



## Diversity, Nativity and Sustainable Use of Forest Flora of Watershed Rissa – Khad

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**ABSTRACT:** Watershed Rissa-khad falling under Sarkaghat Forest Range of district Mandi Himachal Pradesh is endowed with rich forest resources. These forest resources include both timber and non-timber forest products such as gum, resin, fiber, flosses, oil, grasses, bamboos, wild edible, fodder, fuel and medicinal plants etc. These resources have been used for making dyes, building houses, agricultural tools, bridges, medicines, resins, fibers, vegetables etc. both on commercial as well as non commercial bases for uplifting socio-economic conditions of inhabitants of watershed. A high percentage of the total population depends upon forest resources for their livelihood options and fulfilling their day to day activities. People exploited floral diversity in the form of leaf, root, stem, fruit and flowers etc. exerting immense pressure on natural forest wealth, like pressure from human beings for fuel, fodder, wild edibles, small timber etc., pressure from wild animals, from domestic animals due to grazing and removal of fodder, pressure due to encroachments, pressure due to conversion of forest land for non forestry purposes, pressure due to forest fire, pressure due to landslides etc. Exploitation and use of forest resources is not sustainable over a long period of time and need proper resource assessment, conservation and adoption of participatory approaches under which the local communities come together to take collective action.

**Keywords:** Watershed; wild edible; forest; sustainable.

**INTRODUCTION:** According to the United Nations Global Environmental Facility (UNGEF) Biodiversity is the “heart of sustainable agricultural systems”. It is the “life insurance of life itself”<sup>1</sup>. Himalayan forests are the most important source of medicinal plants and with useful species for the local people<sup>2</sup> dependence of native communities on floristic diversity is very well known since the Vedic Period They used plant diversity in various forms *i.e.*, medicine, wild edible/food, fodder, fuel, timber, making agricultural tools and various other purposes<sup>3</sup> Women in the Himalayan region have an intimate and long time association with the surrounding forests for fulfilling their daily needs of fuel, fodder and other forest produce<sup>4</sup> focused studies on the diversity of the economically important plants of forest of the watersheds and catchments and their sustainable use have been poorly attempted. It is well-established fact that the sustainable development at small unit areas like watersheds and catchments is easier than development at a larger scale like district, region, state and country, and being preferred for the development. The development at catchment and watershed levels is the best option. The biodiversity particularly floristic diversity plays an important role in developing strategies and action plans for the sustainable development of watersheds and catchments.

### MATERIALS AND METHODS:

**Study Area:** The present study has been conducted in Rissa Khad Watershed (310 37' 38" N latitudes and 760 48' 20" E longitudes) of Mandi district, Himachal Pradesh. It covers approximately 123.07 Km<sup>2</sup> area and represents 20 panchyats and 132 villages. The altitude of the watershed ranges from 700-2150m. It supports diverse habitats, species, communities and Ecosystems. The vegetation mainly comprises of sub-tropical and temperate types and mostly dominated by broad leaved deciduous and evergreen species and coniferous species. The watershed is inhabited by a large number of villages with 11,258 households and 33,458 human populations. The total livestock population is 11,214. The inhabitants are largely dependent on forest floristic diversity for their sustenance.

**Forest:** The vegetation of Rissa Khad Watershed comprises of includes sub-tropical and temperate and mainly dominated by broad leaved deciduous and evergreen and coniferous forests. The forests are characterized by: (i) evergreen conifers forests mainly of *Pinus roxburghii* and *Cedrus deodara*; and evergreen broad leaved forests of *Myrica esculenta*, *Quercus leucotrichophora* and *Rhododendron arboreum*. These forests support a large number of sensitive biodiversity elements including medicinal and aromatic plants,

wild edibles, rare, endangered, native, endemic and wild relatives of crop plants. Also, the watershed supports a unique faunal diversity.

**Method:** Rapid samplings of the forest floristic diversity were conducted throughout the forest of watershed. The knowledgeable persons were interviewed. Information on the local names, life forms, part(s) used, and use values including indigenous knowledge and practices was gathered. Fresh samples of the useful species were collected and identified with the help of flora.<sup>5,6-7</sup> The information on the indigenous uses of the species is based on primary as well as secondary information.<sup>8-9</sup> The nativity of the species has been identified following Anonymous.<sup>10-11</sup>

The species indicating its origin from the Himalayan Region were considered as natives. The endemism of the species has been identified based on the distribution of the species<sup>11</sup>. The species restricted to Indian Himalayan Region has been considered as endemic whereas those with extended distribution to neighboring Countries/States considered as near endemic.

