Geo-Hydro-Biology through GIS vs. Naturopathy,Gandhmardan Hills, India

Abstract:

Objective: The GandhamardanHills (GMH)range is a group of small mountains in Peninsular India in Balangir district in Odisha state in India. There is uniqueness in geology, geography, geomorphology, climatology, Hydrology, petrology,and lithology. The lithology, soil, water, geomorphology, and traditional use of plants in Ayurveda and Unani have paved the way for drug discovery. Geo-hydro-biological amalgamation through Geological Information Systems (GIS) and chemical analysis is still being explored, and the present research emphasises such studies.

Methods: Data about geo-hydro-biology through grapy, geology, geomorphology, hydrology, and traditional medicinal practices areimploredfrom literature sources,using TOPOand Q-GIS maps and applying ERDAS software,and their analytical interpretations were reported.The chemical analysis was conducted using X-ray fluorescence spectrometric studies of the water and soil of GMH, and the exuberance of ethnobotanical species in GMH was correlated.

Results

Laboratory analysis, literature studies, and interaction with Ayurvedic and Unani practitioners, 154 popular speciesdatabases with their pharmacological applications reported for ordinary people. Many species have multidimensional applications that can transform Ayurveda into Materia medica.

Conclusion: This ethnobotanical study documented the use of plants by the local community. The natural medicinal plants are cheap for the rural communities. The information gathered can be used for further scientific investigation to develop new commercial plant-based medicines as they will be safer than synthetic drugs.SDGs 1 to 3 and 12, 13, and 15will be satisfied if we can conserve and adequately manage the hub of medicinal plants in GMH.

Keywords: Ethnobotany, Geomorphology,Gandhamardan Hills, plant species, XRF Spectroscopy, GIS,

Introduction:

Ethnobotany (Aboriginal Botany) is the scientific search for traditional flora'shands-on practice by Indigenous people, an age-old practice with conventional knowledge of medicine, pain relief,and curative applications. It can be described as the science of the plant used by people before commercialisation.Indian civilisation was established during the North-Grippean period, with about 5000 to 8000 KYBP, when people adopted medicines by Jadi-Butti (plants, flowers, roots and barks). Three primitive health care systems (Ayurveda, Siddha, and Unani)areaccredited in India and are in present form the Surgery (By Susruta) and the medicine (by Charak) (Ethnobotany MSCBOT-608, (2023)[1], Singh, 2024[2], Ralte et al., (2024)[3]

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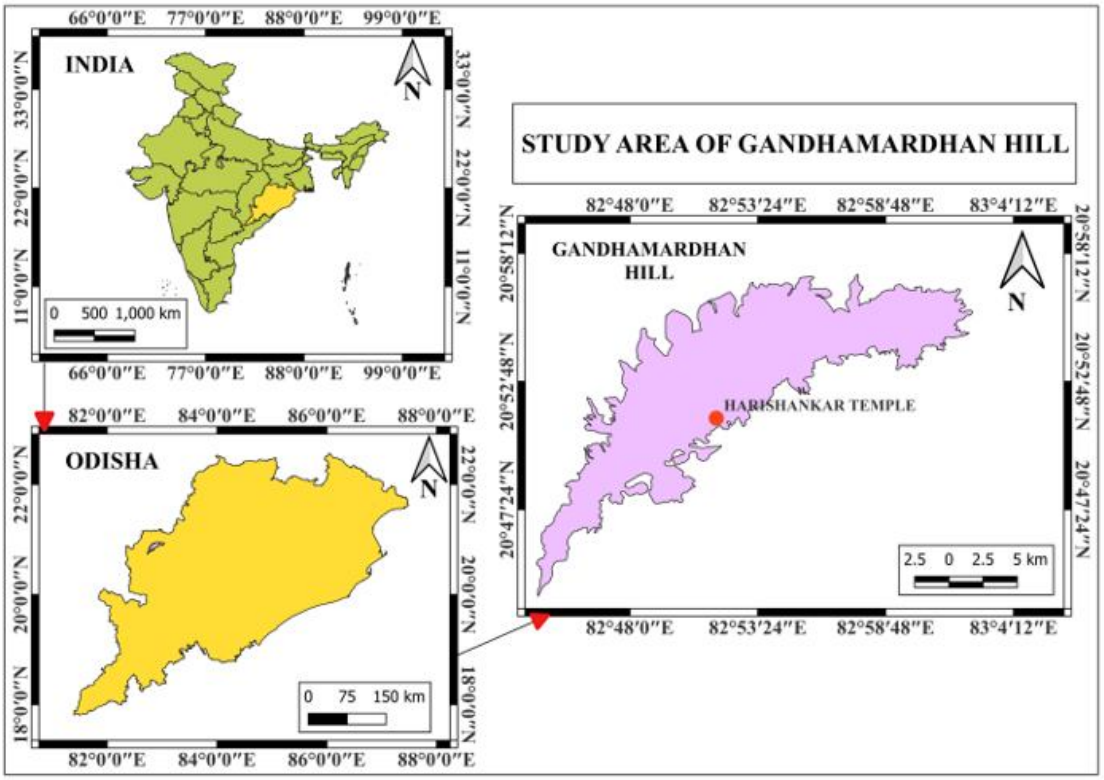


Fig 1: The Index map of the Gandhamardan Hills in Western Odisha

The study area

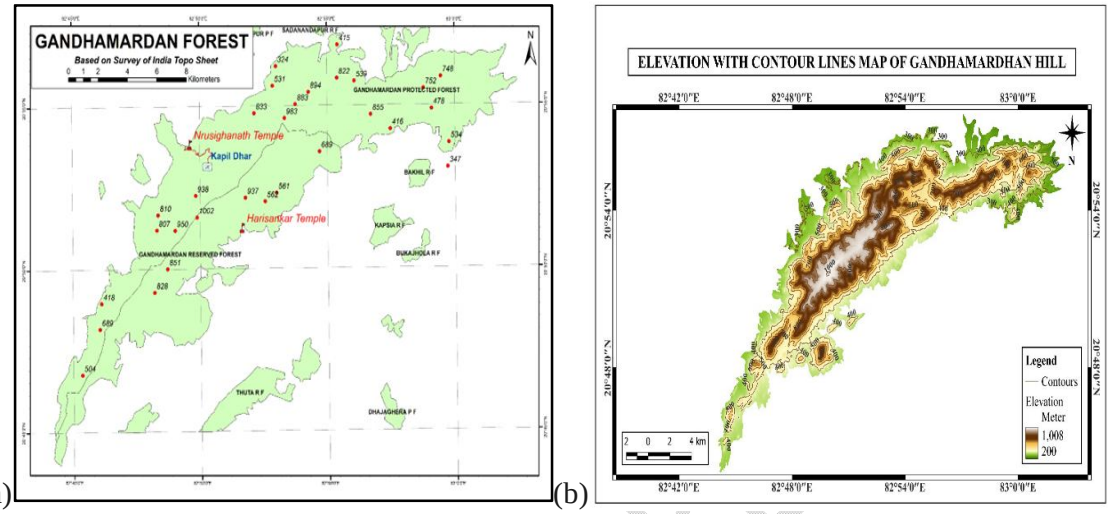
The Gandhamardan Hills (GMH) form the natural boundary to the northwest of Balangir district, and in the southeast, the river Tel (Tributary to River Mahanadi), with a plateau at the top, allowing many rivulets/ falls to origin. GMH has scatteredthick forests adorned with many faunal species like tigers, sambar, deer bison, etc.The Plateau is 16km long andaverage elevation of 914.4m. It is lofty, with thick vegetation and sporadic small settlements. Rivulets in the northern slope emergefrom the range's crestnear Nandupalla, the Harisankar, a famous tourist spot in Western Odisha. Similarly, waterfalls called “The Kapil Dhara” and “The Man Bhang” are housed in the foot-hills of the GMH at Narsinghnath Temple on the southern slope Fig 2 (a and b).

Review of Literature:

The Gandhamardan Hills (GMH) range (20°42'to 21°00'N lat. and 82°41' to 83°05'E long.) is the borderline to the Balangir and the Baragada district, adjacent to Eastern Ghats belt Hills (EGB Hills) of western Odisha, IndiaSahu et al., (2012)[4]. It was called “Gandha Giri or Parimalagiri”, and Chinese pilgrim Yuan Chuang (AD 627-643) reported it as “Po lo mo lo ki li” during the reign of King Harshavardhan. This mountain comprises numerous hills; the highest is the Gandhamardan, and other mountains are Butel, Chandel, Thuta, and Bender, which have peaks with altitudes of 1004.6m, 813.82m, 801.6m,626.67 and 585.22m, respectively Dist Gazettes Bolangirt[5]). Gandhamardan Hills (GMH) range is between Balangir and Bargarh in western Odisha, India.

The Gandhamardan Hills possess assorted. Ecological, biological, and socioeconomic importance. The biosystem accommodates about 1200 species of flora and 500 species of

fauna, including 300 medicinal plants https://www.sunyaias.com/blogs/gandhamardan-hill. It is known as an ayurvedic paradise and has been designated as a "37th Biodiversity Heritage Site (BHS)" in India from 2023 by the Dept of Environment, Forest and Climate Change (MOEFCC) as per the Odisha Biodiversity Regulations Act (Section 37)Mohanty,(2023)[6], The Hindustan Times, https://shodhganga.inflibnet.ac.in/bitstream/10603/464939/6/06.(Fig 1)



(a) (b)

Fig 2(a): The Elevation(b) the contourmap of study the Gandhamardan Hills, Odisha

As per the Botanical Survey of India (2006-2017), the ethnobotanical resources of Odisha report about 1158 plant types belonging to 615 genera (142 families). They have been enumerated the plants and investigated their use as food, fodder, fuel, medicine, veterinary, fabrics, etc. (Botanical Survey of India[7]).The forest products values, including Unani and ethnobotany products, can be correlated with the economic and societal status of aboriginals inGandhamardan Hill Odisha, India,Mishra et al., (2018) [8],Rout (2023) [9].The ethnobotany (medicinal plants) users are the Indigenous communities of the Gandhamardan hills, which refrain from visiting HospitalsMishra et al., (2018)[10], Pandey et al., (2024) [11].

The stratigraphy and ecology under changing climate, the present time passes over geo- bio-hydro-aero spheres of the globe is the human activity changes in the Anthropocene epoch,Mishra et al., (2021) [12].Turmeric rarely grows in GMH, Mishra. et al. (2022) [13].

The hotspot of floral species miscellany of the Gandhamardan Hillswas found in places in Ayurveda and Unani by the aboriginals but not scientifically pondered, and it was found in old printed literature. The geobotany andbiogeochemistry of Gandhamardan Hillhave a few studies,Bhadra et al., (2020)[14].

