(ISSN 2395 - 468X)

Year - 2015 Vol. 2, No. 10 Issue: October 2015

Van Sangyan

A monthly open access e-magazine

Tropical Forest Research Institute

(Indian Council of Forestry Research and Education)

PO RFRC, Mandla Road, Jabalpur – 482021

Van Sangyan

Editoriral Board

Note to Authors:

We welcome the readers of Van Sangyan to write to us about their views and issues in forestry. Those who wish to share their knowledge and experiences can send them:

by e-mail to vansangyan_tfri@icfre.org

or, through post to The Editor, Van Sangyan,
Tropical Forest Research Institute,
PO-RFRC, Mandla Road,
Jabalpur (M.P.) - 482021.

The articles can be in English, Hindi, Marathi, Chhattisgarhi and Oriya, and should contain the writers name, designation and full postal address, including e-mail id and contact number.

TFRI, Jabalpur houses experts from all fields of forestry who would be happy to answer reader's queries on various scientific issues. Your queries may be sent to The Editor, and the expert's reply to the same will be published in the next issue of Van Sangyan.

From the Editor's desk

The ozone layer is a layer in earth's atmosphere which contains relatively high concentrations of ozone. This layer absorbs 93-99% of the sun's high frequency ultraviolet light, which is potentially damaging to life on earth. Over 91% of the ozone in earth's atmosphere is present here. It is mainly located in the lower portion of the stratosphere from approximately 10 km to 50 km above earth, though the thickness varies seasonally and geographically. The ozone layer was discovered in 1913 by the French physicists Charles Fabry and Henri Buisson. Its properties were explored in detail by the British meteorologist G. M. B. Dobson, who developed a simple spectrophotometer (the Dobson meter) that could be used to measure stratospheric ozone from the ground. Between 1928 and 1958 Dobson established a worldwide network of ozone monitoring stations which continues to operate today. The "Dobson unit", a convenient measure of the total amount of ozone. The ozone layer is not really a layer at all, but has become known as such because most ozone particles are scattered between 19 and 30 kilometers (12 to 30 miles) up in the earth's atmosphere, in a region called the stratosphere. The concentration of ozone in the ozone layer is usually under 10 parts ozone per million . Without the ozone layer, a lot of ultraviolet (UV) radiation from the Sun would not be stopped reaching the earth's surface, causing untold damage to most living species.

This issue of Van Sangyan contains an article on earth's natural sun screen - ozone layer and our environment role of ozone layer in environment. There are also useful articles on impact of open cast coal mines on biodiversity and social aspect, agroforestry in eastern Uttar Pradesh, exploring social media as a driver for effective biodiversity conservation in India, Types, importance and factors affecting mycorrhiza production for sustainable plant growth, plant defence against abiotic and biotic stress, some medicinal plants of Achanakmar-Amarkanyak biosphere reserve, their use and conservation and biodiversity of Primula denticulate and Tragopan melanocephalus.

I hope that readers would find all information in this issue relevant and valuable. Van Sangyan welcomes articles, views and queries on various issues in the field of forest science.

Looking forward to meet you all through forthcoming issues.

Dr. N. Roychoudhary

Scientist G & Chief Editor

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Earth's natural sun screen - ozone layer and our environment
(On September 16, 2015 World Ozone Day)

Dr. Rajesh Kumar Mishra, Dr. Naseer Mohammad and Dr. N. Roychoudhury
Tropical Forest Research Institute
Jabalpur

The United Nations' (UN) International Day for the Preservation of the Ozone Layer is celebrated on September 16 every year. This event commemorates the date of the signing of the Montreal Protocol on Substances that Deplete the Ozone Layer in 1987. This Day marks the importance of Ozone layer and its role in the environment. The United Nations General Assembly has designated this Day to reflect the adoption of Montreal Protocol on substances that deplete the Ozone layer. There are numerous activities and programs organized to spread awareness about the global phenomenon of Ozone layer depletion. All member nations of the Montreal protocol take this opportunity to take some concrete steps at their national level in accordance with the aims and objectives of Montreal protocol.

The Theme for the 30th Anniversary of the Vienna Convention and 21st International Day for the Preservation of the Ozone Layer for year 2015 is **"30 Years of Healing the Ozone Together." The theme is supported by the slogan "Ozone: All there is between you and UV."**

The ozone layer is the Earth's natural sunscreen, filtering out harmful ultraviolet (UV) rays from the sun. UV rays can cause damage to humans and other forms of life. Although the ozone layer is high up in the atmosphere, chemical substances used at the

surface of the planet can damage it. If the ozone layer is damaged, UV rays can get through and cause damage to humans and other forms of life.

Therefore, the ozone layer must be protected from these chemicals so that it can recover from the damage over many years. One of the chemicals used that damages the ozone layer is a refrigerant gas known as R22. This gas (a hydrochlorofluorocarbon or HCFC) is one of the last remaining ozone depleting substances that is in common use.

Countries worldwide have been making great efforts to phase out Ozone-Depleting Substances and to renew their commitment to implement the Montreal Protocol. Lebanon is one of these committed countries.

Since 1998, the Ozone Office, established by UNDP through the Multilateral Fund at the Ministry of Environment, facilitated the promotion of the ODS phase-out programme in Lebanon by organizing innovative events to focus attention and action, as well as raise the awareness of the general public on the protection of the ozone layer.

In 1987 representatives from 24 countries met in Montreal and announced to the world that it was time to stop destroying the ozone layer. In so doing, these countries committed themselves, via the Montreal Protocol on Substances that Deplete the Ozone Layer, to rid the world of substances that threaten the ozone layer.

On December 19, 1994, the UN General Assembly proclaimed September 16 to be the International Day for the Preservation of the Ozone Layer, commemorating the date when the Montreal Protocol on Substances that Deplete the Ozone Layer was signed in 1987. The day was first celebrated on September 16, 1995.

Ozone is very rare in our atmosphere, averaging about three molecules of ozone for every 10 million air molecules. In spite of this small amount, ozone plays a vital role in the atmosphere. In the information below, we present "the basics" about this important component of the Earth's atmosphere.

Ozone is mainly found in two regions of the Earth's atmosphere. Most ozone (about 90%) resides in a layer that begins between 6 and 10 miles (10 and 17 kilometers) above the Earth's surface and extends up to about 30 miles (50 kilometers). This region of the atmosphere is called the stratosphere. The ozone in this region is commonly known as the ozone layer. The remaining ozone is in the lower region of the atmosphere, which is commonly called the troposphere. The figure (above) shows an example of how ozone is distributed in the atmosphere.

The ozone molecules in the upper atmosphere (stratosphere) and the lower atmosphere (troposphere) are chemically identical, because they all consist of three oxygen atoms and have the chemical formula O3. However, they have very different roles in the atmosphere and very different effects on humans and other living beings. Stratospheric ozone (sometimes referred to as "good ozone") plays a beneficial role by absorbing most of the biologically damaging ultraviolet sunlight (called UV-B), allowing only a small amount to reach the Earth's surface. The absorption of ultraviolet radiation by ozone creates a source of heat, which actually forms the stratosphere itself (a region in which the temperature rises as one goes to higher altitudes). Ozone thus plays a key role in the temperature structure of the Earth's atmosphere. Without the filtering action of the ozone layer, more of the Sun's UV-B radiation would penetrate the atmosphere and would reach the Earth's surface. Many experimental studies of plants and animals and clinical studies of humans have shown the harmful effects of excessive exposure to UV-B radiation.

At the Earth's surface, ozone comes into direct contact with life-forms and displays its destructive side (hence, it is often called "bad ozone"). Because ozone reacts strongly with other molecules, high levels of ozone are toxic to living systems. Several studies have documented the harmful effects of ozone on crop production, forest growth,

and human health. The substantial negative effects of surface-level tropospheric ozone from this direct toxicity contrast with the benefits of the additional filtering of UV-B radiation that it provides.

The dual role of ozone leads to two separate environmental issues. There is concern about increases in ozone in the troposphere. Near-surface ozone is a key component of photochemical "smog," a familiar problem in the atmosphere of many cities around the world. Higher amounts of surface-level ozone are increasingly being observed in rural areas as well.

There is also widespread scientific and public interest and concern about losses of ozone in the stratosphere. Ground-based and satellite instruments have measured decreases in the amount of stratospheric ozone in our atmosphere. Over some parts of Antarctica, up to 60% of the total overhead amount of ozone (known as the column ozone) is depleted during Antarctic spring (September-November). This phenomenon is known as the Antarctic ozone hole. In the Arctic polar regions, similar processes occur that have also led to significant chemical depletion of the column ozone during late winter and spring in 7 out of the last 11 years. The ozone loss from January through late March has been typically 20-25%, and shorter-period losses have been higher, depending on the meteorological conditions encountered in the Arctic stratosphere. Smaller, but still significant, stratospheric decreases have been seen at other, more-populated regions of the Earth. Increases in surface UV-B radiation have been observed in association with local decreases in stratospheric ozone, from both ground-based and satellite-borne instruments.

The scientific evidence, accumulated over more than two decades of study by the international research community, has shown that human-produced chemicals are responsible for the observed depletions of the ozone layer. The ozone-depleting compounds contain various combinations of the chemical elements chlorine, fluorine, bromine, carbon, and hydrogen and are often described by the general term halocarbons. The compounds that contain only chlorine, fluorine, and carbon are called chlorofluorocarbons, usually abbreviated as CFCs. CFCs, carbon tetrachloride, and methyl chloroform are important human-produced ozone-depleting gases that have been used in many applications including refrigeration, air conditioning, foam blowing, cleaning of electronics components, and as solvents. Another important group of human-produced halocarbons is the halons, which contain carbon, bromine, fluorine, and (in some cases) chlorine and have been mainly used as fire extinguishants.

Through an international agreement known as the Montreal Protocol on Substances that Deplete the Ozone Layer, governments have decided to eventually discontinue production of CFCs, halons, carbon tetrachloride, and methyl chloroform (except for a few special uses), and industry has developed more "ozone-friendly" substitutes. All other things being equal, and with adherence to the international agreements, the ozone layer is expected to recover over the next 50 years or so.

he ozone layer is a belt of naturally occurring ozone gas that sits 9.3 to 18.6 miles (15 to 30 kilometers) above Earth and serves as a shield from the harmful ultraviolet B radiation emitted by the sun.

Ozone is a highly reactive molecule that contains three oxygen atoms. It is constantly being formed and broken down in the high atmosphere, 6.2 to 31 miles (10 to 50 kilometers) above Earth, in the region called the stratosphere.

Today, there is widespread concern that the ozone layer is deteriorating due to the release of pollution containing the chemicals chlorine and bromine. Such deterioration allows large amounts of ultraviolet B rays to reach Earth, which can cause skin cancer and cataracts in humans and harm animals as well.

Extra ultraviolet B radiation reaching Earth also inhibits the reproductive cycle of phytoplankton, single-celled organisms such as algae that make up the bottom rung of the food chain. Biologists fear that reductions in phytoplankton populations will in turn lower the populations of other animals. Researchers also have documented changes in the reproductive rates of young fish, shrimp, and crabs as well as frogs and salamanders exposed to excess ultraviolet B.

Chlorofluorocarbons (CFCs), chemicals found mainly in spray aerosols heavily used by industrialized nations for much of the past 50 years, are the primary culprits in ozone layer breakdown. When CFCs reach the upper atmosphere, they are exposed to ultraviolet rays, which causes them to break down into substances that include chlorine. The chlorine reacts with the oxygen atoms in ozone and rips apart the ozone molecule.

One atom of chlorine can destroy more than a hundred thousand ozone molecules, according to the the U.S. Environmental Protection Agency.

The ozone layer above the Antarctic has been particularly impacted by pollution since the mid-1980s. This region's low temperatures speed up the conversion of CFCs to chlorine. In the southern spring and summer, when the sun shines for long periods of the day, chlorine reacts with ultraviolet rays, destroying ozone on a massive scale, up to 65 percent. This is what some people erroneously refer to as the "ozone hole." In other regions, the ozone layer has deteriorated by about 20 percent.

About 90 percent of CFCs currently in the atmosphere were emitted by industrialized countries in the Northern Hemisphere, including the United States and Europe. These countries banned CFCs by 1996, and the amount of chlorine in the atmosphere is falling now. But scientists estimate it will take another 50 years for chlorine levels to return to their natural levels.

Ozone layer is a deep layer in earth's atmosphere that contains ozone which is a naturally occurring molecule containing three oxygen atoms. These ozone molecules form a gaseous layer in the Earth's upper atmosphere called stratosphere. This lower region of stratosphere containing relatively higher concentration of ozone is called Ozonosphere. The ozonosphere is found 15-35 km (9 to 22 miles) above the surface of the earth. The average concentration of ozone in the atmosphere is around 0.6 parts per million. The thickness of the ozone layer differs as per season and geography. The highest concentrations of ozone occur at

altitudes from 26 to 28 km (16 to 17 miles) in the tropics and from 12 to 20 km (7 to 12 miles) towards the poles.

The ozone layer forms a thick layer in stratosphere, encircling the earth, that has large amount of ozone in it. It protects our planet i.e. Earth from the harmful radiations that comes from the sun. The ozone layer was discovered in 1913 by the French physicists Charles Fabry and Henri Buisson. The ozone layer has the capability to absorb almost 97-99% of the harmful ultraviolet radiations that sun emit and which can produce long term devastating effects on humans beings as well as plants and animals.

Importance of ozone layer

An essential property of ozone molecule is its ability to block solar radiations of wavelengths less than 290 nanometers from reaching Earth's surface. In this process, it also absorbs ultraviolet radiations that are dangerous for most living beings. UV radiation could injure or kill life on Earth. Though the absorption of UV radiations warms the stratosphere but it is important for life to flourish on planet Earth. Research scientists have anticipated disruption of susceptible terrestrial and aquatic ecosystems due to depletion of ozone layer.

Ultraviolet radiation could destroy the organic matter. Plants and plankton cannot thrive, both acts as food for land and sea animals, respectively. For humans, excessive exposure to ultraviolet radiation leads to higher risks of cancer (especially skin cancer) and cataracts. It is calculated that every 1 percent decrease in ozone layer results in a 2-5 percent increase in the occurrence of skin cancer. Other ill-effects of the reduction of protective ozone layer include – increase in the incidence of cataracts, sunburns and suppression of the immune system.

Reasons for ozone layer depletion

During the last several decades, human activities have resulted in considerable reduction in the ozone layer of the atmosphere. Ozone depletion occurs when destruction of the stratospheric ozone is more than the production of the molecule. The scientists have observed reduction in stratospheric ozone since early 1970s. It is found to be more prominent in Polar Regions.

There are two regions in which the ozone layer has depleted.

In the mid-latitude, for example, over Australia, ozone layer is thinned. This has led to an increase in the UV radiation reaching the earth. It is estimated that about 5-9% thickness of the ozone layer has decreased, increasing the risk of humans to over-exposure to UV radiation owing to outdoor lifestyle.

In atmospheric regions over Antarctica, ozone layer is significantly thinned, especially in spring season. This has led to the formation of what is called 'ozone hole'. Ozone holes refer to the regions of severely reduced ozone layers. Usually ozone holes form over the Poles during the onset of spring seasons. One of the largest such hole appears annually over Antarctica between September and November.

Natural causes of depletion of ozone layer: Ozone layer has been found to be affected by certain natural phenomena such as Sun-spots and stratospheric winds. But this has been found to cause not more than 1-2%

depletion of the ozone layer and the effects are also thought to be only temporary. It is also believed that the major volcanic eruptions (mainly El Chichon in 1983 and and Mt. Pinatubo in 1991) has also contributed towards ozone depletion.

Man-made causes of depletion of ozone layer: The main cause for the depletion of ozone is determined as excessive release of chlorine and bromine from man-made compounds such as chlorofluorocarbons (CFCs). CFCs (chlorofluorocarbons), halons, CH3CCl3 (Methyl chloroform), CCl4 (Carbon tetrachloride), HCFCs (hydro-chlorofluorocarbons), hydrobromo fluorocarbons and methyl bromide are found to have direct impact on the depletion of the ozone layer. These are categorized as ozone-depleting substances (ODS). Chlorofluorocarbons are released into the atmosphere due to: Cleaning Agents, Coolants in refrigerators, Packing material, Air conditioning and Aerosol spray cans etc.

The problem with the Ozone-Depleting Substances (ODS) is that they are not washed back in the form of rain on the earth and in-fact remain in the atmosphere for quite a long time. With so much stability, they are transported into the stratosphere. The emission of ODS account for roughly 90% of total depletion of ozone layer in stratosphere. These gases are carried to the stratosphere layer of atmosphere where ultraviolet radiations from the sun break them to release chlorine (from CFCs) and bromine (from methyl bromide and halons). The chlorine and bromine free radicals react with ozone molecule and destroy their molecular structure, thus depleting the ozone layer. One chlorine atom can break more than 1, 00,000 molecules of ozone. Bromine atom is believed to be 40 times more destructive than chlorine molecules.

Some ozone depleting substances

Chlorofluorocarbons: Account for more than 80% of ozone depletion. Used in freezers, air cooling component, dry-cleaning agents, hospital sterilants.

Methyl chloroform: Used for vapour degreasing, some aerosols, cold cleaning, adhesives and chemical processing.

Hydrochlorofluorocarbons: Substitutes for CFC's but still play a vital role in ozone depletion.

Halons

Carbon tetrachloride: Mainly used in fire extinguishers

The "hole" in the ozone layer of our atmosphere is finally beginning to close up, according to observations by NASA scientists. Currently 12 million miles wide, the hole will be eight million miles wide within three decades, and will have disappeared by the end of the century. NASA's Aura satellite and Suomi NPP partnership satellite measured the ozone in the southern hemisphere for each year from 1979-2013, except 1995.

A report published in the journal Geophysical Research comes as a proof of the effectiveness of the Montreal Protocol initiated in 1987 to limit the use of gas propellants like chlorofluorocarbons (CFCs) worldwide and protect the ozone layer. "With this new information, we can look into the future and say with confidence that ozone hole will be consistently smaller than eight million square miles by 2040," said Susan Strahan, a senior research scientist at the Nasa Goddard Space Flight Center.

The CFCs released by the products were found to interact with UV radiation to release chlorine, which in turn destroyed the ozone. One atom of chlorine can destroy more than a 100,000 ozone molecules, according to the US Environmental Protection Agency.

It was in 1985 that scientists from the British Antarctic Survey first reported observations of large losses of ozone over Antarctica.

With wind currents sweeping the CFCs toward the poles, the effect was pronounced there as the polar vortex trapped the chemicals which accumulated over time to high concentrations.

As the sun shines for long periods of the day, chlorine reacts with ultraviolet rays, destroying ozone on a massive scale of up to 65% creating the hole seen by the BAS team, says NatGeo.

The ozone layer at 15 to 30kms above Earth shields the planet from harmful levels of ultraviolet rays, which can cause cancer, cataracts and sunburn.

Ultraviolet B radiation reaching Earth can inhibit the reproductive cycle of phytoplankton that make up the bottom rung of the food chain.

However, some scientists believe that restoring the ozone layer will add to global warming as ozone is a greenhouse gas and can trap heat in the atmosphere.

