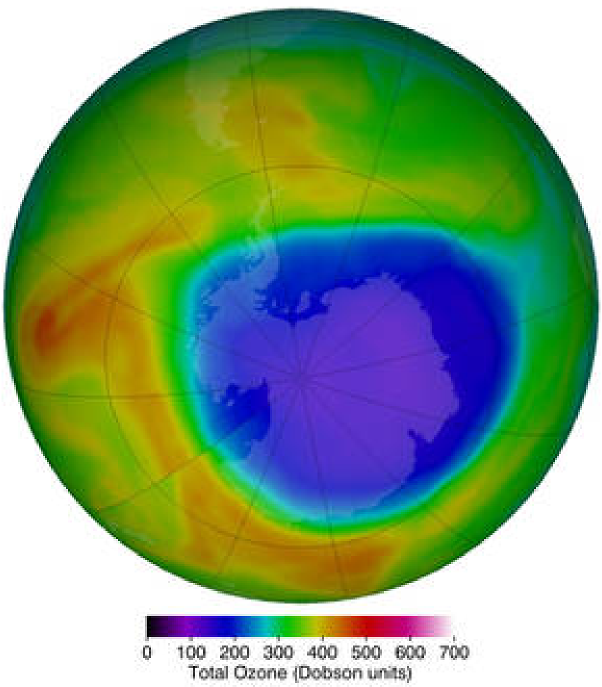
OZONE AND FORESTS

Our unmanned friend, satellites have given scientists the ability to overcome this problem. The Nimbus satellites were a series of seven Earth-observation satellites launched by NASA over a 14-year time period, one of which did not achieve orbit. In total, the satellites provided Earth observations for 30 years and collectively carried a total of 33 instruments, including ozone mappers, the Coastal Zone Color Scanner instrument and microwave and infrared radiometers. Total Ozone Mapping Spectrometer (TOMS) measured the solar irradiance and the radiance backscattered by the Earth's atmosphere in six selected wavelength bands in the ultraviolet. TOMS scanned in 3- degree steps to 51 degrees on each side of the sub satellite point, in a direction perpendicular to the orbital plane. Consecutive cross-scans overlapped, creating a contiguous mapping of ozone. It was first to measure ozone columns and profiles from space, which led to the first confirmation of the ozone hole and the documentation of the recurrence of the hole every year during the southern-hemisphere springtime. These confirmations backed researches of scientists and aided policy makers in determining solutions to the ozone depletion problem. Faced with the strong possibility that CFCs could cause serious ozone depletion, policy makers from around the world signed the Montreal Protocol treaty in 1987, limiting CFC production and usage.

Today, NASA monitors ozone from space using the Microwave Limb Sounder (MLS) and Ozone Monitoring Instrument aboard its Aura spacecraft, and the MLS also measures trace gases containing chlorine.NASA has been monitoring the status of the ozone layer through satellite observations since the 1970s, beginning with the TOMS sensors on the Nimbus satellites. The latest-generation ozone-monitoring technology, the Ozone Monitoring Instrument (OMI), is flying onboard NASA's Aura satellite.Ongoing ground- and space-based monitoring of ozone and other trace gases, by NASA and other institutions, will help inform development of environmental policies designed to make sure levels continue trending in a positive direction even in the midst of other changes, such as Earth's warming climate.
One chlorine atom can destroy thousands of ozone molecules – and with millions of tons of CFCs pumped into the atmosphere from the 1920's through the early 1990's, the Antarctic polar region bore the brunt of the damage. CFCS,Montreal Protocol

At the South Pole, NOAA staff launch weather balloons carrying ozone-measuring "sondes" which directly sample ozone levels vertically through the atmosphere. Most years, at least some levels of the stratosphere, the region of the upper atmosphere where the largest amounts of ozone are normally found, are found to be completely devoid of ozone.

https://www.nasa.gov/feature/goddard/2019/2019-ozone-hole-is-the-smallest-on-record-since-its-discovery

