fraxinifolia (lam.) spach	Ph	Euro.-Sib.(Hyrc.)
	Juglans regia	Ph	IT-ES-M
Juncaceae	Juncus acutus L.	He	Plure.
	Erodium cicularium L.	Ge	Plure.
	Geranium rotundifolium L.	Ge	IT-ES-M
Geraniaceae	Geranium columbinum L.	Ge	Plure.
	Geranium divaricatum Ehrh	Ge	Plure.
	Geranium lucidum L.	Ge	Plure.
	Geranium tuberosum L. subsp. micranthum Schonbeck-Teme	Ge	IT
Hamamelidaceae	Parrotia persica C.A.Mey.	Ph	Euro.-Sib.(Hyrc.)
Hypericaceae	Hypericum androsaemum L	He	IT
	Hypericum perforatum L.	He	Euro.-Sib.
Hypolepidaceae	Pteridium aquilinum L.	He	IT-ES-M
	Ajuga reptans L.	He	IT-ES-M
	Calaminta grandiflora (L.) Moench	He	IT,ES
	Mentha longifolia (L.) Hudson	Ge	IT-ES-M
	Salvia glutinosa L	He	IT
	Clinopodium umbrosum (M. B.) C. Koch	Ph	IT
	Mentha aquatica L.	He	Euro.-Sib.
Nyctaginaceae	Mirabilis jalapa L.	Th	Euro.-Sib.
Moraceae	Ficus Carica var. genuine	Ph	Medi.- Euro.-Sib.-Ir.Tur.
Oleaceae	Fraxinus excelsior L.	Ph	Euro.-Sib.
	Papaver dubium L	Th	ES,IT, M
Papaveracea	Chelidonium majus L	Th	Medi.- Euro. -Ir.Tur.
	Glaucium G. grandiflorum Boiss. & Huet in Boiss	Th	Ir.Tur.
Phytolacaceae	Phytolacca Americana L.	Th	Euro.-Sib.
Plantaginaceae	Plantago major L.	He	Plure.
Podophyllaceae	Epimedium pinnatum Fisch. in DC.	Ge	Euro.-Sib.- Ir.Tur.
	Rumex scutatus L.	He	Medi.- Euro-Ir.Tur.
Polygonaceae	Rumex tuberosus L.	He	Euro.-Sib.
	Polygonum convolvulus L.	He	Plure.
	Polygonum hydropiper L.	He	Plure.
Primulaceae	Primula heterochroma Stapf	He	Euro.-Sib
	Cyclamen coum Miller	Ge	Medi.- Euro-
Polypodiaceae	Polypodium vulgare L.	Cr	Plure.