The GIS studies of the Gandhamardan Hills have very littleresearch, which is at par with nearby forests like Simili-Pal, Deomali Hills range in the eastern Ghats Hills, and coastal fronts, Bhitar Kanika and Rambha Hills. Many reports exist on the medicinal plants in Odisha's forests,Mishra et al., (2023)[15].However, a research gap exists between these medicinal plants and geology, geomorphology, climate, geography, and geo-chemical studies of GMH.

Present study:

The present attempt is to conductthe generation of maps and in-situ field studies toinvestigate:

1. To study the area's geology, geo-hydrology, and geomorphology.
2. GIS construction, analysis and interpretations of aspect, slope, land use/land cover (LULC) and drainage map of the area.
3. The geo-hydro-biographical studies of the GMH zone (Harishankar area).
4. Quest for ethanol-botanical values of grasses, herbs, creepers and trees in GMH.

All-in-one baskets have been tried in the present work considering climate changes, anthropogenic interventions and vegetation losses.

Methods and methodology:

The physical, chemical, geological, geomorphological, and lithological studies of the flora, fauna, aquafauna, and avifauna of the Gandhamardan area were carried out. The land use and land cover (LULC) of the vegetation and other attributes of the region have been taken up by using the Geographical information system, Q-GIS, and EREDAS software to know the geospatial loss of vegetation due to urbanisation and anthropogenic interventions over the hilly forests over the GMH Mountains.The workflow diagram is shown in Fig 3.

The GMH ethnobotanical plants are searched in the villages, and localVaidya's (Kaviraj) with the Balangir and Bargarh districts of western Odishainteract about medicinal plants. Bargarh and Balangir districts of Western Odisha. The data and information are also collected from the people, available literature, Journals and interviews with a few Aboriginals. They are recorded and confirmed for a second opinion from Ayurvedic doctors. The work flow diagram shows the documentation of these established Ayurvedic, Naturopathic flora and fauna and their local, botanical or Latin/English names.(Fig 3).

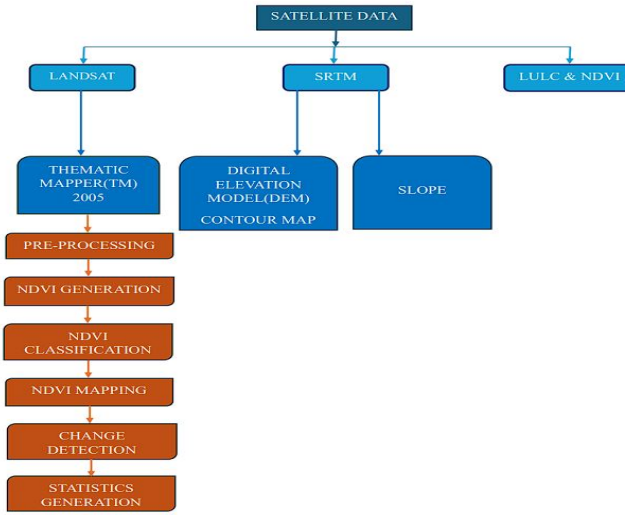


Fig 3: The workflow diagram of the geo-hydro-biological studies of Gandha-Mardan Hills

The Survey of India (SOI) map 2005 is georeferenced, and the GMH elevation and the hills' maps were constructed. Landsat data is acquired from the US Geological Survey (USGS), www.glovis.usgs.gov. The Landsat 8 cloud-free imageis georeferenced by OLI (Operational Land Imager). Allthe data about the study area are projected to aUniversal Transverse

Mercator (UTM) coordinate, Datum WGS1984, zone 45N, by application of a 1:50,000 topographic map. Standard false colour composites (FCC) are constructed by extracting the satellite imagery on band combination with the help of ERDAS IMAGINE 9.2 software. The LULC and the NDVI are built from the multispectral RS image using separated bands, and the final map is prepared. The NDVI values are created manually using Arc GIS 9.3 software.

Geography and Geology

Gandhamardan hills range was taken from theSOI Topo Sheet No 64L/13, extends in the NE-SW direction for a length of 9.8 km, width ranges from 0.4 to 2.6 km. and averages 0.75 km. The hills near Gandhamardan are Mahadasani in Gudvella (at Kandhan) and Bhim Dungri in Matkai. The GMH range extends until the Eastern Ghat Super Group, which consists of Khondalites, Gneissic rocks, Charnockites, and Migmatites, with small patches of Bengpal Group rocks with exposures of quartz mica schist and hornblende schist towards the north-eastern corner of the district. The Iron deposits inthe GMH area have two stratigraphies. The banded formations with irregular stratification exhibit fracture filling, and the other low-dipping sheets at the hilltop. Laterites cap the banded iron formation.Bauxite zones also occur at the top of the GMHby the weathering action of Bauxite rocks,Gallo et al., (2007)[16], Mishraet al., (2023)[17].

The Lithology of the area:

The GMH areas are of Recent and Sub-Recent formations of Alluvium in the plains, laterite capping on the plateau top long with lower Gondwana sandstones Quartz, pegmatite, gneissic rocks, Liptinitic gneisses; Granulitic rocks (incl. charnockites); and Khondalites). They are widespread Archaean formations of the Eastern Ghats belt.The region shows the stones of the Khondalites Series and extends up to the western limit of the district. The Lower Gondwana Unconformity comprises Archaean rocks (Pre-Cambrian). The young geological formations in the GMH plateau are mostly laterite, followed by alluvium.

The Biological Hotspot:

This is the 37th Biodiversity Heritage Site (BHS) in India, and the 3rd in Odisha are fragile ecosystems with diverse biodiversity. The GMH are classified according to the vegetation type in the lowerelevation ranges. ii) Middle Elevation Range and Upper Elevation Range (LER: 340–547m),(MER:547–754m),(UER: 754–top) respectively.The floral biodiversity accommodated in GMH is 1055 flora, including 849 angiosperms, 56 pteridophytes, 40 bryophytes, 45 lichens, two gymnosperms, and63 species of macro-fungi. One angiosperm (Ficus concertina var. daycare) and one spider, *peacetime Harishankarensis*, are endemic to this hill, Bhadra et al. (2018)[18].Mishra et al.(2023) [19], Mohanty et al., (2023) [6].

The Nature'sLash:Climate hazards Gandhamardan Hills:

Balangir Dist. has confronted thedeaths, sufferings, livelihoodsand societal humiliations due to thedistressingeffects of drought, heavy rainfall, heatwaves, floods, fire accidents and lightning. Recently, the district has faced drought in 1996,1998, 2000, 2002, 2009, 2010, 2011, 2015, 2017,2018, and 2021, and Flood / Heavy rain in 2001, 2003, 2014 and 2019. This District isin the hot zone in the country, with the mercury reaching 45^0C.

The climate of the hills range, though not recorded, is AW Savanna-type climate with minimum and maximum mercury lying between winter 7^0 C (Nov. to Feb.) to summer 48^0 C

with high humidity (79%) (Mar.to June).The average rainfall in the district is 1289.8 mm, mainly due to its positioning below Indian tropical convergence zone ITCZ, (the band of low-pressure area encircling clouds) moon soon trough line, and nearer to the tropic of cancer and prevalence of SW monsoons. Winds are generally light to moderate,mainly in the directions between the north and northeast. The winds are variable in the summer and blow from Gandha Mardan Hills (Fig 3a).

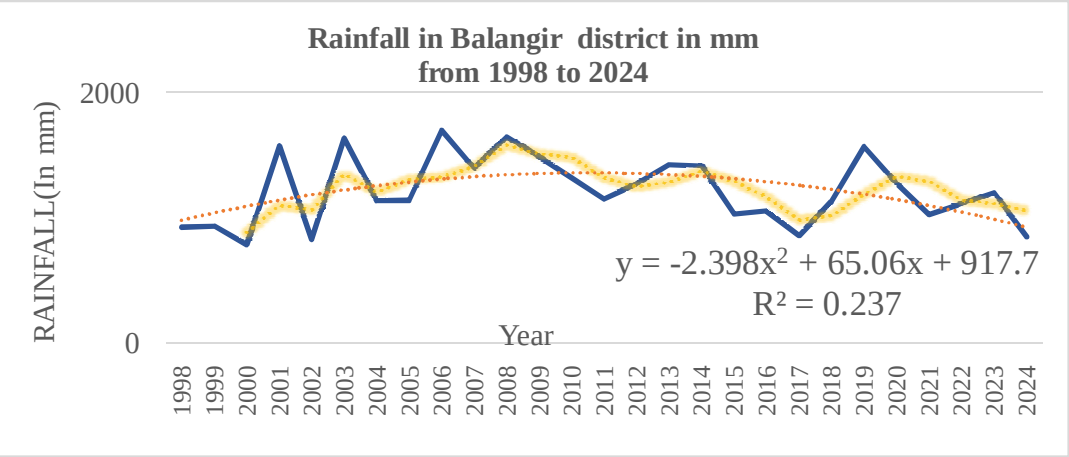


Fig 3a: Annual rainfall of the Gandhamardan Hillsin the Balangir district

The districtencounters medium to severe drought regularly, and the prominent drought years are 1996,1998, 2000, 2002, 2009, 2010, 2011, 2015,2017,2018,and 2021 and Flood / Heavy rain during 2001, 2003, 2014 and 2019 in the Balangir district.The impact of storms over the hill range is less, but it receives severe rain during the passage of storms that slam the east coast of India. The rainfall trend line is polynomial over Gandhamardan is varying, and the befitting equation is y = -2.3983x2 + 65.068x + 917.71with R^2-value is 0.237

The Land use and land cover (LULC):

According to NRSC, the land use and land cover map is generated to get comprehensive information and understand the current topography and landscape used. Annual LULC data provides monitoring of chronological agricultural ecosystems, forest area conversions, and lacustrine areas of 2020. Present LULC depicts the earth's such as vegetation, forests, built-up areas, water, grassland, etc., Bid (2016)[20],Barik et al., (2024)[21].

The Landsat Normalized Difference Vegetation Index (NDVI) quantifies green vegetation to know about vegetation density and plant health in the Gandhamardan canopy.The NIR is the spectral reflectance at the near-infrared band, while RED represents the red band.The Normal Difference Vegetation Index (NDVI) is

NDVI= (NIR-RED) / (NIR+RED) ……. (1)

The present NDVI map and the LULC map analysis indicate that the Gandhamardan Hills in the Eastern Ghats belt have sparse vegetation values of 0.27 to 0.36, and dense forests range from 0.36 to 0.74. The thick forests mean more vegetation and many trees. These trees are ethnobotanical. Hence, ethnobotanical studies are used at present. Sarania et al, (2022[22]).