**RESULTS AND DISCUSSION:**

**Diversity:** Forest of Watershed Riisa-Khad is very rich in forest resources, which include timber and non timber products including medicinal plants. The present study recorded 99 forest plant species, belonging to 65 genera and 45 families species (Figure 1). The family Moraceae and Rosaceae (7 each) showed the highest no of plant species followed by Mimosaceae<sup>6</sup> Caesalpiniaceae and Urticaceae (5 each) Combretaceae (4 each), Acanthaceae, Berberidaceae, Dioscoreaceae, Fabaceae, Lauraceae, Meliaceae, Menispermaceae, (3 each), Aceraceae, Agavaceae, Anacardiaceae, Araceae, Asparagaceae, Cordiaceae, Lythraceae, Myrtaceae, Pinaceae, Rutaceae Salicaceae, Tiliaceae, Ulmaceae, Vitaceae (2 each), Annonaceae, Apocynaceae, Bombacaceae, Ericaceae, Fagaceae, Flacourtiaceae, Fumariaceae, Geraniaceae, Lardizabalaceae, Malvaceae, Myricaceae, Myrsinaceae, Pittosporaceae, Poaceae, Rhamnaceae, Sapindaceae each Verbenaceae each represented by single species.

**Table 1: Diversity, Nativity utilization pattern and indigenous uses of the forest plants of the watershed Riisa-Khad.**

Family/Taxa	Local Name	LF	Nativity	Part Used	Indigenous Uses
<b>Acanthaceae</b>					
<i>Aechmanthera gossypina</i> (Wall.) Nees		Sh	Ind Or		Fodder
<i>Goldfussia dalhousiana</i> Nees		H	Reg Himal	Lf	Fodder
<i>Justicia adhatoda</i> L.	Vasuti	Sh	As Trop	Wp	Medicinal (Asthma, boils, child birth, dislocation of joints); Edible;
<b>Aceraceae</b>					
<i>Acer caesium</i> Wall. ex Brandis.	Mandru	T	Reg Himal	Lf, Wd	Fodder; Fuel; Agricultural tools
<i>A.oblongum</i> Wall. ex DC.	Parange	T	Reg Himal	Lf, St	Fodder; Agricultural tool; Timber; Fuel
<b>Agavaceae</b>					
<i>Agave omiting</i> L.	Ranbans, Koaed	Sh	As Trop	Lf	Medicinal (Hair fall); Fiber; Insecticidal; Pesticidal
<i>A cantula</i> Roxb.	Desi Rambas	Sh	Mexic	Rt, Lf	Medicinal (Anasarca, ascites, dropsy, boils, burn);fodder; Fiber;Insecticidal, Pesticidal
<b>Anacardiaceae</b>					
<i>Pistacia integerrima</i> Bin 75.	Kakarsingi	T	Reg Himal Aegypt Persia	Fr, Lf	Medicinal (Cough & cold, antiscorpion, snake bite); Fodder; Fuel; Household (Craft & Toyes)

<i>Spondias pennata</i> Willd.	Ambara	T	As Trop	Lf, Br, Fr	Medicinal (Cholera, 76omiting, dysentery, ear-ache, itching, nightfever, revive taste, rheumatism, ring worm, stomachache); Edible; Fodder; Fuel
<b>Annonaceae</b>					
<i>Annona squamosa</i> L.	Sharifa or Sitaphal	T	Ind Or	Wp	Medicinal (Antifertility, abdomen pain, abortifacient, cold, cuts, dandruff, 76omiting, dysentery, fits, guineaworm, hysteria, lice, melancholia, menstrual problem., spinal disorder, tonic, tumor, ulcers, worms, insecticidal, anti-cancer); Edible; Fuel
<b>Apocynaceae</b>					
<i>Carissa opaca</i> Stap.	Kauranda	Sh	Ins Molucc	Lf, Rt, Br, Fr	Medicinal (Cough, fever, 76omiting76); Edible; Fodder
<b>Arecaceae</b>					
<i>Phoenix humilis</i> Royle ex Becc. & Hk.	Khajoor	T	Ind Or Burma	Rh, Fr	Medicinal (Bronchitis, cough, fever, laccation, stomach disorder after child birth); Edible; Household; Broom; Fiber
<i>P. sylvestris</i> Roxb.	Khajara	T	Ind Or	Rt, Lf, Ft.	Medicinal (Souring of teeth) Household (For making mats, broom, basket & for thatching). Fruit edible
<b>Asparagaceae</b>					
<i>Asparagus adscendens</i> Roxb.	Satawar	Sh	Reg Himal Afgan	St, Lf, Rt	Medicinal (dysentery, tonic, veterinary); Edible; Religious
<i>A. racemosus</i> Willd.	<i>Sansarpali</i>	Sh	Ind Or Afr Austr Trop	Wp	Medicinal (Antihelmintic, aphrodisiac rheumatism, bleeding from nose, blood in urine, cough, 76rostrat, dysentery, febrifuge, gastric problem, 76rostrate, headache, leucorrhoea, stomachache, tonic, menstrual problem, gastric problems, ulcer in tounge, urin complaints, wounds); Edible; Religious
<b>Berberidaceae</b>					
<i>Berberis lyceum</i> * Royle	Kasmale	Sh	Reg Himal	Rt, Fl	Medicinal (Nervous disorder, vomiting), Fuel
<i>B. aristata</i> * DC.	Kasmale	Sh	Ind Or	Wp	Medicinal (Jaundice, eye disease); Edible (flower & fruits used as chatni)
<i>B. asiatica</i> Roxb.	Kasmale	Sh	Reg Himal	Br, Wd	Medicinal (Ophthalmia); Household (wood & bark yield yellow dye)
<b>Bombacaceae</b>					
<i>Bombax ceiba</i> L.	Sembal	T	Amer Austr	Wp	Medicinal (Abdomen pain, acne, pimple, anaemia, antifertility, asthma, blood dysentery, boils, bone fracture, burns, chicken pox, cholera, cough, 76omiting, dysentery, fever, inflammation, leprosy, menorrhagia, rheumatism, scabies, scorpion bite, sex weakness, skin disease, small pox, snake bite, sore in mouth, spleen complents, gum trouble, tonic, toothace, ulcer, urin complaints, vitality); Edible; Religious; Fuel

