CONSEQUENCES OF ANTHROPOGENIC PRESSURE ON FORESTS OF UTTARAKHAND

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Abstract

Woodlands are among the main common assets in Uttarakhand as they possess 71% of the geographic zone and contribute a decent offer in state economy. They are rich stores of biodiversity and are suppliers of environment merchandise and enterprises to both local and worldwide network. Individuals are subject to woodlands for fuel wood, grass and other biomass. Be that as it may, lamentably ongoing pattern of information shows a gigantic debasement of forestland because of regular and anthropogenic exercises. Varieties in climatic condition and catastrophic events are setting off pace of debasement of woods in Uttarakhand. The current paper audits the status of timberland in Uttarakhand and talks about the significant normal and anthropogenic components liable for its corruption.

Keywords: Biodiversity, Climate Change, Forest fire, Forestland, Global warming, Uttarakhand.

INTRODUCTION

Geographical Location of Study Area

Uttarakhand is the 27th territory of Republic of India which lies between 280 44' and 310 28' N Latitude and 770 35' and 810 01' E longitude. It was cut out of Uttar Pradesh on ninth November 2000 and was separated into two divisions of Garhwal and Kumaon with absolute of 13 areas to be specific Pithoragarh, Bageshwar, Champawat, Nainital, Pithoragarh, Udham Singh Nagar, Dehradun, Haridwar, Tehri Garhwal, Uttarkashi, Chamoli, Pauri Garhwal, Rudraprayag. It has an absolute geological region of 53,483 km2, of which huge zone is bumpy with under snow cover and steep slants. It imparts a global limit to Nepal in the East and China in the North. In the West, it contacts state Himachal Pradesh, and in the South, Uttar Pradesh. The human populace of the state is 101.167 lakhs (2011census) out of which

around 70% lives in provincial zones. There are four significant stream frameworks viz. Ganga, Yamuna, Ramganga and Sharda starting from the state alongside their feeders filling in as the prime wellspring of water for drinking, water system and hydropower. A short insights of Uttarakhand state is referenced in Table 1.

Classification of Study Area

The critical wealth of the state is its rich biodiversity boondocks. Taking into account height assorted air zones are assigned warm quiet (900 m-1800 m), cool mellow (1800 m-2400 m), cold zones (2400 m-3000 m), high zone (3000 m-4000 m), ice sheet zone (4000 m-4800 m), and frozen zone (more than 4800 m). The ordinary yearly precipitation is around 1550 mm. Taking into account land rise, the State is an assigned area region (under 300 m above msl), lower lopsided region (300-600 m), upper inclining territory (600-2400 m) high stature locale (2400-4500 m) and upper high height region (more than 4500 m). Udham Singh Nagar and Haridwar are the lone plain areas in the State. The state incorporates five lithotectonically and physiographically undeniable districts explicitly, the Outer Himalaya (containing the Tarai and Bhabhar), Sub-Himalayan belt of the Siwalik, the Lesser Himalaya, the Greater Himalaya and the Trans-Himalaya or Tethys. Human home is found up to a height of 3500 m above msl; regardless, the zone between 1200 - 2000 m, generally falling in the Lesser Himalaya (1500 - 2500 m above msl), is thickly populated.

Table 1: Uttarakhand forest statistics.

1.	Geographical area of Uttarakhand	53, 483 Sq.Km.
2.	Total Forest area under various classes	37999.60 Sq.Km.
3.	Per Capita Forest Area	0.376 Hectare
4.	Total Forest area as percentage of geographical area	71.05%

5.	Forest area under Forest Department	25,863.18 Sq.Km.
6.	Forest Cover	24,508 Sq.Km.
7.	National Parks(No./Sq.Km)	6/ 5,001.82
8.	Wildlife Sanctuaries (No./Sq.Km)	7/ 2,683.79
9.	Conservation Reserves (No./Ha.)	4/ 21244.56
10.	Total Reserve Forest	26,547.00 Sq.Km.
11.	Total (Protected Forests)	154.02 Sq.Km.
12.	Total (Civil & Soyam Forests)	9,730.555 Sq.Km.
13.	Private Forests (Municipal and Cantonment *etc*.)	123.506 Sq.Km.