The effect of increasing temperature over the southern pole has seen many alarming studies on the rapid rate of ice melt in the Antarctic continent.

The flip side is that ozone-depleting substances like CFCs are also powerful greenhouse gases and while substitutes are ozone safe, many are powerful greenhouse gases.

In their first review in four years, the UN has confirmed today (10 September) that the fragile ozone layer is "well on track" for recovery by mid-century.

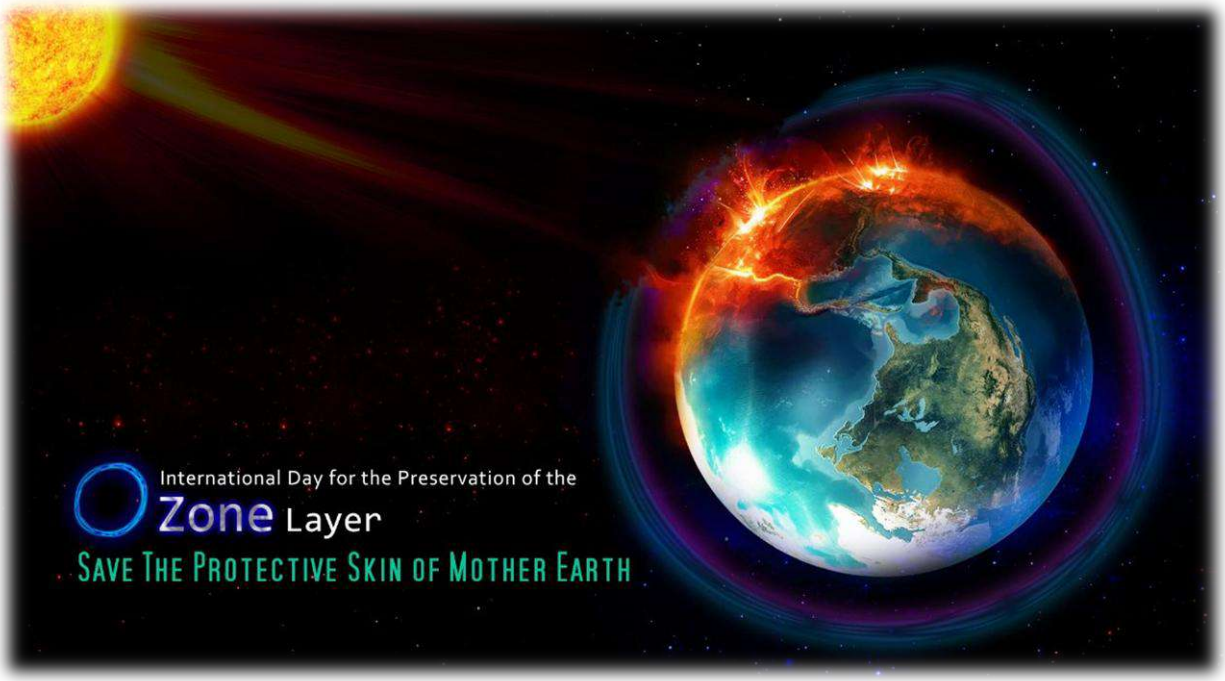
"The Earth's protective ozone layer is well on track to recovery in the next few decades... before mid-century in mid-latitudes and the Arctic, and somewhat later for the Antarctic ozone hole," read a statement from the report, which is co-produced by the UN Environment Programme (UNEP) and the World Meteorological Organisation (WMO).

The ozone layer is a natural protective shield for life on Earth that filters out harmful ultraviolet light from the Sun that can lead to skin cancer. Ozone hole is a term that represents the annual thinning of the ozone layer over Antartica, mostly by manmade chlorine compounds, such as propellants found in hair sprays.

The report also confirmed that the ozone hole over Antarctica has stopped growing bigger every year, however, it will take a decade before it starts shrinking.

While UNEP chief Achim Steiner celebrated the Montreal Protocol, she noted that, "the challenges that we face are still huge. The success of the Montreal Protocol should encourage further action not only on the protection and recovery of the ozone layer but also on climate."

While the 110-page report authored by 200 scientists brought good news, it also carried some warnings pointing towards the rise of ozone-eroding compounds, like carbon tetrachloride and man-made nitrous oxide (NO_2).



"International action on the ozone layer is a major environmental success story ... This should encourage us to display the same level of urgency and unity to tackle the even greater challenge of tackling climate change," said Michel Jarraud, WMO Secretary-General.

There has been an unexpected increase in a substance linked with the destruction of the ozone layer, scientists have said.

Under the Montreal Protocol, the 1989 treaty to protect the ozone layer by phasing out destructive substances, it was expected there would be a steady decline in these chemicals.

However, researchers at the University of Leeds working with an international team of scientists have found there has been an increase in atmospheric hydrogen chloride (HCI).

Published in the journal Nature, experts said the recent and unexpected increase is due to a temporary anomaly in atmospheric circulation, which changes the balance between CFCs and their breakdown product – HCI.

The increase in HCI was only seen in the northern hemisphere. Concentrations of the substance declined in the southern hemisphere in line with expectations.

NASA recently announced the ozone hole over the Antarctic was about the size of North America at its peak this year – a very small increase on the maximum reached last year.

“Through comparison with detailed computer models, we have identified this decline as temporary due to changes in upper atmospheric wind patterns, so we remain optimistic that the ozone layer will recover during the second half of the century”

Martyn Chipperfield, who led the modelling work for the study, said: "The expected deterioration of ozone-destroying chemicals

in the atmosphere is certainly more complex than we had imagined.

"Rather than a steady decline, these findings have presented a rather more complicated picture.

"Through comparison with detailed computer models, we have identified this decline as temporary due to changes in upper atmospheric wind patterns, so we remain optimistic that the ozone layer will recover during the second half of the century."

He said there are natural differences between the northern and southern hemispheres, which explain the differences between the two regions in terms of HCI.

"While atmospheric chlorine levels remain high we may see cases of large ozone depletion, especially over the polar regions," Chipperfield said.

Researcher Peter Bernath, from the University of York, added: "Atmospheric variability and perhaps climate change can significantly modify the path towards full recovery and, ultimately, it will be a bumpy ride rather than a smooth evolution.

"The recovery of ozone-depleting chemicals in the atmosphere is a slow process and will take many decades. During this time the ozone layer remains vulnerable."

Scientific evidence indicates that stratospheric ozone is being destroyed by a group of manufactured chemicals, containing chlorine and/or bromine. These chemicals are called "ozone-depleting substances" (ODS).

ODS are very stable, nontoxic and environmentally safe in the lower atmosphere, which is why they became so popular in the first place. However, their very stability allows them to float up, intact, to the stratosphere. Once there, they are broken apart by the intense ultraviolet light, releasing chlorine and bromine. Chlorine and bromine demolish ozone at an alarming rate, by stripping an atom from the ozone molecule. A single molecule of chlorine can break apart thousands of molecules of ozone.

What's more, ODS have a long lifetime in our atmosphere — up to several centuries. This means most of the ODS we've released over the last 80 years are still making their way to the stratosphere, where they will add to the ozone destruction.

The main ODS are chlorofluorocarbons (CFCs), hydrochlorofluorcarbons (HCFCs), carbon tetrachloride and methyl chloroform. Halons (brominated fluorocarbons) also play a large role. Their application is quite limited: they're used in specialized fire extinguishers. But the problem with halons is they can destroy up to 10 times as much ozone as CFCs can. For this reason, halons are the most serious ozone-depleting group of chemicals emitted in British Columbia.

Hydrofluorocarbons (HFCs) are being developed to replace CFCs and HCFCs, for uses such as vehicle air conditioning. HFCs do not deplete ozone, but they are strong greenhouse gases. CFCs are even more powerful contributors to global climate change, though, so HFCs are still the better option until even safer substitutes are discovered.

The main ozone depleting substances (ODS)

- Chlorofluorocarbons (CFCs)

- The most widely used ODS, accounting for over 80% of total stratospheric ozone depletion.
- Used as coolants in refrigerators, freezers and air conditioners in buildings and cars manufactured before 1995.
- Found in industrial solvents, dry-cleaning agents and hospital sterilants.
- Also used in foam products — such as soft-foam padding (e.g. cushions and mattresses) and rigid foam (e.g. home insulation).

- Halons
  - Used in some fire extinguishers, in cases where materials and equipment would be destroyed by water or other fire extinguisher chemicals. In B.C., halons cause greater damage to the ozone layer than do CFCs from automobile air conditioners.
- Methyl Chloroform
  - Used mainly in industry — for vapour degreasing, some aerosols, cold cleaning, adhesives and chemical processing.
- Carbon Tetrachloride
  - Used in solvents and some fire extinguishers.
- Hydrofluorocarbons (HCFCs)
  - HCFCs have become major, "transitional" substitutes for CFCs. They are much less harmful to stratospheric ozone than CFCs are. But HCFCs they still cause some ozone destruction and are potent greenhouse gases.
- Stratospheric ozone filters out most of the sun's potentially harmful shortwave ultraviolet (UV) radiation. If this ozone becomes depleted, then more UV rays will reach the earth. Exposure to higher amounts of UV radiation could have serious impacts on human beings, animals and plants, such as the following:
- Harm to human health:
  - More skin cancers, sunburns and premature aging of the skin.
  - More cataracts, blindness and other eye diseases: UV radiation can damage several parts of the eye, including the lens, cornea, retina and conjunctiva.
  - Cataracts (a clouding of the lens) are the major cause of blindness in the world. A sustained 10% thinning of the ozone layer is expected to result in almost two million new cases of cataracts per year, globally (Environment Canada, 1993).
  - Weakening of the human immune system (immunosuppression). Early findings suggest that too much UV radiation can suppress the human immune system, which may play a role in the development of skin cancer.
- Adverse impacts on agriculture, forestry and natural ecosystems:
  - Several of the world's major crop species are particularly vulnerable to increased UV,

resulting in reduced growth, photosynthesis and flowering. These species include wheat, rice, barley, oats, corn, soybeans, peas, tomatoes, cucumbers, cauliflower, broccoli and carrots.
    - The effect of ozone depletion on the Canadian agricultural sector could be significant.
    - Only a few commercially important trees have been tested for UV (UV-B) sensitivity, but early results suggest that plant growth, especially in seedlings, is harmed by more intense UV radiation.
- Damage to marine life:
    - In particular, plankton (tiny organisms in the surface layer of oceans) are threatened by increased UV radiation. Plankton are the first vital step in aquatic food chains.
    - Decreases in plankton could disrupt the fresh and saltwater food chains, and lead to a species shift in Canadian waters.
    - Loss of biodiversity in our oceans, rivers and lakes could reduce fish yields for commercial and sport fisheries.
- Animals:
    - In domestic animals, UV overexposure may cause eye and skin cancers. Species of marine animals in their developmental stage (e.g. young fish, shrimp larvae and crab larvae) have been threatened in recent years by the increased UV radiation under the Antarctic ozone hole.
- Materials:
    - Wood, plastic, rubber, fabrics and many construction materials are degraded by UV radiation.
    - The economic impact of replacing and/or protecting materials could be significant.
- Although most ozone depleting substances are used in industry and commerce, what you do at home can still make a difference. The most effective way of protecting the ozone layer is to reduce or even stop using ozone depleting chemicals. You can do this by:
- buying air-conditioners that do not use HCFCs or CFCs as refrigerants;
- regularly inspecting and maintaining your air-conditioners and refrigeration appliances to minimise refrigerant leaks;
- Recovering and recycling HCFCs and CFCs in air-conditioners and refrigeration appliances when they are serviced; replacing and retrofitting such equipment to operate on non-HCFC and non-CFC refrigerant should also be considered.

Overall, the best way to help protect the ozone layer is to stop buying all products, big and small, that contain ozone depleting substances. Together we can make a difference.

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Impact of open cast coal mines on biodiversity and social aspect

P.B. Meshram
Biodiversity Division
Tropical Forest Research Institute,
P.O. RFRC, Mandla Road, Jabalpur-482021 M.P.

Introduction

The open cast coal mining and protection of environment are essential for survival and prosperity of human race. The important impact of coal mining is damage of lands. Coal India limited recorded production of 435.84 million tons of Coal in 2011-2012 (Anonymous, 2012). During the 1st Plan period, the need for increasing coal production efficiently by systematic and scientific development of the coal industry was felt, resulting in setting up of the National Coal Development Corporation (NCDC). Right from its genesis, the commercial coal mining in modern times in India has been dictated by the needs of the domestic consumption. Given the size of India's coal mining industry it is no surprise that its environmental impacts are considerable. Mining can generally be divided into four phases: exploration, development, extraction and Exploration is the defining of the extent and value of the ore. During the development stage, the deposit is opened for production (exploitation or extraction), i.e. access is gained to the deposit. This is done by either stripping the overburden to expose the ore near the surface or by excavating openings as preparation for underground mining for deeper deposits. The choice of extraction method is based on the characteristics of the mineral, safety and environmental concerns, and technology and economics (Hartman and Mutmansky, 2002).

Impact on biodiversity

The biosphere is adversely affected by mining mainly by pollution and by degradation of land and vegetation resulting in loss in biodiversity. Mining can also have impact on local microclimate (Aswathanaryana, 2003). The most obvious impact to biodiversity from mining is the removal of vegetation, which in turn alters the availability of food and shelter for wildlife. At a broader scale, mining may impact biodiversity by changing species composition and structure. For example, acid drainage and high metal concentrations in rivers generally result in an impoverished aquatic environment. Some species of algae and invertebrates are more tolerant of high metals and acid exposure and may, in fact, thrive in less competitive environments (Kelly, 1998). Exotic species (e.g., weedy plants and insect pests) may thrive while native species decline.

Impact on fauna

Both micro and macro fauna are the integral parts of forest ecosystem and are valued in maintain bio-geo-chemical cycle and food chain, respectively. Formation of green belts, roadside plantation and parks must be planned to improve the habitats and overall ecology of the area.

Impact on soil fauna and microorganisms

Due to mining activities, the population of soil fauna and soil microorganisms goes down considerably. However, it has been observed that some plant species will not survive or grow if particular microorganisms are lacking. Soil organic matter content and the carbon biomass play an important role in minimizing the rate of soil degradation. A number of soil faunal groups viz. spider, beetle, millipede, centipede, woodlouse, silverfish, termites and other arthropods were observed in the ecosystems. These fauna have direct and indirect effect on physical, chemical and biological properties of soil

Impact on flora

Vegetation is an important unit of ecosystem as it controls various functions of ecosystems viz., biomass production, energy flow in different trophic levels and bio-geo-chemical cycling of minerals, gases and water. It protects the top soils and land quality along-with under ground water regime.

Impact on socio-economic environment

Development projects have both positive and negative impacts on the social and economic characteristics of the local people. Civic and welfare amenities like water supply, power supply, medical facilities, banking, education and market will come with the opening of mine. Though, population growth in the area often leads to the narrowing of the natural resources base essential for the survival of the economically and socially backward tribal people. Human population living in the core region is most backward and solely dependent on forests for their daily needs. However, villages in the distant sub-impact zone (5-10 km.) are comparatively more developed and are linked with diverse with occupations. Displacement and resettlement of local people is the main problem associated with mining and other development projects. Considering above in view, there should be well thought out rehabilitation policy to ensure adequate compensation in terms of land, worth and other possible benefits irrespective of their ownership, literacy and skill.

Sensitivity of select ecosystems to mining

Mining and oil development may pose risks to some environments due to the sensitivity and/or rarity of these ecosystems. These include the following:

Forests

Forests are the most biologically diverse terrestrial ecosystems. Tropical forests are particularly diverse and provide the greatest source of endemic plant species in the world. The key direct impact of mining on forest ecosystems is the removal of vegetation and canopy cover. Indirect impacts include road-building and pipeline development, which may result in habitat fragmentation and increased access to remote areas. While larger intact forest ecosystems may withstand the impacts of mining and oil development, smaller fragments are likely to be particularly sensitive to clearing.

Climate change

The World Health Organization states that climate change is the greatest emerging threat to public health and to the environment. Coal-fired power stations are potent emitters of greenhouse gases and are important contributors to climate change. Climate change will profoundly affect some

of the most fundamental prerequisites for good health: clean air and water, sufficient food, adequate shelter and freedom from disease (Mc-Michel *et al.,* 2009)

Indirect impacts of mining

In addition to waste management issues, mines also pose environmental and social challenges due to potential disruptions to ecosystems and local communities. Mining requires access to land and natural resources, such as water, which may compete with other land uses (Ashton *et al.,* 2002). The soil environment which was extremely harsh just after mining is improved and changed gradually to hospitable condition through natural succession allowing fresh invaders to come. Once the dumps become established to some extent and ground flora arrives, tree plantation programme should be taken up. Effective planting will reduce dust pollution and even noise pollution to an appreciable extent, besides other benefits such as checking erosion, stream flow, improving water regime etc. Selection of species should be site specific and may include grasses, herbs shrubs and tree species. Native vegetation of the locality should be preferred over other. Species selection should be based on:

1. Species capable of colonizing in the disturbed area.
2. Species which can fix atmospheric nitrogen as well as conserve spoil.
3. Species capable of producing fuel, fodder and fibre and local population.
4. Species which can attract birds, butterflies and other faunal population.

Recommendations

1. Contiguous forest must be brought under protection and conservation measures to ensure habitat development for locally restricted flora, rare, endangered and threatened wild flora, wild fauna, avifauna and aquatic life.
2. Habitat development for flora and fauna during mining and post-reclamation activities must be done to maintain process of bio-geo-chemical cycling and energy flow, which are essential to maintain the status of homeostatis.
3. Effective management strategies with compensatory afforestation should be adopted in the vicinity of the mine area to keep the ecosystem pollution free.
4. Formation of greenbelts, roadside aesthetic plantation and parks must be developed to improve the habitat and ecology of the area.
5. Construction of check-dams, ponds, stop dams etc. may be required in mining areas to recharge surface aquifers and to minimize the possibility of lowering water tables.
6. Regular monitoring of ground water level through installation of hydrograph station must be done. Drinking water quality should be tested regularly as per the standards prescribed under Central and State Pollution Control Board.
7. Improved blasting technologies to minimize the subsidence effect should be used. The quality filling material should be comparable with original subsoil. Adequate compaction and thickness of filling material should be maintained.

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Agroforestry in eastern Uttar Pradesh

Anubha Srivastav, Anita Tomar and Kumud Dubey
Centre for Social Forestry and Eco-Rehabilitation,
Allahabad (UP)

Introduction

While increasing population and decreasing per capital land, current and future demands for agricultural and forestry products could not be fulfilled by our old land use practices. In such situation agro-forestry as a land use system may be regarded as an effective and low cost means for minimizing the degradation processes associated with land cultivation and maintaining and even increasing the productive capacity of agro-ecosystem. Agro-forestry has been in existence since very early times and is a collective name of land use system and technologies in which woody perennials including trees, shrubs and bamboos *etc.* are deliberately combined on the same land management unit with herbaceous crops. The modern concept of Agro-forestry aims at sustainable use of a system involving more of less intimate and interacting association of agriculture, horticulture, pastoral crops and woody perennials all in harmony with one another. This type of land use has two main positive impact *i.e.* enhanced productivity involving the multiplicity of output and sustainability which implies conservation or even improvement of the environmental aspects of whole system (Tewari, 1992).