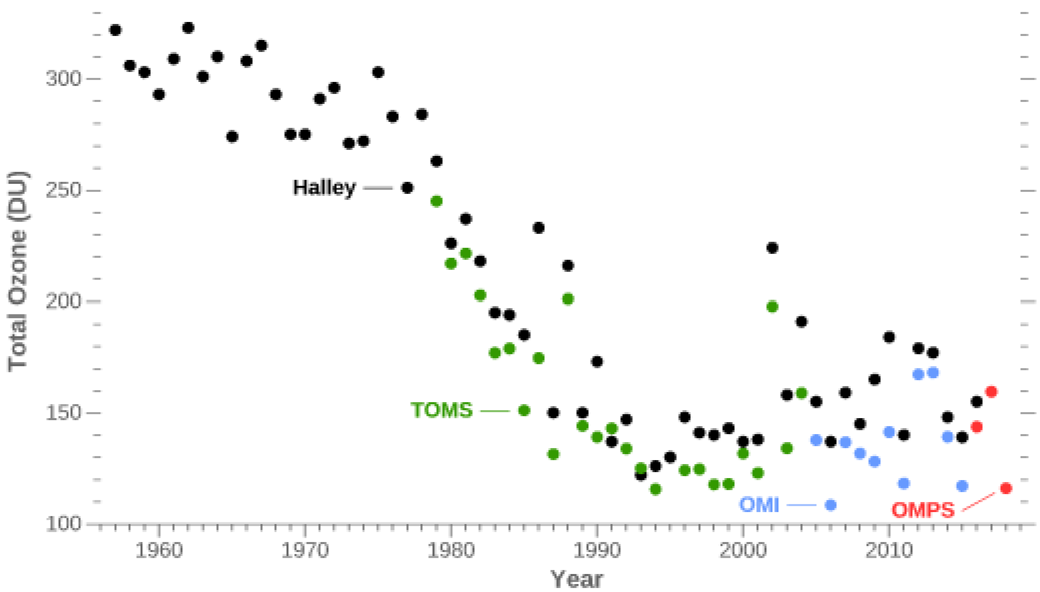


Satellites, including NASA's Aura satellite, the NASA-NOAA Suomi National Polar-orbiting Partnership satellite and NOAA's Joint Polar Satellite System NOAA-20 satellite, measure ozone from space. The Aura satellite's Microwave Limb Sounder also estimates levels of ozone-destroying chlorine in the stratosphere.

Today, instruments onboard Aura satellite measure trace gases in the atmosphere by detecting their unique spectral signatures. Microwave Limb Sounder (MLS) observes

the faint microwave emissions from rotating and vibrating molecules. High Resolution Dynamics Limb Sounder ([HIRDLS)](#) and Tropospheric Emission Spectrometer ([TES)](#) observe the infrared thermal emissions also due to molecular vibrations and rotations. Ozone Monitoring Instrument ([OMI)](#) detects the molecular absorption of backscattered sunlight in the visible and ultraviolet wavelengths. NASA monitors ozone from space using the Microwave Limb Sounder (MLS) and Ozone Monitoring Instrument (OMI) .The MLS also measures trace gases containing chlorine.
Along with NASA’s Aura satellite, the NASA-NOAA Suomi National Polar-orbiting Partnership satellite and NOAA’s Joint Polar Satellite System NOAA-20 satellite, together monitor ozone from space.

In 1956, the British Antarctic Survey set up the Halley Bay Observatory on Antarctica in preparation for the International Geophysical Year (IGY) of 1957. In that year, ozone measurements using a Dobson Spectrophotometer began.

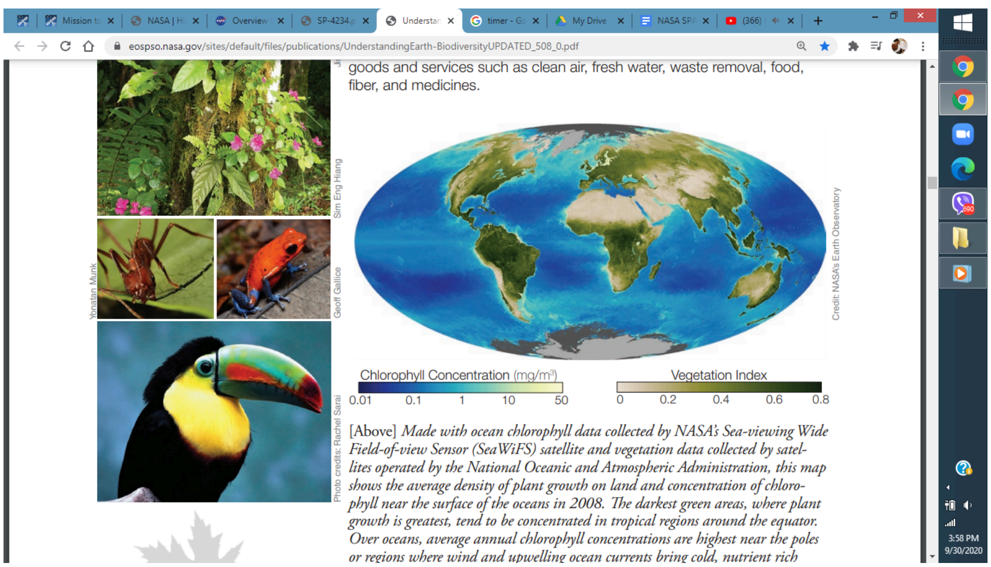


Instruments on the ground (at Halley) and high above Antarctica (the Total Ozone Mapping Spectrometer [TOMS] and Ozone Monitoring Instrument [OMI]) measured an acute drop in total atmospheric ozone during October in the early and middle 1980s. (Halley data supplied by [J. D. Shanklin, British Antarctic Survey](#)).