Caesalpiniaceae					
<i>Bauhinia vahlii</i> (Wt. & Arn.) Benth.	Tour	Sh	Ind Or	Sd, Fr	Medicinal (Antifertility, dysentery, fatness, stomachache, tonic); Edible; Household; Fuel; Fodder, Religious
<i>B. variegata</i> L.	Kachnar	T	Ind Or Burma China	Lf, Br Fr, Fl	Medicinal (Diarrhoea, dysentery, fatness, flatul, piles, scrofula, skindisease, Leprosy, snake bite, tumors, ulcers, worms); Edible; Fuel; Fodder; Religious
<i>Cassia fistula</i> L.	Yelo	T	As Trop	WP	Medicinal (Antiseptic, abdomen pain, asthma, blindness, bloodpurifier, burns, cancer, constipation, chest Infection, cool, cough, diarrhoea, dog bite, dysentery, epilepsy, gargle, gastric, jaundice, leprosy, liver complaints, pimples, rheumatism, ring worm, scorpion bite, skin disease, swell, snakebite, toothache, vermicide); Edible; Religious; Household; Fuel
<i>C. occidentalis</i> L.	Badi yelo	Sh	Cosmop Trop	Wp	Medicinal (Bone fracture, diarrhoea, dropsy, dysentery, eczema, fever, gastric problems, actation, rheumatism, ring worm, skin disease, wounds, snakebite, throat infection, toothbrush, whooping cough, wounds); Edible
<i>C. tora</i> L.	Pumar	H	Cosmop Trop	Wp	Medicinal (Abnormal child birth, antihelminthic, antiseptic, boils, bone fracture, cold, cuts, eczema, epilepsy, fever, intestinal disease, itch, jaundice, night blindness, rheumatism, ringworm, scabies, scorpion bite, skin disease, sores, stomachache, tonic, to increase fat, vermicide, wounds); Edible
Combretaceae					
<i>Terminalia arjuna</i> (Roxb.ex DC.) Wt.& Arn.	Haryan	T	Ind Or	Br, Lf	Medicinal (Dysentery, heart disease, leprosy, neural pain, sores, pneumonia, tonic, wounds); Religious (Symbol Saint Narad tunned Kuber's two sons into this tree in Brijbhumi, land of Krishna),Fuel,Fodder.
<i>T. bellirica</i> (Gaertn.) Roxb.	Behera	T	Ind Or Malaya	Fr, Br, Sd	Medicinal (Asthma, bronchitis, cholera, cold, cool, constipation, cough, diabetes, diarrhoea, dropsy, fever, gastric complaints, leprosy, Itch by ticks, piles, liver problem, muscle pain, respiratory disease, snake bite, stomachache Edible ,Fodder
<i>T. chebula</i> Retz.	Harad	T	As Trop	Fr	Medicinal (Bronchitis, cold, cough, constipation, diabetes, eye disease, measles, menstrual problem, pneumonia, sores, sore throat, spleen complaints); Dye for hair; Edible ;Religious
<i>T. tomentosa</i> (Roxb.) Wt. & Arn.)	Alshahan	T	Bras	Lf, Wd	Fodder, Fuel
Cordiaceae					
<i>Cordia obliqua</i> Willd.	Asing	T	Ind Or	Fr, Br	Edible, Household; Fiber; Fuel
<i>C. dichotoma</i> Frost.	Lasora	T	As Trop Auster	Lf, Sd, Fr	Medicinal (Chest infection, constipation, headache, jaundice); Edibile; Fuel,Fodder
Dioscoreacea					
<i>Dioscorea bulbifera</i> L.	Tardi	H	As Trop	Tu	Medicinal (Abdominal pain, bone fracture, jaundice); Edible; Religious ceremonies (Shivratri)
<i>D. belophylla</i> (Prain) Voigt.ex Haines	Taroor	H		Tu	Edible; Religious ceremonies (Shivratri)