Pteridaceae	Pteris cretica L.	He	Euro.-Sib.-Medit.
Punicaceae	Punica granatum L.	Ph	Medi.- Euro-Ir.Tur
Ranunculaceae	Ranunculus arvensis L.	Th	Euro.-Sib.(Eux.-Hyrc.)- Ir.-Tur., Medit.
Rhamnaceae	Paliurus spina-christi Miller	Ph	Euro.-Sib.(Eux.-Hyrc.)-
Rosaceae	Arctium Lappa L.	He	Euro.-Sib.
	Mespilus germanica L.	Ph	Euro.-Sib.(Eux.-Hyrc.)- Ir.-Tur., Medit.
	Laurocerasus officinalis Roemer	Ph	Euro.-Sib
	Cydonia oblonga Mill	Ph	Ir.-Tur
	Fragaria vesca L.	Ge	Euro.-Sib.
	Prunus spinosa L.	Ph	Euro.-Sib.(Pont.)-Ir.-Tur.
	Prunus divaricata Ledeb	Ph	Euro.-Sib.(Pont.)-Ir.-Tur.
	Cerasus avium(L.) Moench	Ph	Euro.-Sib.(Pont.)-
	Crataegus microphylla C. Koch	Ph	W. Ir.-Tur.). Euro.-Sib. (Eux.-Hyrc.)
	Crataegus melano Carpa M. B.	Ph	(W. Ir.-Tur.). Euro.-Sib. (Eux.-Hyrc.)
	Crataegus monogyna	Ph	(W. Ir.-Tur.). Euro.-Sib. (Eux.-Hyrc.)
	Rubus hyrcanus Juz.	Ph	Euro.-Sib.(Hyrc.)
	Sorbus torminalis	Ph	Ir.-Tur.
	Potentilla reptans L.	Th	Plure.
Rubiaceae	Callipeltis cucularis Stev.	Th	Medit. -Ir.-Tur.
	Galium aparine L.	Th	Medit. -Ir.-Tur.
Caprifoliaceae	Sambucus nigra L.	He	- Euro.-Sib.-Medit. -Ir.-Tur.
Salicaceae	Populus nigra L	Ph	Euro.-Sib.
Solanaceae	Solanum nigrum L.	Th	Cosmo.
	Atropa belladonna L.	Th	Euro.-Sib.
Spermatophytes/Angiospermae/Monocotyledonae			
Alliaceae	Allium sp.	Ge	Polyregional
	Allium ursinum L	Ge	IT
Colchicaceae	Colchicum speciosum Steven	Ge	ES
Liliaceae	Bellevalia sp.	Ge	IT
	Smilax aspera L.	Ph	Euro.-Sib.(Pont.)-
	Smilax excelsa	Ph	Euro.-Sib.(Pont.)-Ir.-Tur
	Danae racemosa (L.)Moench	Ph	Euro.-Sib.
	Ruscus hyrcanus Woron.	Ge	Euro.-Sib.(Hyrc.)
Ophioglossaceae	Ophioglossum vulgatum L	Th	Euro.-Sib.(Hyrc.)
Oxalidaceae	Oxalis carniculata L.	Th	Euro.-Sib.-Medit. -Ir.-Tur.
Poaceae (Graminea)	Agropyron repens (L.) P. Beav	Th	ES,IT,M
	Cynodon dactylon L.	Ge	Plure.
	Festuca arundinacea Schreb.	Th	ES,IT,M
	Festuca gigantean L.	He	ES,IT,M
	Bromus danthoniaeTrin	Th	IT, M
	Avena sativa L.	Th	ES,IT,M
	Sorghum halepens (L.) Perss.	Ge	ES,IT,M
	Digitaria sanguinalis (L.)Scop	Th	Euro.-Sib.-Medit.
	Oplismenus ndolatifolius (Ard. P.Beauv.)	Th	Euro.-Sib.-Medit. -Ir.-Tur
	Oplismenus compositum L. P.Beauv.	Th	Euro.-Sib.-Medit. -Ir.-Tur
	Hordeum marinum Hudsn	Th	Euro.-Sib.-Medit. -Ir.-Tur

Tiliaceae	Tilia platyphyllos subsp. Caucasica	Ph	Euro.-Sib.-Medit
Thelpteridaceae	Thelypteris palustris Schott	He	Euro.-Sib.
Typhaceae	Typha latifolia L.	He	Euro.-Sib.-Medit. -Ir.-Tur
Ulmaceae	Ulmus glabra Hudson.	Ph	Euro.-Sib.
	Zelkova carpinifolia (Pallas) C. Koch	Ph	Euro.-Sib.
	Celtis australis L.	Ph	Euro.-Sib.
Urticaceae	Urtica urens L.	He	Euro.-Sib.-Medit.

Life form: Th, therophytes; Ge, geophytes; Ph, phanerophytes; Ch, chamaephytes; He, hemicryptophytes.
Chorotype: IT, irano turanian; IT-M, irano turanian and mediterranean; M-ES-IT, mediterranean and europe and siberian and irano turanian; It-ES, irano turanian and europe and siberian; ES, europe and siberian; M, mediterranean; M-ES, mediterranean and europe and siberian; Cosm, cosmopolitan.