Climate and Soil of Uttarakhand

In the bumpy locales of Uttarakhand the atmosphere is chilly, damp and mild sort yet it differs with the elevation. The valleys are sweltering in summer and a lot colder in winter. So by and large Uttarakhand has a mild atmosphere besides in the plain regions where the atmosphere is tropical. The state has various sorts of soil going from low to medium rich in status. The significant soil bunches in the state are earthy colored slope soil, mountain glade soil, sub-mountain soils, and red loamy soils. A large portion of the dirts in the high height locale are acidic in nature. The Tarai soils are generally rich, clayey topsoils, blended in with humus thought about best for the development of rice and sugarcane.

UTTARAKHAND FOREST

The state positions 6th among different states as far as level of recorded backwoods zone. The complete woodland territory under different classes of the State is 37,999.53 km2, which is 71% of the geographic region. The backwoods region under woodland office is 25,863.18 km2. As per woodland study of India (FSI-2015), thick timberland is 4,785 km2, tolerably thick backwoods is 14,111 km2, open timberland is 5,612 km2 and Scrub is 262 km2. About 19% zone of the State is under lasting snow cover, ice sheets and steep slants and hence it is unacceptable for trees development. The backwoods branch of Uttarakhand has 13 circles, 44 divisions, 284 territories and 1569 beat. The human and domesticated animals populace is generally reliant on woods because of agrarian-economy prompting substantial tension on backwoods and ensuing corruption of nature and climate of the region. In spite of the fact that the State of Uttarakhand is exceptional with organic assets, the most recent couple of many years have seen a press the state's backwoods environments concerning for example the Shiwalik scope of Uttarakhand has been essentially corrupted of its woods cover and forested scene has been pushed to the upper districts. In the most populated belt (1000-2000 m asl) of Uttarakhand state, Oak (Quercus spp.) and Pine (Pinus roxburghii) woodlands structure the predominant backwoods vegetation which cover about 12.3% and 16.4%, separately of the all out topographical region of the state (Singh and Singh, 1992).

TYPES OF FORESTS IN UTTARAKHAND

The various kinds of woods found in Uttarakhand (Fig. 1) as grouped by Champion and Seth, 1968 are:

Soggy Alpine Scrub: It happens at timberline around an elevation of 3500 m and the predominant species saw here are *Betula utilis* and *Rhododendron campanulatum*

Sub Alpine Forest: It exists at an elevation of 2900 m to 3500 m above ocean level and are described by patches of Abies-Betula timberland mixed with meadow called as Bugyals.

Himalayan Dry Temperate Forest: This kind of backwoods is found in the internal dry trans-Himalayan valleys of the state. Significant species happening here are *Cedrus deodara*, an exceptionally esteemed endemic animal groups, fills primarily in the western piece of the

reach. Different species that happen somewhere in the range of 1,900 and 2,700 m are blue pine (*Pinus wallichiana), Juniperus spp*.

Himalayan Moist Temperate Forest: This kind of woods happens between 1600-2900m heights and is mostly portrayed by coniferous species, for example, *Picea smithiana, Abies pindrow, Cedrus deodara, Betula spp. also, Quercus spp*.

Sub Tropical Pine Forest: This sort of woods is found in the lower district of Himalayas with pines as the predominant species.

Tropical Dry Deciduous Forests: This sort of woodland happens in the dry southern face of Shiwaliks and connecting plain's region. It is open and blended sort timberland with the significant species as *shorea robusta, Terminalia tomentosa, Anogeissus latifolia,etc*.

Littoral and Swamp Forest: This sort of backwoods happens in the valleys of the lower regions, described by the presence of water cherishing species, for example, *Ficus glomerata, Syzygium cumini, Pterospermum acerifolium and Diospyros embryopteris*