Uttar Pradesh is the most populous state in the country accounting for 16.4 per cent of the country's population. The geographical area of the state is 240,928 sq km which constitutes 7.3 % of the total area of the country. The state can be divided into two physiographic zones namely the vast Gangetic plains having highly fertile alluvial soil and the smaller southern hill plateau having predominantly rocky strata. The recorded forest area of the state is 6.88 % of its geographical area. The tree cover of the state has been estimated using sample data of the TOF inventory, a total of forest and tree cover comes around 8.82 % for the state (FSI Report, 2013). Therefore, to achieve the forest and tree cover as per our national forest policy, agro forestry is the only viable option to be adopted by different stakeholders in the region.

General features of agroforestry in U.P.

The state of UP can be divided into four agro-climatic zones, namely Tarai region bordering Nepal, Western Gangetic plains, Eastern Gangetic plains and Vindhyan and Bundelkhand Plateau. Despite the state has witnessed timber extraction activity in the reserved and other forest areas, but there has been increased afforestation activity in the agricultural fields under the social forestry programmes. The demand for fuel-wood for domestic use has grown faster than supply. The natural forests, which are already in poor conditions, are being exploited at a much faster rate than their regeneration capacity.

Agro forestry is lagging in Eastern Utter Pradesh in comparison to the western parts

of the UP. The less availability of land for farmers, inadequate marketing facility as less industries, poor technical knowledge about plantation and sale of end produce to the farmers are some key factors for current status of agroforestry in the eastern region. In Eastern UP, the plywood , veneer and paper industries are very less and the marketing of the Poplar, Eucalyptus etc. is a problem for the farmers. The species like Semal, Kadamb and Eucalyptus which is suited to plywood industry and can grow easily in Tarai zone has not been promoted well. The farmers are more interested in the timber species like Shisham, Teak etc and fruit varieties of Aonla, Mango, Ber, and Guava etc. in eastern part. The fruit varieties like Aonla and Guava are very popular in the districts of Allahabad and Pratapgarh as orchard and agroforestry trees, as they do not affect the production of Rabi crops due to leaf shedding in that season. The majority of the farmers are less interested to adopt agro forestry because they concentrate more on food grains than tree production due to poverty, small land holding and fear of low and long term return from trees.

The tree growing movement by the farmers was mainly confined to the western districts of U. P. The species promoted in the western parts of UP are *Eucalyptus* sps, *Poplar sps*, *Melia sps.* etc., which are readily utilized in the industries. In the western parts of UP, the plywood and paper industries are abundant and the marketing of forestry species is not a problem for farmers. The major motivating factor for adoption of commercial agroforestry in western Uttar Pradesh was assured income whereas the availability of fuel wood was the prime reason for patronizing trees on farmlands under traditional agroforestry systems. Poplar and Eucalyptus based commercial agroforestry systems are comparatively profitable than both the traditional agroforestry systems and conventional cropping patterns in the western Uttar Pradesh. The contribution of the trees in the farming systems certainly added to the diversity dimension by way of income and employment to the farm households besides fulfilling the requirement of wood. Both forms of agroforestry have specific roles to play in the livelihoods and industrial development, which have to be carefully nurtured for their sustainability (Dwivedi *et al*. 2007).

The farmers in the Western part have taken to modern, mechanized commercial agriculture and farm forestry/ agro forestry of better clones of Eucalyptus and Poplar in a big way like the states of Punjab and Haryana but the farmers in the eastern part lag behind in all the respects. It has been possible due to market support from the plywood and paper industries in that area. The marketing of the forest produce in U. P. from both forest and non-forest areas is done mainly through public auctions. Divisional sales Managers under Forest Corporation have been posted to execute sales in various sales depots spread all over the state (Thapliyal, 1991).

In a study done by Kumar *et al.* (2011), quality of life and tree planting pattern have been studied in representative districts of eastern and western U.P. (Varanasi and Saharanpur). It was found that plantation activity is negligible in eastern part as compared to the western one. The farmers in

western part mainly concentrate on cash crops along with trees on their farm bunds whereas farmers of eastern part are confined to staple agricultural crops.

Major constraints /challenges in adopting agroforestry in eastern U.P.

To study the major constraints in adopting agroforestry by the farmers in the region of Eastern U.P., timber market places as saw mills, furniture markets, contractors, plywood/ veneer industries, other timber industries and villagers/ growers in selected districts of Eastern U P were surveyed for important agroforestry species. The salient features are as following:

1. It was found during study that preferred species of farmers of this region are – Eucalyptus, Teak, Shisham etc. on farm bunds and Mango, Mahua, Neem, Jamun, Kathal, Babool etc. in form of orchards/woodlots etc. The availability of Poplars is mostly limited to tarai region.
2. The poor land holding, as majority of farmers (70 -78 %) are marginal in the region is a major constraint for farmers in planting trees. The less availability of good planting material of preferred species from forest nurseries is also a problem for farmers.
3. Eucalyptus plantations are available in plenty but due to unavailability of markets and industries, most of the raw material is used in construction of houses, fencing etc. in Allahabad district. In Karchchana range of Allahabad, it is much used in packing boxes industries. Eucalyptus is lowering the water level of the land, thus, farmers do not prefer this species in Allahabad. Due to poor irrigation facilities, farmers are not planting more trees. In Allahabad, eucalyptus trees are sold at very low rates in construction work for phanti and balli etc. As this species is free for permit, it can be easily transported to adjacent Raebareli district for industrial consumption, but only some middlemen are involved in this practice.
4. In Raebareli, farmers are planting Eucalyptus on tree bunds of sodic land. In district Raebareli, a good number of veneer /plywood industries are existing. In these industries, only 60-65 % raw material is available as per demand. The market value is Rs. 1500- 1800 per tree for seven to eight year old tree of Eucalyptus. In Laganj range of Raebareli, despite of presence of plenty of Eucalyptus trees, growers are not aware about their industrial uses. Thus, knowledge about source of market places/industries may strengthen market channels of wood in this area.
5. The timber sale is done at sawmills, timber traders etc. through contractors (70-80%). Only 20-30% farmers directly sell their produce to timber traders.
6. Complexity of the system for tree growers to sell the produce directly to traders as getting felling and transit permit, contractor/ middlemen, felling, loading/unloading, transportation etc are major hurdles in the way to success.
7. Logs of wood are rejected many times due to poor quality and these are sold in the market at very low rates compared to their actual cost.

8. Brokerage / Arhat/ commission agent and kat charges are major constraints in market channels. In a sale deal of farmer through contractor to timber trader in wood mandis, the profit of these intermediaries are fixed on percentage basis and affects farmer's gain over deal.
9. Interference of police is a major constraint for tree growers. There are many species as Eucalyptus and Poplar etc. which are free from felling permit in all districts of U. P. and exempted for transit permit too for selective districts including Allahabad and Raebareli districts. But in many cases, police interferes with the farmers during felling and transportation of exempted species.
10. Less availability of industries for consumption of raw material, thus, lowering the rates of timber is a major constraint.
11. In wood mandis, market is dominated by buyers as for sellers there is no provision of storage of wood. He is bound to sell the produce on the same day to avoid further transportation charges. The commission agent and buyer get united during auction of wood.
12. The rates of Forest Corporation for purchase of timber is not revised. The process of selling timber through Forest Corporation is not easily approachable for common farmers.
13. The poor knowledge about market places to the growers and less information about raw material to the traders is major constraint in maintaining the adequate marketing channel in the region.

Recommendations to streamline market strategies of timber in the region:

- The forest corporation should come forward in more approachable way to purchase timber directly from the farmers. The corporation should also revise their rates as comparable to the market. A pamphlet dealing with detailed rate list of forestcorporation along with contact number may be distributed among tree growers to lower the role of middlemen from the system and making them available the proper value of their products. Tree ownership certification process for sale of trees through corporation should be simplified. Further, it is suggested that farmers themselves may transport their wood produce to the corporation depots and store it directly there on nominal monthly rental basis as supervision charges. They may sell their produce as per expected value at the time of auction. They may refuse sale of their produce for next auction. The quantity of timber should not be a barrier for farmers. The 50 % amount of total value of the wood may be immediately paid to the farmers after formalities. The farmer may wait for the sale of timber till next three auctions for getting best value of the produce. The balance amount of the timber may be paid after sale after deducting rest charges.
- Interference of police even on producing desired permits (felling and transit) by farmers may be strictly seen by local administration. This should be definitely checked by forest deptt. / govt. so as to improve the system and further

harassment of farmers/ tree growers. Interference of police while transportation of timber (permitted) on free species should also be checked.

- Rules regarding felling and transit permit should be more simplified and well circulated to the tree growers. The issue of tree felling and transit permit should be mandatory within thirty days from the date of application.
- Behavior of forest officials with the farmers should be cooperative and friendly for issuing of felling and transit permit.
- Motivation for planting of more trees for tree growers/farmers should be encouraged. Seedlings of important agroforestry species should be provided to the farmers by forest nurseries at subsidized rates.
- The private plantation agencies should be checked by forest department/ state government for quality and rates of seedlings as they are selling seedlings at very high rates to the farmers of the region.
- The adequate knowledge about traders and growers to each other i.e. channelized market system will be beneficial for traders and growers/ farmers, thus, improving agroforestry in the region.
- The govt. may introduce some introductory offer like tax rebate, reduced registration charges etc. for entrepreneurs to set up more industries for consumption of raw materials in the region.
- The extension and training programmes based on development of agroforestry in the region will be beneficial for farmers.

Conclusion

The farmers engaged in farm forestry, agro forestry and social forestry suffer a lot due to non-availability of adequate market of different forest species in the region of Eastern U.P. is a major problem. Bamboo growers suffer a lot due to non-availability of paper and pulp industry in Eastern U. P. The absence of industries affects adversely the plantations of important tree species specifically, the plantation of Eucalyptus, Poplar, Semal, Kadamb etc. Further, non-availability of market information system of important timber species, their up-to-date rates and traders associated with business of rural as well as urban areas affecting adversely the cultivation of the species. The interference of police and forest department in felling and transportation of timber should be minimized to strengthen agroforestry in the region. Thus, streamlining of existing marketing channel for local farmers/ villagers and traders for sale of important tree products, viz. timber and firewood will be of paramount importance for developing agroforestry in the region of Uttar Pradesh.

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Exploring social media as a driver for effective biodiversity conservation in India

Manoj Kumar Behera
Natural Resource Management Consultants India Pvt. Ltd.,
Bhubaneswar

Introduction

Biodiversity refers to the variety and variability of plants, animals and microorganisms at genetic, species and ecosystem levels which are considered to be necessary for smooth running of ecological services and crucial to the existence of living organisms on the earth. Evidently, biodiversity has been providing the base for livelihoods, cultures and economies of several hundred millions of people, including farmers, fisher folk, forest dwellers and artisans. It provides raw material for a diverse medicinal and health care systems. It also provides the genetic base for the continuous up-gradation of agriculture, fisheries, and for critical discoveries in scientific, industrial and other sectors. With the impact of climate change already visible through extreme weather events and with a worsening scenario projected for the future, the genetic wealth in biological diversity could be the key to providing ecological and economic stability to countries like India and building climate-resilient agriculture. There is ample evidence that climate change affects biodiversity. According to the Millennium Ecosystem Assessment, climate change is likely to become one of the most significant drivers of biodiversity loss by the end of the century. Climate change is already forcing biodiversity to adapt either through shifting habitat, changing life cycles, or the development of new physical traits. According to the Intergovernmental Panel on Climate Change (IPCC) Working Group I (WGI) Fourth Assessment Report, from 1850 to 2005, the average global temperature increased by about 0.76ºC and global mean sea level rose by 12 to 22 cm during the last century. These changes are affecting the entire world, from low-lying islands in the tropics to the vast polar regions (CBD). Climate change predictions are not encouraging; according to the IPCC WGI Fourth Assessment Report, a further increase in temperatures of 1.4°C to 5.8°C by 2100 is projected.

India, which is also one of the 12 primary centres of origin of cultivated plants and domesticated animals and one of the mega-diverse nation, the biodiversity is rich and unique. India, with only 2.4% of the world's land area, harbours 7-8% of all recorded species, including over 45,000 species of plants and 91,000 species of animals. It is also amongst the few countries that have developed a biogeographic classification for conservation planning, and has mapped biodiversity-rich areas in the country (CBD, 2014). It is also one of the pioneer country to enact Biological Diversity Act, 2002 soon in consonant with the principles and commitments made in1992 Rio Summit. In the recent past, India has experienced a few critical weather related events which have negatively affected the biological diversity of the country. Further the Fourth Assessment Report of IPCC has

warned similar or more aggravated climate related events to be occurred in near future. This necessitated a critical review of the existing legal and institutional mechanisms and exploring the scope and utility of modern tools in the conservation programmes or efforts.

Role of social media

Social media has now become indispensable in our society with 29% of world's population are active users of social media platforms. With the introduction of social media, people are now well connected with each other and other global/local issues. This has brought a visible transformation among the lives of many people. An average social media user spends 2 hours and 25 minutes per day using social networks and microblogs as per the research findings of Global Web Index. Facebook dominates the list in terms of number of users or reach and scope with 1.366 billion active Facebook users as on January 2015. Surprisingly, 83 percent of the global Facebook users have access through mobile devices. Much of this is because of introduction of cheaper smart phones. Social media platforms has enabled us to communicate beyond local or social boundaries. Social media platforms are mostly utilized by industry and government agencies as a preferred tool of communication with the general public. Today almost all political leaders and bureaucrats are well connected and active in social media. This has led in emergence of a new form of governance with more accountability and transparency. People are now considering social media as the major platform to garner support and also build pressure on government for any irregularities, policy and institutional lapses. Platforms such as change.org has been seen as the most effective platform to file e-petitions on regional and national issues.

India's journey in social media

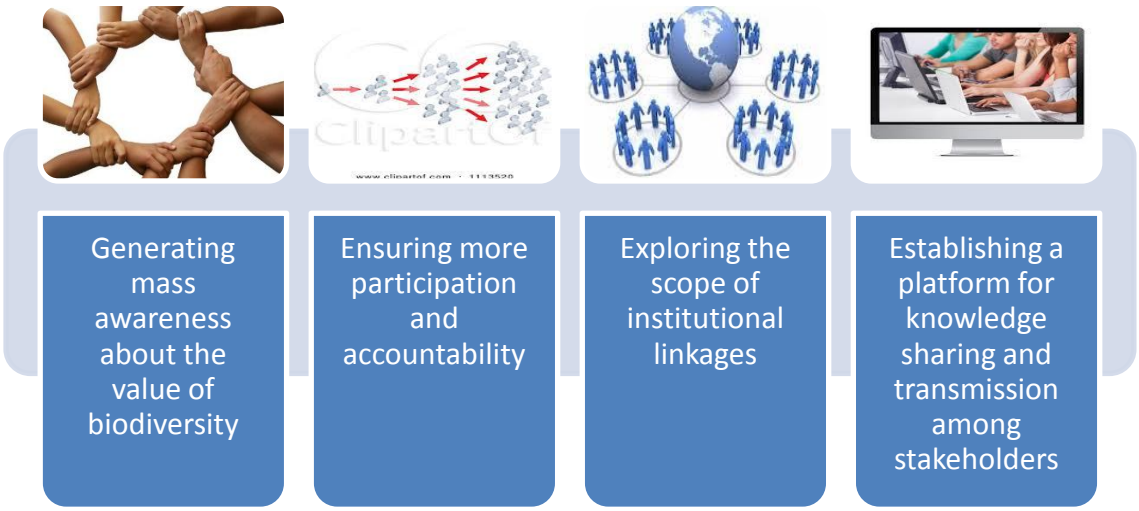
India is home to about 244 million internet users and 143 million active social media users. Further there are some 100 million Indians with active Facebook accounts. Though the overall social media penetration in India is only 8 percent as per 2014 report, the country is undergoing a visible digital transformation. This can be evident now with the grounding of digital India initiative by the NDA government.

In a recent survey in 2015, it was reported that rural India is moving faster to get connected with the digital world with a growth of 100 percent in 1 year taking the social media users from 12 million to 25 million in April, 2015. On the other hand, urban areas witnessed a growth of 35 per cent with 118 million users as of April 2015 (IAMAI-IMRB report, 2015)

In the recent past India has evidenced that social media is contributing significantly to the development causes. Mega programmes of the NDA Government who came to power in 2014 such as Swachh Bharat Mission, Clean Ganga Mission, Jan Dhan Yojana, Atal Pension Yojana, etc. have achieved spectacularly within a short time. Much of this is mostly because of the connections between government and people over social media platforms. Temsutula Imsong and Darshika Shah Sakaar Sewa Samiti recently were in news because of their efforts to clean Ganga through creating social volunteers using social media platforms. The duos were highly appreciated by Prime Minister Narendra Modi in twitter and Facebook who wrote "This effort by Temsutula Imsong & the entire team to clean the Ghats in Varanasi is phenomenal! I salute them".

Social media in biodiversity conservation

Like other programmes, social media has immense role to play in conserving the biological diversity through creating awareness and sharing of ideas for better policy making decisions and their effective implementation on ground thereby promoting its conservation, sustainable use and equitable sharing of benefits (ICRISAT, 2012). Ironically, biodiversity conservation efforts in India have not seen any such kind of massive response by the people. In India, biodiversity conservation efforts are yet to be grounded and one can see the role of social media to sensitize peopleabout the importance of biodiversity for human existence. More importantly Facebook has immense potential to create environmental volunteers or biodiversity conservation leaders at the village level and most importantly sharing each other's experiences and challenges to facilitate better conservation of biodiversity. India has many invisible village level conservation or environmental volunteers mostly youths who need to be identified and well connected over social media. Above all, the research findings and success stories related to biodiversity conservation needs to be shared or discussed amongdifferent stakeholders using social media. Social media can contribute to the efforts of government around biodiversity conservation in the following ways;



Indian Council of Agricultural Research (ICAR) is actively working over social media platforms such as Facebook for disseminating information on research findings and day to day happenings around agriculture sectorto the public as well as sensitizing them about the importance of agriculture for food & nutritional security through the organization of different types of events such as painting or photo competitions on environmental or agricultural topics. Recently a similar type of event by ICAR could witness a massive response from youths. Similar or even better engagement by Indian Council of Forestry Research & Education (ICFRE) and its institutions would help to bring in more number of people in the biodiversity conservation efforts.

Conclusion

Social media has immense role to play in sustainable use of natural resources as well as conservation of biodiversity. Today, India is evincing a major loss of

biodiversity and narrowing of gene pool mostly because of critical threats of deforestation, land degradation, poaching, forest fire etc. At this crucial time, social media platforms seem to be one of the main driving force that can help facilitate more immediate action to address all these issues. By spreading information on environmental advocacy, awareness and education through social media, we can strengthen our conservation efforts and better formulate strategies for effective conservation of biodiversity in India.