<i>D. deltoidea</i> Kunth.	Gethi	H	Ind Or	Tu	Edible
<b>Ericaceae</b>					
<i>Rhododendron arboreum</i> Sm.	Burans	T	Reg Himal India Or Zeylan	Lf, Fr	Medicinal (Headache, nasal bleeding, fever, wounds); Edible; Religious ceremonies (Phooldeli), Fuel, Fodder.
<b>Fabaceae</b>					
<i>Butea monosperma</i> (Lamk.) Taub.	Palas Dhak	T	Ind Or Burma	Wp	Medicinal (Pimples cooling, gum, wounds, eye disease); Edible; Religious; Household
<i>Indigofera atropurpurea</i> DC.	Kathi	Sh	Afr Trop	Lf, Wd	Fuel; Fodder
<i>Pterocarpus marsupium</i> Roxb.	Laxmi pata	T	Ind Or Arab	Lf, Br Wd	Medicinal (Ashtma, bodypain, digestion, fever); Religious; Fodder; Household (Various pupose)
<b>Fagaceae</b>					
<i>Quercus leucotricophora</i> A. Camus	Ban	T	Reg Himal	Sd, Wd	Medicinal (Skin disease) Edible; Household, Fodder
<b>Flacourtiaceae</b>					
<i>Flacourtia indica</i> (Burm.f.) Merr.	Kangu	T	Ind Or Malaya Madag	Lf, Br Fr, Rt	Medicinal (Veterinary foot & mouth diseases, bite of med dog, facilitates child birth); Edible ,Fodder, Fuel
<b>Fumariaceae</b>					
<i>Fumaria indica</i> Pugsley	Pitpapda	H	Geront Trop	Wp	Medicinal (Antihelminthic, blood purifier, bodyache, 78iarrhea, flue, indigestion, liver complaints, skin disease); Edible
<b>Geraniaceae</b>					
<i>Geranium nepalense</i> Sw.	Kharyade	H	Ind Or China	Rt	Medicinal (Cuts, jaundice, toothache, ulcer)
<b>Lardizabalaceae</b>					
<i>Holboellia latifolia</i> Wall.	Gomphal	Sh	Reg Himal	Lf, Fr	Medicinal (Burn, wounds); Edible; Fodder
<b>Lauraceae</b>					
<i>Cinnamomum tamala</i> * L.	Tejpata, meethapata	T	Reg Himal	Br, Lf	Medicinal (Heart & throat problem); Edible, Fodder
<i>Cocculus laurifolius</i> DC		T	Reg Himal Japon	Wd	Fuel
<i>Litsea monopetala</i> (Roxb.) Pers.	Gwanyu	T	Ind Or Malaya	Br, Lf, Fr	Medicinal (Astringent, boils, rheumatism, veterinery sores, ulcer); Edible, fuel, Fodder,
<b>Lythraceae</b>					
<i>Woodfordia fruticosa</i> (L.) Kurz	Dhoth	Sh	As et Afr Trop	Lf, Fl	Medicinal (Dirrhoea, Dysentery)
<i>Magnolia grandiflora</i> L.		T	Am Bor		Ornamental
<b>Malvaceae</b>					
<i>Malvastrum coromendelianum</i> Garcke	Harayara	H	Cosmop Trop	Lf	Medicinal (Jaundice, sprain, sores, wounds); Household (Broom)
<b>Meliaceae</b>					
<i>Melia azedaracht</i> L.	Dreak	T	Reg Himal	Lf, Fl, Fr, Wd	Medicinal (Blood purifer, hair fall, insecticide, promote conception); Religious; Fodder; Fuel; Household; Agriculture implement
<i>Toona ciliata</i> Roem.	Tuni	T	Malaya Austr	Br, Lf, St	Medicinal (Antiseptic, fever, gastric Problems); Fuel; Household (Construction purpose, furniture, other article)