https://ozonewatch.gsfc.nasa.gov/facts/history_SH.html

Tropical Rainfall Measuring Mission TRMM , collaboration between JAXA and NASA allowed scientists to look inside and under Hurricane Katrina’s clouds to see the rain structure on August 28, 2005. Just before Katrina strengthened into a Category 5 hurricane, TRMM observed tall cumulonimbus clouds, depicted as red spikes, emerging from the storm’s eyewall and rain bands.
https://eospso.nasa.gov/sites/default/files/publications/Precip508.pdf

Made with ocean chlorophyll data collected by NASA’s Sea-viewing Wide Field-of-view Sensor (SeaWiFS) satellite and vegetation data collected by satellites operated by the National Oceanic and Atmospheric Administration, this map shows the average density of plant growth on land and concentration of chlorophyll near the surface of the oceans in 2008.
(since data was in pdf format i couldn’t get the image/you may either exclude this , search image or crop it through the link)



NASA’S Landsat 7 and 8 contributing to Detailed Map for forest Managers

Able to map
(1) percent canopy cover of five different conifer species in mixed forest stands with mean errors of less than 4% between observed and predicted composition, depending on the species,

(2) percent forest mortality with mean errors of less than 3%, and

(3) post disturbance surviving sub-canopy composition by species with mean errors of five or less trees per Landsat pixel, depending on the species.

to study patterns of biodiversity and understand how biodiversity is changing. In particular, they are using both passive and active satellite and airborne remote sensing technologies to directly observe and identify biodiversity patterns, such as the distribution of ecosystems and vegetation structure, as well as the environmental parameters that influence them such as topography and climate conditions. Together, these observations strengthen our understanding of ecosystem function and Earth's biodiversity
https://eospso.nasa.gov/sites/default/files/publications/UnderstandingEarth-BiodiversityUPDATED_508_0.pdf

1. 

Afforestation programs are emerging as important policy interventions globally to increase carbon sequestration, yet there has been little systematic study of the impacts of afforestation programs on the livelihoods of forest dependent people. Afforestation projects do not simply improve ecosystem service provision, as widely assumed; they replace other land-cover types such as grasslands, savannas, or degraded forests thus changing the mix of goods provided by these ecosystems. Depending on the species planted and the success of the plantation, afforestation may increase the availability of timber and fuelwood while decreasing availability of fodder and some non-timber forest products. Livelihood impacts will depend on the importance of these goods and services to different households, the availability of alternatives, and the capacity of households to respond. As a result, plantations may improve the livelihoods of some households while hurting others, particularly those dependent on non-forest resources produced on lands converted to plantation. Better understanding of the effects of plantations on livelihoods is crucial for designing policies that maximize the positive benefits and mitigate negative impacts of afforestation. We propose to study the impact of afforestation programs in India, a country in which afforestation efforts are extensive, on the livelihoods of the rural poor. We will do so by combining recent government data on afforestation with long-term estimates of afforestation based on NASA satellite data and household surveys in 140 villages with varying levels of exposure to afforestation. In April of 2016, we obtained government records for all 2252 plantations made by the state forest department in the Kangra district of the Western Himalayan state of Himachal Pradesh between 2005-2015. We will combine this data with ground-truthing in a subset of these plantations. We will conduct land-cover/land-use change (LCLUC) analysis based upon use of an advanced image endmember-estimation algorithm and spectral unmixing/endmember mapping. This will allow us to detect and differentiate different types of small plantations using historical Landsat data. We will conduct household livelihood surveys in a sample of 140 villages which have been exposed to different types of plantations. Combining estimates of afforestation activities with household livelihood data will allow us to estimate, using regression and propensity score matching techniques, the impacts of afforestation on the livelihoods of households with different characteristics. These analyses will allow us to develop guidelines, which will help Indian policy-makers develop and implement plantation programs that align the imperative for carbon sequestration with the needs and interests of the poor.