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पर्यावरण में ओजोन परत की भूमिका

(१६ सितम्बर विश्व ओजोन दिवस पर)

डॉ. रेखा अग्रवाल

शासकीय आदर्श विज्ञान महाविद्यालय, जबलपुर (म.प्र.)

ओजोन परत तकरीबन 97 से 99 प्रतिशत तक पराबैंगनी किरणों का अवशोषण करती है । इसके संरक्षण को बढ़ावा देने के लिए मांट्रियल प्रोटोकॉल के अनुसार 16 सितंबर को ओजोन दिवस के रूप में मनाया जाता है । प्रति वर्ष की ही भांति इस वर्ष भी समस्त संसार १६ सितम्बर को विश्व ओज़ोन दिवसके रूप में संसार मना रहा है । यह दिवस वास्तव में प्रथ्वी पर सूर्य की हानिकारक पैराबैगनी किरणों के प्रकाश से धरती की रक्षाकरने वाली ओज़ोन परत को बचाने हेतु अपनी जिम्मेदारी को दोहराने के प्रयास के रूप में प्रतिवर्ष जाता है । पृथ्वी पर पैराबैगनी किरणों के कुप्रभाव तथा 'ओज़ोन' परत की जीवनदायनी शक्ति को समझना आवश्यक है । हमारी पृथ्वी पर जीवन, सूर्य द्वारा उपलब्ध करायी ऊर्जा पर ही निर्भर है । सूर्य द्वारा प्रदान की गयी कुल ऊर्जा का लगभग आधा भाग ही वास्तव में प्रभावी रूप से पृथ्वी को प्राप्त होता है । इस में से लगभग तीस प्रतिशत भाग प्रत्यक्ष सौर्य विकीरण के रूप में तथा शेष बीस प्रतिशत भाग पार्थिव विकीरण के रूप में पृथ्वी से बाहर चला जाता है ।

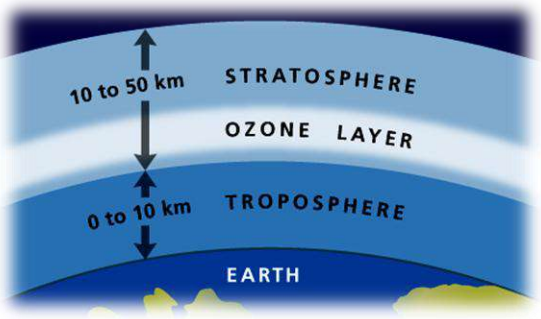
ओजोन के अणुओं (ओ-3) में ऑक्सीजन के तीन परमाणु होते हैं । यह जहरीली गैस है और वातावरण में बहुत दुर्लभ है । प्रत्येक 10 मिलियन अणुओं में इसके सिर्फ 3 अणु पाये जाते हैं । 90 प्रतिशत ओजोन वातावरण के ऊपरी हिस्से या समतापमंडल (स्ट्रेटोस्फेयर) में पाई जाती है जो पृथ्वी से 10 और 50 किलोमीटर (6 से 30 मील) ऊपर है । क्षोभमंडल (ट्रोपोस्फेयर) की तली में जमीनी स्तर पर ओजोन हानिकारक प्रदूषक है जो ऑटोमोबइल अपकर्षण और अन्य स्रोतों से पैदा होती है ।

ओजोन की परत सूर्य से आने वाले ज्यादातर हानिकारक पराबैंगनी- बी विकिरण को अवशोषित करती है । यह घातक पराबैंगनी (यूवी- सी) विकिरण को पूरी तरह रोक देती है । इस प्रकार ओजोन का सुरक्षा कवच हमारे जीवन के लिये बहुत जरूरी है और यह हम जानते हैं । ओजोन की परत की क्षति से पराबैंगनी विकिरण अधिक मात्रा में धरती तक पहुंचता है । अधिक पराबैंगनी विकिरण का मतलब है और अधिक मैलेनुमा और नॉनमैलेनुमा त्वचा कैंसर, ऑखों का मोतियाबिंद अधिक होना, पाचन तंत्र में कमजोरी, पौधों की उपज घटना, समुद्रीय पारितंत्र में क्षति और मत्सय उत्पादन में कमी ।

1970 में जब प्रोफेसर पाल क्रुटजन ने ये संकेत दिया कि उर्वरकों और सुपरसोनिक एयर क्रॉप्ट से निकलने वाली नाइट्रोजन ऑक्साइड से ओजोन की परत को नुकसान होने की आशंका है तो इसके बारे में वैज्ञानिक चिंतित हुए । 1974 में प्रोफेसर एफ

शेरवुड रॉलेंड और मारियो जे मोलिना ने ये पता लगाया कि क्लोरोफ्लोरोकार्बन वातावरण में विभाजित होकर क्लोरीन के परमाणु जारी करते हैं और वे ओजोन क्षय का कारण बनते हैं। हेलेन्स के जरिए जारी होने वाले ब्रोमीन परमाणु भी ऐसा ही बुरा प्रभाव डालते हैं। इन तीन वैज्ञानिकों ने अपने महत्वपूर्ण कार्य के लिए 1995 में रसायन विज्ञान में नोबल पुरस्कार प्राप्त किया था।

वायुमंडल में उपस्थित ऐसी गैसों की अत्यधिक उपस्थिति, जो वायुमंडल में अप्राकृतिक तथा घनत्व में अधिक, बादलों का निर्माण करती है, पैराबैगनी किरणों के ज़्यादा प्रवेश तथा ज़्यादा समय तक उपस्थिति का कारण बनती हैं। इसी कारण अप्रत्यक्ष रूप से पृथ्वी के तापमान में वृद्धि होती है, जो पृथ्वी पर विभिन्न प्रकार की आपदाओं का कारण बनती है। जैसे असमय वर्षा, बाढ़, सूखा, 'कैंसर' जनित रोग आदि।



जो गैस प्रभावी रूप से पृथ्वी के तापमान को अप्रत्यक्ष रूप से बढ़ाने में ओज़ोन की जीवनदायनी परत को हानि पहुचने में सहायक होती है उन्हें 'ग्रीनहाउस' गैसें कहा जाता है। मुख्यत: मीथेन, सल्फरहेक्साफ्लोराइड, परफ्लोरोकार्बन आदि गैसों को 'ग्रीनहाउस' गैस कहा जाता है।

इनका नाम ग्रीनहाउस गैस इसलिए पड़ा क्योंकि वैज्ञानिकों ने प्रयोग कर कांच से घिरे, एक कृत्रिम बाग़ का निर्माण कर उसमें अन्दर आती हुई सूर्य की किरणों को बाहर जाने से रोका, जो इन गैसों के निर्माण में सहायक सिद्ध हुआ तथा इसने ठंडे स्थानों पर गर्म क्षेत्र (कृत्रिम रूप से) की स्थिति पैदा कर गर्म स्थलों के पौधे यहां उपजाने की स्थिति पैदा की। अतः छोटे स्तर पर जहाँ मानव का यह कृत्रिम निर्माण उसके लिए सहायक लगता है, परन्तु यही स्थिति जब संपूर्ण पृथ्वी पर पड़ती है, तो अभूतपूर्व गर्मी तथा इसके चलती असीमित विपदाएं आती हैं।

क्लोरो-फ्लोरो कार्बन (सी.अफ.सी) आदि गैसों का उपयोग 'फ्रिज' में, ओप्टिकल फाइबर आदि में होता है। यह एक आश्चर्यजनक तथ्य यह है कि 'ओजोन परत' में कमी अथवा ओजोन छिद्र, जो आज फुटबॉल के स्टेडियम जितना बड़ा है, का निर्माण हमारे ध्रुवों पर हुआ है जहाँ औद्योगिक गतिविधियाँ न्यूनतम हैं। इसका कारण है - ध्रुवी संताप मंडल बादल कम तापमान पर (जो ध्रुवों पर होता है) क्लोरीन को स्वतंत्र क्रिया करने के लिए सतह प्रदान करती है तथा सूर्य की रोशनी की उपस्थिति में 'अंतर्तिका' में बसंत के आगमन पर बर्फ जमने के समय क्लोरीन (जो सी.एफ.सी. में उपस्थित है) ओजोन अणुओं पर आक्रमण कर उन्हें नष्ट कर देते है। हमारे 'ग्लेशियर' इसी कारण तीव्रता से पिघल रहे हैं।

आई. पी. सी. सी (इंटर गवर्नमेंटल पैनल ऑन क्लाइमेट चेन्ज') की वर्त्तमान रिपोर्ट के अनुसार पृथ्वी का तापमान पिछले १०० वर्षों में ०.७४%

तक बढ़ा है । इसके निम्न प्रभाव विनाशक हो सकते हैं ।

- समुद्र स्तर में अप्रत्याशित बढ़ोतरी, अतः इंग्लैंड जैसी तटीय देश जलमग्न हो सकते हैं ।
- भारत जैसे देश में 'ग्लेशियर' (हिमाद्री आदि) पिघलने पर पहले बाढ़ का खतरा फिर सूखे की विभीषिका से सामना हो सकता है ।
- उत्तर भारत में वर्ष २००८ में जल्द मानसून आना कोई हर्ष का विषय नहीं था अपितु एक चेतावनी थी ।

इस विकट समस्या से निपटने हेतु अभी और कदम उठाने की आवश्यकता है । कुछ उपयोगी उपाय इस प्रकार हो सकते हैं:

1. उन वृक्षों को बचाना होगा जो कार्बन-डी-ऑक्साइड जैसी गैसों को नियंत्रित करते है ।
2. वन शैली में परिवर्तन लाना होगा, जैसे:कम ऊर्जा के दोहन का सतत प्रयास ।
3. प्रकृति से धनात्मक सम्बन्ध रखने वाली तकनीकों का उपयोग, जैसे: कृत्रिम खाद के स्थान पर जैविक खाद का प्रयोग ।
4. कार्बन ट्रेडिंग को विभिन्न देशों द्वारा अपनाए जाने की प्रक्रिया में तेज़ी लाना ।
5. जलवायु को बेहतर बनने की तकनीकों का वैश्वीकरण ।

पृथ्वी की सतह से 19 से 48 किलोमीटर की ऊंचाई तक ओज़ोन की परत पाई जाती है त्वचा कैंसर की उत्तरदायी सूर्य की पैरबैगनी किरणों से ओज़ोन परत हमे बचाती है एक सुरक्षा कवच के तौर पर ओज़ोन 95 से 99 प्रतिशत पैरबैगनी किरणों को सोख लेती है । लेकिन अब यह परत धीरे-धीरे क्षतिग्रस्त हो रही है, जिससे त्वचा कैंसर में वृद्धि के अलावा जीव जंतुओं का प्रतिरक्षा तंत्र भी प्रभावित हो सकता है । ओज़ोन परत में छिद्र के बारे में सबसे पहले ब्रिटिश वैज्ञानिकों ने 1985 में जानकारी दी थी । पिछले 6 वर्षों में करीब 2 करोड़ 40 लाख वर्ग किलोमीटर हिस्से में छिद्र पाया गया है ।

वैज्ञानिको के अनुसार ओज़ोन परत को सबसे ज्यादा नुकसान क्लोरोफ़्लोरोकार्बन (सीएफ़सी) अणुओं से हो रहा है । सीएफ़सी मानव निर्मित रासायनिक पदार्थ है जिसका उपयोग फ्रिज, वातानुकूलक तथा कुछ खास तरह के पैकिंग में आने वाले घोलो में किया जाता है, वायुमंडल में सीएफ़सी अणु पृथ्वी के ऊपरी हिस्से में पहुँच कर सूर्य की किरणों के साथ रासायनिक प्रक्रिया करते है, एक अनुमान के अनुसार एफ़सीएफ़ का एक अणु ओज़ोन के एक लाख अणुओं को नष्ट कर देता है ।

सूर्य का प्रकाश ओजोन परत से छनकर ही पृथ्वी पर पहुंचता है । यह खतरनाक पराबैंगनी विकिरण को पृथ्वी की सतह पर पहुंचने से रोकती है, और इससे हमारे ग्रह पर जीवन सुरिक्षत रहता है । ओज़ोन परत के क्षय के मुददे पर पहली बार 1976 में संयुक्त राष्ट्र पर्यावरण कार्यक्रम की प्रशासनिक परिषद (यूएनईपी) में विचार-विमर्श किया गया । ओजोन परत पर विशेषज्ञों की बैठक 1977 में आयोजित की गई। जिसके बाद यूएनईपी और विश्व मौसम संगठन (डब्ल्यूएमओ) ने समय-समय पर ओजोन परत में होने वाले क्षय को जानने के लिए ओजोन परत समन्वय समिति (सीसीओएल) का गठन किया ।

ओजोन-क्षय विषयों से निबटने के लिए अंतर्राष्ट्रीय समझौते हेतु अंतर-सरकारी बातचीत 1981 में प्रारंभ हुई और मार्च, 1985 में ओजोन परत के बचाव के लिए वियना सम्मेलन के रूप में समाप्त हुई । 1985 के वियना सम्मेलन ने इससे संबंधित अनुसंधान पर अंतर-सरकारी सहयोग, ओजोन परत के सुव्यवस्थित तरीके से निरीक्षण, सीएफसी उत्पादन की निगरानी और सूचनाओं के आदान-प्रदान जैसे मुद्दों को प्रोत्साहित किया । सम्मेलन के अनुसार मानव स्वास्थ्य और ओजोन परत में परिवर्तन करने वाली मानवीय गतिविधियों के विरूध्द वातावरण बनाने जैसे आम उपायों को अपनाने पर देशों ने प्रतिबध्दता व्यक्त की । वियना सम्मेलन एक ढांचागत समझौता है और इसमें नियंत्रण अथवा लक्ष्यों के लिए कानूनी बाधयता नहीं है ।

ओजोन परत को कम करने वाले विषयों पर मॉन्ट्रीयल प्रोटोकॉल को सितम्बर, 1987 में स्वीकार किया गया । ओजोन परत के क्षय को रोकने वाले, ओजोन अनुकूल उत्पादों और जागरूकता जगाने के लिए मॉन्ट्रीयल प्रोटोकॉल विषयों के कार्यान्वयन के महत्व का उल्लेख करते हुए ओजोन परत के संरक्षण के लिए 16 सितम्बर को अंतर्राष्ट्रीय दिवस घोषित किया गया । सभी सदस्य देशों को इस विशेष दिवस पर मॉन्ट्रीयल प्रोटोकॉल के उदेश्यों एवं लक्ष्यों और इसके संशोधन के साथ राष्ट्रीय स्तर पर ठोस गतिविधियों को प्रोत्साहित करने के लिए आमंत्रित किया जाता है ।

वर्ष 1985 के अंत में दक्षिण ध्रुव (एंटारकटिक) के ऊपर ओजोन की परत में छिद्र का पता चलने के बाद क्लोरोफ्लोरोकार्बन (सीएफसी-11, 12, 113, 114 और 115) और अनेक हैलॅन्स (1211, 1301, 2402) के उत्पादन और खपत को कम करने के कड़े उपायों की आवश्यकता को पहचाना गया । प्रोटोकॉल इस तरह से तैयार किया गया है ताकि समय-समय पर वैज्ञानिक और प्रौद्योगिकी आंकलनों के आधार पर इस प्रकार की गैसों से निजात पाने के लिये इसमें संशोधन किया जा सके । इस प्रकार के आंकलनों के बाद इस प्रकार की गैसों से छुटकारा पाने की प्रक्रिया को तेज करने के लिये 1990 में लंदन, 1992 में कोपेनहेगन, 1995 में वियेना, 1997 में मॉन्ट्रीयल और 1999 में पेचिंग में चरणबध्द बहिष्करण में तेजी लाने के लिए प्रोटोकॉल को समायोजित किया गया । अन्य प्रकार के नियंत्रण उपायों को शुरू करने और इस सूची में नये नियंत्रण तत्वों को जोड़ने के लिये भी इसमें संशोधन किया गया ।

1990 में लंदन संशोधन के तहत अतिरिक्त क्लोरोफ्लोरोकार्बन (सी एफ सी-13, 111, 112, 211, 212, 213, 214, 215, 216, 217) और दो विलायक (सॉल्वेंट) (कार्बन टेट्राक्लोराइट और मिथाइल क्लोरोफार्म) को शामिल किया गया जबकि 1992 में कोपेनहेगन संशोधन के तहत मिथाइल ब्रोमाइड, एचबीएफसी और एचसीएफसी को जोड़ा गया । 1997 में मॉन्ट्रीयल संशोधन को अंतिम रूप दिया गया जिसके तहत मिथाइल ब्रोमाइड से निजात पाने की योजना बनायी गयी । 1999 में पेइचिंग संशोधन के तहत ब्रोमोक्लोरोमिथेन के उपयोग से तुरंत छुटकारा पाने (चरणबध्द ढंग से बाहर करने) के लिये इसे

शामिल किया गया। इस संशोधन के तहत एचसीएफसी के उत्पादन पर नियंत्रण के साथ-साथ गैर-पक्षों के साथ इसके कारोबार पर लगाम लगाने की योजना भी बनाई गई।

1980 के दशक के प्रारंभ में जब से इसका मापन शुरू हुआ तब से दक्षिण ध्रुव के ऊपर ओजोन की परत स्थिर रूप से कमजोर हो रही है। बेहद ठंडे वातावरण और ध्रुवीय समताप मंडलीय बादलों के कारण भूमंडल के इस भाग पर समस्या और गंभीर है। ओजोन की परत में क्षय वाला भू-क्षेत्र स्थिर रूप से बढ़ रहा है। यह 1990 के दशक में 20 मिलियन वर्ग किलोमीटर से अधिक हो गया और उसके बाद यह 20 और 29 वर्ग किलोमीटर के दायरे में फैल गया। उत्तरी ध्रुव के ऊपर ओजोन की परत 30 प्रतिशत जबकि यूरोप और अन्य उच्च अक्षांश वाले क्षेत्रों में ओजोन की परत में क्षय की दर 5 प्रतिशत से 30 प्रतिशत के बीच है।

मॉन्ट्रीयल प्रोटोकॉल के तहत फिलहाल 96 रसायनों पर नियंत्रण लगाया गया है जिसमें शामिल हैं:

हेलो कार्बन जो क्लोरोफ्लोरोकार्बन और हेलॅन्स के रूप में उल्लेखनीय है। 1928 में क्लोरोफ्लोरो कार्बन की खोज हुई और इन्हें आश्चर्यजनक गैस माना गया, क्योंकि ये लम्बे समय तक रहती है, और विषैली नहीं होती हैं। इनसे जंग नहीं लगता (असंक्षारक) और ये अज्वलनशील होती हैं। ये परिवर्तनशील है और 1960 के दशक से रेफ्रिजरेटरों, एयरकंडीशनरों, स्प्रे केंस, विलायकों, फोम और अन्य अनुप्रयोगों में इनका उपयोग बढ़ता जा रहा है। सी एफ सी-11 पचास वर्षों तक वायुमंडल में रहती है, सीएफसी-12 एक सौ दो वर्षों तक और सीएफसी-115 सत्रह सौ वर्षों तक वायुमंडल में रहती है। हेलॅन-1301 प्राथमिक रूप से आग बुझाने में उपयोग की जाती है और यह वायुमंडल में 65 साल तक रहती है।