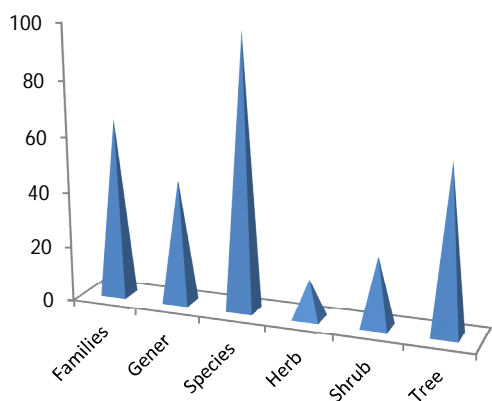
<i>T. serrata</i> Royle	Dal	T	Ind Or	Lf, Br, Wd	Medicinal (Asthma, boils ,Ulcer); Fuel; Fodder; Household ;Timber
<b>Menispermaceae</b>					
<i>Cocculus laurifolius</i> DC.	Paroda	T	Reg Himal Japan	Lf	Medicinal (Lactation); Fodder
<i>Stephania glabra</i> (Roxb.) Miers.	Biskhapar.	H	As Trop	Tu, Rt	Medicinal (Asthma, headache, eye disease, tumur in stomach)
<i>Tinospora cordifolia</i> (L.) Merr.	Giloe, Gulje	H	Ind Or	Wp	Medicinal (Asthma, tuberculosis); Edible,Fodder
<b>Mimosaceae</b>					
<i>Acacia catechu</i> (L.f.) Willd.	Khair	T	Ind Or	Rt, Lf, Br, Wd	Medicinal ( Abortificant. asthma, bleed for nose, child birth, digestive, pain in chest, toothace); Fuel; Fodder
<i>A. nilotica</i> (L.)	Keekar Babul	T	Afr As Trop	Wp	Medicinal (Hairfall, leprosy, skindisease, throat infection, toothbrush); Edible; Religious (Sprits of Muslim saints rest on this tree); Fodder
<i>A. pennata</i> (L.) Willd.	Shembi	Sh	As et Afr Trop	Rt, Lf Br	Medicinal (Fever, headache, body pain, snake bite); Household; As detergent ; Fuel
<i>A. chinensis</i> Osbeck	Oyee	T	As Trop Austr	St, Br, Sd	Medicinal (Backace, body pain); Fuel; Fodder; Household; Wood packing pupose; Timber
<i>A. julibrissin</i> Durazz		T	As Afr Trop		Fodder
<i>Albizzia lebeck</i> (L.) Willd.	Siris	T	Geront Trop	Wp	Medicinal (Diarrhoea, dysentery, eye sores, nightblindness, piles); Edible; Religious; Fuel; Fodder; Household (Various article & Furniture) ;Timber
<b>Moraceae</b>					
<i>Ficus. bengalensis</i> L.	Bad	T	Ind Or Afr Trop	Wp	Medicinal (Hair growth, snake bite, cough, sex disease, spermatorrhoea, toothbrush, sores in mouth, tonic, fever); Edible;Fuel; Fodder; Religious; Household ; Tent poles; cart-yokes; Boats
<i>F. foveolata</i> Wall.	Phregdi	T	Reg Himal Burma China	Lf, Ft	Fodder, Edible, Medicinal ( cold.)
<i>F. hispida</i> L.	Dhaebri	T	As et Austr Trop	Lf, fr, La, Sd	Medicinal (Ulcer in mouth, galactagogue, veterinary calf lying); Edible; Fuel
<i>F. lacor</i>	Plakhre	T	Ind Or		Fodder. Religious,Fuel
<i>F.nemoralis</i> Wall. ex Mir		T	Reg Himal		Fodder
<i>F. palmata</i> Forsk.	Phaegda	T	Afr Trop Arab Ind Or	Fr, Infl	Medicinal (Dysentery); Edible, Fuel.
<i>F. roxburghii</i> Wall.	Trayambalu	T	As Trop	Wp	Medicinal (Ringworm, skin disease, galactagogue); Edible; Fuel; Fodder; Religious
<b>Myricaceae</b>					
<i>Myrica esculenta</i> Ham.ex Don	Kaphal	T	As Trop et Sub Trop	Br, Fr	Medicinal (Asthma, catarrh, cholera, cough, fever, indigestion, malaria); Edible
<b>Myrsinaceae</b>					
<i>Maesa indica</i> Willd.	Dhave	Sh	Ind Or Malaya	Fr	Medicinal (Syphilis, women disease); Edible
<b>Myrtaceae</b>					
<i>Psidium guajava</i> L.	Amrood	T	Amer Trop	Lf, Br	Medicinal (Blister in mouth, fever, headache, jaundice, stomachache, tonic); Edible

<i>Syzygium cuminii</i> (L.) Skeels	Jamun	T	As et Austr Trop	Br, Lf, Sd, Fr	Medicinal (Astringent, blister in mouth, cancer, piles, pimples, fermentation for rice beer); Edible; Fuel; Household; Various construction purpose; Dying; Tanning; Religious; Timber
<b>Pittosporaceae</b>					
<i>Pittosporum eriocarpum</i> ** Royle	Thira	T	Reg Himal	Br, Rt	Medicinal (Bronchitis, rheumatism, swelling) Fodder
<b>Pinaceae</b>					
<i>Cedrus deodar</i> * (Roxb.) Loud.	Devdar	T	Reg Himal	Resin	Medicinal (Antihelminthic, rheumatism, ulcers); Religious; Timber; Fuel
<i>Pinus roxburghii</i> *Sarg.	Chil	T	Reg Himal	Resin	Medicinal (Bone of fracture, craks in sore of feet, snake bite, snake disease, leprosy, sprain, swell, ulcer); Religious; Timber; Fuel
<b>Poaceae</b>					
<i>Dendrocalamus strictus</i> Nees	Bans	T	Ind Or	Rt, Lf, Br	Medicinal (Antifertility, cough, fever, tonic, veterinary); Edible; Household; Religious
<b>Rhamnaceae</b>					
<i>Zizyphus mauritiana</i> Lamk.	Ber	Sh	Ind Or Malaya	Fr	Edible; Household ; Agriculture implement; Religious
<b>Rosaceae</b>					
<i>Fragaria nubicola</i> Lindl. ex Lacaita	Bumbra	H	Reg Himal	Fr	Edible
	Jangli kaphal	H	Ind Or (Sikkim)	Fr	Edible
<i>P. cerasoides</i> Don	Pajja	T	Reg Himal	Br, Lf, Fr	Medicinal (Bone dislocation, burns, cuts, joint pain, wounds, fever); Edible; Religious; Fuel
<i>P. pashia</i> Buch. -Ham.ex Don	Kenth, Segal	T	Reg Himal	Lf, Fr	Medicinal (Eye problem); Edible; Religious
<i>Rubus biflorus</i> Buch.- Ham.ex Smith	Kamla	Sh	Reg Himal	Fr	Edible
<b>Rutaceae</b>					
<i>Murraya koenigii</i> (L.) Spr.	Gandhelu	Sh	Ind Or	Rt, Lf, Fr, Br	Medicinal (Anthelmintic, diarrhoea, dysentery, lactation, malarial fever); Edible, Fuel.
<i>Zanthoxylum armatum</i> DC.	Timur	T	Reg Himal China	Fr, St, Sd	Medicinal (Cough, cholera, fever, eczema, itch, piles, tonic, toothache)
<b>Salicaceae</b>					
<i>Populus ciliata</i> Wall.	Popular	T	Reg Himal	Br, Wd	Medicinal (Bone fracture); Household ; Pulp paper; Plywood
<i>Salix acmophylla</i> Boiss.	Bhains	T	Orins Ind Or	Lf, St	Fodder; Fuel; Household; Sticks
<b>Sapindaceae</b>					
<i>Sapindus mukorossi</i> Gaertn.	Reetha	T	As Trop	Nut	Medicinal (Fever); Detergent ,Fuel, Fodder.
<b>Tiliaceae</b>					
<i>Grewia elastica</i> L	Pharsa	T	Ind Or		Fuel; Fodder; Timber
<i>G. oppositifolia</i> * Roxb. Ex Mast.	Beul	T	Reg Himal	Lf, Br, Wd	Fuel; Fodder; Fiber; Household; Agriculture implement; As torch sacred in religious festivals, fresh branches and dried sticks are used for worshipping during the festival of lights (Diwali); Timber
<b>Ulmaceae</b>					
<i>Celtis australis</i> DC.	Kharik	T	Europe As Temp Ind Or	Wp	Medicinal (Leprosy); Edible; Fuel; Fodder

