**GRAPHS**

**ANNUAL LOSS OF FOREST COVER AND TREE COVER(2001-2018)**

***CONCLUSIONS:***

1. Annual Loss of forest Cover in India have shown a non-linear trend, where there is a great loss of about 9000 he forest area in 2003-2004 and loss of about 10000 he in 2015-2016
2. Primary Forest Cover Loss(2002-2018): 310,624
3. Tree Cover Loss: 1,625,397

Heat Map shows the entire statistics of annual loss

Darker regions shows a drastic loss whereas regions with light colors shows comparatively less loss

It is clear that there is a great loss of forest cover as well as Tree Cover between 2015 to 2017

The other graph clearly shows a non-linear trend in both forest cover and tree cover loss.

**FOREST COVER AREA OF INDIA:**

Classifications of Geographical Area as Forest and Non-Forest:

1. Very Dense Forest
2. Moderately Dense Forest
3. Open Forest
4. Total Forest Cover
5. Scrub
6. Non-Forest

The bar chart shown has clearly classified the geographical area, where the area of total Forest cover is 712249 sq. km in 2019.

This will help us in understanding the increase and decrease in forest cover.

**CARBON EMISSIONS:**

From the year 2008 to 2014, Carbon emission rate was found to be increasing. Data was found to be consistent for the later years followed by a slight increase in the year 2017-18.

**AGRICULTURAL TRENDS:**

**RAINFALL TRENDS**

**IMPACTS OF DEFORESTATION**

1. **CO2 EMISSIONS**

Trees remove some of this carbon dioxide from the air through photosynthesis and store that carbon in their tissues and in the soil. Deforestation reduces the removal component of this cycle, further increasing the carbon dioxide in the air. This results in an increase in temperature, an effect known as global warming.

1. **LOSS OF HABITAT**

One of the most dangerous and unsettling effects of deforestation is the loss of animal and plant species due to their loss of habitat. [70% of land animals and plant species](http://environment.nationalgeographic.com/environment/global-warming/deforestation-overview) live in forests. Not only does deforestation threaten species known to us, but also those unknown.

(Wildlife Extinction)

1. **AFFECTING THE WATER CYCLE**

The trees also help control the level of water in the atmosphere by helping to [regulate the water cycle](https://e360.yale.edu/features/how-deforestation-affecting-global-water-cycles-climate-change). In deforested areas, there is less water in the air to be returned to the soil. This then causes dryer soil and the inability to grow crops.

1. **LOSS OF HABITAT**

In addition to the loss of habitat, the lack of trees also allows a greater amount of greenhouse gases to be released into the atmosphere. Healthy forests [absorb carbon dioxide](http://environment.nationalgeographic.com/environment/global-warming/deforestation-overview) from the atmosphere, acting as valuable carbon sinks. Deforested areas lose that ability and release more carbon.

1. **SOIL EROSION AND FLOODING**

Further effects of deforestation include [soil erosion](https://www.worldwildlife.org/threats/deforestation-and-forest-degradation) and coastal flooding. Trees help the land to retain water and topsoil, which provides the rich nutrients to sustain additional forest life. Without forests, the soil erodes and washes away, causing farmers to move on and perpetuate the cycle. The barren land which is left behind in the wake of these unsustainable agricultural practices is then more susceptible to [flooding,](https://www.greenpeace.org/international/press-release/20301/activists-expose-illegal-deforestation-linked-to-flooding-in-argentina/) specifically in coastal regions.

1. **DESTRUCTION OF HOMELANDS**

As large amounts of forests are cleared away, allowing exposed earth to whither and die and the habitats of innumerable species to be destroyed, the [indigenous](https://www.pachamama.org/advocacy/indigenous-resilience) communities who live there and depend on the forest to sustain their way of life are also under threat.

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# **STAKEHOLDERS OF FOREST RESOURCES**

* People who live around the forest areas and depend upon the forest resources for sustenance.
* The Government Forest Department, which owns the forest land
* The industrialists who use forest products for various industrial purposes.
* The enthusiasts for the conservation of wildlife and nature.