कार्बन टेट्राक्लोराइड विलायक के रूप में उपयोग की जाती है और वायुमंडल में विघटित होने में करीब 42 वर्ष लेती है। मिथाइल क्लोरोफोर्म (1, 1, 1-ट्राईक्लोरोइथेन) भी विलायक के रूप में इस्तेमाल की जाती है और विघटित होने में करीब 5.4 वर्ष लेती है। हाइड्रोब्रोमोफ्लोरोकार्बन (एच बी एफ सी) का अधिक इस्तेमाल नहीं किया जाता है, परंतु किसी नये इस्तेमाल से बचने के लिए इनको भी प्रोटोकॉल के तहत शामिल किया गया है।

हाइड्रोक्लोरोफ्लोरोकार्बन (एच सी एफ सी) सी एफ सी के स्थान पर प्रयुक्त करने के लिए पहले प्रमुख विस्थापक के रूप में इसका विकास किया गया था। यह क्लोरोफ्लोरोकार्बन की तुलना में बहुत कम विनाशक है। एचसीएफसी भी ओजोन की क्षय में योगदान देती है और वायुमंडल में करीब 1.4 से 19.5 वर्ष तक विद्यमान रहती है।

मिथाइल ब्रोमोइड (सी एच-3 बी आर) बहुमूल्य फसलों, कीट नियत्रंण और निर्यात के लिये प्रतीक्षित कृषि जिंसों के क्वेरेन्टाइन उपचार के लिये धूम्रक (फ्यूमिगैन्ट) के रूप में इस्तेमाल की जाती है। वायुमंडल में विघटित होने में इसे करीब 0.7 वर्ष लगते हैं।

ब्रोमोक्लोरोमीथेन (बीसीएम) ओजोन को क्षति पहुंचाने वाला नया तत्व है जिसे कुछ कम्पनियों ने

1998 में बाजार में उतारने की अनुमति मांगी थी। इसको इस्तेमाल से बाहर करने के लिये 1999 के संशोधन में शामिल किया गया।

भारत को चार प्रमुख रसायन-क्लोरोफ्लोरा कार्बन, सी टी सी, हेलॅन्स और हाइड्रोक्लोरोफ्लोरोकार्बन इस्तेमाल से बाहर करने थे जिनमें से 2003 के प्रारंभ में हेलेन्स को इस्तेमाल से बाहर किया गया। 1 अगस्त 2008 तक सीएफसी को भी इस्तेमाल से बाहर कर दिया गया है। सीटीसी का इस्तेमाल 2009 के आखिर तक बंद कर दिया गया और हाइड्रोक्लोरोफ्लोरोकार्बन को बाहर करने की प्रक्रिया अभी जारी है। सभी ओजोन को क्षति पहुंचाने वाले ऐसे नये तत्वों के विपणन से बचने के उपायों पर विचार कर रहे हैं जो अब तक प्रोटोकॉल में शामिल नहीं है।

विकसित देशों में हेलॅन्स और क्लोरोफ्लोरोकार्बन, कार्बन टेट्राक्लोराइड, मिथाइल क्लोरोफार्म और हाइड्रोब्रोमोफ्लोरोकार्बन को इस्तेमाल से बाहर करने की प्रक्रिया क्रमश: 1994 और 1996 में पूरी कर ली गई है। 1999 तक मिथाइलब्रोमोइड के इस्तेमाल में 25 प्रतिशत कमी की गयी। 2001 में 50 प्रतिशत और 2003 में 70 प्रतिशत कमी की गई। 2005 तक इसे इस्तेमाल से पूरी तरह बाहर कर दिया गया है।

इस दौरान 2004 तक हाइड्रोक्लोरोफ्लोरोकार्बन के इस्तेमाल में 35 प्रतिशत की कमी गई जिसके इस्तेमाल में 2010 तक 65 प्रतिशत तक, 2015 तक 90 प्रतिशत और 2020 तक 99.5 प्रतिशत कमी की जानी है। 2030 तक सिर्फ रख-रखाव के उद्देश्यों में ही इसके 0.5 प्रतिशत इस्तेमाल की अनुमति होगी। 1996 तक हाइड्रोब्रोमोफ्लोरोकार्बन और बीसीएम को तुरंत इस्तेमाल से बाहर करने का कार्यक्रम बनाया गया। विकासशील देशों को इन गैसों को इस्तेमाल से बाहर करने का कार्यक्रम शुरू करने से पहले कुछ समय की छूट दी गई। इससे इस बात का पता चलता है कि विकसित देश वायुमंडल में कुल उत्सर्जन के अधिकांश के लिए उत्तारदायी है और उनके पास इनके विस्थापकों को अपनाने के लिये अधिक वित्तीय और प्रौद्योगिकी संसाधन है। विकासशील देशों का कार्यक्रम इस प्रकार था-

- 1996 तक हाइड्रोब्रोमोफ्लोरोकार्बन और बीसीएम को तुरंत इस्तेमाल से बाहर करना।
- क्लोरोफ्लोरोकार्बन, हेलेन्स और कार्बनटेट्राक्लोरोइड को 1 जुलाई 1999 तक 1995 से 97 के औसत पर लाना, 2005 तक 50 प्रतिशत कमी, 2007 तक 85 प्रतिशत कमी और 2010 तक पूरी तरह इस्तेमाल से बाहर करना।
- 2003 तक मिथाइल क्लोरोफार्म के इस्तेमाल को 1998-2000 के औसत स्तर पर लाना, 2005 तक 30 प्रतिशत कमी और 2010 तक 70 प्रतिशत कमी और 2015 तक पूरी तरह इस्तेमाल से बाहर करना।
- मिथाइलब्रोमोइड के इस्तेमाल को 2002 तक 1995 से 98 के औसत स्तर पर लाना, 2005 तक इस्तेमाल में 20 प्रतिशत कमी और 2015 तक इस्तेमाल से पूरी तरह बाहर करना।

- 2016 तक हाइड्रोक्लोरोफ्लोरोकार्बन को 2015 के स्तर पर और 2040 तक इस्तेमाल से बाहर करना।

इस्तेमाल से बाहर करने के कार्यक्रम में लक्षित पदार्थों के उत्पादन और खपत दोनों शामिल है। हालांकि इसके बाद भी विकसित और विकासशील देशों में लक्षित पदार्थों के आवश्यक इस्तेमाल को पूरा करने के लिए सीमित मात्रा में इनके उत्पादन की अनुमति है जिसके लिए अब तक किसी विकल्प की पहचान नहीं की गई है।

प्रोटोकोल के बिना, वर्ष 2050 तक ओजोन का अवक्षय उत्तरी गोलार्ध्द के मध्य अक्षांश में कम से कम 50 % और दक्षिणी मध्य अक्षांश में 70 % बढ़ जाएगा जो मौजूदा स्तर से 10 गुणा अधिक बुरा होगा। इसका परिणाम उत्तरी मध्य अक्षांश में धरती पर दुगुनी तथा दक्षिण में चौगुनी पराबैंगनी विकिरण के रूप में दिखाई देगा। वायुमंडल में ओजोन के अवक्षय के लिए जिम्मेदार रसायनों की मात्रा पांच गुना अधिक होगी। इसके परिणामस्वरुप नॉन-मैलेनोमा कैंसर के 19 मिलियन अधिक मामले, मैलेनोमा कैंसर के 1.5 मिलियन मामले और आंख के मोतियाबिंद के 130 मिलियन अधिक मामलों के रूप में सामने आ सकते हैं।

विश्व समुदाय ने ओजोन के अवक्षय, जलवायु परिवर्तन, जैव विविधता और अंतर्राष्ट्रीय पानी जैसी चुनौतियों से निपटने में विकासशील देशों की मदद करने के लिए वैश्विक पर्यावरण सुविधा (जी ई एफ) की स्थापना की थी। जीईएफ परिवर्तनशील अर्थव्यवस्थाओं वाले देशों में ओजोन के अवक्षय के लिए जिम्मेदार पदार्थों को इस्तेमाल से बाहर करने की परियोजनाओं और क्रियाकलापों को बढ़ावा देती है। जीईएफ ने इन परियोजनाओं और कार्यकलापों के अंतर्गत 1996 और 2000 के बीच 17 देशों (अज़रबैजान, बेलारूस, बुलगारिया, चैक गणराज्य, इस्टोनिया, हंगरी, कज़ाख्स्तान, लातविया, लिथुआनिया, पोलैण्ड, रूसी संघ, स्लोवाकिया, ताजिकिस्तान, तुर्कमेनिस्तान, यूक्रेन और उज्बेकिस्तान) की सहायता के लिए 160 मिलियन डालर से अधिक की मंजूरी दी है। जीईएफ ने हाइड्रोक्लोरोफ्लोरोकार्बन और मिथाइल ब्रोमाइड को इस्तेमाल से बाहर करने में इन देशों की मदद करने के लिए 60 मिलियन डालर का अतिरिक्त कोश चिन्हित किया है।

वैज्ञानिकों ने अनुमान व्यक्त किया है कि अगले पांच वर्षों के दौरान ओजोन क्षय अपने सबसे बुरे स्तर पर पहुंच जाएगा और फिर धीरे-धीरे इसमें विपरीत रूझान आना शुरू होगा एवं करीब 2050 तक ओजोन परत सामान्य स्तर पर आ जाएगी। यह अनुमान इस आधार पर व्यक्त किया गया है कि मांट्रीयल प्रोटोकोल को पूरी तरह लागू किया जाएगा। ओजोन परत फिलहाल बेहद संवेदनशील अवस्था में है। क्लोरोफ्लोरोकार्बन उत्सर्जन में कमी के बावजूद, समतापमंडलीय सांद्रण अब भी बढ़ रहा है (तथापि निचले वायुमंडल में वे कम हो रहे हैं) क्योंकि लम्बे समय तक बने रहने वाले क्लोरोफ्लोरोकार्बन का जो उत्सर्जन हो चुका है वह समतापमंडल में अब भी बढ़ना जारी है। कुछ निश्चित क्लोरोफ्लोरोकार्बन (जैसे सीएफसी-11 और सीएफसी-113), कार्बन टेट्राक्लोराइड और

मिथाइल क्लोरोफार्म की प्रचुरता घट रही है । ज्यादातर हैलॅन्स की प्रचुरता में वृध्दि जारी है । वास्तव में हाइड्रोक्लोरोफ्लोरोकार्बन और हाइड्रोफ्लोरोकार्बन बढ़ रहे हैं, क्योंकि वे क्लोरोफ्लोरोकार्बन के विकल्पों के रूप में इस्तेमाल किए जा रहे हैं । ओजोन सुरक्षा की सफलता संभव हुई है क्योंकि विज्ञान और उद्योग ओजोन का क्षय करने वाले रसायनों के विकल्पों को विकसित करने और उनका व्यासायीकरण करने में सफल रहे हैं ।

यूरोपीय वैज्ञानिकों का कहना है कि सौरमंडल के ग्रह शुक्र पर ओज़ोन की एक पतली परत है जो पृथ्वी के मुक़ाबले सैंकड़ो गुना कम है । यूरोपीय स्पेस एजेंसी के वीनस एक्सप्रेस क्राफ़्ट की सहायता से शोधकर्ता इस नतीजे पर पहुंचे हैं । ये शोध इकारस नाम की पत्रिका में प्रकाशित हुआ ।

अब तक सिर्फ़ पृथ्वी और मंगल ग्रह के वायुमंडल में ही ओज़ोन परत होने की बात पता थी ।

इस नई खोज से पृथ्वी के अलावा किसी अन्य ग्रह पर जीवन की संभावना खोज रहे खगोलशास्त्रियों को सहायता मिलेगी ।

यूरोपीय स्पेसक्राफ़्ट ने शुक्र ग्रह के वायुमंडल पर केंद्रित अध्ययन के दौरान ओज़ोन परत होने की खोज की है । ओज़ोन एक मोलेक्यूनल यानि अणुकणिका होता है जिसमें तीन ऑक्सीजन परमाणु होते हैं ।

शुक्र पर इसका निर्माण तब होता है जब सूर्य की रोशनी ग्रह के वायुमंडल में कार्बन डॉय-ऑक्साइड को विछिन्न कर ऑक्सीजन परमाणुओं को जन्म देती है । पृथ्वी पर भी ओज़ोन का निर्माण इसी तरह होता है । ओज़ोन परत सूर्य की हानिकारक यूवी-रेज़ को पृथ्वी तक पहुंचने से रोकती है ।

वीनस एक्सप्रेस मिशन के लिए यूरोपीय स्पेस एजेंसी के प्रोजेक्ट वैज्ञानिक हकान स्वेढेम के अनुसार "ओज़ोन परत के बारे में जानकारी से हमें शुक्र के वायुमंडल के विषय में बहुत अधिक जानकारी हासिल हुई है । इसके अलावा ये चट्टान वाले ग्रहों में मौलिक एकरुपता का एक और उदाहरण है ।

कुछ वैज्ञानिक ये मानते हैं कि अगर किसी ग्रह के वायुमंडल में ऑक्सीजन, कार्बन और ओज़ोन मौजूद हैं तो ये वहां जीवन होने की ओर इशारा करते हैं ।

एक नए अध्ययन में यह चेतावनी दी गई है कि कुछ रसायनों में तेज वृद्धि की वजह से ओज़ोन परत के सामने उसके क्षरण का एक नया खतरा पैदा हो गया है । ये रसायन ऐसे हैं, जिन्हें ओज़ोन क्षरण रोकने के बनी संयुक्त राष्ट्र की मोंट्रियल संधि के तहत नियंत्रित नहीं किया जाता । वैज्ञानिकों का कहना है कि इनमें से एक 'बेहद कम जीवनकाल वाले अर्थात् वीएसएलएस' रसायन की वातावरण में मौजूदगी तेजी से बढ़ रही है । यूनिवर्सिटी ऑफ लीड्स के स्कूल ऑफ अर्थ एंड एन्वायर्नमेंट में अध्ययन के प्रमुख लेखक डॉक्टर रेयान हुसैनी ने कहा कि वीएसएलएस के प्राकृतिक एवं औद्योगिक दोनों स्रोत हो सकते हैं । वीएसएलएस के औद्योगिक उत्पादन पर संयुक्त राष्ट्र के मोंट्रियल प्रोटोकॉल के तहत नियंत्रण नहीं है क्योंकि पूर्व समय में इन रासायनों की ओज़ोन क्षरण में बहुत कम ही भूमिका रही है । हुसैनी के अनुसार लेकिन अब हमने पता लगाया है कि इनमें से एक रसायन

की मात्रा तेज गति से बढ़ रही है और यदि इस वृद्धि को जारी रहने दिया जाता है तो यह मोंट्रियल प्रोटोकॉल के जरिए ओज़ोन परत को मिले कुछ लाभों को प्रभाव शून्य कर सकता है। यह अध्ययन नेचर जियोसाइंस में प्रकाशित हुआ है।

ओजोन परत के बारे में लोग आम तौर पर भले ही ज्यादा न जानते हों लेकिन यह पृथ्वी और पर्यावरण के लिए एक सुरक्षा कवच का कार्य करती है तथा इसे सूर्य की खतरनाक पराबैंगनी (अल्ट्रा वायलेट) किरणों से बचाती है। ओजोन परत बहुत ही महत्वपूर्ण है जो सूर्य की खतरनाक पराबैंगनी (यूवी) किरणों से हमारी रक्षा करती है । बिना ओजोन परत के हम जिंदा नहीं रह सकते क्योंकि इन किरणों के कारण कैंसर, फसलों को नुकसान और समुद्री जीवों को खतरा पैदा हो सकता है और ओजोन परत इन्हीं पराबैंगनी किरणों से हमारी रक्षा करती है । आस्ट्रेलिया में ओजोन परत को काफी नुकसान पहुंचा है । इसी नुकसान की वजह से सूर्य की पराबैंगनी किरणों से बड़ी संख्या में वहां लोग त्वचा के कैंसर का शिकार हुए हैं । एक अन्य खतरा इसके कारण ध्रुवों के पिघलने का है । अंटार्कटिका में ओजोन में एक बड़ा छिद्र हो गया है । अंटार्कटिका क्षेत्र में बड़े हिमखंड हैं । यदि ये हिमखंड पिघलते हैं तो तटीय क्षेत्रों में बाढ़ सहित कई खतरे पैदा हो सकते हैं। इसके अलावा गर्मी भी बढ़ेगी जो नुकसानदायी होगी।

ओजोन परत के क्षरण के लिए मुख्यतः क्लोरीन और ब्रोमीन के अणु जिम्मेदार हैं। जब इन अणुओं से युक्त गैसे पर्यावरण में छोड़ी जाती हैं तो ये कालांतर में ओजोन परत के क्षरण का कारण बनती हैं । ओजोन को नुकसान पहुंचाने वाली सबसे आम हैलोजन गैस क्लोरोफ्लोरो कार्बन है जिसे सीएफसी के नाम से भी जाना जाता है।

इसे बचाने के लिए सबसे पहले तो जरूरी है कि लोग ओजोन परत और इसके संरक्षण को लेकर जागरूक हों । सभी लोगों को उन पदार्थों और उनके नुकसान को लेकर जागरूक रहना चाहिए जो इस परत को नुकसान पहुंचाते हैं । कई आसान तरीके हैं जिन्हें अपनाकर ओजोन परत को बचाया जा सकता है जैसे पर्यावरण मित्र उत्पादों का इस्तेमाल करना, एयरोसोल और अन्य सीएफसी से युक्त चीजों के उपयोग से बचना, पौधारोपण को बढ़ावा देना, यदि फ्रीजर और एसी काम नहीं कर रहा तो उसे ठीक करवाना आदि। इस तरह की कई छोटी छोटी बाते हैं जिनका ध्यान रखकर ओजोन परत को बचाने में योगदान दिया जा सकता है । अतः विश्व 'ओज़ोन' दिवस के दिन हमारी जिम्मेदारी मात्र इस दिन तक की संवेदनशीलता तक ही सीमित नहीं रह जानी चाहिए पितु प्रत्येक क्षण के साथ हमें पृथ्वी को बचाने हेतु कार्य करना होगा । नहीं तो यह आने वाला विध्वंस मानव-जनित होगा, प्राकृतिक नहीं।

Types, importance and factors affecting mycorrhiza production for sustainable plant growth

[*]Vikas Kumar, [1]Surendra Gopal K. and [2]Lishamol Poulose
[*]Department of Silviculture and Agroforestry, College of Forestry, Vellanikkara
Kerala Agricultural University, KAU, Thrissur, Kerala 680656, India
[1]Department of Agricultural Microbiology, KAU, Thrissur, Kerala
[2]MES College Marampally, Aluva, Kerala

The study of soil microbial-plant relationships, introduced the Greek term 'mycorrhiza', which literally means 'fungus roots'. Mycorrhiza is a symbiotic association between the roots of higher plants and fungi. It means that fungus-root association implies a true symbiotic relation between fungi and plant roots, which is similar to that of nodule bacteria in legumes (Ajeet et al., 2015). Of the seven types of mycorrhizae described. The arbuscular mycorrhizae and ectomycorrhizae are the most abundant and widespread (Smith and Read, 1997; Allen *et al.*, 2003).