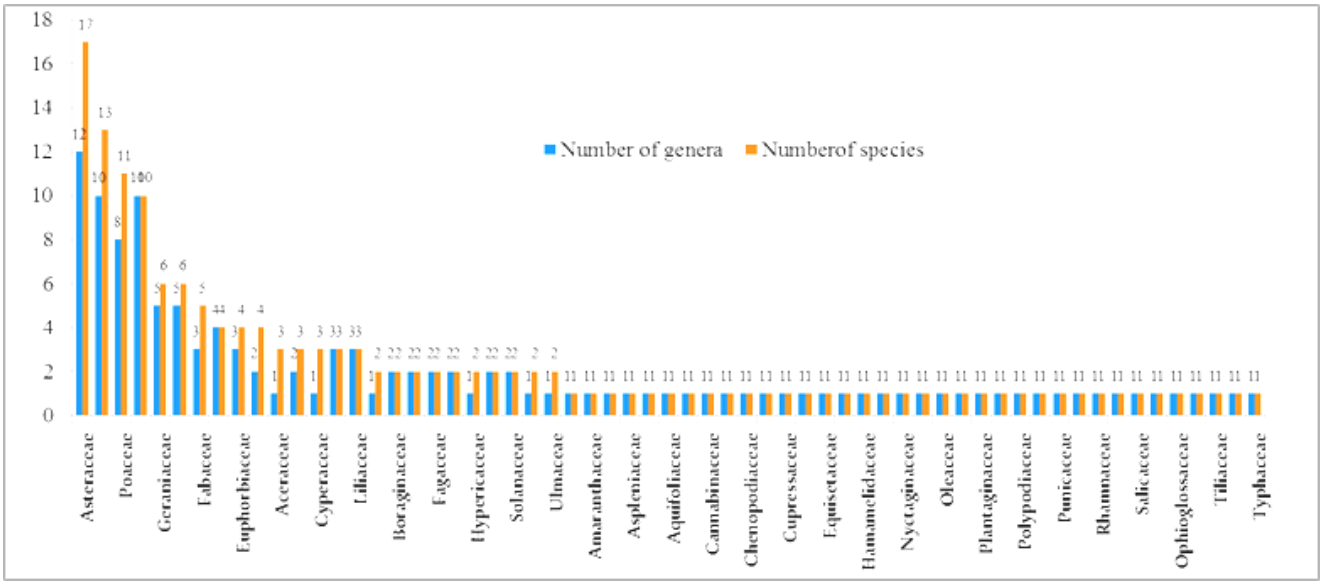

Figure 2 Plant species plants percentage in different families in Asalem basin (Shafarood forest), Iran.

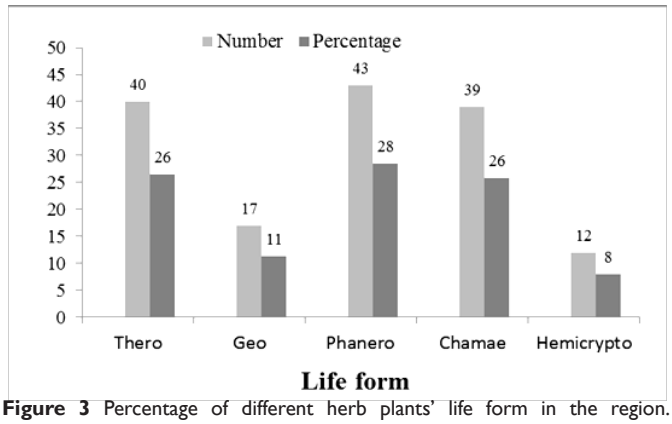

Figure 3 Percentage of different herb plants' life form in the region. Ther, Therophytes; Geo, Geophytes; Phanero, Phanerophytes; Chamae, chamaephytes; Hemicrypto, hemicryptophytes in Asalem basin (Shafarood forest), Iran.