# **DATASETS**

1. 2017 FOREST COVER AREA STATE WISE(area In sq. km)

* With the help of this dataset, we can find out total area covered by forests in each state
* Also, total area covered by different kinds of forests(Moderately Dense, Very Dense and Open forests)
* So, MDF > OF > VDF
* Total area covered by forests in India is 7,08,273 in 2017

1. 2019 FOREST COVER AREA STATE WISE(area In sq. km)

* With the help of this dataset, we can find out total area covered by forests in each state in values as well as percentage
* %age change in forest cover w.r.t. ISFR 2017 which tells that there is a decrease in forest cover in North-eastern states of India like Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim
* MDF > OF > VDF
* Total area covered by forests in India is 7,12,249 in 2019

1. ANNUAL LOSS OF PRIMARY FOREST COVER AND TREE COVER(2001-2018)
2. Total Forest Cover in 2013 is 6,92,027
3. **Total Forest Cover in years 2013 and 2019 (STATE WISE):**

* We find that although the total forest cover increases from 6,97,898(in 2013) to 7,12,249(in 2019), but there is a decrease in Moderately Dense Forest

1. **Total Forest Cover from 2001 to 2015 (STATE WISE AS WELL AS GENERAL):**

* Again, the same conclusion, the total forest cover increases but area covering moderately dense forest decrease

# **CAUSES OF DEFORESTATION**

## **STUDY-1**

<https://india.mongabay.com/2019/05/indian-forests-resilient-to-climate-change/>

1. **CLIMATE CHANGE AND RAINFALL**

* The majority of Indian forests are exceptionally resilient to large variations in rainfall and short droughts caused by climate change.
* According to IIT Kharagpur study, forests have been surprisingly resilient to changing rainfall patterns
* CLAIM: ‘precipitation threshold’: forest cover would remain resilient at rainfall levels over 1400 mm per year
* Previous studies show 80% of forest is vulnerable/sensitive to climate change in UTTARAKHAND. It is therefore important to investigate options for improving adaptive capacity of these forests, while evaluating the causes and remedial measures for reducing their sensitivity
* forests in the drier landscapes may experience alterations due to climate change.
* [The scientists reported](https://www.researchgate.net/publication/332234936_Can_the_forest_cover_in_India_withstand_large_climate_alterations) in the journal *Biodiversity and Conservation* that only 0.02% of the total forest cover in India – in the dry regions of the Trans-Himalayas – was estimated to be “least resilient”. Forests in wetter areas such as the Western Ghats, Western Himalayas, Eastern Ghats and Northeast India are predicted to be “highly resilient”. So, the “majority of forest covers in India are extremely resilient” to large precipitation changes in addition to the shorter drought periods.
* Their 2011 study concluded that vulnerable forests were concentrated in the upper Himalayas, parts of central India, and northern portions of the Western and Eastern Ghats in India. In contrast, forests in northeast India, southern Western Ghats and eastern India were estimated to be least vulnerable.

1. **NON-CLIMATIC STRESSORS CAUSE GREATER FOREST COVER LOSS**

* The reports, based on a mix of satellite data, ground observations and historical maps, found that [the Eastern Ghats have lost 15.83% of its forest area](https://www.sciencedirect.com/science/article/pii/S1470160X17306362) over a span of almost 100 years; [tropical montane forests continue to disappear](https://www.sciencedirect.com/science/article/pii/S0143622817305982) in the Sikkim Himalayas, particularly at lower altitudes; and there is noticeable [decline in quality across all forest types in India](https://www.sciencedirect.com/science/article/pii/S1470160X17307446).
* the example of north east India, where the climate is favourable for forests but the wide practice of shifting cultivation has caused forest loss.

**CONCLUSION**

On studying only 2 factors that is, climate change(rainfall) and anthropogenic activities, it is quite clear that anthropogenic activities are a greater cause of change in forest cover and deforestation because majority of Indian forests are exceptionally resilient to large variations in rainfall or climate, except the dry forests which are more vulnerable.

So, the role of human activities has a dominant impact on forests which should be taken under consideration and a few balanced methods should be introduced by the government in order to protect the forest as well as people’s needs.

Awareness through community participation by Government policies and programs and NGOs could play a significant role in conservation of forest. Alternative energy sources like use of renewable energy sources i.e. hydroelectricity as substitute for firewood in cooking and heating purposes can reduce pressure on forest resources. Government assistance in the form of financial, fodder, medication etc. to the Brokpa (semi-nomadic people) community may reduce the conversion of forest land into grazing land. Awareness on Family planning in the rural areas.