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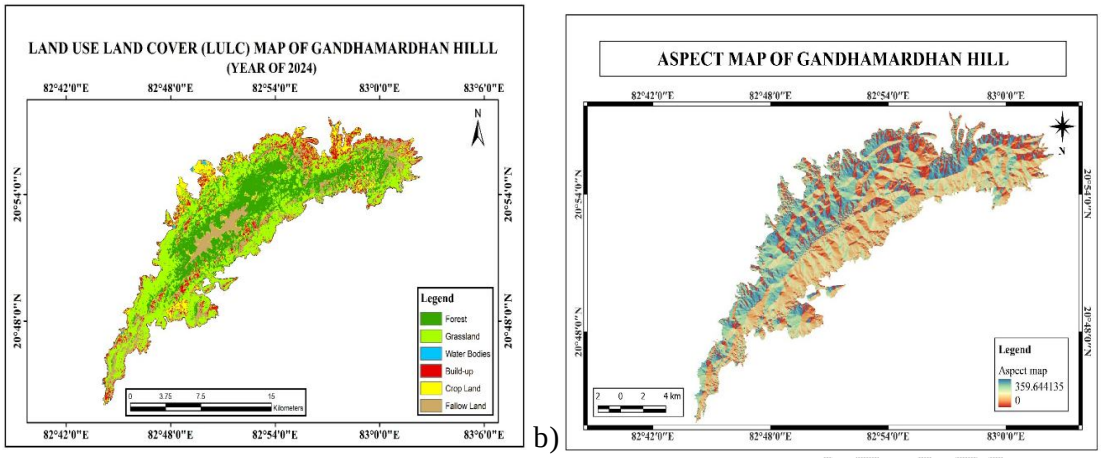
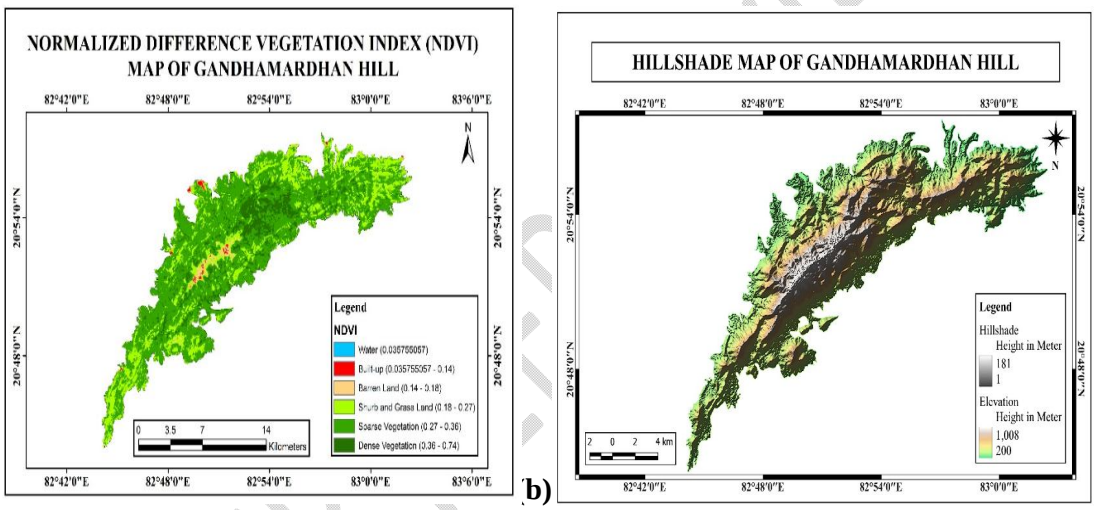


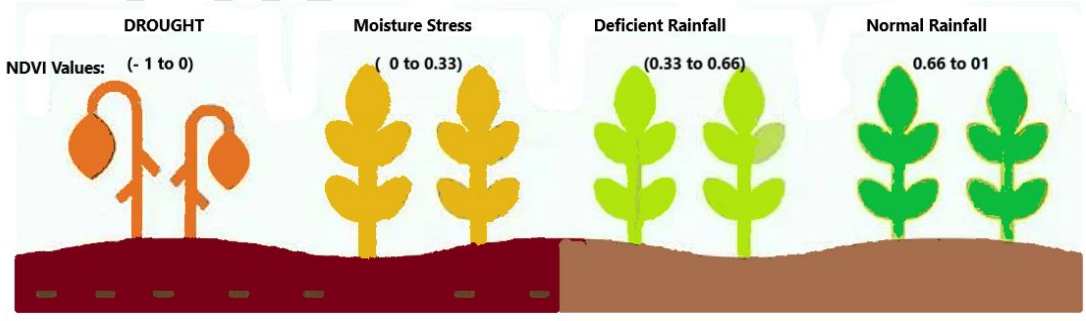
(a) b)

Fig 4(a): TheLand use and landcover (LULC)& Aspect map of Gandhamardan Hills



(a) **(b)**

Fig 5(a& b)):The Normalised difference vegetation Index(NDVI) and (b)the Hills shade map of Gandhamardan Hills, Odisha



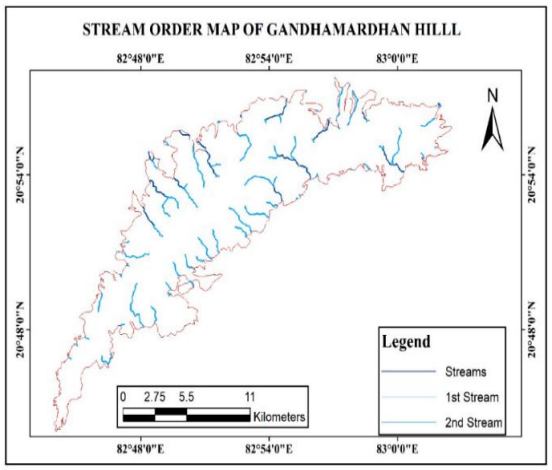
(C)

Fig 5 (c): The LULC, The NDVI map of Gandhamardan Hills and the result interpretation.*Source Modified: Team Cropin:17- 12-.2021*

The riverine system

The Gandhamardan hillsemanate two significant tributaries (Ong and Tel) of the River Mahanadi. The Tel River starts from the Nabarangpur district and passes through the

Gandhamardan plains, joining the Mahanadi R. at Subarnpur. The prominent distributaries are the Udanti, Sutkel, Hatti, Indra, Lant, Ret, Raul, Uttei, and Khadago.The river Ong receives the runoff from the northern slope of the Gandhamardhan range, Fig 6 (a), Mishra SP. (2022)[23].

(a) 

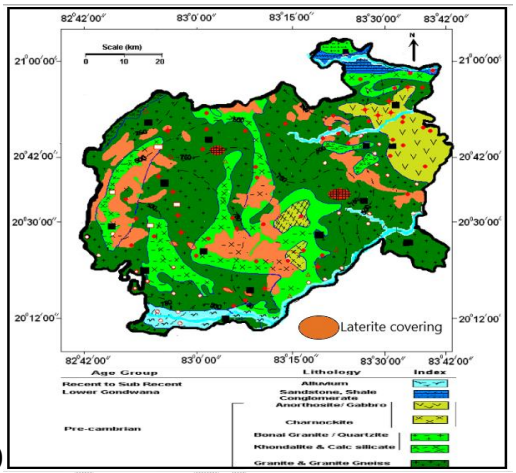
b) 

Fig 6(a): The Stream order map and (b) Geology map of the Gandhamardan Hills range in the Eastern Ghats belt, Source modified: "The District Disaster Management Plan 2024-25"

The GMH is of 190sq. Km accommodates 1200 floral species, 500 faunal species, and many trees, herbs, ethnobotanical plants, etc. Other floral biodiversity hot spots in different hills of Odisha are Mahendra Giri Hills (Gajapati) and Mandasuru in Phulbani district, as per the State Forest and Environment Dept. Odisha.The dwarf hills have sporadic trees at Patpani, Nandupalla and Chhatardandi, and the plateau isleafy in laterites 6 (b).

The Physicochemical Analysis

X-ray fluorescence (XRF) spectroscope is a physicochemicallyanalytical method that determines the chemical structure of various soil, water, and metal samples and describes the composition of multiple constituents. The water and soil samples near the Harishankar area were collected and tested in the Centurion University of Technology and Management laboratory.XRF is a modern instrument used in various fields,like metallurgy, ecology,geology,and archaeology, Fig 7(a),d Fig 7(b), Das et al., (2019)[24],Singh et al., (2019)[25],

01-Aug-2024 17:03:02 **Sample results** Pa

Sample ident
Harishakar

Application	<Omnian>
Sequence	1 of 1
Position	Large sample
Measurement time	01-Aug-2024 16:40:17

Normalisation factor	1.319

Compound	Si	P	S	Cl	Ca	Mn	Fe	Br	Sn	Hg	Pb	H2O
Conc	725.3	452.1	0.0	219.0	173.8	0.0	33.0	0.0	41.8	227.7	0.3	99.813
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%

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Fig 7 (a): The water sample at Harishankar (OMNI)**XRF spectroscopy analysis results**

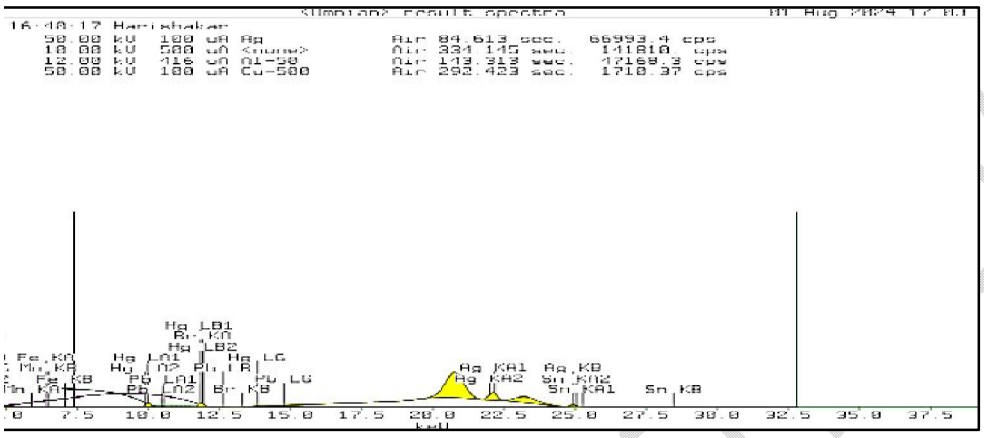

Fig 7(b): The XRF Spectroscopic graph result of Water at Harishankar

From the results of water and soil samples, anX-ray fluorescence spectrometer (CUTM Lab). It is observed that in the water sample,the objectionable elements present are in Table 1