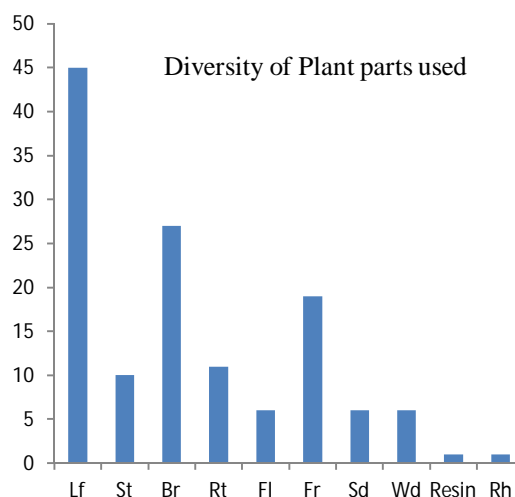
<i>Ulmus wallichiana*</i> Planch.	Mairu	T	Reg Himal	Br	Medicinal (Bone fracture, dislocation); Fodder; Fuel
<b>Urticaceae</b>					
<i>Boehmeria macrophylla</i> Horn.	Chamarala i	Sh	Reg Himal Burma	Lf, St	Medicinal (Dysentery, eczema)
<i>B. platyphylla</i> D.Don	Chamarala i	Sh	As et Afr Trop Pacif	Lf, St	Medicinal (Dysentery, eczema); Fodder; Fibre
<i>Debregeasia longifolia</i> Wedd.	Shyaaru	T	Ind Or	Fr, Lf, Br	Medicinal (Bone fracture); Edible; Fodder; Fibre; Fuel
<i>D. salicifolia</i> (D.Don) Rendl.	Shyaaru	T	Ind Or	Fr, Lf, Br	Medicinal (Bone fracture); Edible; Fodder; Fibre; Fuel
<i>Gerardenia heterophylla</i> Decne	Badi-Kogsi.	Sh	N Calid	Lf, St	Medicinal (Gonorrhoea); Fibre for rope or cord- ages
<b>Verbenaceae</b>					
<i>Vitex nirgundo</i> L.	Banae, Suraei	Sh	As Trop et Subtrop	Wp	Medicinal (Blister, bone fracture, bodyache, cold, colic, diarrhoea, epilepsy, fever, gout, gum trouble, headache, itch, mental disturbance, piles, reduce sex desire, skin problem, tonic, ulcer); Insect repellent; Religious; House- hold ,Fuel
<b>Vitaceae</b>					
<i>Tetrastigma serrulata</i> (Roxb.) Planch.	Maryangae	H	Reg Himal	Lf	Medicinal (Boils, wounds); Fodder
<i>Vitis capriola</i> D. Don,	Ulte	Sh	Reg Himal		Fodder

**Abbreviations used:** H=Herb; T=Tree; Sh=Shrub; St=Stem; Fr=Fruit; Rh=Rhizome; Sd=Seed; Res=Resin; WP=Whole Plant; Ap= Aerial Part; Lf=Leaf; Fl= Flower; Infl=Inflorescence; Br=Bark; Kr=Kernel; AP= Aerial part; Rt=Root; Tu=Tuber; Rh=Rhizome; La= Latex; Frd= Frond; Wd= Wood; Fi=Fiber; and Bb= Bulb; NE=Near endemic; E=Endemic; Reg Himal= Himalayan region; As=Asia; Trop= Tropical; Ind Or=Indian Oriental; Amer= America; Trop=Tropical. Near Endemic; \*\*=Endemic

Among the genera Ficus showed the richness of the forest plant species (7 spp.) followed by Acacia (5 spp. each), Terminalia (4 spp. each), Berberis, Cassia, Dioscorea Fragaria (3 spp. each). The diversity of the taxonomic groups families, genera, species, life form and parts used is illustrated in table