Tropical Moist Deciduous Forests: This multi-story type backwoods is found in the soggy locales of the lower Himalayas and tarai territory. The prevailing vegetation of these backwoods is *Terminalia tomentosa, Adina cordifolia, Anogeissus latifolia and Shorea robusta*
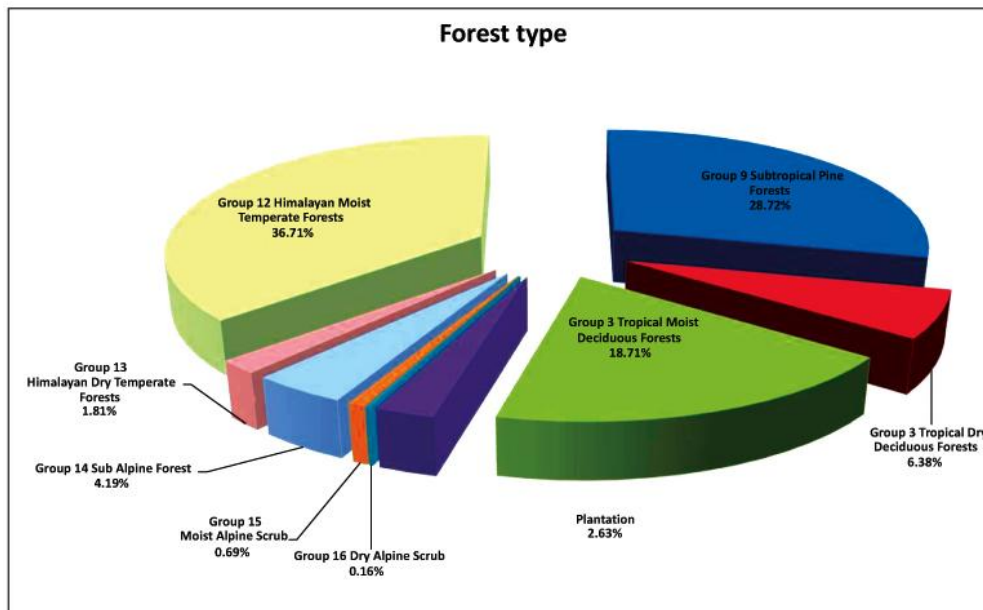
Fig. (1) Different types of forest in Uttarakhand (Champion and Seth, 1968).

4. FOREST BIODIVERSITY

Woodlands are the significant characteristic asset of Uttarakhand which upholds endurance of the individuals in the mountains as food, fuel, grub, and haven. Other than holding many types of therapeutic and food plants, the woodlands of Uttarakhand are additionally home of numerous endemic and jeopardized fauna and verdure. A portion of the endemic verdure of Uttarakhand woodland are *Garuga pinnata, Madhuca longifolia, Aristolochia indica, Bacopa monnieri,Ceropegia bulbosa, Gloriosa superba, Rauvolfia serpentina* and so on Uttarakhand state is honored with assortment of vegetation going from tropical deciduous to high vegetation. In the lower area upto 800 m, damp tropical and dry deciduous woodland of sal, teak or blended backwoods of *Acacia, Aegle, Haldina, Syzygium and Terminalia species* are found. The predominant trees in the district are *Acacia catechu, Albizia lebbeck, Butea monosperma, Aegle marmelos, Dalbergia sissoo, Diospyros melanoxylon, Ficus auriculata, Ficus religiosa, Syzygium cumini, Shorea robuta, Terminalia alata, Cassia fistula, Ficus benghalensis,* and so forth The predominant bushes found at this height are *Zanthoxylum armatum, Berberis lycium, Berberis asiatica, Rubus ellipticus, Grewia hirsuta, Ziziphus mauritiana, Lantana camara,* and so on The most well-known spices at this height are

Argemone mexicana, Eclipta alba, Saccharum spontaneum, Cassia tora, Desmostachya bipinnata, Ocimum basilicum, Tribulus terrestris, Alternanthera sessilis, and so forth

With an elevation of 1000-3000 m blended backwoods of *Abies pindrow, Picea smithiana, Myrica esculenta, Acer caesium, Lyonia ovalifolia, Betula alnoides, Quercus leucotrichophora and Rhododendron arboretum, Quercus semecarpifolia, Aesculus indica, Taxus wallichiana, Picea smithiana, Cedrus deodara, Pinus roxburghii,*etc. The most well-known spices at this elevation are *Morina longifolia, Paris polyphylla, Anemone obtusiloba, Giganteum spp*, and so on The prevailing bushes found at this height are *Inula cuspidata, Mahonia nepalensis, Viburnum cotinifolium, Girardinia heterophylla,* and so forth (Kumar and Rawat, 2011).