Table 1: The XRF elements beyond permissible limits Water Sample as per IS 12500-2012[26]

Element /compound	Unit	Quantity present	Permissible limit	IS Code
Silicon (Si)	mg/l	725.3		
Phosphorous (P)	mg/l	452.1		
Chlorine (Cl)	mg/l	219	1000	IS 3025 (Part 32)
Calcium (Ca)	mg/l	173.8		

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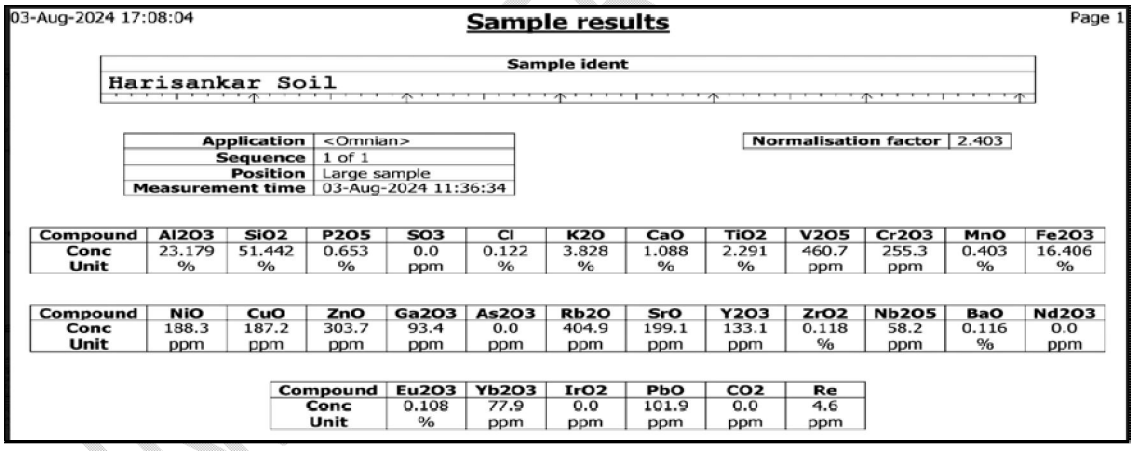
Iron (Fe)	mg/l	33.0	0.3	IS 3025 (part 53)
Strontium (Sn)	mg/l	41.8		
Mercury (Hg)	mg/l	227.7	0.001	IS 3025 (Part 48)/1994
Lead (Pb)	mg/l	0.3	0.01	IS 3025 (Part 47)

One ppm = one mg/lit; Hg, Fe, and Lead conc. are beyond permissible limits in water.

Bio-Geo-Chemistry of Gandhamardan Hills:

At a high meditation, the soil contaminants that dismay the plant metabolism to reach the wilting point are Co, Cu, Mn, Zn, Ni and Boron.Bhadra (2020)[14]. The Oxides of elements As, Cd, Co, Cu, Mn, and Al have less variation in the Gandhamardan hills. The Zn has a substantial accumulation in the bark and roots of vegetation in Gandhamardan Hills.The As and Mn have higher concentrations due to moregeospatial bioaccumulation in the soil stratum in the hills. The Gandhamardan soilshavea higher accumulation of Al, Fe, As, Zn, and Cr at the top of the mountain atUpper Elevation Range (UER): 754–top),(ii)Cu, Zn, Fe in themid-elevation region (MER): (547–754m). But at the foothills of Harishankar, LER: 340–547m,it is found that theoxides of five dominant elements are Cu, Zn, Ti, Ni, Sr, Pb and Fe. The gradation of the contaminants is Fe_2O_3 (16.4%) and Ti (2.29%).

The present study reveals that the Ti concentration found is 2.29%. Titanium (Ti) in soil enhances plant growth at low concentrations. This increases the process of photosynthesis, chlorophyll content, nutrient uptake, and better stress management, which augments plant growth and yield. Ca, K, and P's presence in the GMH enhances vegetation.



03-Aug-2024 17:08:04 **Sample results** Page 1

Sample ident: Harisankar Soil

Application	<Omnian>
Sequence	1 of 1
Position	Large sample
Measurement time	03-Aug-2024 11:36:34

Normalisation factor: 2.403

Compound	Al2O3	SiO2	P2O5	SO3	Cl	K2O	CaO	TiO2	V2O5	Cr2O3	MnO	Fe2O3
Conc	23.179	51.442	0.653	0.0	0.122	3.828	1.088	2.291	460.7	255.3	0.403	16.406
Unit	%	%	%	ppm	%	%	%	%	ppm	ppm	%	%

Compound	NiO	CuO	ZnO	Ga2O3	As2O3	Rb2O	SrO	Y2O3	ZrO2	Nb2O5	BaO	Nd2O3
Conc	188.3	187.2	303.7	93.4	0.0	404.9	199.1	133.1	0.118	58.2	0.116	0.0
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	%	ppm

Compound	Eu2O3	Yb2O3	IrO2	PbO	CO2	Re
Conc	0.108	77.9	0.0	101.9	0.0	4.6
Unit	%	ppm	ppm	ppm	ppm	ppm

Fig 7(c) The soil sample at Hari Sankar XRF Spectroscopy results

Iron (Fe) is an indispensable mineral for the growth of all plants. That enhances chlorophyll production and relieves the plant stress (moisture or salinity and drought, etc.), protein integral structures, Cellular processes, etc. Iron deficiency invites reaching the wilting point by yellowing leaves. The presence of ferric oxide (Fe_2O_3) is 16.4%, which is abnormally high, so the plants in the Gandhamardan Hills are luxuriant and greenish.

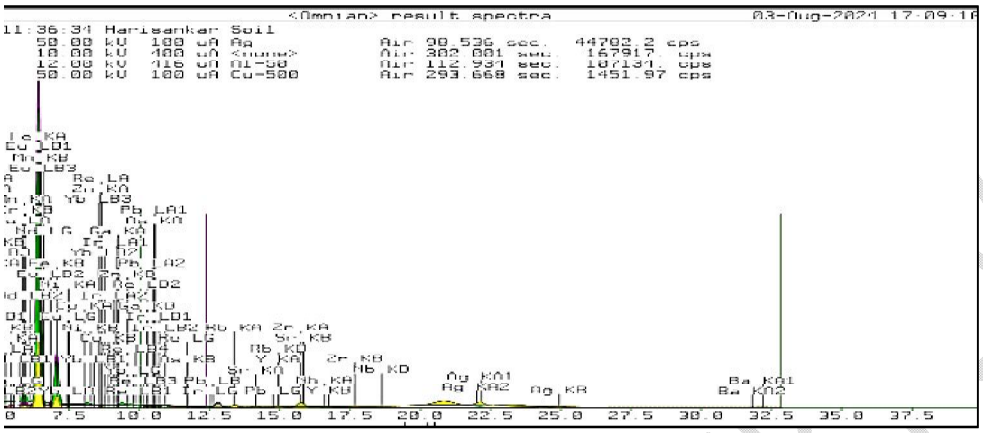


Fig 7(d): The XRF Spectroscopic graph results of Harishankar Soil results

From the XRF spectroscopic analysis, it is observed that the presence of Al, Fe, Cr, Mn, CU, Zn, Sr and Barium at higher concentrations initiates bioaccumulation/bio-adsorption in the plant at its roots, barks, wood, leaves, buds and flowers and adds to their ethnobotanical values.However, the surged weathering action on the top of the hills and elevation gradient degrades the trend of the ecosystem.

Table 2: The traditional ethnobotany of vegetation and their uses in Gandhamardan Hills.Atlas of Medicinal Plants[27], (https://gandhamardan.coenpt.in/[20])

#	Phonetics Odiya	Common or Hindi	Botanical Name	Parts Used	Properties/ Can by Used to treat diseases
1	Jangli Bhindi	Aibika;Jangli Bhindi	*Abelmoschus manihot L.*	Bark	To treat wounds and cuts.
				Flower	To Treat chronic bronchitis and toothache.
2	Musk mallow	Latakasturi	*Abelmoschus moschatus*	Seed	Digestive, , tonic, stimulant, antiseptic, antispasmodic, cooling, carminative,