**Figure 1: Species composition of wild edible plant.**



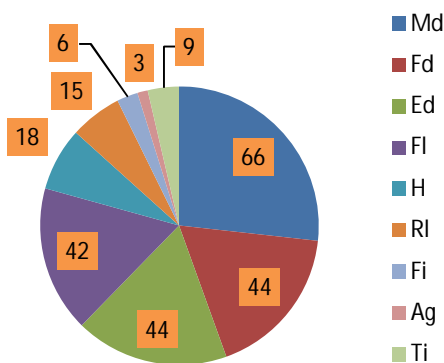
**Figure 2: Diversity of plant parts used (Abbreviations used: Fr=Fruit; Rh=Rhizome; Sd=Seed; WP=Whole Plant; Ap= Aerial Part; Lf=Leaf; Fl= Flower; AP= Aerial part; Rt=Root; Tu=Tuber; Rh=Rhizome; Frd= Frond; Tsh =Tender shoot).**

**Resource Value:** The resource value of the area ranges from timber to non-timber forest products. The

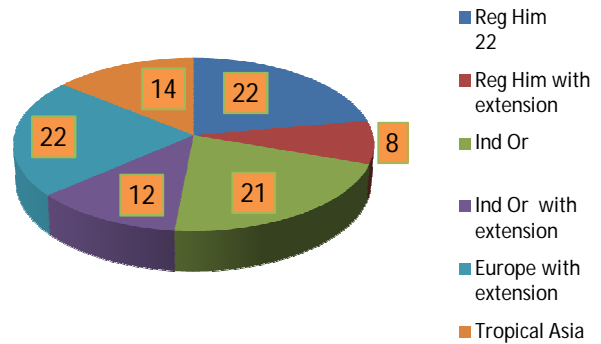


principal marketable products from the area are timber, resin, firewood and charcoal, besides the medicinal herbs, mushrooms, wild fruits, incense and condiments. The people living in the area depend on forests for their fuel wood, fodder, timber and other requirements. *Pinus roxburghii*, *Cedrus deodara* and *Myrica esculenta* are in great demand for various products. In addition to these, there occurs diversity with reference to the traditional practices of people including terrace farming, mixed cropping, forestry, horticultural and agricultural, crops, etc. The traditional crops cultivation has significantly decreased. Wild edibles like *Myrica esculenta*, *Rhododendron arboreum*, *Pyrus pashia*, *carrisa opeca*, *Syzygium cuminii*, *Rubus ellipticus*, *berberis lysium* etc. are also very popular in the area. These resources have been used for medicine (66), wild edible (44), fodder (44), Fuel (42), house implement (18), religious (15), timber (09), fiber (6), agricultural tool (03), both on commercial and non commercial basis

**Endemism:** In spite of the influence of the flora of the adjoining countries/ region, the flora of Indian Himalaya includes about 46.20% (3165) endemic out of a total of a 6850 endemic in India.<sup>13</sup> In this context of the plant forest resource of water-shed Rissa-khud the taxa restricted to the Indian Himalaya, were considered as endemics and those extending their distribution to adjacent countries/state, like Nepal, Bhutan, Tibet, Pakistan, Afghanistan, Assam, Meghalaya were considered as near endemic. Of the total 99 forest plant species 22 are restricted to Indian Himalaya Province, Hence classified as endemic. On the other hand 8 Species showed extension of their range to adjacent countries/state and are considered as near endemic.



**Figure 3: Resource value of Forest Plants (Abbreviations used: Md =Medicine, Ed= Edible, Fd=Fodder, Fl =Fuel, H=House implement, Ri =Religious, Fi=Fiber, Ag=Agriculture tool, Ti=Timber).**



**Figure 4: Nativity of the wild edible plants.**

**Environment problem and need for sustainable development of forest resources:** Plant diversity of forest of watershed besides acting as a source of nutrients, fodder fuel, fiber, medicine, dye etc closely intermingled in social fabric of study area. Although forest diversity is livelihood option of many people but their mode of exploitation and use is not sustainable over a long period of time as enhanced depletion of trees, over lopping and loss of regeneration, so necessitates integrated watershed development of three basic resources soil, vegetation and water by adopting an integrated watershed approach.

Harvesting of forest products particular timber may lead to ecological degradation as there is a ban on falling of green trees in forest which helped to conserve the ecology and environment. Exploitation of non wood forest product is ecological safe though over-exploitation could lead to degradation of environment which further necessitates resource assessment and Resource conservation.

**Resource assessment:** Resource assessment including survey and mapping of timber as well as non wood forest products need to be carried and plan to exploit them need to be based on resource assessment, more important is the case of non wood products because their distribution is scattered in the forest and there is dearth of data about the non wood forest products.

**Resource conservation:** Forest resource particularly non-wood forest products are in danger of over exploitation hence their use as exploitation should take into account the conservation needs by adopting participatory approaches so that these can be sustainably exploited.

Sustainable watershed development is a complex process and should involve following steps or phases:

**1) Recognition phase:** it involves recognition of the problem analysis of the cause its adverse affects and identification of various option for sustainability

- Survey and classification of the problem of forest degradation and decline of valuable resources
- Condition of forest and grasslands
- Survey of the socio-economic condition of the people living around the study area.