The significant creatures of Uttarakhand backwoods are tiger, deer, monkey, kites, elephants, panther, mountain bear, earthy colored bear, sloth bear, musk dear, stag, sambhar, yapping deer, bharal, thar, goral, crocodile, ghariyal, blue bull, serow, wild pig, vulture and cheel.

FOREST DEGRADATION

Uttarakhand woods are exposed to various burdens like over extraction, live-stock brushing, backwoods fires, environmental change, characteristic disasters, infringement and unlawful felling. Out of 13 areas, greatest timberland cover lost was found in Uttarkashi (73sqkm) trailed by Nainital (70sqkm), Udham Singh Nagar (40sqkm), Haridwar (27sqkm) and Bagheshwar (22sqkm). The primary explanations behind diminishing in woodland cover referenced in the report were rotational felling and redirection of backwoods land for improvement exercises. An examination by Prabhakar et al. (2006) assessed that 78% of the backwoods (counting clean) region was debased and had a crown front of under 40% in Almora region of Uttarakhand by various formative exercises. Unsettling influences in the woods structure builds the pace of species misfortune and make more open doors for presentation of obtrusive species, for example, *Eupatorium, Lantana camara, Parthenium, and Ageratum spp.* in the characteristic woodlands, which will competitively affect existing species. In the *Pithoragarh locale* a net deforestation pace of - 0.13 and a gross deforestation pace of 0.52% was assessed in the middle of 1976 to 2006 (Munsi et al. 2009). Additionally in the Kuchgad miniature watershed of Almora area, a net deforestation pace of 0.48 was

seen from 1967 to 1997 (Wakeel et al. 2005). These creators recommend that with expanding human exercises, the deforestation rate has expanded over the considered a very long time in Uttarakhand. Significant foundations for corruption of backwoods in Uttarakhand are examined beneath.

Climate Change

The central point that controls the environment of an area is atmosphere (Faisal, 2008). Slight change in atmosphere can altogether adjust the development, bounty, endurance, arrangement, efficiency, variety and conveyance of species in an environment (Leemans and Eickhout, 2004). Backwoods biological systems are perhaps the most weak environments to any adjustment in the atmosphere (IPCC, 2001). A sign of environmental change is the sudden variance in the meteorological information. Fig. 2 shows 4-year record of month to month found the middle value of surface temperature perceptions. Essentially, month to month arrived at the midpoint of surface temperatures got from the NCEP reanalysis have been analyzed throughout a similar time span for the Garhwal area (30°22"N 78°78" E). Extensive variety of temperatures from year to year has been seen in both informational indexes. Patterns in yearly mean temperature inconsistencies indicated an expansion in surface temperature in this district of Garhwal locale during recent years. In view of mean month to month and yearly surface air temperature records at the Chauras grounds, HNB Garhwal University, steady warming of the request for 0.2 °C ($\pm$ 0.022) every year has been seen according to NCEP reanalysis information. In any case, Annual surface temperature at Chauras grounds, HNB Garhwal University has been noticed 1.58 $\pm$ 1.22 °C arrived at the midpoint of during 2010 and - 0.08 $\pm$ 0.47 °C found the middle value. Also, in an investigation of 100 years of temperature and precipitation information and saw that the Uttarakhand area has recorded a declining precipitation pattern during the 1911-1970 period and after 1970 forward, this pattern has gotten more extreme. Moreover, temperature pattern of the district shows an expansion in warming with year which was more conspicuous during the most recent decade (Fig. 3).

Because of expansion in temperatures, quick deforestation, environment pulverization, change in vegetation, shortage of water and passageway fracture may lead termination of wild verdure (Negi et al. 2012). The unexpected changes in climatic states of Uttarakhand are