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3	Barkanghi,*(Swee)*	Indian Mallow	*Abutilon hirtum Lam.*	Plant/Root/leaf	Herb for cough, toothache, easy childbirth (expels the placenta.), Abscesses.
4	Kanghi	Atibal (Sans)	*Abutilon Indicum L.*	Plant (*Sweet)*	Used to treat Fever, Colic, Ulcer, and Cough. Leprosy,Infusion.
5	Gohira/ *Climber*	Chilati, Agla Bel	*Acacia pennata (L.);*	Plant	Counter digestive disorders, Curb stomach infections and pain, and lower Cholesterol.
6	Vachaa	Ugragandha,(Sweetflag)	*Acorus calamus L.;*	Rhizome	Beneficial in colic, gout, cough, asthma, calculi, bronchitis, epilepsy, amentia etc.
7	Gokhura (Odiya)	Kaanthi(Hindi)	*Acanthospermumhispidum DC.*	Plant	Treats jaundice, malaria, vomiting, snake bite, headache, colic, convulsions, epilepsy, constipation, viral/ microbial infections
8	Toothache plant	Akarkara	*Acmella paniculata.*	Plant	Used for food /medicine and insecticide, toothache and oral infections.
9	Gorbach	Gorbach (herb)	*Acorus calamus*	Plant	Used for gastrointestinal (GI) problems (gastritis, anorexia, etc.
10	Apmaranga	Adhahshalya, kinihi	*Achyranthes aspera L.;*	Whole plant	Digestive, stomachic, carminative, boils, laxative, diuretic, expectorant, colic, cough, asthma, bronchitis, pneumonia, paediatric colic, piles, leprosy, vomiting, skin diseases, gonorrhoea, anaemia, etc.
11	Gopakana/Hanasp ada	Ishar-mul/ Ishwari	*Aristolochia indica Linn.*	Creeper: Leaf/ root	Raise sexual desire, immunity, and menstruation; treat snake bites, intestinal / gallbladder pain, wounds, gout, arthritis, rheumatism, eczema, etc.
12	Bel	Bael	*Aegle marmelos Linn.*	Stem/bark/ leaf /fruit/seed.	Antidiarrheal, antimicrobial, antiviral, radio-protective, anticancer, diuretic, antipyretic, ulcer healing, antigenotoxic, antifertility, anti-inflammatory
13	Madhu Malati	Malati: (Creeper)	*Aganosmacaryophyllaa*	Leaves	Used for Pitta disease.
				Flower	Eye Disorder., Skin infection between toes
14	Pokasungha	Jangali Pudina	*Ageratunconyzoides (L.)*	Plant	Treat Pneumonia, burns, fever, colic, cold, rheumatism, headache, diarrhoea, spasm.
				Leaves	Treat brain malaria and common malaria.
15	Aisha	Ankola (Hindi)	*Alangiumsalvifolium (Linn.f.)*	Plant	Treat haemorrhoids, rheumatic arthritis, loose stools, herpes, blood disorders etc.
				Seed	Aphrodisiac and energige the body.
16	Sisrisha (Tree)	Siris (Hindi)	*Albizia lebbeck (Linn.)*	Leaf/ Seed	Treat boils, cough, the eye, flu, gingivitis, lung problems, pectoral problems, tonic, abdominal tumours, and pest management.
				Bark	Treat inflammation.
17	Ghi-Kuanri	Kumari, / Aloe	*Aloebarbadensis Mill.*	Leaves, leaf-juice,	Carminative, colic, stomachic, burns, fertility, epilepsy. Anti-inflammatory, skin diseases, antibacterial, bowel disorders, dyspepsia, hypotensive, anti-spasmodic, dysuria, renal calculi tumours, dropsy, etc.
18	Chatiyana(tree)	Chitvan (Hindi)	*Alstoniascholaris L*	Bark Latex Leaves	Treating neuralgia and toothache. Beriberi, dropsy and congested liver., etc.
19	Guduri Sag	Gudrisag (Hindi)	*Alternanthera sessilis(L.)*	Herbs	Used to treat hepatitis, tight chest, bronchitis, asthma, Lung diseases, stop bleeding & hair tonic.
20	Jangaligailia	Gubal (Hindi)	*Alysicarpus vaginalis L.*	Root Seed	Treatment of coughs chewed during fevers. Used to treat dysentery and colic.
21	Olua	Stink Lily (Herb)	*Amorphophallus paeniifoliu,(Dennst.)*	Root Stem	Carminative, stomachic tonic. Curing dysentery. The fresh root is expectorant,& treats rheumatism, as well as snakebites.
22	Lanka Amba (Odiya)	Cashew (Indin)	*Anacardium occidentale Linn.*	Leaves	Reduce fever, malaria, toothache, anaemia, and constipation.
				Bark	Lessen blood sugar & detoxify snake bites.
				Serrup	used as relief from coughs and colds.
23	Chiretta / Bhuinnimba	Bitterweed (English)	*Andrographis paniculata (Burm. f.)*	Shrub	Treat cancer, diabetes, high pressure,ulcers, leprosy, bronchitis, skin diseases, colic,influenza, dysentery, dyspepsia, and malaria.
24	Apanga/Kala bhangra	Indian Catmint	*Anisomeles indica (Linn.)*	Shrubs	Analgesic, anti-inflammatory, spinach, snakebites, antioxidant, antimicrobial, anti-HIV, anti-Helicobacter, pylori and anti-cancer activity, chronic rheumatism.
25	Atta, Meghua	Sita Phala (Hindi)	*Annona squamosa Linn.*	Tree (Leaves)	Anti-microbial, anti-fungal, anti-cancer, anti-inflammatory, antiulcer, antidiabetic, antidiarrheals, antiplatelet, antioxidant, hepato-protective, neuroprotective

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26	Jamrala/Marmuri	Amoori (Hindi)	*Antidesmaacidum*	Tree	Plants are used to treat dysentery, pneumonia, sores and muscular pains.
27	Kaincha	Gunja (Climber)	*Abrus Precarorius (L)*	Root, Leaf, seed	used in skin diseases, wounds, alopecia, asthma, tubercular glands, stomatitis, hyperdipsia & fever.
28	Kanta Kusuma	Satyansi	*Argemone Mexicana L.*	Herbs	used by traditional healers in Mali to treat malaria.(Isolated from drugs)
29	Panasha	Kathal or jackfruit	*Artocarpus heterophyllus*	Tree	Used as especially anti-oxidant, anti-inflammatory, antimicrobial, anti-cancer and anti-fungal activity.
30	Musdanai	Samudrapalakah, Bastanbi	*Argerianervosa (burn f)*	Seeds	Treat Stomach disorder, debility
31	Bari	Satavari (Hindi)	*Asparagus racemosus Willd.*	Tree	Used for dyspepsia, constipation, spasms, ulcers, pain, anxiety, cancer, diarrhoea, bronchitis, alcohol withdrawal, diabetes, tuberculosis, dementia, etc
32	Bana Kulitha	ulthia	*Atylosiascarabaeoides Linn (Creeper).*	Stem & Leaves	Used for leg swelling, pain in pregnancy, night fevers, renal stones, eye diseases, dropsy, anaemia, hemiplegia, burns, wounds, small-pox, syphilis, gonorrhoea, gravel, cholera, dysentery, snake-bite, venereal diseases.
33	Neem	Indian Lilac/ Neem	*Azadirachta indica*	Root/seeds/ leaf/ Large tree	Digestive, treat bellyache/ gastritis. Roots include skin disorders, deafness, diabetes, and insecticides/ pesticides.
34	Dhaura	Dhaora	*Anogeissus latifolia Roxb.*	Large tree	Ayurveda medicine in cardiac disorder. UTI infections, skin diseases, liver complaints, fever, epileptic fits, etc.,
35	Khandakoli	Reetha	*Allophylus serratus Roxb.*	Plant/bark	used to treat analgesia, swelling, ulcers,
				Leaves	investigated for its anti-inflammatory and analgesic activities in animal models.
36	Brahmi	Brahmi	*Bacopa monnieri (L.)*	Leaves	Memory-enhancing, anti-inflammatory, analgesic, antipyretic, sedative and anti-epileptic agent.
37	Donti	Danti (Shurb)	*Baliospermummontanum,W.*	Root/ Seed	Used for oedema and pain, blood purifier.
38	Bans	Bans (Large tree)	*Bambusa arundinacea (Retz.) Willd.*	Leaves/ stem/ Bark Leaf/roots	Used for cough, skin diseases, wounds, digestive disorders, nausea, gynaecological disorders, diabetes, fever, blood diseases, colic, syphilis, malarial, diabetes, stomachache, etc.
39	Koilekha	Bajradanti (Herb)	*Barleriaprionitis Linn.*	Stem, flower	For oral health, pain relief, boils, digestive, tonic. Whooping cough, inflammations, jaundice, fever, eczema, gastric, diuretics, pimples, etc.
40	Poi	Poi/ Creeper	*Basella albaL.*	Leaf/Stem	Treat dysentery, Constipation, & Diuresis.
41	Kanchan	Kanchan	*Bauhinia purpurea L..*	Total Plant	Antibacterial, antidiabetic, analgesic, anticancer, anti-inflammatory, anti-diarrheal, nephroprotective regulate thyroid hormone, Carminative uses.
42	Magha latenga	Kurei (small sub-Herb)	*Bidens biternata (Lour.)*	Wwhole plant	Used against digestion, inflammation, infections, diabetes, malaria, leprosy, toothache, fever, cough, asthma, liver infection, toothache, and diarrhoea.
43	Chhota Lajakuli Lata	Lakchana, or, Lajalu (herbs)	*Biophytumsenstitivum Linn. Dc.*	Decoction of roots, leaf /stem.	Treat gonorrhoea, bladder stones, chest complaints, tuberculosis, anti-inflammatory, sore throat, abscesses, chronic wounds, and fever. etc.
44	Jajan or Jhanjiki	Tikher or Suka surani.	*Breynia vitis-idaea (Burm. f.)*	Leaf	used to treat boils and skin diseases.
				Bark	astringent and anti-inflammatory, used for rheumatism and to stop the bleeding.
45	Rakta trichuli, Kajan ;	Kangli or kambhi , Retund (Hindi)	*Breynia retusa (Dennst.) (Shrub)*	Whole plant	Fresh plant juice is given as eye drops for eye diseases and conjunctivitis.
				Leaf	Treat skin diseases, analgesic, anti-inflammatory, antimicrobial, swollen testicles.
46	AtikapudiGuodapuruni	Punarnava, Biskhapara, Gadahpurna	*Boerhaviadiffusa L. Herb*	Leaves	used as an anti-diabetic, anti-inflammatory, hepatoprotective and diuretic, treating fluid accumulation, anaemia, and liver diseases
47	Ram Kanda	Seemar or Semal kanda	*Bombax ceiba Linn.*	Flower	Astringent & treat Skin troubles. Roots are diuretic and tonic. Treat cholera, fistula, cough, urinary problems, abdominal pain, impotence.; Treats dysentery and menorrhagia. Influenza, Haemoptysis in tuberculosis,
				Root	
				Gum	