Ectomycorriza

It is associated mainly with temperate-Zone trees such as pine, poplar, willow and also other forest tree species. These fungi form a sheath or mantle around their host's root surfaces and the roots become swollen. Most ectomycorrhizas can be isolated and growth in pure culture. *Eg: Laccaria laccata, Pisolithus tinctorious.*

Endomycorrhiza

It forms associations with most of the plants (approximately 80 percent of all plant species). These fungi cannot be growth in pure culture but can be grown in suitable plant roots. They form branched structures called arbuscules within the plant root cells (Arbuscules are sites of nutrient exchange between the fungus and the host) and also vesicles which acts as storage organs as well as reproductive structures. They are known as vesicular arbuscular mycorrhiza; fungi (VAM) or arbuscular mycorrhizal fungi (AMF). The associations that arbuscular mycorrhizal fungi from with plants are called symbiotic associations because they exchange for carbohydrates produced by the host through photosynthesis and the fungi help the plant take up water and immobile soil nutrients such as phosphorus (P), copper, and zinc. The fungus extends from the plant root and expands the volume of soil so that the root system can explore by itself. In many tropical soils, P availability is limited due to P fixation. In addition, the association helps the plant obtain water, which is critical to plant survival and growth under dry conditions. Eg. Glomus sp., *Gigaspora* sp., *Scutellospora* sp.

Ectendomycorrhiza

It is between ectomycorrhiza and endomycorrihiza. It has mantle around the roots as well as hyphae within the roots. It is very uncommon.

Ericoid mycorrhiza

Associated with plants belonging to ericaceae family such as Erica, Vaccinium-healthland plants. These fungi belong to ascomycota and deuteromycota. They form

loose network on surface and hypal coils inside epidermal cells of root hairs where nutrient exchange is through to take place. They also supply N to plant so that fungi secrete proteinases.

Orchid mycorrhiz

It is associated with orchids which are very small and do not contain enough organic reserves to allow development of the plant. Such orchids must be infected soon after germination to provide seedling with carbohydrates by the fungus. Basidiomycetes involved in this mycorrhiza are litter decomposing species of Rhizoctonia, Armillaria that produce cellulases. Fungi are widely distributed outside the symbiosis in which some are plant pathogens and others are saprotrophs. Orchid keeps fungus in check by digesting intracellular hyphal coils and production of antifungal substances so that fungus doesn't kill the orchid.

Arbutoid mycorrhizae

It is also associated with the plants belonging to Ericaeceae which includes *Arbutus*, *Arctostaphylose*, *Pyrola*. Fungi are basidiomycetes that also from ectomycorrhizae. Fungi from sheath and harting net and hyphae also penetrate outer cortical cells.

Monotropoid mycorrhizae

It is associated with the plants which are noncholophyllous such as *Monotropa*. Fungi are basidimycetes that form ectomycorrhizae with other plants (conifers). The plant depends on its mycorrhizal fungus for organic nutrients as well as inorganic nutrients.

Importance of mycorrhizae

Suggested roles of mycorrhizae; fungi natural and managed ecosystems are listed below.

Benefits to plants

- Increased plant nutrient supply by extending the volume of soil accessible to plants
- Increased plant nutrient supply by acquiring phosphorus and other micronutrients which would not be normally is available to plants.
- Some ECM and ericoid fungi have the capacity to breakdown phenolic compounds in soils which can interfere with nutrient uptake.
- Root colonization by ECM and VAM fungi can provide protection from parasitic fungi and nematodes.
- Mycorrhizae benefits can include greater yield, nutrient accumulation, and/or reproductive success.
- Mycorrhizae can cause growth from changes to root architecture, vascular tissue, etc.
- Suppression of completing non-host plants, by mycorrhizal fungi has been observed.
- A significant amount of carbon transfer through fungus mycelia connecting different plant species has been measured. They could reduce competition between plants and contribute to the stability and diversity of ecosystems.
- Networks of hyphae supported by dominant trees may help seedlings become established or contribute to the growth of shaded under-storey plants.
- Nutrient transfer from dead to living plants may occur.

- Helps in reducing transplantation shock in transplanted crops.
- Increases water uptake in plants.
- Helps in enhancing nitrogen fixation in legumes by supplying phosphorous as a source of energy to the nitrogen fixers.

Other roles in ecosystems

- Soil hyphae are likely to have an important role in nutrient cycling by helping to prevent losses from the system, especially at times when roots are inactive.
- Hyphae may transport carbon from plant roots to other soil organism involved in nutrient cycling processes. Thus, cooperating with other members of the decomposition soil food-web.
- Soil hyphae may have an important role in nutrient cycling by acquiring nutrients from saprophytic fungi.
- Epigeous and hypogeous sporocarps of ECM and VAM fungi are important food sources for mammals.
- Mycorrhizas influence soil microbial populations and exudates in the mycorrhizosphere.
- Hyphae of VAM fungi are considered to contribute tom soil structure. Their role in mechanical aggregation has been questioned. Hyphal mats produced by ECM fungi considerably alter soil structure
- Mycorrhizae fungi contribute to carbon storage in soil by alternating the quality and quantity of soil organic matter.

Factors affecting the growth and development of mycorrhiza

Several factors affected the mycorrhiza growth and development. Some of the important factors are:

Soil temperature

The effect of soil temperature on mycorrhizal function has already been reported. Soil temperature may alter the psychology of mycorrhizal symbiosis to stimulate grater inoculum production by influencing root morphology and host plant nutrition. Optimal temperature for the germination may be related to the environment to which each endophyte is indigenous. It is evident that the effect of temperature on symbiosis varies with the specific host and endophyte.

Soil acidity

Effect of soil acidity on AMF has been reported by several investigators. Inoculation with *Glomus* sp. increases phosphorus uptake and plant growth when the soil pH is 7.0 or higher. The relation between VAM and pH depends on soil type, plant species and fungal species. Mycorrhizal fungi vary in their soil pH tolerance; some grow in low pH and others grow after adding amount of line for soil pH modification. Soil pH is a critical factor in studying endomycorrhizal fungi ecology.

Crop rotation

It has critical effect on soil microbial communities, soil structure and organic matter. Hence, crop rotation is known to affect AMF in the field. Crop rotation also affects species diversity.

Fertilizer and organic matter

Mycorrhizal hypha acts as binding agents within and between aggregates. In the mycorrhizosphere, mycorrhizal hyphae maycontribute further to the aggregating affect as they grow into small pores and bind soil particles together. Phosphorous fertilizers are known to inhibit colonization

of roots and spore production by AMF. In agricultural soils, a decline in numbers of viable and healthy AM propagules can occur during long weed-free fallows or during rotation with non-mycotrophic plants.

Drought stress and soil moisture

Drought stress results in greater yield loss than any other single biotic or abiotic factor. AMF colonization enhances plant growth under drought stress indirectly through influence of the soil moisture retention via glomalin's effect on soil water stable aggregates, although direct mineral nutrition effects could not be excluded.

Pesticides

Several interactions between mycorrhizal fungi, their host and the environment must be recognized to understand the impact of pesticides. Cause and effect can be difficult to determine, because what influences the fungi may thereby indirectly influence the host and vice versa. An herbicide that severely damages the host will almost certainly damage the mycorrhizae. Mycorrhizal fungi grow with the roots of many plants and aid in nutrient uptake. These fungi can also be damaged by herbicides in the soil.

Heavy metals

AMF could be of particular benefits to plants m relation to alleviating heavy metals. Plants growing in heavy metal soils can be colonized by AMF. Recent reviews showed that polluted soil contain AMF that are specifically adapted to soil pollution. It has been stressed that specific AMF spores from heavy metal soils possess enormous potential for phytoremediation.

Soil salinity

AMF have been known to occur naturally in saline environment. Salinity, not only affects the host but also the AMF. It can hamper colonization percentage, growth of hyphae and spore germination of fungus. Numerous researchers have documented the negative effects of salinity on the fungus. Colonization of plant roots by some AMF is reduced in the presence of sodium chloride.

Propagules of mycorrhizal fungi

The spread to new roots, long-range dispersal and persistence of mycorrhizal fungi in ecosystems is dependent on the formation of propagules and their interactions with soil and environmental conditions. Propagules of VAM fungi include spores, root fragments containing hyphae and vesicles (storage structures) and soil hyphae. Propagules of ectomycorrhiza fungi include hyphae, mycelial strands and rhizomorphs.

Dispersal of mycorrhizal fungi

The spread of mycorrhizal fungi can occur by active processes (hyphal growth through soil) or passive dispersal mechanisms. Hyphae of VAM fungi radiate outward from mycorrhizal plants and thus can slowly spread the association to adjacent plants. Dispersal mechanisms are responsible for introduction of mycorrhizal fungi to new geographic locations and the transfer of genetic information.

Advantages of mycorrhizal bio-fertilizer inoculation

- 1 ton of VAM is equivalent to 24 tons of phosphorus with the application dose of 0.5kg/ha spore suspensions.

- Solubilize and absorb phosphate and sulphur and increase availability and uptake efficiency of plants for secondary and micronutrients which are relatively insoluble and immobile.
- It leads to saving of 20-40 kg of inorganic phosphates per hectare.
- Provide plant nutrients like phosphorus, potassium, calcium magnesium sulphur, iron, manganese, zinc and copper etc at a very low cost. Enhances plant growth by release of vitamins and hormones and plant growth substances like auxins and cytokinins etc. Increase in crop yield has been recorded by about 20-40% with their use.
- Improves the physical, chemical and biological properties of soil by organic matter decomposition and soil aggregation.
- It is required in very small amount and also becomes available to the subsequent crop. Helps in nutrient recycling.
- Helps survival and proliferation of beneficial microorganisms like phosphorus solublizers, organic matter decomposers and nitrogen fixers etc.

Conclusions

Mycorrhizae fungi are now known to provide a wide range of significant benefits to their plant hosts. In addition to enhancing mineral nutrition, they induce greater resistance to soil pathogens, enhance tolerance to drought stress, and reduce sensitivity to toxic substances occurring in the soil. Many efforts have been made in recent years to accrue benefits from mycorrhizae for agriculture, horticulture, forestry, and site remediation. The results have been consistently positive, with some difficulties due to complications from diverse variables under field conditions. Mycorrhizae interactions between plants, fungi, and the environment are complex and often inseparable. Mycorrrhizae are an essential below-ground component in the establishment and sustainability of plant communities, but thorough knowledge is required to achieve maximum benefits from these microorganisms and their associations.

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Plant defence against abiotic and biotic stress

Shephali Sachan
Forest Ecology and Rehabilitation Division
Tropical Forest Research Institute
Jabalpur (M.P.)

Introduction

The concept 'stress' was given by Hans Selye in 1936. Like any living organism, plants also go through the condition called 'stress'. The meaning of stress varies with the field of study. In physical definition, the stress is applied force divided by the area on which the force or pressure act upon. In chemistry, the stress is change in chemical equilibrium in order to relief from it. While in biological organisms, stress can be described as any environmental factor unfavourable for the living organisms.

Stress in plants differ from animals as plants are stable and can not show physiological and morphological changes in response to stress. Plant stress is a state in which increasing demands made upon a plant lead to an initial destabilization of functions, followed by normalization and improved resistance or it may also result into permanent damage or even death if the tolerance limits and adaptive capacity is crossed. Stress is caused by biotic or abiotic factors or with highly unpredictable fluctuations imposed on the regular metabolic pattern, that cause body tension like body injury, disease or aberrant physiology. These factors are often called as stress inducers or stressors.

Types of plant stress

Plant stress can be divided into two primary categories – Abiotic and Biotic stress.

Abiotic stress is a physical or chemical factor that the environment may impose on a plant. There are multiple abiotic factors that limit the plant growth. Drought, waterlogging, freezing, salinity, air pollutants, acid soil, mineral toxicity, mineral deficiency etc. are the examples of abiotic stress. Plant responses to abiotic stresses are dynamic and complex, they are both elastic (reversible) and plastic (irreversible). Prolonged exposure to these abiotic stresses results in altered metabolism and damage to biomolecules. There is only 3.5% of the global land area left unaffected by abiotic stress resulting about 70% reduce limit in crop production.

Biotic stress is a biological factor that plant may be exposed during its life time. Under natural conditions, plants face the threat of infection by pathogens (including bacteria, fungi, viruses and nematodes) and attack by herbivore pests. The habitat range of pests and pathogens can be influenced by climate change. Similar to abiotic, biotic stresses also results in altered metabolism and damage to biomolecules. The damage caused by biotic stress may be 100% due to severe attack of pathogens. For example potato blight in Ireland, coffee rust in Brazil, maize leaf bight in the USA and the Great Bengal Famine in 1943. The intensity of damage varies with the location as susceptibility for same biotic stressor is different in different location. According to

ICAR-NIBSM (Indian Council of Agricultural Research – National Institute of Biotic Stress Management) in India there is loss in crop production by 25% due to insects, 20% due to nematodes and 8% due to vertebrate pests like rodents.

The combined effect of abiotic and biotic stress proved to be more defensive as compare to effect of individual stress. Many abiotic stress conditions were shown to weaken the defence mechanism of plants and enhanced their susceptibility to pathogen infection. Plants activate a specific and unique stress response when subjected to a combination of multiple stresses. In a stressful environment, the specific genotypes with appropriate gene combinations become dominant in the population.

Table 1. Sources of environmental stress in plants

Physical	Chemical	Biotic
Drought	Air pollution	Competition
Temperature	Heavy metals	Allelopathy
Radiation	Pesticides	Herbivory
Flooding	Toxins	Diseases
Wind	Soil pH	Pathogenic fungi
Magnetic field	Salinity	Viruses

Ref.: Nilsen and Orcutt 1996

Working function of plant stress

Plant stress arises as a result of deviation in environmental factors from normal condition but this does not mean that every deviation in environment leads to stress. Normal seasonal changes does not create stressful conditions but adverse conditions for prolonged period can lead to stress conditions *viz.* maintaining high temperature without rainfall can lead to drought condition turning into drought stress to the plants.

Plants are confined to the place where they grow and have a limited capacity to avoid unpredictable unfavourable changes in their environment (confrontation with extremes of temperature, water shortage, insufficient or excessive light or mineral nutrients, attack by pathogenic bacteria, fungi, viruses and viroids). But they have developed some strategies to defend themselves against such biotic and abiotic stresses, like alteration of growth and developmental patterns, lignifications, gum deposition, tyloses formation, release of some phenolic compounds, proteins and sugar etc. (Fig. 1). Plants are either more or less sensitive to particular stressor at specific developmental stages. The sensitivity stages of development are called windows of sensitivity. Few plants have ability to survive the unfavourable factor called as "stress resistance".

A response may be triggered directly by a stress, such as drought, or may result from a stress induced injury, such as loss of membrane integrity. The intensity of stress (pressure to change exerted by a stressor) is not easily quantified. Stress could occur at a low level with little effect, if this mild stress continues for a long time, becomes chronic stress and the physiology of plants is likely to be altered. In contrast, conditions could become difficult quickly, resulting in acute condition. Therefore, it can be said that stress is dramatic when applied for a short duration at high intensity and when applied

for a long duration at low intensity. It thus accounts for the influence of both intensity and duration on physiological performance. Plant responses to chronic stress and acute stress may be very different even though the dose is the same. The reason is due to the different genetic responses during acute and chronic stress. The acute stress is more harmful as compare to chronic stress proved in number of experiments. For example, UVB has more harmful effect on plant genome stability by acute exposure than chronic exposure. Similarly, transient reduction of expression levels of the transgene driven by the 35S promoter results during acute exposure to abiotic stress, there is no change in case of chronic stress.

The effect of environmental stress (abiotic or biotic) on plant can cause three types of responses – Resistance, susceptibility, and avoidance (Fig. 2). The plant may show either of three responses as a result of stress. Plants show death response when they are susceptible to stress, at this time flowering stops, no seed formation, induce senescence that ultimately leads to death. Plant survive when they develop resistivity or avoidance nature. Some of the plants escape from stress, this is referred as avoidance. Avoidance mechanism reduce the impact of stress even though the stress is present in the environment.

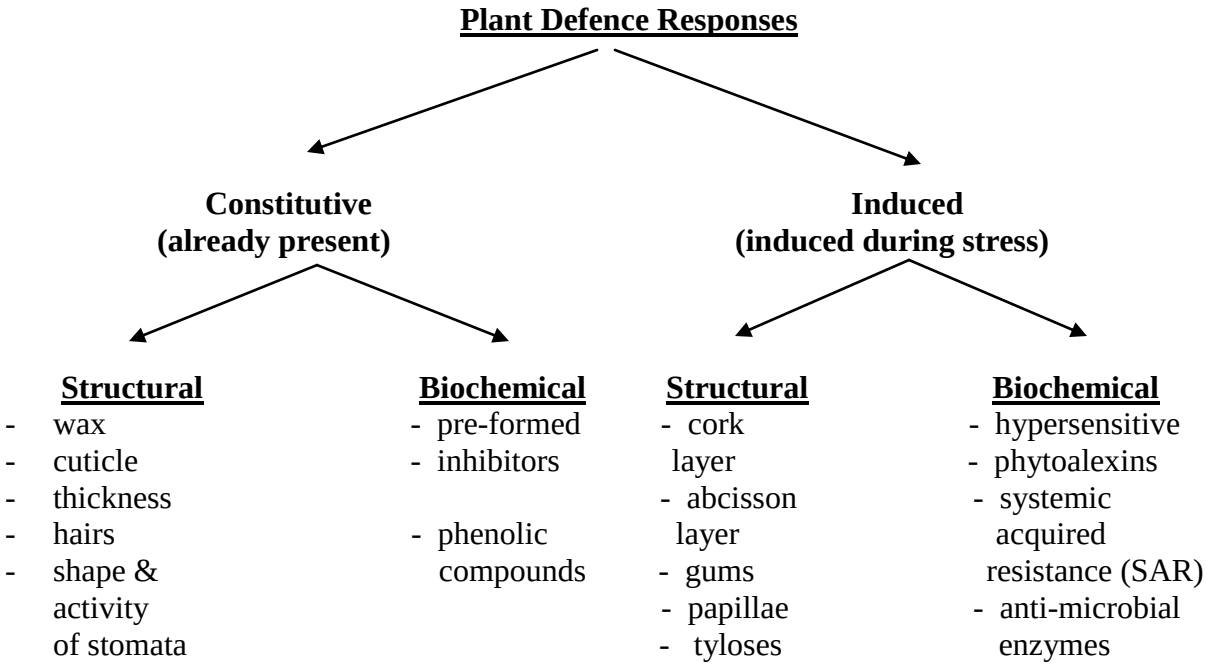

Fig. 1: Plant defence responses against abiotic and biotic stress

Resistivity response of plants may be acquired either by acclimation or adaptation process. Stress resistance plants have capacity to tolerate particular stress. There is very important distinction between acclimation and adaptation responses. Acclimation is a change in homeostasis (a steady state condition of plant) to adjust

physiological and structural attributes on the scale of seconds or seasons *i. e.* in a time-dependent manner within a single genotype to accommodate (further) shifts in its external environment. Acclimation is a temporary acquired process i.e. on removal of stress condition plant acquires its original attributes back. This attribute of plant to undergo non-permanent changes is referred as phenotypic plasticity and the process of acclimation to a stress is known as hardening. The plant species having capacity of being acclimatized are hard species. Whereas Adaptation occurs by various mechanisms at the genetic level in populations over many generations that represent permanent changes in the physiology or morphology of the individual which cannot be reversed if the prevailing environmental conditions become same. Thus acclimation is a physical reaction made in order to adjust to said changes and adaptation involves changes in both physical and chemical composition of an organism brought about by habitat changes. Adaptation is natural and necessary process for survival of a species, while acclimation only happens when there are small changes in the habitat.