straightforwardly or in a roundabout way influencing the vegetation development and recovery of significant backwoods species. The recovery of numerous species is subject to the storm precipitation predominantly the prevailing Sal, Banj Oak and Telonj oak in the timberlands. The variety in precipitation and temperature may prompt changes in phenological occasions, for example, blossoming, fruiting, maturing, shading and so forth of numerous species, especially the prevailing oaks. In the Himalayan mountains early blooming of a few individuals from *Rosaceae (e.g., Pyrus, Prunus spp.) and Rhododendrons* are viewed as the effect of an Earth-wide temperature boost (Khanduri et al. 2008; Negi et al., 2012). Early bud break in *Betula utilis* has been recorded in 2010 when contrasted with before years (Rai et al., 2010). One of the significant outcome of Global warming is the moving of vegetation from lower height to higher rise and thusly elevated environments are more are truly vulnerable to the antagonistic impacts of environmental change. The species making due at this district will have no space for their upward development. (Kumar et al. 2012). Upset and divided woodlands and monoculture backwoods are viewed as more helpless against environmental change (Rosenzweig 1995; Jandl et al. 2007).
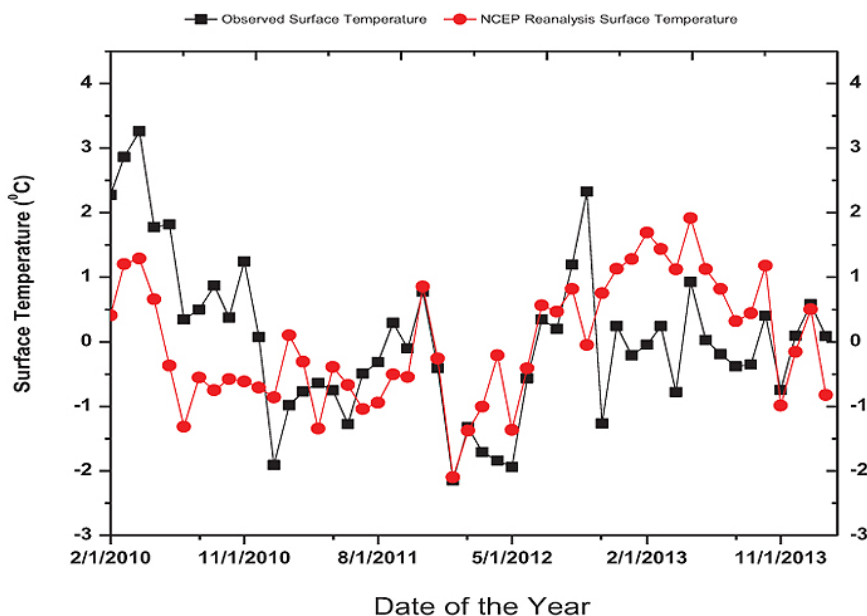

Fig. (2) A 4-years record of monthly averaged surface temperature observations (Hourly) at Srinagar Uttarakhand.
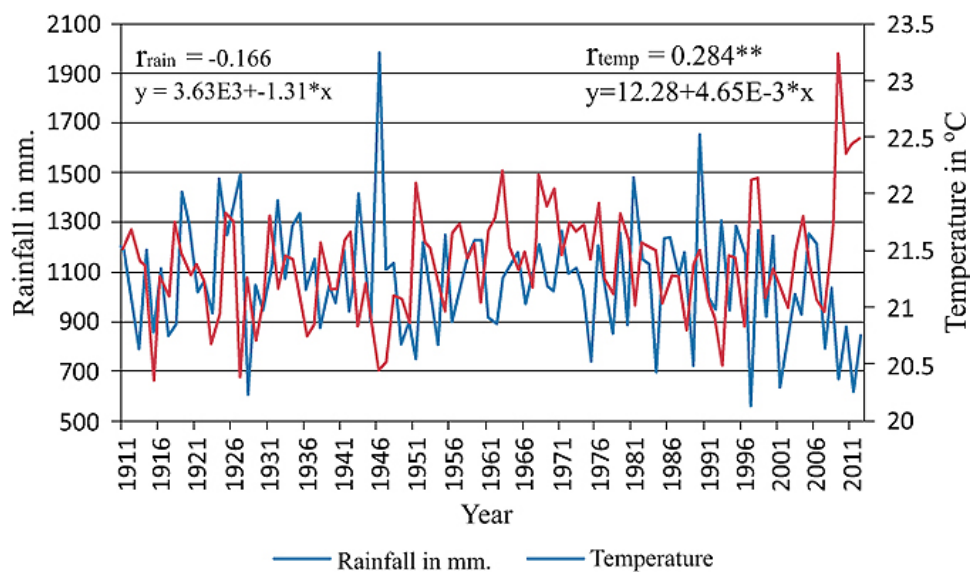
Fig. (3) Pattern of temperature and rainfall in Uttarakhand