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48	Tala or Tal's palm	Tar (tree)	*Borassus flabellifer Linn.*	Root	Anthelmintic, diuretic, respiratory diseases.
				Flower	The ash of the flower is taken to relieve heartburn and enlarged spleen and liver.
				Bark	A tonic, diuretic, stimulant, laxative, anti-phagmatic, amoebicide for liver disorders.
49	Salia	Shallaki	*Boswellia serrata Roxb.*	Sap, bark, and others	Treat brain injury, osteoarthritis, joint pain, rheumatoid, fluid-filled pads, tendons.
50	Palasa	Dhak or palasa	*Butea monosperma Lam.*	Leaves	Treatment of diarrhoea and wounds.
				Seed	With honey as anthelmintic, anti-fungal, antibacterial and purgative, etc
51	Shallaki or Salia	Shalai/ Shallaki	*Butea superba Roxb.(Climber)*	Leaves	Treats skin ageing during post-menopause
				Root	used for Erectile dysfunction, easy delivery. Poisonous bites of animals.
52	Gilo/ Gila	Karanju, Kata karanja	*Caesalpinia bonduc L.*	Root Bark Seed Leaves	Treat fevers, asthma, cough, worms, colic, dyspepsia.: Elephantiasis, intestinal worms, fevers, hepatomegaly, amenorrhoea, etc./ Used in inflammations, cough, asthma, hydrocele, leucoderma, leprosy, skin, colic, diseases, fevers. Dyspepsia, dysentery, worms, diabetes,
53	Lata karanja	Katakarnja (Creeper)	*Cajanus scarabaeoides*	Fruit, leaves	Treat leg swelling, pregnancy pain, diarrhoea, renal stones, eye diseases, dropsy, anaemia, burns, wounds, smallpox, syphilis, cholera, gonorrhoea, dysentery, and snakebite.
54	Arakha (*Bush)*	Madar or Ark	*Calotropis gigantea or procera (Linn.)*	Root, seeds, Flower, latex	used for treating skin, digestive, respiratory, circulatory and neurological disorders, fevers, elephantiasis, nausea, vomiting, diarrhoea, cramps, joint pain, and Dried latex for fistula.
55	Dhonoty	Kokoray	*Calycopteris floribunda (Roxb.)*	Mainly leaves	Treat worms, colic, leprosy, ulcers, malarial fever, dysentery, and vomiting. The fruits treat jaundice, ulcers, pruritus and skin diseases.
56	Bhunilimba	Bhui Neem	*Canscoradiffusa (Vahl)*	Whole Plant	Anti-inflammatory, analgesic, antitubercular, spermicidal, useful in allergy, ascites, fever, verminous, hepatopathy, skin diseases,laxative, stomachic, liver tonic, etc.
57	Kuruma, Jordaru, Karuna	Kuruma	*Canthiumdicoccum (Gaertn.)*	Bark & Root	Used for the treatment of diabetes. The plant extract cures diarrhoea and fever.
					Anti-diarrheal, antipyretic, and febrifuge.
58	Karir or Krakara ; Ker	ArdandaJhiris/KairTenti	*Capparis brevispina DC.*	Leaves Root/Bark	Cure testicle swelling, smallpox, boils, cholera, colic, pneumonic, neuralgia, and sores.
					Used in smallpox and swelling of testicles.
59	Pirika;	Kanthari; Heens	*Capparis sepiaria L.*	plant	used as a blood purifier, stomachic, tonic, appetiser, cough, toxaemia, and snakebites.
60	Golia lata	Kitamari/r Godhapadi	*Cayratiapedata Lam.*	Leaves (rare)	used for treating ulcers, diarrhoea and inflammation; IUCN:Vulnerable (VU).
61	Haratali or Brahmi	Karnasphota or kapalphodi	*Cardiosperumhelicacabum L.*	Hedge herb ; Leaves	Used for rheumatism, nervous disorder, snakebite,abdominal pain, lung diseases, rheumatism and stiffness of the ear ach and eye sore, cough,
62	Kumbha	Kumbhi	*CareyaArborea,R.*	trees/Bark	It treats ulcers, coughs, and wounds, promotes digestion, and relieves swellings.
61	Guachipo (herb)	Philippine tea;	*Carmona retusa Linn.*	Roots/fruits	Treat fever, scabies, lung diseases.
63	Benimanj/Kakra	Chilla	*Casearia elliptica (W)*	Fruit	Anti-diabetic, anti-microbial, diuretic, Cures diabetes, fevers, ringworm, ulcers, snake bites
64	Banakolathi	Chakanu / Chakasu	*Cassia absus Linn.*	Leaves, Roots, seeds	Treat bronchitis, asthma, cough, renal, hepatic diseases, conjunctivitis, leucoderma, wound constipation, tumours, ulcers, and headache.
65	Sunari	Amaltas	*Cassia fistula Linn*	Seed	Laxative, febrifuge, tonic, anthelmintic, anti-inflammatory, antiperiodic, febrifuge, diuretic, ophthalmic, carminative, diuretic.
66	Patwaghas	Patwa Ghas	*Cassia mim-osoides,Linn*	leaves	Treat diarrhoea/dysentery, intestinal problems.
67	Kasundri	Badakosandi	*Cassia occidentalis Linn.*	Leaves, Root, Seed	Used to treat antibacterial, antifungal, anti-malarial, anti-inflammatory, antioxidant, hepatoprotective and Immunosuppression, etc.
68	Chakonda	Charota or, Chakvad	*Cassia Tora Linn.*	Seeds/ Flower	Treat skin diseases, leprosy, ringworm, itching, psoriasis, and snake bites.
69	Chakunda	Mukarasi,	*Cassini albums Retz.*	Seed	extractused for parasitic worm infections.
70	Akashvuli	Akas Bel (Creeper)	*Cassytha filiformis L.*	Leaves, stem	Anthelmintics, Antimicrobials, Antifungal Oedema, Headache, Hepatitis

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71	Sada bahar	Indian Periwinkle	*Celastrus paniculatus(W)*	Plant	Anti-arthritic, wound healing, hypo-lipidemic, antioxidant. Treat pain, gout, and rheumatism to surge sperm in semen.
72	Bornoptri	Priyangu; Beautiberry (Shrubs)	*Callicarpa tomentosa (Linn.)*	Leaves and roots	Ulcers. Fever. Hydrocele. Leucorrhoea. Liver Diseases. Malaria. Paralysis. Effective Liver Tonic.Anthelmintic, Antispasmodic etc.
73	Lobanga or Sirali	Safed Murga or Sarwari	*Celosia argentea(L.)*	Flower/ Seed	Medicine for uterine bleeding, leucorrhoea, dysentery, diarrhoea, eyesight, eye diseases.
74	Salvah	Sevar / Coontail	*Ceratophyllumdemersum Linn.*	Aquatic ; leaves	Antimicrobial, antibacterial, antibilious, and purgative. Treatment of wounds, fever, burning sensation, haemorrhoids or piles,, etc.
75	Thalkudy; Srabani; Manduki	Brahmi or Mallari *herb*	*Cetella asiatica (Creeper)*	Leaf & Root Extract	Repair nervous tissue in spinal injury and neuromuscular disorders, increase brain function, memory, and skin conditions.
76	Sanapuspi	Banshan, Jhunjhunia	*Crotalaria verrucosa L.*	Root	Used as a treatment against fever and stomach pains, to purify blood and skin diseases.
77	Bana Maricha	Ban Tulsi	*Croton bonplandianus*	Seed/ leaves	Treat liver disorders, skin diseases, asthma, jaundice, swelling, ringworms, bronchitis, constipation, abscesses, etc.
78	Talamuli	Kalimusali	*CurculigoorchioidesG.*	Fruit Flower	Diuretics and laxatives Treat piles, cough, debility, jaundice, asthma, piles, etc.
79	Dhoboni/Sujuni	takoli	*Dalbergia lanceolata*	Bark	Stem bark is pasted with water, and the lotion is applied externally to leukoderma.
80	Sisu	Shisham	*Dalbergia sissoo Roxb.*	Bark	Stem bark is pasted with water, and the lotion is applied externally to leukoderma.
81	DhalaDurdura	Dhatura	*Daturastram onium L..*	Leave Seed	Treat asthma and bonesetting, antiasthmatic, antispasmodic, hypnotic and narcotic.
82	Salia, Dhaba Bansa,	Vansha	*Dendrocal musstrictus.*	Leaves, Plant	Anticarcinogenic, Decoction + honey+ jaggery for post-delivery problems
83	Madanga	Vrksadani or Banda Patha	*Dendrophthoe falcata (Linn. f.)*	Plant paste/juice	Narcotics and diuretics treat pulmonary ulcers, tuberculosis, asthma, menstrual disorders, swelling wounds, renal vesicle calculi, etc.
84	Makarkendu /Mankada Kendu	Malabar ebony	*Diospyros malabarica (Desr.)*	bark, leaf, flowers, fruits	T treats diarrhoea/ dysentery. The bark treats boils/tumours; juice treats bilious fevers/ blood diseases, gonorrhoea, leprosy, snake bites, etc.
85	Kalicha, Kanchia	Sola tree	*Diospyros sylvatica Roxb*	Fruit/	Used to cure stomachache. Used as a laxative.
				Leaves	Used as an expectorant.
				Stem	Used as a tonic for constipation, Stomach problems, diarrhoea, Malaria, fever, etc.
86	Bhringraj / Pita Bhringaraj	Bringraj/ keshraj	Eclipta alba (L.) Hassk	(Seed, Whole)	Protect Lever, antiviral, antibacterial, anticancer, antioxidant, Early hair greying & fall, disorders, jaundice, & skin diseases etc.
87	Amalia	Gobhi (Gojihva)	*Elephantopusscaber*	Root	Treat pediatric diarrhoea. Rheumatism. Root paste treats spermatorrhoea to loosen motion.
88	Bai bidanka/Fatangdi	Babranga/Bhingi	*Embeliatsjeriam-cottom*	Plant	The fruits are anthelmintic, antispasmodic, and carminative ointments for treating toothache. The leaves with ginger gargled for sore throats.
89	Hidimichikaa	Hilamochi, arkuch sag ;	*Enydrafluctuans L..*	Whole Plant	Used as antioxidative and analgesic; dropsy, anasarca and snakebite.
90	Dhaniya /Jangali Dhaniya	Wild Coriaender	*Eryngium foetedum*	Leaves	Treat burns, earaches, fevers, hypertension, worms, constipation, fits, asthma, stomachaches, infertility, snake bites, diarrhoea, malaria, apetiser, etc.
97	Khir-sag Chitakuteai	Bidarie, Dudhi	*Euphorbia hirta*		Treat female disorders like cough, bronchitis, asthma, worm children, dysentery, jaundice, pimples, gonorrhoea, digestive, tumours, etc.
98	Khadisiju,hadabhanga	Milk bush/Amar	*Euphorbia tirucalli*	The paste	Treat rheumatism, warts, cough, asthma, earache, toothache, fever, bronchitis, etc.
99	Sweta puruni / Neelchampa	Phooli, Sankhaholi	*Evolvulusalsinoides*	Whole plant	The plant is passed on to skin diseases.Brain tonic treats nervous debility, dysentery, etc.
100	Hidimichika, Hidimicha	Harkutch,Hilmochika	*Enhydra fulctunas L..*	Juice of plant	Inflammation, cancer, diarrhoea, microbial infection, diabetes, wounds, constipation etc.
101	Raj Dimari	Phagoora/Timila	*Ficus auriculata*	Fruit	Delays ejaculation and increase sexual power.
102	Dharmaoar	Pukar/ Banij	*Ficus benjamina Linn.*	Fruit	Its latex/fruit extracts treat skin disorders, inflammation, piles, vomiting, leprosy, malaria, nose diseases, cancer, general tonic, antimicrobial, antipyretic, anti-dysentery, etc.
103	Dimri, Kharsan	Gobla, Kagsha,	*Ficus hispida Linn.*	Fruit & Bark	Purgative: Decoction from the fruit or bark treats jaundice, piles,and abdomen pain