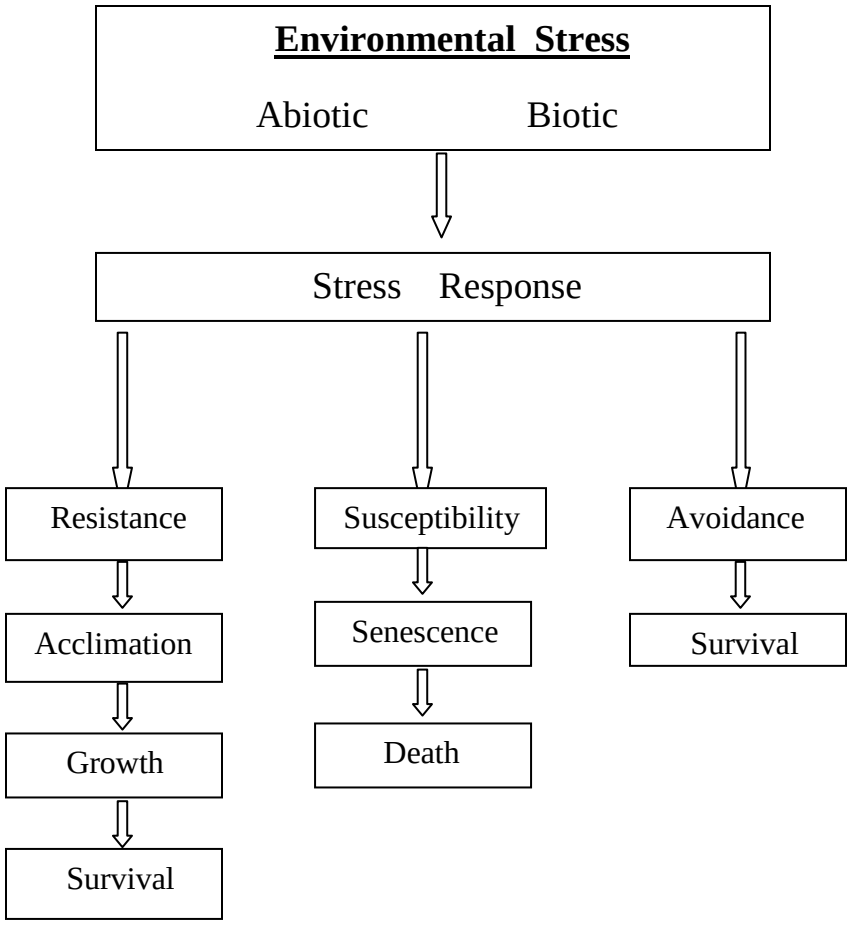

Fig. 2: Three types of responses against plant stress

Measures to mitigate stress conditions

Plant growth, productivity and distribution are greatly affected by both abiotic and biotic stress as a result affecting the life of man and animal. In the world, the biotic stress have resulted in 800 million people under fed due to yield loss. In the same way 2/3rd of the yield potential of major crops are routinely lost due to the abiotic stress. By 2050, the world population is estimated to reach about 10 billion facing serious food shortages. Hence, it is required to deal with plant stresses either by lower down them or to develop such varieties which are resistance to them. Lower down the plant stress is a difficult task as to deal with the climate changes and environmental risks is beyond the human capability. But the later option to develop the resistive plant varieties against stress is under human capability and is widely used to mitigate the problems of food scarcity and afforestation. Followings are the ways to approach the target of developing the plant variety with stress resistance and high yielding potential:

Conventional method

These methods involve proper landscape management practices, selecting and growing stress resistance/tolerant and high yielding variety either by simple hybridization method, e.g. cassava, millet and sunflower or by applying plant tissue culture approach, e.g. maize, rice, wheat, rice, sugarcane etc.

Modern methods

These methods include mutation breeding, tilling (targeting induced local lesions in genomes), microarray method, by using biochemical (proline, protein, chlorophyll, MDA etc) and molecular (RAPD, AFLP, SNP) markers, and genetic engineering by developing transgenic varieties. For example varieties of rice, wheat, tobacco, sugarcane have been developed through modern techniques.

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अचानकमार-अमरकंटक बायोस्फियर रिजर्व में पाये जाने वाले औषधीय पौधे, उनकी उपयोगिता एवं संरक्षण: भाग दो

डॉ. रूबी शर्मा*, डॉ. राजेश कुमार मिश्रा एवं डॉ. एन. रॉयचौधुरी

उष्णकटिबंधीय वन अनुसंधान संस्थान, जबलपुर

*पूर्व महिला वैज्ञानिक 'बी', अचानकमार-अमरकंटक बायोस्फियर रिजर्व के अन्तर्गत विज्ञान एवं प्रौद्योगिकी विभाग की परियोजना, उष्णकटिबंधीय वन अनुसंधान संस्थान, जबलपुर

विश्व में औषधीय पौधों की लगभग 2500 प्रजातियां पाई जाती हैं। इनमें 1158 प्रजातियां भारत में हैं। इन औषधीय पौधों की उपयोगिता का अनुमान इसी से लगाया जा सकता है कि इनका उल्लेख वेदों में भी किया गया है। इनमें से 81 औषधीय पौधों का वर्णन यजुर्वेद, 341 वनस्पतियों का उल्लेख अथर्ववेद, 341 का उल्लेख चरक संहिता और 395 औषधीय पादपों और प्रयोग का वर्णन सुश्रुत में है।

भारत के उच्च हिमालयी और मध्य हिमालयी रेंज में पाई जाने वाले गन्द्रायण, कालाजीरा, जम्बू, ब्राह्मी, थुनेर, घृतकुमारी, गिलोय, निर्गुडी, इसवगोल, दुधी, चित्रक, बहेड़ा, भारंगी, कुटज, इन्द्रायण, पिपली, सत्यानाशी, पलास, कृष्णपर्णी, सालपर्णी, दशमूल, श्योनांक, अश्वगंधा, पुनर्नवा, अरण आदि जड़ी बूटियां अब दुर्लभ होती जा रही हैं। इसका कारण जलवायु परिवर्तन और वनों से जड़ी-बूटियों का अवैानिक तरीके से किया जा रहा दोहन को माना जा रहा है।

पिछले कुछ दशकों के भीतर बढ़ती आयुर्वेदिक दवाओं की मांग को पूरा करने के लिए औषधीय पौधों का अत्यधिक दोहन हो रहा है। भारत के हिमालयी रेंज में पाई जाने वाले औषधीय पादपों पर संकट छाया हुआ है। तापमान में बढ़ोतरी से भी जड़ी बूटियां विलुप्त हो रही हैं। मौजूदा समय में 800 प्रजातियां संकटग्रस्त श्रेणी में शामिल हो चुकी हैं। जिस हिमालयी रेंज में यह औषधीय वनस्पतियां बहुतायत में पाई जाती थी वहां पर अब यह दुर्लभ हो चुकी हैं। यहां तक कि विभिन्न बीमारियों में बनने वाली दवाओं में अब इन औषधियों के स्थान पर इनके प्रतिस्थानी (सब्सीट्यूट) का उपयोग किया जा रहा है।

पेड़-पौधे हमारे शरीर में होने वाली बीमारियों से छुटकारा पाने के लिए हमें बहुत कुछ दे सकते हैं। यही कारण है कि प्राचीन काल से ही मनुष्य ने तरह-तरह के पेड़-पौधों का उपयोग किया है अपने-आप को बीमारियों से सुरक्षित रखने के लिए। मानव सभ्यता के विकास के साथ ही इस विज्ञान ने भी तरक्की की है। यही कारण है कि प्राचीन जितनी

भी विकसित सभ्यताएँ थी उन सभी में औषधीय पौधों के उपयोग की सबल परम्परा थी, चाहे मिस्र हो, यूनान हो, बेबीलोन की सभ्यता हो, चीन हो या सिन्धु घाटी की सभ्यता हो। सभी के साथ कुछ ऐसा अवश्य था कि उन्होंने अपनी अलग परम्परा विकसित कर ली थी। स्वास्थ्य सम्बन्धी समस्याओं से निपटने के लिए उन परम्पराओं में औषधीय पौधों का महत्त्वपूर्ण स्थान था।

भारत विश्व के गिने चुने देश में से है जिन्हें उच्च जैव विविधता वाले देश का दर्जा दिया जाता है। इसका कारण है कि भारत में अनेक प्रकार के जीव पाये जाते हैं जिनमें वनस्पति तथा पशु दोनों ही हैं। इन दोनों में भारत अत्यधिक सम्पन्न है और बहुत सारे पेड़-पौधे तथा पशु-पक्षी ऐसे हैं जो केवल भारत में ही होते हैं। तरह-तरह के पेड़-पौधों में ऐसे पेड़-पौधे भी हैं जिनमें औषधीय गुण होते हैं। इनका उपयोग भारत में सदियों से होता रहा है। भारत को इस सम्बन्ध में एक खास स्थान प्राप्त है। आज भी भारत में करोड़ों लोग ऐसे हैं जो सीधे जड़ी-बूटियों से अपनी बीमारियों का इलाज करते हैं या ऐसी दवाओं का उपयोग करते हैं जिनका आधार जड़ी-बूटियाँ हैं।

अचानकमार -अमरकंटक बायास्फियर रिजर्व में अभी तक कुल 1527 पादप प्रजातियों की पहचान की जा चुकी है जिनमें लगभग पेड़ पौधों का औषधीय प्रयाग भी रिकार्ड किया गया है। चूँकि यह जीवमंडल कई तरह के जंगल तथा प्राकृतिक आवासों जैसे साल वन, मिश्रित वन, बाँस वन, पहाड़ी क्षेत्र, घाटी क्षेत्र नदी नालों के किनारे, वृक्षारोपण क्षेत्र, चारागाह, आदि पाये जाते है, इसलिए यहाँ पादपों में बहुत विविधता देखी गयी है। इस जैव विविधता का संरक्षण तभी किया जा सकेगा, जब हम इनकी पहचान कर सकेंगे। इसके अलावा यहाँ निवास करने वाले स्थानीय आदिवासी समुदायों में प्राथमिक प्राकृतिक चिकित्सा को बढ़ावा देने के उद्देश्य से द्वितीय भाग में यहाँ 29 पौधो का प्रचलित नाम , कुल, वैज्ञानिक नाम, उपयोगी भाग व उपयोग दर्शाया गया है।

प्रचलित नाम - शंखपुष्पी

कुल - कान्वॉल्वुलेसी

वैज्ञानिक नाम - ईवाल्व्यूलस अल्सीनॉईडिस

उपयोग भाग - पंचांग व जड़

उपयोग - मानसिक रोग, उन्माद, अपस्मार, अनिद्रा, भम्र व विष में लाभकारी है। श्वास रोग, रक्तस्त्राव व रक्त वमन में लाभदायक जड़ केन्द्र प्रयोग से दस्त द्वारा शारीरिक

विष निकल जाता है। पंचांग का स्वरस उन्माद व अनिद्रा में अतिलाभकारी है । इसका प्रयोग, मलेरिया, ज्वर, कण्डमाल में किया जाता है।

प्रचलित नाम - हुरहुर

कुल - कप्पारिडेसी

वैज्ञानिक नाम - कलिओम विस्कोसा

उपयोग भाग - पत्ती व बीज

उपयोग - रक्तपित्त, श्वासरोग, ज्वर, कुष्टरोग, प्रमेह, कृमिनाशक के रूप में इसका प्रयोग किया जाता है। आन्तरिक शोथ में पत्रों का लेप लाभकारी होता है । जोड़ो के दर्द, पाचन के लिए भी बीज उपयोग किये जाते है।

प्रचलित नाम - काली मूसली

कुल - अमैरिलीडेसी

वैज्ञानिक नाम - कुरकुलिगो आरकियाईडिस

उपयोग भाग - कंदिल जड़

उपयोग - इसकी जड़ अतिसार, बल, लिंग दौर्बल्य, शूल, मूत्रकच्छ में

लाभकारी होती है। इसके मूल का लेप अस्थिभंग व चोट के लिए किया जाता है।

प्रचलित नाम - भृंग राज

कुल - एस्टरेसी

वैज्ञानिक नाम - ईकलिप्टा अल्बा

उपयोग भाग - पंचांग, पत्ती, बीज व जड़

उपयोग - यह घाव, अस्थिरोपण, कैंसर, जीर्णज्वर, केश, कुपचन, यकृत रोग, श्वासरोग, चर्मरोग, स्वरभेद, अग्निदग्ध, सफेद दाग आदि में प्रयोग किया जाता है । इसके पंचांग स्वरस से यकृतवृद्धि, प्लीहावृद्धि, उदररोग आदि विकार नष्ट होते हैं।

प्रचलित नाम - भुई आंवला

कुल - यूफोर्बियेसी

वैज्ञानिक नाम - फाईलेंथस स्प़ी

उपयोग भाग - जड़, पत्ती व पंचांग

उपयोग - जलोदर, मूत्र रोग, दाह, प्रमेह, अतिसार, शूल प्रवाहिका अग्निमंधता, चर्मरोग आदि में इसका प्रयोग किया जाता है । मलेरिया व पीलिया में इसका क्वाथ, रक्तप्रदर में बीजें का चूर्ण, मधुमेह में पंचांग, खाज खुजली में पत्रों का पुल्टिस व अतिसार में पंचांग का क्वाथ हितकारी है ।

प्रचलित नाम - विदारीकंद

कुल - लेग्यूमिनोसी

वैज्ञानिक नाम - प्यूरेरिया टयूबरोसा

उपयोग भाग - कंदिल जड़

उपयोग - इसका कंद दुग्ध वर्धक, शुक्रवर्धक बल, कांति, बढ़ाने व वायु व दाह नाशक है । विषम ज्वर व पित्तशूल में विदारीकंद का स्वरस लाभकारी होता है । अशक्ति व पोषण के अभाव वाले बच्चों को इसका पाक लाभ देता है ।

प्रचलित नाम - सहदेवी

कुल - एस्टरेसी

वैज्ञानिक नाम - वरनोनिया साईनेरिया

उपयोग भाग - जड़, फूल, बीज, पंचांग

उपयोग - इसकी जड़ जलोदर व विषम ज्वर में लाभकारी है । ज्वर, में पंचाग स्वरस से लाभ होता है । इसके बीज कृमिनाशक है, इसकी मूल सिरहाने रखने से अनिद्रा में लाभ मिलता है । मुखरोगों में ज्वर का स्वरस पिलाने से ज्वर उतर जाता है ।

प्रचलित नाम - कंटकरीका

कुल - सोलेनेसी

वैज्ञानिक नाम - सोलेनम सुरेटेन्स

उपयोग भाग - पंचांग, फल, बीज

उपयोग - इसके पंचांग का प्रयोग जीर्णश्वसनी शोथ, श्वासरोग, स्वरयंत्र शोध, हृदयघात, रक्तदाव नियंत्रण में लाभकारी होता है। इसके मूल का क्वाथ मूत्रकच्छ ज्वर में इसकी मूल आमवात में पत्तों के स्वरस व गले की सूजन में फल का स्वरस लाभकारी होता है।

प्रचलित नाम - महाबला

कुल - फेबेसी

वैज्ञानिक नाम - साईडा रोम्बीफोलिया

उपयोग भाग - पंचांग, जड़, पत्ती

उपयोग - हृदय रोग, शोथ, शुक्रवर्धक, विषम ज्वर, आमवात, श्वेत प्रदर की यह लाभकारी औषधि है। सूजन में पत्तियों का लेप शीतज्वर व आमवात में मूल का क्वाथ व श्वेतप्रदर में पत्तियों को पीसकर मधु के साथ सेवन से लाभ मिलता है।

प्रचलित नाम - मन्जीष्ठा

कुल - रूबीयेसी

वैज्ञानिक नाम - रूबीया कार्डीफोलिया

उपयोग भाग - जड़ व तना

उपयोग - इसके तने का प्रयोग कोबरा, नागदंश, बिच्छूदंश में लाभकारी होता है। इसके मूल का प्रयोग अंगघात, मूत्रघात, प्रमेह, चर्मरोग, अतिसार, नेत्ररोग आदि में लाभकारी होता है। अस्थिरोग में इसके मूल को अर्जुन व मुलैठी को क्वाथ के साथ लेने से लाभ होता है। यकृत रोग में इसके फल का प्रयोग लाभकारी होता है।

प्रचलित नाम - झुलीफूल

कुल - जिरेनियेसी

वैज्ञानिक नाम - बायोफाइटम सेंसीटिवम

उपयोग भाग - पंचांग, पत्ती, बीज

उपयोग - बीज का चूर्ण जख्मी भाग व त्वचा के रोगों में प्रयोग किया जाता है। पत्ती, रक्तरोधी, स्वरस चोट आदि पर बाहरी

प्रयोग व क्वाथ श्वास रोग, मूल का क्वाथ ज्वर में लाभकारी होता है।

प्रचलित नाम - तेजराज

कुल - एपियेसी

वैज्ञानिक नाम - प्यूसिडेनम नागपुरेंस

उपयोग भाग - बीज, जड़, फल

उपयोग - इसकी जड़ बलवर्धक मानी जाती है। इसके फल व बीज आमाषय के रोग, अग्निमंद्यता, दौर्बल्य, पाचन तंत्र, बच्चों के अनेक रोग, आद्यमान, पाचन विकार, उदरमूल, वमन, अतिसार आदि के लिए किया जाता है।

प्रचलित नाम - पाठर

कुल - मेनिर्स्पमेसी

वैज्ञानिक नाम - सिसेम्पेलॉस पटेरा

उपयोग भाग - मूल व छाल

उपयोग - इसकी जड़ मूत्राशय शोथ, मूल का क्वाथ पलीहा वृद्धि, कुपाचन, सिर वेदना, अतिसार, पत्रों का रस, नेत्ररोगों में, चर्मरोगों एवं घाव, ज्वर, अपस्मार, श्वसनीशोथ, उदरशूल आदि में अत्यंत लाभकारी होता है।

प्रचलित नाम - सतावर

कुल - एस्पेरेगेसी

वैज्ञानिक नाम - एस्पैरेगस रेसिमोसस

उपयोग भाग - जड़

उपयोग - पत्ती का रस कैंसर प्रतिरोधक, व बलवृद्धि करने की क्षमता रखता है। रक्तातिसार में जड़ का चूर्ण, स्वरभेद, कफ, जुकाम, रात्री अंधता में लाभकारी होता है। उदर, आमाषय आंत के अल्सर, अम्लपित्त में मूल का चूर्ण। गर्भाशय की विकृति दुग्धवर्धक, शुक्रदोष, मधुमेह व सामान्य दौर्बल्य में यह अतिलाभकारी होती है।