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## **STUDY -2**

<http://www.fao.org/3/am253e/am253e.pdf>

**EFFECTS OF DEMOGRAPHIC CHANGES ON FORESTS:**

* Forests and land use. Population pressure is often cited as a primary reason for land use changes, forest encroachment and conversion to crop lands and built up areas. However, there is no “linear relationship” that shows that an increase in population puts more pressure on land and forests, as argued by different studies. This increase in pressure depends on the stage of development of the country, which is influenced by their dependency on land (agricultural population), extent of urbanization and level of income.
* The pressure on land and forests has increased in developing countries with the growing population and rapid urbanization.
* The demographic changes have less impact on land and forests in Developed countries since these are in final stages of urbanization; the population is stabilizing and has less land dependency.
* The needs also increase and utilize forest resources. To meet the demands of a rapidly growing population, agricultural lands and settlements are created permanently by clearing forests.

# **IMPORTANT AGENTS LEADING TO DEFORESTATION, DEGRADATION AND FRAGMENTATION**

* **slash-and-burn farmers** - clear forest to grow subsistence and cash crops
* **commercial farmers** - clear the forest to plant commercial cash crops, sometimes displace slash and-burn farmers who then move to the forest
* **cattle ranchers** - clear the forest to plant pasture, sometimes displace slash-and-burn farmers who then move to the forest
* **Livestock herders** - intensification of herding activities can lead to deforestation
* **Loggers** - remove commercial timber, logging roads provide access to other land users
* **commercial tree planters** - clear mostly forest fallow or previously logged forests to establish plantations to supply fibre to the pulp and paper industry
* **firewood collectors** - intensification of firewood collection can lead to deforestation
* **mining and petroleum industrialists** - roads and seismic lines provide access to other land users, localized deforestation related to their operations
* **land settlement planners** - relocation of people into forested areas as well as settlement projects displacing local people who then move to the forest
* **infrastructure developers** - new access for other land users from road and highway construction through forested areas, flooding by hydroelectric dams

# **DRIVERS OF DEFORESTATION**

Deforestation drivers can be divided into so-called “immediate” and “underpinning” drivers. The underpinning drivers are :

* ***Demographic factors***: population growth and density, urbanization and migration
* ***Economic factors***: changes in relative prices, economic structures, shifts in demand for commodities, infrastructure development
* ***Technological factors***: technological progress to increase agricultural production
* ***Policy and institutional factors***: macro-economic policies, tenure rights, corruption, access to loans, education
* ***Cultural factors***: public and individual attitudes and values, lack of concern about forests, rent-seeking, frontier mentality

# **CAUSES OF DEFORESTATION**

#### **1. Agriculture:**

Conversion of forests to agricultural land to feed growing needs of people. There are an estimated 300 million people living as shifting cultivators who practice slash and burn agriculture and are supposed to clear more than 5 lakh ha of forests for shifting cultivation annually. In India, we have this practice in the North-east and to some extent in Andhra Pradesh, Bihar and M.P. which contribute to nearly half of the forest clearing annually.

#### **2. Commercial logging:**

Logging, or cutting down trees in a forest to harvest timber for wood, products or fuel, is a primary driver of deforestation. Logging affects the environment in several ways. Since trucks and large equipment need to get into the forest in order to access trees and transport timber, loggers must clear large areas for roadways. Selective Logging -- where only the most valuable trees are felled -- doesn't help matters, as one falling tree can bring down dozens of surrounding trees and thin the forest's protective canopy

**3. Mining:**

Mining also results in deforestation. Digging a coal, diamond or gold mine requires the removal of all forest cover, not just for the mines but also for trucks and equipment.

#### **4. Increase in population:**

The needs also increase and utilize forest resources. To meet the demands of a rapidly growing population, agricultural lands and settlements are created permanently by clearing forests.

#### **5. Urbanization and industrialization:**

Since Industrialization and Urbanization needs land to grow, a major amount of forest lands are cut in order to promote Industrialization and Urbanization. This creates harmful effects on the environment and forest ecological balance.

#### **6. Construction of dam reservoirs:**

For building big dams, large scale devastation of forests takes place which breaks the natural ecological balance of the region. Floods, droughts and landslides become more prevalent in such areas.

**7. Forest fires:**

They may be natural or manmade, and cause huge forest loss.

#### **8. Overgrazing:**

Overgrazing occurs when plants are exposed to intensive grazing for extended periods of time, or without sufficient recovery periods.Overgrazing reduces the usefulness, productivity, and biodiversity of the land and is one cause of desertification and erosion. Overgrazing is also seen as a cause of the spread of invasive species of non-native plants and of weeds.