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104	Jari/Pippal/ Aswastha	Pipal	*Ficus religiosa (L)*	Leaves, bark/ root	Treat asthma, diabetes, diarrhoea, epilepsy, gastric inflammations, sexual disorders.
105	Bainchokoli	ramontchi, and Indian plum	*Flacourtia indica (Burn. F.)*	Fruit	Appetising and digestive, diuretic, in jaundice enlargedspleen.Bark: intermittent fever.Roots:spermatorrhoea and rheumatism.
106	Brahman Jhati	BhaliaBisbut	*Fleminga macrophylla*	Root	Treatment of spermatorrhoea and rheumatism.
107	Sugandhraj	Gardenia /cape jasmine,	*Gardenia jasminoides*	Root	Treat headaches, dyspepsia, nervous disorders, jaundice, kidney diseases, lungs etc.
108	Gambhari	Gamhar	*Gmelina arborea R.*	Leaves Root	Leaves: appetitive, Colic and after delivery as an appetiser. Juice: for fever, liver complaints for eczema and skin affections, treat diarrhoea, coughs, rheumatism, anaemia, jaundice, etc.
109	Agni kumari/ Bajramula	Akhatari	*Grangeamaderaspatana (Linn.)*	Leaves, root, fruit etc.	Considered antipyretic, astringent. antiseptic Root:diuretic, anthelmintic and stimulant, Leaf: stomachic, deobstruent, antispasmodic,
110	Pita sag	Jima	*Glinnousoppositifolius L.*	Leaves	Antibacterial, Anti-diabetes, anti-microbial, fever, Arthritis, Diarrhea, Stomach upset, Jaundice, inflammation, malaria, and wounds.
111	Dhamuraa, Dhaman	Dhanurvrks, Sutejana,	*Grewia tillifoliavahl.*	Bark, fruits.	Treating non-healing wounds, ulcerative colitis, menorrhagia, and cough.
112	Gudamari	Gurmar:	*Gymnemasylvestre (Retz.)*	Leaves/ roots	Lower Blood Sugar Levels. Maintaining insulin levels, digestive, eye pain, snake bite, cholesterol, triglyceride levels etc.
113	Jarajaati; Gharpodia	Pitpapra/ Parapata	*Hedyotiscorymbosa (Linn.)*	Leaves	Antitoxic, anti-oxidant, antibacterial, antirheumatic, anthelmintic, depurative, digestive, activates blood circulation, appendicitis, hepatitis, pneumonia, urinary infection, cellulitis and snake bites.
114	Hatisundha, Kaf Gajri	Hatisundhi/ Chanchuphal	*Heliotropium indicum*	Plant Leaves	Plant: treat diarrhoea, diabetes, venereal diseases, urination frequency, eye infection, asthma, ulcers, dysentery, colds, wound healing, bronchitis boils, fractures, menstrual or nerve disorders, kidney problems, etc. Leaves: Cough, treat eye pain, etc.
115	Anantamul	Indian Sarsaparilla, and Sariva	*Hemidesmus indicus (Linn.)*	Root	Diuretic, tonic, anti-pyretic,blood purifier. Treat leprosy, skin diseases, fever, asthma, syphilis, bronchitis, urinary diseases, rheumatism, etc..
116	Jangal Bhindi	Natanageswari	*Hibiscus vitifolius; Hiptagebenghalensis L.*	Leaves	Leaves are pasted, boiled with castor oil, and applied to the rheumatic part of the body.
				Seed	Seeds are pasted with honey and applied on the eyes' inner lids to treat cataracts.
				Leaves	used to treat cutaneous diseases.
117	Koilikhiaa/ Gandha Tulasi/Koelekha	Talimakhana	*Hygrophila auriculata Hyptissuaveolens*	Root	Root: Treat blennorrhoea, hydropsy and anuria, stomach ache; leaves/stem: ulcers and rheumatic; Seeds: diuretic, fever, analgesic, enhanced blood circulation, decongestant, etc.
118	Suamnai/Syamolota or Madhodi	Kali-dudhi, Krishna Sariva	*Ichnocarpus frutescens*	Whole Plant	Treat dysentery, glossitis, haematuria, measles, atrophy, convulsions, cough, measles, tuberculosis, tumour, diabetes, skin disease, bleeding gums, etc.
119	Painlaha/Panikoda	morning glory	*Ipomoea hederifolia Linn.*	Roots/ seeds	It acts as an oxytocin, anti-cancer, anti-oxidant, antipsychotic, anti-inflammatory, anti-microbial, stomach aches, diuretics, etc.
120	Banamali	Nevaari,Nepaali, Saptalaa,	*Jasminum arborescens Roxb.,*	Leaves & roots.	Treats menstrual disorders, miscarriage, colic, flatulence & debility etc. Roots: ringworm, eczema, fruit as a tonic, etc.
121	DhadaJadaJahazigaba	Curcas nut, Bagranda,	*Jatropha curcas*	Root/ Latex	Fruits - roots -boiled with castor oil to treat joint rheumatism. Latex:spermatorrhoea.
122	Baigaba	Ratanjot/purging nut	*Jatropha gossypiifolia*	Root / Latex	Roots with castor oil to treat joint rheumatism. Stem: bleeding; Latex:: spermatorrhoea.
123	Jati/Jaiphula	Maalati, Spanish jasmine	*Jasminum grandiflorum L.;*	Root, leaves, Aromatic flowers.	Roots*:* headache, paralysis, mental debility, constipation, sterility, ulcers, corns, Menstrual disorder, ringworm, leprosy. *Leaves:* dental pains, stomatitis, ulcers, wounds, leprosy. *Flowers:* headache, skin diseases.
124	Vasak, Basanga (Shrub)	Malabar Nut/adulsa, /vasa,	*Justicia adhatoda Linn.*	Deco. of Leaves	Fever, hepatitis, typhoid, cough suppressant, bronchodilator,
125	Amarpoi	Amarpoi	*Kalanchoe pinnata (Lam.)*	Leaves/ stem	Treat gastric ulcers, COPD, boils, wounds, gastric ulcers, rheumatoid arthritis, kidney stones, pulmonary infection, rheumatoid arthritis, etc.

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126	Manjuatii	Mehendi	*Lawsonia inermis Linn.*	Plant	Plants are antibacterial, antifungal, antiparasitic, antiviral, anticancer, antidiabetic, tuberculostatic, anti-inflammatory, antifertility, wound healing, etc.
127	Jivanti (climber)	Dori	*Leptadenia reticulata (Retz.)*	leaves	Control stomach diseases, facilitate abortion and, provide contraception, use t for diabetes.
128	Samar khaya	"Upanya" or Thumbai	*Leucas mollissima Wall. ex.(B.)*	Flower Leaves Roots	Used as a tonic, flower for fevers, Leaves cure wounds(eyes and nose), and skin diseases (psoriasis/ scabies. , fevers, colds, rheumatism, snake bites, etc. Roots for gout, rheumatism
129	Kaitho	Dadhittha, Malura	*Limoniaacidissima, L*	Fruit	Digestive, appetiser, diuretic, stomatitis, tumour bronchitis, debility, hiccough, cardiac pharyngodynia, & haemorrhoids etc.
130	Garuda Govinda / Medha	Menda, Chandana, Maidalakri	*Litsea glutinous a(Lour.)*	Plant	Bark/leaves: diarrhoea, dysentery, cut wounds. Stomachache, indigestion, gastrics.Seeds: trauma, fracture and traumatic injury.
131	Ashoka	Hemapuspa, Ashok	*Saracaasoca (R..)de Wilde*	Bark, flowers, seeds.	Treat liver disorders (jaundice.dysentery), scabies, strangury, dyspepsia, diabetes, bone fractures etc.
132	Baghanakhi	Cats law	*Martynia annua Linn.*	Leaf/ Fruit	Treating epilepsy, inflammation, sore throat, burns, itching, skin infection, tuberculosis, etc.
133	Achu, Noni	Akasika, Morinda	*Morinda pubescens Sm. in Rees.*	Roots, fruits, leaves	Treat leprosy, skin diseases, dysentery, leaves (tonic), digestive inflammations. ulcersgout,,Carminative, wounds,stomatitis, fever, etc.
134	Baaidanka	Aatmagupta, Vaanari./ Cowhage	*Mucuna pruriens (L.) DC.*	Root/leaf, leaves, seeds, hairs.	Febrifuge, Laxative, nephropathy, strangury, dysmenorrhoea, elephantiasis, dropsy, ulcers, neuropathy, helminthiasis, cephalalgia, sterility gonorrhoea, , parkinsonism & debility etc.
135	Barbari; Durlava	Tungi, Arjaka Sweet Basil	*Ocimumbasilicum L.*	Whole Planrt	Aromatic, digestive, stomachic, carminative, sores, cardiotonic, expectorant, diuretic, burning, wounds, seminal weakness, dysentery, debility, etc.
136	Changheri/ Ambiliti	Amlapatrikaa, Changeri	*Oxalis corniculata L.;*	Whole plant	Digestive, carminative, corns, warts, constipating, liver tonic, diuretic, anti-bacterial, antiseptic, I.Q. promoter, diarrhoea, gout, anaemia, scurvy, ulcers, toxicity, menstrual disorders, etc.
137	Pasaruni	Prasaarini, Puti gandhaa	*Paederiafoetida L. ;*	Root, stem, leaves	antiinflammatory, antispasmodic, Anti-cancer, colic rheumatic arthritis, flatulence, fever, , calculi, gout, herpes, diarrhoea, etc
138	Anlaa	Dhatree/ Amla	*Phyllanthus emblica L.*	fruits. (Vit-C)	Antioxidant, anti-diabetic, Antimicrobial, Hair tonic, Anti-ageing, anti-inflammatory Antiageing, Antidiarrheal,
139	Bija / Piasal	Bijaka, Pitashaalaka	*Pterocarpus marsupium Roxb*	Leaf, heart wood,flowe r, gum.	Urinary, fracture, leprosy, skin diseases, leucoderma, asthma, gout, diabetes, arthritis, cough, bronchitis & greyness of hair. Leaves: boils, sores, boils, &skin diseases, ulcers, Flowers: appetizing, gleet, anorexia, fever. um: liver tonic, diarrhoea, psoriasis, wounds, etc.
140	Karanja	Naktamala/Indian beech	*Pongamia pinnata (L.) Pierre*	Plant & oil oil.	Antipyretic, hypotensive, sedative,anti-tubercular, ophthalmopathy, cough, intestinal disorders, gonorrhoea, rheumatologic, diabetes, hydrocele, anaemia, fever & herpes.
141	Jadaa	Castor ;	*Ricinus communis L.*	Plant & oil.	Constipation, inflammations, fever, bronchitis, cough, skin diseases, colic, colitis, etc.
142	Bhalia; Bhallataka	Marking nut; Aruskara, Agnika	*Semecarpus anacardium L.f.*	Seeds	Digestive, carminative, purgative, liver tonic, expectorant, antiseptic, cardio-tonic, treat beriberi, sciatica, neuritis, leprosy, leucoderma, GIT/ urinogenital disorders, etc.
143	Chandan	Chandana; sandal wood	*Santalum album L. ;*	Heartwood ; Oil	Aromatic, cooling, deodorant, diuretic, disinfectant, antibacterial, antiviral, cough, antifungal, tonic, jaundice, cough, bronchitis, dysentery, leprosy, skin diseases, etc.
144	Bisiripi	Vaatyaalikaa (Country mallow),	*Sida cordifolia L.;*	Plant,	Cardiotonic, appetizer, conceptive, colic diuretic, antipyretic, treat debility, sciatica, rheumatism, spondylitis, gonorrhoea, etc.
145	Gajapipali	Gaja Pipali Ibhakanaa,	*Schindapsus officinalis (Roxb.)*	Dried	stimulant, expectorant, digestive, cough, carminative, sudorific, anthelmintic, tonic. Treat diarrhoea, bronchitis, etc.
146	Tunda podia	Tiksnaasya, (Forest Pepper)	*Toddalia asiatica (L.) Lam*	Root, leaf, flower, fruits.	Aromatic, digestive, constipating, expectorant, antibacterial, tonic & treat paralysis, malarial, colic, dyspepsia, diarrhoea, cough, nausea,