Discussion and conclusion

The value and importance of existing reserves about the forests are still being ignored. In terms of forest products, unfortunately, non-wood products have been neglected in many forests while there is a valuable reserves from the aspect of vegetation diversity (in forest understory). Meanwhile, the change in global ecology issue will affect almost all the forest conditions and may endangering the survival of species in forests.[5] Therefore, this is important to identify understory plants diversity of forests around the world. In forests, identification of plants, understory plants specie specially, is the first step related to plant issues and their usages. Thiess plants may be used for many purposes and in this area some species due to have beautiful flowers, have a medicinal effect and etc. are of great importance. Therefore, evaluation of biodiversity reserves (plants species specially) is the first degree of importance and is the first step in terrestrial ecosystems management as well.

An overall review of other related studies show that this application type is mostly ignored in other areas, whereas 16% of understory plant species in this area are used for decorating the houses and living spaces. These plants are the symbol of nature for local people and they can touch the nature all the time. In Asalem forests, some of the plant species in forest understory are sold as an income resource for local community. Also some parts (seeds, leaves and stems) of limited plant species such as Heracleum persicum are used in food, but is destroyed in some place due to over-harvesting. The research also showed that there are many different plants species in this area in different family and genus. More than 152 species belonging to 124 genera and 61 families existed in the study area (Asalem forest) was recorded. Similarly, Ravanbakhsh and Amini[4] disclosed a number of 76, 66 and 45 which are species, genera and plant families, respectively for Gisoum forest area. The largest families were Asteraceae and Rosaceae with 5 species. Investigation of the geographical distribution of plant

species indicated that 44 % belonged to the Europe – Siberian zone. Plant life forms by Raunkiaer method showed that phanerophytes with 35.5 % and hemicryptophytes with 27.6 % are the most frequent understory plants life forms in this area. Yazdanshenas et al.[8] also reported a vast range of different annual and biannual plant species in western area of Iran's Isfahan which are mainly belonging to Asteraceae, Papilionaceae, and Apiaceae with 21, 15 and 12 percent, respectively. Based on the results in this research, the largest families were Asteraceae, Rosaceae, Poaceae and Apiaceae with 17, 13, 11 and 10 species, respectively. Investigation of the geographical distribution of plant species indicated that there is a composition of Europe – Siberian, Iran-Turan, Mediterranean (and Polyregional and cosmo.) plant elements (Figure 2). Just like that competition limits diversity when superior competitors increase in abundance until other species are excluded Wright,[9] and similarly, in this study, understory plants diversity showed higher value (Table 1) Simpson Index= 0.64 for Nave1) for areas with low tree cover. Similar to this, Tárrega et al.[10] reported that trees distance had a positively correlation to diversity and to annual species richness based on Shannon index, and a negative correlation to woody cover in the understory.

Like many other areas, some areas of Asalem's foreste destroyed due to over using. Anthropogenic pressure alter the understory vegetation in forests.[11] Moreover, deforestation often creates matrices of human-managed areas, secondary vegetation regrowth and fragments of primary forests[12] and this is should be noted in forest areas. But utilization and consumption should be done based on ecological principles to ensure sustainability and conservation of the resources.[13] Therefore, non-destructive harvesting, conservation, recovery of threatened plant species and proper management should be mange for plant conservation and their usages. Moreover, this is vital to identify their ecological needs, and propagation of the forest understory plant species. And sometime depends on local beliefs and capabilities, the ease of cultivating and economic potential these plants can be cultivated.[14] However, recognition of the forests understory plants species by stakeholders has a paramount importance[15] and should be studied more in the future. For this proposes forest management can significantly affect both the diversity and spatial patterning of understory vegetation.[16,17] Moreover, as time passes and changes occurred in available forests, non-timber forest products should become more and more important and utilized ecologically-based. For this, identification of the understory plants species is the first and most important step in sustainable forestry. The results of this study also showed that the there is a very high diversity of understory plants in Asalem forest which consists of a range of important herbaceous plant species and are often not seen in the forest generally.

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Conflicts of interest

The author declares there are no conflicts of interest.

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