Forest Fires

Timberland fires in the Uttarakhand state has been a typical wonder which is expanding all the more oftentimes in the decade because of rising temperatures. Woods fires by and large happen in two stages; late March and early April when the amassing of new litter can consume, and May-June, when high temperatures, low mugginess, extraordinary dryness gets ideal. Uttarakhand woodlands are comprised of numerous types of trees; including chir pine, blue pine, boycott oak, sal, sissoo, eucalyptus, and so on The most fire inclined zone is the banj oak at the higher heights and the chir pine zone, which possesses 17% of the all out timberland region, and its progress zone with sal (11% of the complete woods zone) at the lower elevation, a zone with the greatest home. Controlled backwoods fires help in eliminating and dried litter and permit new development to come up. In any case, uncontrolled backwoods fires, particularly summer fires, cause serious harm to the woods biodiversity. Low precipitation during summer season diminishes dampness level in the timberland making it more defenseless to burst into flames and spread rapidly over enormous region of the woodland land. It has been seen that woods fires happen basically because of helping however in the event of Uttarakhand events because of helping is less when contrasted with anthropogenic event. All flames in the chir pine woodlands of Uttarakhand are man-made purposeful or unintentional. Of the absolute timberland fires rates in

Uttarakhand, 63% were deliberate and staying 37% were inadvertent (Tiwari et al., 1986, 1987). Table 3 is clarifying that an enormous portion of territory is influenced each year because of backwoods fires and correspondingly a decent measure of financial misfortune is seen in Uttarakhand. Some different impacts of woods fires are change in species creation, loss of miniature greenery, loss of seeds, loss of environment of specific species, change in microclimate, relocation of species, soil drying up, soil disintegration bringing about avalanches and attack by extraordinary species.

Table 3 loss due to forest fire in Uttarakhand.

Year	Area Affected (Ha.)	Estimated Loss (INR lakhs)
1999-2000	925.00	2.99
2000-2001	1393.00	1.17
2001-2002	3231.00	5.19
2002-2003	4983.00	10.12
2003-2004	4850.00	13.14
2004-2005	3652.00	10.82
2005-2006	562.44	1.62
2006-2007	1595.35	3.67
2007-2008	2369.00	2.68
2008-2009	4115.00	4.79
2009-2010	1610.82	0.05
2010-2011	231.75	0.30
2011-2012	2826.30	3.03

Encroachment on Forest Areas and Illicit Felling

Expanding populace prompting neediness is the main consideration for animating forestland infringement. In Uttarakhand state huge populace is beneath destitution level and the majority of them infringe timberlands for haven, food and a scope of means items like fuel wood, food, feed, lumber and so forth Timberland infringement brings about woodland debasement which further outcomes in land corruption and prompts agrarian stagnation and even a bringing down of efficiency, which thusly advances further infringement and finishes the endless loop. In the, Kumaun divison contribute 8318.3 Ha. furthermore, Garhwal divison 1323.2 Ha. While the commitment from ensured regions incorporates Rajaji National Park 2.988 Ha, Corbett Tiger save 1.980Ha and Nanda Devi Biosphere Reserve 0.117 Ha. To control infringement powerful legitimate limitations ought to be constrained in the state.

Unlawful felling is one of the significant foundations for backwoods corruption in Uttarakhand. Numerous procedures are actualized by government against unlawful felling yet there is an enormous volume of illegal felling directed in the backwoods.

OBJECTIVES OF THE STUDY

1. Restoration priority map for the state of Uttarakhand.

2. Understanding of stakeholder perceptions on degradation and drivers.

CONCLUSION

Individuals in Uttarakhand may have their personal stake of getting momentary advantages from backwoods, though the drawn out repercussions are not known to them. Both common and anthropogenic variables are assuming critical parts in corruption of woods. Environmental change has additionally begun demonstrating its more regrettable effect on timberland of the state. It is critical to save woods in Uttarakhand as they are significant hotspot for food, cover and furthermore a modern instrument to battle the an Earth-wide temperature boost. Uttarakhand is quite possibly the most weak locales to environmental change. Sloping districts are in danger to environmental change and nearby meteorological conditions indicated "better than expected warming" in the twentieth century. The effect evaluation of abnormalities in the downpour fall example will diminish hereditary variety of species and furthermore will influence water assets.

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