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					ulcers, wound, bronchitis, epilepsy, gonorrhoea, debility, etc.
147	Guluchi / Koilsutaa	Guduchi / Giloy (Climber)	*Tinospora cordifolia (Willd.) Miers*	Root, stem, leaves.	Antimicrobial, antipyretic,diuretic, gout,antiallergic, anti-inflammatory, analgesic, antistress, antioxidant, ophthalmic, antitumour, expectorant, anti-diabetic, hypotensive, etc.
148	Brhati / Dhengabheji	Raastrikaa, Simhi, Vaarttaaki	*Solanum violaceum*Orteg.	Root, leaf.,fruit, flower	Digestive, carminative, diuretic, Cardio tonic & treat dyspepsia, colic, cough, asthma, fever, bronchitis, skin diseases, trichopathy etc.
149	(Gokhura (Small or large) /Bada gokhura	Swaadukantaka,/ puncture vine	*Tribulus terrestris L./ Pedalium murex L.*	Fruits, whole plan	Diuretic, asthma, appetizer, digestive, cough, depurative, anthelmintic, tonic, expectorant, anodyne, anti-inflammatory, laxative, calculi, cardiotonic, stomatitis, anorexia, arthritis, etc.
151	Haridaa	Abhayaa, Pathyaa, (Haritaki)	*Terminalia chebula Retz.*	Fruits	Stomachic, laxative, diuretic, digestive, purgative, carminative, cardiotonic, antiseptic, tonic, epilepsy ophthalmic, GIT /renal/ urogenital disorders, cardiopathy, neuropathy, & general debility etc.
152	Bahada	Bibhitaki, Aksa; Bibhitaka	*Terminalia bellirica (Gaertn.) Roxb.*	Fruits, seeds, bark	Digestive, expectorant, ophthalmic, purgative, antifungal, anti-spasmodic, antibacterial, bronchitis, amoebicidal, Antiinflammatory,BP, & treats cough, asthma, insomnia, dyspepsia, skin diseases, etc.
153	Ashwagandha, Askanda	Vajigandhaa : Winter cherry	*Withaniasomnifera (L.) Dunal*	Root, leaves, seeds.	Stimulant, diuretic, tonic, hypotensive, respiratory stimulant, ulcers antibacterial, obesity,immuno-stimulatory, anti-inflammatory, analgesic, antipyretic, fever, antiarthritic, sedative, cardiotropic, cardioprotective, asthma, etc.
154	Dhaaiphula	Dhataki; DhaatupuspiTaam rapuspi,	*Woodfordiafruticosa (L.) Kurz*	Flowers	Uterine sedatives, constipation, urinary problem. Treat leprosy, skin diseases, diarrhoea, dysentery, wounds, diabetes, fracture, etc.

Source: CABI digital Library, Kavita et al, 2022,India Biodiversity Portal, USDA Plant database, World Flora online, e-Charak, India flora online, 110720221483458139_ Visual_ Guide_to_Wild_Medicinal_Plants_of_Orissa (1); Tropical plant database, Botanical survey of India, https://gandhamardan.coenpt.in/bindex.html, Hand Book on - Weed Identification. Pdf., Naidu et al, 2012[28],

Fig 8: Plants,leaves and barks of Gandhamardan Hills with ethnobotanical importance

Hubs of naturopathy: Traditional indigenous acquaintance is delimited to a specified locality or region.The present venture is to acquire and spread knowledge from local experts to populariseinformation on the efficient meditational values of forest resources.The uses of the plant species and their doses may need to be authenticated. Mostly ordinary people and the Aboriginals use these plants to treatprimary health care etc.

Lack of efficacy: However, the naturopaths decide the doses, methodology of injection or application of the decoction, extract, direct use or in powder form, or use with some additives as ingredients as per their experience but have yet to be scientifically confirmed. As in naturopathy, there is a delayed speed of action/ effectiveness. It is due to actionsneeding more evidence,ignorance of side effects due to supplements and detox diets, untrained practitioners, and lack of adequate quality control and specifications.

Primaeval Medical practices: With medicinal plants' plenty and luxuriant growth, about 100 traditional healthcare practitioners (Vaidya and Kaviraj) practice within and around the outskirts of the GMH, serving around 65 thousand tribal and economically backward people. These naturopaths are available in all settlements. Thereare two Ayurvedic colleges cum hospitals constructed on both the Harishankar flange in the Balangir district and the Narsinghnath side in Baragada District.

Abolition of Quackery: The exclusive versatile floral biodiversity of the therapeutic use of the meditational plants and their availability in various elevations are analysed and reported for the knowledge gain of the economically and socially backwards uneducated people. The authors request that people using the forest wealth consult with certified Ayurvedic/unani doctors who deal with naturopathic medicines.

Wise use of nature's wealth: These medicinal, quasi-medicinal, and economically vital plants are freely available to them at no cost. However, ayurvedic production units like Himalaya, Dabur, Zandu, and many ayurvedic pharmaceuticals have ethnobotanical plant collection centres situated in villages like Khandijharan, Magurmal, Manbhang, and Cherengajhanj for their growth employing local collectors. But these people are ignorant and are low-paid.

Proper Documentations: Indigenous informationabout the remedial flora and faunal species variable keeps a million-dollar value. Their priceless ethnobotanical importance and therapeutic applications by the aboriginals and local naturopathic importance need documents and provide vital information for where modern health care is inaccessible and scarcely available.

Societal values: Allopathy is based on modern medicine but is costly beyond poor people’s reach. Allopathy is in wide use and dominates the use of ethnobotany with the development of skills and expertise. The Unani medicines use has diminished due to taste, availability, and acceptance by ordinary peopleAbbasi et al., 2013[29].

Pros and Cons The ethnobotanyuses are ofminimum risk of adversative reaction, affordable, customisable, variety of treatment options, complement to allopathic medicine, etc., so have great societal values despiteproper clinical studies and research. All the traumas caused by the use of ethnobotanical medicines, though time-consuming, are not covered by insurance and have possible side effects. Very few local trainers like Vaidya'sof the pastare in practice and have stopped their Vaidya Sala, and ignorant Aboriginals are collecting the ingredients of the medicinal species.

Climate change in Gandhamardan Hills: The GMH in Odisha is encountering challenges of climate change accompanied by anthropogenic stresses. The erratic Indian summer monsoon and unusual behaviour of the Indian tropical climate zone (ITCZ) have invited frequent droughts that deplete the GBM vegetation. The anthropogenic stresses are unplanned mining, poaching of elephants, illegal chopping of trees for construction, forest fire, and faulty harvesting of Unani vegetation, which have transformed the deep forests into sparse ones,Applequist et al., (2022)[30]

Medicineplant protection:

Local communities and the Aboriginals who know the value of these plants can be managed from theirover-exploitation and conserve them for future generations. The conservation process involves Identification, protection, and sustainable cultivation for better yield. Some protected zones, herbal gardens, or ethnobotanicalhubs must be created, and vulnerable medicinal species may be cultivated for future use,Mulhauser et al., (2024)[37].

Management and recording of medicinal plants: Medicinal plant species parallel to Homosapien's development in almost all cultures. The great Charak, and Sushrut, are well-known as the men with medicine and surgery from history. The reporting is available from ancient times, but new medical inventions need big data setsto maintainidentification recordsof the scientific name, including genus, species, subspecies, variety, author, family, etc,for each ethnobotanical species, with local and commonname. The details of extinct plant species or vulnerable must be recordedKunwar et al., (2014)[32]Ameca et al, 2024 [33].

Sustainable development Goals: Ethnobotany contributes towards Sustainable Development Goals (SDGs) to address global challenges by emphasising the Indigenous people/Local Communities (IPLC) knowledge throughno poverty (SDG 1), zero hunger (SDG 2.5), good health and well-being (SDG 3).Improvingthe food system and promoting cooperation to protect our planet,Kumar et al, (2021[34]). The other SDGs covered to take care of the traditional ethnobotanical knowledge covers (TEK) are Responsible consumption and production (SDG 12), Climate Action (SDG 13), and Life on land (SDG 15).Pei et al, (2020)[35], Sharma et al, (2022)[36],

Conclusion:

Ethnobotanical species are reducing gradually due to anthropogenic activitiesand forestry exploitation in the GMH. The present study reveals that the geological housing of the GMH ispredisposed by the activities of the Tropic of Cancer, the Intertropical Convergence Zone ITCZ, is giving a good amount of rainfall.

Quantitative ethnobotany of medicinal plants used by indigenous communities of Gandhamardan Mountain Chains. It is our responsibility, connectively, for NGOs and the

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government to inherit the TEK from tribal communities and various residential settlements, Vaidya's, and Ayurvedic practices and have recourse over it. Noviceplants' insight must be brought to the limelight and preserved officially with proper recording for future generations. The conservation of medicinal plants in GMH can complement many SDGslike SDGs1 to 3 and 12, 13, and 15.

Declaration:*All plants and medicinal approaches are collected from various sources for ordinary people's knowledge perspective.Any suggestions for correction may be made to the author within one month. Request to use any ethnobotanical medicines may only be made after consultation with an authorised Ayurvedic doctor.*

Disclaimer *(Artificial intelligence)*

Author(s) hereby declares that NO generative AI technologies such as Large Language Models like (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of manuscripts.

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