2) **Restoration Phase;** This phase involve forest regeneration on barren lands and densification of existing forests and include

- Natural regeneration, mainly from seeds but also from vegetative parts.
- Artificial regeneration through sowing seeds.
- Artificial regeneration through transplanting saplings raised in the nursery.
- Other method of. artificial regeneration include tall planting, deep planting and planting branch and stem cutting.

3) **Forest Protection:** this phase include protection against damage by forest fires, climate factors such as high temperature, frost, snow, very high rainfall and drought, grazing by domestic animals, lopping of trees, illicit removal of forest produce and damage by wild animals, insect pests as well as forest disease.

4) **Forest Management:** Forests of watersheds may be managed on scientific lines for well-defined objectives like ecological stability, soil and moisture conservation, optimum use of land, obtaining the desired forest products on sustained bases, increasing forest productivity, conservation of biological diversity as well as meeting the need of local people that may be site specific .the main objective of forest management are Integrated watershed development leads to sustainable improvement in ecological stability enhance productivity of the land and vegetation ultimately uplifting the socio-economic status of local people.<sup>14</sup>  
&<sup>15</sup>

**CONCLUSION:** The increasing human and livestock population and decreasing floristic diversity have created imbalance in the sub-tropical and temperate ecosystems of the Watershed. This has necessitated initiating studies on diversity, distribution, indigenous uses and conservation of floristic diversity in Rissa Khad Watershed. Forest resources, particularly non-wood forest products are in danger of over-exploitation. Hence their use or exploitation should also take into account the conservation needs so that these can be sustainably exploited. Exploitation or harvesting of forest products in the Himalaya can at best be done by adopting the participatory approaches under which the local communities come together to take collective action.

**Recommendations:** Various options available for ensuring sustainability are:

- Preparation of micro for each important plant species, including data on best harvesting practice and quantity to be harvested.
- Use of alternative fuels.
- Planting multipurpose species and fuel wood in and around villages.
- Restricting lopping.
- Soil and moisture conservation.
- Afforestation.

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#### REFERENCES:

1. Mc Neil and Shei (2002) A framework for action on biodiversity and ecosystem management. WEHAP Working Group, WSSD
2. Bhat A. jahangeer, Kumar Munesh & Busmann W. Rainer (2013) Ecological status and traditional knowledge of medicinal plants in Kedarnath Wildlife Sanctuary of Garwal Himalaya,India, *Journal of Ethnobiology and Ethnomedicine*, 9, 1.
3. Samant, S. S. and Dhar, U. (1997) Diversity, endemism and economic potential of wild edible plants of Indian Himalaya, *International Journal of Sustainable Development and World Ecology*, 4, 179-191.
4. Chauhan P. S., Bisht, Suman, Ahmed Sharaz, (2017) Traditional and Ethnobotanical uses of Medicinal Trees in District Tehri Garhwal (Western Himalayas), *International Journal of Ayurvedic and Herbal Medicine*, 7(1), 2442 – 2448.
5. Babu, C. R. (1977) *Herbaceous Flora of Dehradun*, CSIR, New Delhi.
6. Naithani, B. D. (1984-85) *Flora of Chamoli district. Vol.I & II*. Botanical Survey of India, Howrah.
7. Dhaliwal, D. S. & Sharma, M. (1999) *Flora of Kullu District (Himachal Pradesh)*. Bishen Singh Mahendra Pal Singh, Dehradun.
8. Samant, S. S., Dhar, U. and Rawal, R. S. (1996a) Natural resource use by some natives within Nanda Devi Biosphere Reserve in west Himalaya, *Ethnobotany*, 8, 40-50.
9. Rana M. S., Samant S. S. (2011) Diversity, indig-

- enous uses and conservation status of medicinal plants in Manali wildlife sanctuary, Northwestern Himalaya, *Indian Journal Traditional Knowledge*, 10 (3), 439-459.
10. Anonymous (1883-1970) Index Kewensis Plantarum Phanerogamarum Vol. 1-2 (1883-1885) and 15 Supplement. (1886-1970). Clarendon Press, Oxford.
  11. Samant, S. S., Dhar, U. and Rawal, R. S. (1998b) Biodiversity status of a protected area of West Himalaya: Askot Wildlife Sanctuary, *Int. J. Sustain. Dev. World Ecol.*, 5, 192-203.
  12. Sen Tara & Samant S. S. (2013) Diversity, Endemism and Economic Potential of Wild Edible Plants in Rissa khad Watershed of District Mandi, Himachal Pradesh, *Journal of Non-Timber Forest Products*, 20(2), 155-164.
  13. Chatterjee, D. (1939) Studies on the endemic flora of India and Burma, *Journal of Royal Asiatic Society of Bengal*, 5, 19-67.
  14. Sharma. R. (1998) National watershed project for rain-fed areas (NWDPPRA), Strategies for Ninth Plan, Proc of national workshop on watershed approach to rain-fed farming, New Delhi.
  15. Roy, S. B. and Chaterjee, M. (1994) *Joint forest Management a training manual*, Inter India Publ, New Delhi.