प्रचलित नाम - केवकंद

कुल - कॉस्टेसी

वैज्ञानिक नाम - कॉस्टस स्पीसीयोसस

उपयोग भाग - प्रकंद

उपयोग - इसके प्रकंद से स्टेरॉयड का उत्पादन किया जाता है। इसे ज्वर, जलोदर, श्वास, सर्वांग शोथ, आमवातत्र, मूत्राशय के रोग आदि में प्रयोग किया जाता है। श्वास व हृदय रोग

में मूल के चूर्ण लाभकारी होता है । हड्डियों की पीड़ा वात रोग में अतिलाभकारी होता है।

प्रचलित नाम - तिखुर

कुल - जिन्जीबरेसी

वैज्ञानिक नाम - कुरकुमा अंगस्टीफोलिया

उपयोग भाग - प्रकंद

उपयोग - इसके प्रकंद में पाया जाने वाले स्टार्च का सत (एक्स्ट्रेक्ट) कर आटे के रूप में प्रयोग में लाया जाता है। यह बुजुर्ग, बच्चे व लंबी बीमारी से (उबरे) व्यक्तियों के लिए अतिलाभकारी होता है। इसे पीलिया व मोतीझिरा के रोगियों के लिए लाभकारी है।

प्रचलित नाम - आमाहल्दी

कुल - जिन्जीबरेसी

वैज्ञानिक नाम - कुरकुमा अमाडा

उपयोग भाग - प्रकंद

उपयोग - इसका प्रकंद, पाचक व उदर बल्य के लिए अच्छी औषधि है। इसे मोच व अंदरूनी चोटों की चिकित्सा में भी प्रयोग किया जाता है।

प्रचलित नाम - कालीहल्दी

कुल - जिन्जीबरेसी

वैज्ञानिक नाम - कुरकुमा केसिया

उपयोग भाग - प्रकंद

उपयोग - इसका प्रकंद दमा रोग की लाभकारी औषधि है। इसे मूंद्रिचोट व मोच आदि में प्रयोग किया जाता है। इससे द्रव्य निकाला जाता है जो कपूर के उत्पादन में प्रयोग किया जाता है।

प्रचलित नाम - अकरकरा

कुल - एस्टरेसी

वैज्ञानिक नाम - स्पाईलेन्थस एक्मेला

उपयोग भाग - फूल, पंचांग, जड़

उपयोग - इसके फूल का प्रयोग, गले के विकार, जीभ का लकवा व बच्चों में हकलाने की प्रवृत्ति लाभकारी होता है। इसके फूल

का अर्क दांत व जबड़ों के शूल में प्रभावी होता है।

इसकी जड़ पाचक होती है।

घर की बाड़ी में लगाये जाने वाले औषधीय पौधे

प्रचलित नाम - अदरक सौंठ

कुल - जिन्जीबरेसी

वैज्ञानिक नाम - जिन्जीबर ऑफिसिनेलिस

उपयोग भाग - प्रकंद

उपयोग - इसमें रक्तषोधन, बातहर, कफ, निःसारक, पाचन, उत्तेजक आदि गुण पाये जाते है। इसे आमवात, स्लीप-डिक्स, स्नायुविकार, श्वासरोग, खांसी, रोग प्रतिकारक शक्ति की वृद्धि आदि में प्रयोग किया जाता है।

ताजी प्रकंद व सूखी सौंठ दोनों ही रूप में यह प्रतिदिन भोजन में मसाले की तरह प्रयोग किया जाता है।

प्रचलित नाम - लेमनग्रास

कुल - पोएसी

वैज्ञानिक नाम - सिम्बोपोगॉन सिट्रेटस

उपयोग भाग - पत्तियाँ

उपयोग - यह बहुवार्षिक ऊँची घास की प्रजाति हैं जिसकी पत्तियाँ सुगंधित (नींबू सी महक) होती है। इसे ज्वर, वमन, अतिसार, जीर्ण मलेरिया, उदरषूल, आमवाल व खाज खुजली आदि में प्रयोग किया जाता है। नसला-जुकाम में इसके तेल की फोहे सूँघने से लाभ मिलता है।

प्रचलित नाम - तुलसी

कुल - लेमिएसी

वैज्ञानिक नाम - ऑसीमम बेसिलिकम

उपयोग भाग - पांचांग, पत्ती व बीज

उपयोग - तुलसी की लगभग चार-पांच प्रजातियाँ आमतौर पर औषधि के रूप में उपयोग किये जाते हैं। इसका पांचांग

जीर्ण, अतिसार, उदररोग, कृमिनाशक,

कीटाणुनाशक, फंफूदनाशक, कुपच, मूत्रकुच्छ में लाभकारी होता है । कर्णशूल व दंतशूल में इसका स्वरस लाभकारी होती है। बिच्छू के विष में इसका प्रयोग किया जाता है। पक्षाघात, सर्पविष, दाह में इसके बीजों का सेवन लाभकारी होता है।

प्रचलित नाम - पुदीना

कुल - लेबिएटी

वैज्ञानिक नाम - मेन्था स्पाईकेटा

उपयोग भाग - पंचांग, पत्ती व तना

उपयोग - इसका उपयोग बंधत्व, रजोरोधि, कीटाणुनाशक व फफूँद नाशक की औषधियों में आमतौर से प्रयोग होता है । खांसी,

जुकाम, अतिसार, अग्निमांद्य, जीर्ण ज्वर, उदरमूल, वमन आदि में प्रयोग किया जाता है।

प्रचलित नाम - प्याज

कुल - लिलिएसी

वैज्ञानिक नाम - ऐलियम सेपा

उपयोग भाग - पत्ती व बल्ब

उपयोग - यह हृदय रोग, श्वास रोग, रक्त में शक्कर आदि में लाभकारी औषधि का काम करती है । इसके बीज का रस सिरका में

पीस कर दाद में लगाने से लाभ देता है । कंद के रस सरसों के तेल के साथ आमवातादि, चर्मरोग, संधि विकार में लाभकारी है । मसूड़ों की सूजन, शूल में नमक के साथ पीने से लाभ मिलता है।

प्रचलित नाम - लहसुन

कुल - लिलियेसी

वैज्ञानिक नाम - ऐलियम सटाईवम

उपयोग भाग - पूर्ण पौधा, पत्ती, कंद

उपयोग - यहां ज्वर, अपस्मार, चर्म रोगों में, बाहय रोग में, चर्म विकार, सर्दी जुकाम में कीटाणु नाशक, कफ निःसारक के रूप में कार्य करता है।

प्रचलित नाम - गवारपाठा, घृतकुमारी

कुल - लिलियेसी

वैज्ञानिक नाम - अलोय बारबाडेंसिस

उपयोग भाग - पत्ती, पत्ती का गूदा

उपयोग - पत्ती का गूदा, आमवात विकार, ज्वर, शूल, यकृत रोग, पाचन विकार, पलीहा के रोग, चर्म विकार आदि में अति लाभकारी है। यह त्वचा के जलने पर लेप करने से जल्दी लाभ देता है।

प्रचलित नाम - अरंड

कुल - यूफोर्बियेसी

वैज्ञानिक नाम - रिसीनस कम्यूनिस

उपयोग भाग - पंचांग, पत्ती, बीज, मूल, मूल छाल, पत्ती, पुष्प, फल, बीज का तेल।

उपयोग - पत्ती का प्रयोग मूलकृच्छ, कृमिरोग में लाभकारी है। इसका फल ज्वर, यकृत रोग, प्लीहावृद्धि शामक, श्वास रोग, चर्मरोग, नेत्र रोग, नाड़ी रोग, आमवात में लाभकारी है।

प्रचलित नाम - हल्दी

कुल - जिन्जीबरेसी

वैज्ञानिक नाम - कुरकुमा डोमेस्टिका

उपयोग भाग - प्रकंद

उपयोग - यह अतिविशिष्ट औषधि है व इसका प्रयोग देश के कोने-कोने में प्रतिदिन भोजन के माध्यम से किया जाता है। इसमें रक्तशोधन, शोथहर, कतहर, विषध्न, उत्तेजक, यकृत

बल्य दायक, चर्मरोग शोधक जैसे गुण जाये पाते है । चोट, दाद, खुजली, त्वचा रोग, प्रमेह, खांसी-जुकाम, नेत्ररोग, बिच्छूविष, रक्ताविष, जीर्णज्वर आदि में इसे आमतौर पर प्रयोग किया जाता है ।

प्रचलित नाम - मेंहदी

कुल - लाईथरेसी

वैज्ञानिक नाम - लॉसोनिया इर्नमिस

उपयोग भाग - पत्ती, फूल, फल

उपयोग - यह शिरःशूल, श्वासनली शोथ, पलीहा रोग, केशवर्धक, प्रमेह आदि में प्रयोग किया जाता है । रक्तातिसार में बीज व षिरःषूल में इसके पत्रों को तेल व राल के साथ देने से लाभ मिलता है । इसकी छाल का क्वाथ जलने से होने वाले जख्मों में, पत्र व पुष्प का सत कुष्ठरोग में अत्यंत लाभकारी होता है ।

मानव शरीर की कोशिकाओं को नवीनता प्रदान करने वाली दवा में उपयोगी दुर्लभ वनस्पति कुनरनवा सहित 20 जड़ी-बूटियों का अमरकंटक में संरक्षण किया जा रहा है । इनमें डायबिटीज के दवा में उपयोगी वनस्पति गुड़मार व लीवर से जुड़ी बीमारियों का दवा बनाने में उपयोगी वनस्पति मजिस्ठा सहित अलग-अलग बीमारियों के इलाज में जरूरी औषधी बनाने में उपयोगी दुर्लभ वनस्पतियां शामिल हैं । जंगल से विलुप्त होती जा रही इन वनस्पतियों को संरक्षित करने के लिए अमरकंटक में संरक्षित वनक्षेत्र के जंगल क्षेत्र चिन्हित किया गया है । मजिस्ठा, ममीरा, कलिहारी, केवकंद, पताल कुम्हड़ा, वन अदरक, गुड़मार, देवसेमर, मालकामनी, गुरीच, चित्रक, कुनरनवा, वायविडंग, वनप्याज, कंधारी, लक्ष्मणकंद, मकोय, वनलहसुन, तीखुर व मुसली शामिल हैं । ये वनस्पतियां लीवर से जुड़े मर्ज, आंखों के सूरमा, कृमि नाशक, गैस से जुड़ी तकलीफ, हाइड्रोसिल, कफ व खांसी, ब्लड प्रेशर सहित अन्य बीमारी के इलाज में उपयोगी है । दवा बनाने वाली कई फर्म उत्पादन क्षमता की होड़ में जड़ी-बूटी व वनस्पति तैयार किए जाने के दौरान रासायनिक उर्वरकों का उपयोग करते हैं । इससे तैयार होने वाली वनस्पतियों की तुलना में अमरकंटक में प्राकृतिक रूप से उगने बढ़ने वाली जड़ी-बूटियां ज्यादा प्रभावी होगी । यहां के जंगल में पाई जाने वाली जड़ी-बूटियां विशिष्ट गुणधर्म युक्त होती हैं । अमरकंटक की खास विशेषता यहां का वातावरण व जलवायु का माइक्रो क्लाइमेट होना है । मैकल पर्वत की अनेक छोटी पहाडियां और पर्याप्त जलस्रोत यहां दुर्लभ जड़ी-बूटियों वनस्पतियों को विकसित होने के लिए अनुकूल है । अमरकंटक व छत्तीसगढ़ की सीमा के अचानकमार

में जैव विविधता की बाहुल्यता को युनेस्कों ने भी मान्यता दी है।

औषधीय पेड़-पौधों का बढ़ता उपयोग तथा व्यापार देश की आर्थिक स्थिति के लिए लाभदायक है। परन्तु इस कारण एक समस्या उत्पन्न हुई है। समस्या है कि अनेक प्रकार के औषधीय पेड़-पौधे विलुप्तावस्था में पहुँच गए हैं। कारण है इनकी कटाई बिना इस तथ्य को ध्यान में रख कर हो रही है कि बढ़ते उपभोग का उनके बचे रहने पर क्या प्रभाव पड़ेगा। इस समय देश में जितने औषधीय पेड़-पौधों का उपयोग होता है उसमें से लगभग 90 से 95 प्रतिशत वनों से प्राप्त होता है। बहुत कम मात्रा है जो खेती से आती है। जहाँ तक वनों का सम्बन्ध है तो स्वयं वनों का क्षेत्रफल समय के साथ देश में कम हुआ है। इस समय देश में लगभग 19 प्रतिशत क्षेत्र में वन हैं और इसमें भी काफी बड़ा भाग है जो अच्छी हालत में नहीं है। ऐसी स्थिति में औषधीय पौधों का बढ़ता दोहन ऐसी स्थिति पैदा कर सकता है कि शीघ्र ही अनेक प्रकार के औषधीय पौधे पूरी तरह लुप्त हो जाएँ।

ऐसी स्थिति में यह आवश्यक है कि इस धरोहर को बचाने के लिए प्रयास किया जाए। इस क्षेत्र में काफी कुछ हो रहा है। उदाहरण के लिए देश में वनों के बड़े क्षेत्र को सुरक्षित कर दिया गया है ताकि वहाँ उपस्थित पेड़-पौधे तथ पशु-पक्षी को पूरी सुरक्षा मिले। उनत्तीस प्रकार के ऐसे पेड़-पौधे हैं जिनके निर्यात पर खास तरह से प्रतिबन्ध लगाया गया है। अधिक उपयोग में आने वाले औषधीय पौधों की खेती को बढ़ावा दिया जा रहा है। वनों के अन्दर ऐसे क्षेत्र जहाँ औषधीय पौधे अधिक हैं उन्हें एक खास दर्जा देकर सुरक्षित किया जा रहा है। इन्हें औषधीय पौधे सुरक्षित क्षेत्र का नाम दिया गया है। इन सबके अतिरिक्त एक अधिनियम भी भारत सरकार ने जारी किया है। इसे "जैवविधिता अधिनियम 2002" का नाम दिया गया है। परन्तु इस सबके बाद भी इस धरोहर को सुरक्षित रखने के लिए आवश्यक है कि अधिक कारगर कदम उठाए जाएँ तथा आम लोगों को इस शुभ कार्य में शामिल किया जाए।

Know your biodiversity

Dr. Swaran Lata and Pradeep Bhardwaj
Himalayan Forest Research Institute (HFRI)
Shimla (Himachal Pradesh)

Primula denticulata

It is beautiful Himalayan herb distributed in Afghanistan, Burma to S. Tibet, Bhutan. In India it is found in Temperate Himalaya, Kashmir to Kumaon, E. Himalaya at Altitude of 1500-4500 m. It belongs to family Primulaceae. Species epithet '*denticulata*' means 'small toothed'. *Primula elata, Primula telemachica* and *Primula aequalis* are the synonyms of *Primula denticulata*

Erect stems are topped with round balls of tiny bell shaped flowers and appears like drumstick hence it is commonly known as Drumstick primula. In Tibet it is known as *Keechey* and in Himachal Pradesh it is known as *Jaibeez*. It is one of the very early flowering plant in Himalayan regions.

It is small hairy, scapigerous, somewhat powdery or mealy-looking, perennial herb. Rootstock stout, short and thick. Rhizome short. Stems base surrounded with broadly ovate, brownish-red, succulent, persistent bud scales. Leaves oblong to oblanceolate, erect or spreading, blunt, rounded or obtuse at the apex, toothed, wrinkled, margins denticulate, wavy, puberulus on the upper surface.

Leaves much enlarges after flowering and seen in compact rosettle. Flowers pale-lilac or pinkish-purple or somewhat white with yellowish throat, in compact, globular, head. Petals bilobed. Stamens 5 in number. Fruits (Capsules) subglobose or oblong or cylindrical. Flowering and fruiting period is May-August.

It is generally found in meadows, wet open places, alpine slopes, and shrubberies. It contains primin and other quinoid compounds which are contact allergens. It is not evaluated in IUCN Red List Criteria.

Plant is used in diabetes, headache, liver problem, giddiness, pulmonary disease, urinary ailments and as a appetizer. Flowers are eaten as salads. Powdered roots are used for killing leeches. They may be used as a substitute for Senega (*Polygalla senga*). Roots are generally used to kill lice. It is cultivated as ornamental plant and propagated by seeds and rhizomes.

Tragopan melanocephalus

It is very beautiful bird, endemic to Western Himalayan regions of Jammu Kashmir, Himachal Pradesh and Uttrakhand. In Himachal Pradesh it is distributed widely in Chamba, Lahaul-Spiti, Kinnaur, Shimla and Kullu districts. It commonly known as Western tragopan and locally known as

Jajurana means 'king of birds'. It belongs to order Galliforme and family Phasianidae. It is state bird of Himachal Pradesh and its captive breeding center is located in Sarahan of Himachal Pradesh.

Western tragopan is bright dark grey and black in colour with numerous white spots each spot bordered with black and deep crimson patches on sides. Male is slightly larger in size than female. Head is black with red cheek patches. Sides of the head and throat are thin feathered and brightly colored. Bill is short, strong and sought. Neck is bright red. Wings rounded and tail comprises 18 feathers. Male and female are almost similar in appearance except longer legs in males and variable amount of black and red on neck.

It is found in temperate and deciduous forest of Himachal Pradesh at altitude of 1500-3600 m. In winters it shows local altitudinal movements in lower areas. It is arboreal but generally feeds on ground. It feeds on leaves, buds, flowers, shoots, roots, seeds, fruits and insects. *Skimmia laureola, Viburnum nervosum, Quercus semecarpifolia, Sarcococca saligna, Principia utilize* are the examples of some of the food plants of Western tragopan. April to June is its nesting and breeding season. It lays 2-6 eggs at a time. Incubation period is 26-30 days.

It is protected under schedule-1 of wildlife protection act 1972 and given status Vulnerable (VU) in International Union of Conservation of Nature (IUCN) Red List. Convention on International Trade in Endangered Species (CITES) has listed this species in Appendix I in order to discourage selling of its feather. Although it is fully protected locals in their range are still using fathers of Western tragopan for decoration and status symbols.

There are only 2500-3500 individuals in the wild (Pandey and Rehmani 2012). Natural habitat loss is major reason behind the declining population of Western tragopan. This species is highly threatened in its range by several anthropogenic factors like construction of hydro power projects, tourism activities, forest fire, grazing, hunting for decorative plumage, trapping for meat and over exploitation of plants and mushrooms. Hence public awareness is very necessary along with its in situ and ex situ conservation.

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Tropical Forest Research Institute

Published by:

Tropical Forest Research Institute
(Indian Council of Forestry Research & Education)
(An autonomous council under Ministry of Environmnet, Forests and Climate Change)
P.O. RFRC, Mandla Road
Jabalpur – 482021 M.P. India
Phone: 91-761-2840484
Fax: 91-761-2840484
E-mail: vansangyan_tfri@icfre.org
Visit us at: http://tfri.icfre.org or http://tfri.icfre.gov.in