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Van Sangyan

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.

Cover Photo: Panoramic view of Achanakmar-Amarkantak Biosphere Reserve
Photo credit: Dr. N. Roychoudhury and Dr. Rajesh Kumar Mishra, TFRI, Jabalpur (M.P.)

From the Editor's desk

Forests influence climate change largely by affecting the amount of carbon dioxide in the atmosphere. When forests grow, carbon is removed from the atmosphere and absorbed in wood, leaves and soil. Because forests (and oceans) can absorb and store carbon over an extended period of time, they are considered "carbon sinks". This carbon remains stored in the forest ecosystem, but can be released into the atmosphere when forests are burned. Quantifying the substantial roles of forests in absorbing, storing, and releasing carbon is key to understanding the global carbon cycle and hence climate change. Conserving natural resources is a basic requirement for sustainable development and improving the quality of human life. To reverse the trend towards resource degradation, we need to give greater priority to ecological principles. Climate change is one of the greatest challenges facing humanity today. Its effects are already being felt – from strengthened storms and rising sea levels to changing temperature and weather patterns – and they will only grow worse. Urgent action is needed to reduce emissions and to mitigate and adapt to these changes. Everyone will be impacted by climate change, especially those who are poor, vulnerable and lacking the resources to adapt. All communities will need to build resilience and sustainability and with migration and urbanization taking place on an unprecedented scale, this will require understanding how populations are changing, and then planning to address people's current and future needs.

Climate influences the structure and function of forest ecosystems and plays an essential role in forest health. A changing climate may worsen many of the threats to forests, such as pest outbreaks, fires, human development, and drought. Climate changes directly and indirectly affect the growth and productivity of forests: directly due to changes in atmospheric carbon dioxide and climate and indirectly through complex interactions in forest ecosystems. Climate also affects the frequency and severity of many forest disturbances. Climate change could alter the frequency and intensity of forest disturbances such as insect outbreaks, invasive species, wildfires, and storms. These disturbances can reduce forest productivity and change the distribution of tree species. In some cases, forests can recover from a disturbance. In other cases, existing species may shift their range or die out. In these cases, the new species of vegetation that colonize the area create a new type of forest.

This issue of Van Sangyan contains an article on Agroforestry and climate change. There are also useful articles, such as El-Niño, La-Niña and itheir impact on monsoon, Sunspots and climate change, Medicinal plants based homegardens system, Mycorrhizal biofertilizer for quality maintenance, Ethno-medicinal plants for controlling chronic disorder diabetics mellitus, Silent actions for the conservation of flora, Importance of Ginko biloba Linn., Rose as commercial flower and biodiversity of Ceiba speciosa and Ardea alba.
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. Roychoudhury
Scientist G & Chief Editor

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Agroforestry systems and climate change

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Introduction

Agroforestry systems can be better climate change mitigation option than ocean and other terrestrial options because of the secondary environmental benefits such as food security and secured land tenure, increasing farm income, restoring and maintaining above ground biodiversity ,watershed hydrology and soil conservation. Approximately 1.2 billion people (24% of the world's population) depend directly on agroforestry products and services in rural and urban areas of developing countries (Leakey and Sanchez, 1997). Indian National Forest Policy (1988) emphasizes that at least 33% of total geographical area should be under forests. But India's designated forest land constitutes over 23.41% of total land area of the country. Deforestation over the period 1980-1990 reached 8.2% of total forest area in Asia, 6.1% in Latin America and 4.8% in Africa. In India loss of nearly 4.5 million ha since 1950, mainly for agriculture and diversion for development projects (anonymous 2006). Hence agroforestry will be playing a key role to enhance the green cover as well as MAD (Mitigation Adaptation and Development) challenges.

Rising levels of greenhouse gases are already changing the climate. 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 rise 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 region (IPCC-2007). Climate change predictions are not encouraging; according to the IPCC WG I Fourth Assessment Report, a further increase in temperatures of 1.4°C to 5.8°C by 2100 is projected.

CO_2 plays a leading role. It contributes to 50% of total green house effect. In 1988 an estimated 6 Giga tonnes of CO_2 was released into the atmosphere from anthropogenic sources and tropical deforestation.

About two-thirds of the global terrestrial carbon, exclusive of that sequestered in rocks and sediments is sequestered in the standing forests. This include forest under storey plants, leaf and forest debris and forest soils. There are some non natural stocks in form of long lived wood products, waste dumps. This form of carbon stock is gaining importance with increased global timber harvest and manufactured wood products over the past several decades. The problem of increasing atmospheric CO_2 can be addressed in a number of ways. Agroforestry is one of the potential options. Agroforestry has been defined in various ways. The World Agroforestry Centre (www.icraf.cgiar.org) defines it as a dynamic, ecologically based, natural resources management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels. The Association for Temperate Agroforestry, AFTA (www.aftaweb.org) defines it as an intensive land management system that optimizes the benefits from the biological interactions created when trees and/or shrubs are deliberately combined with crops and/or livestock. In essence, they all refer to the practice of the purposeful growing of trees and crops, and/or animals, in interacting combinations, for a variety of benefits and services (Nair *et al.*, 2008).

Role of agroforestry in adapting and mitigation to climate change:

1. Agroforestry systems play a critical role in moderating the microclimate.
2. Agroforestry systems are highly effective in soil and water conservation.
3. Agroforestry systems have the capacity to enhance the use efficiency of rain water.
4. Agroforestry systems provide economically viable and environmentally friendly means to improve soil fertility.
5. Agroforestry systems have the potential to limit carbon emissions and sequester carbon.
6. Agroforestry systems offer a major pathway for sustainable diversification of agricultural systems and incomes.

Agroforestry systems as carbon sinks

Agroforestry for carbon sequestration is attractive because:

(i) It sequesters carbon in vegetation and in soils depending on the pre-conversion soil C,

(ii) The more intensive use of the land for agricultural production reduces the need for slash-and-burn or shifting cultivation,

(iii) The wood products produced under agroforestry serve as substitute for similar products unsustainably harvested from the natural forest,

(iv) To the extent that agroforestry increases the income of farmers, it reduces the incentive for further extraction from the natural forest for income augmentation, and finally,

(v) Agroforestry practices may have dual mitigation benefits as fodder species with high nutritive value can help to intensify diets of methane-producing ruminants while they can also sequester carbon.

Table 1: Total carbon storage under agroforestry systems

Agroforestry system and components	Total carbon storage (t C/ha)
Silvi-pastoral system (age 5 years)	
Acacia nilotica + natural pasture	9.5-17.0
A.nilotica + established pasture	19.7
Dalbergia sissoo + natural pasture	12.4
D.sissoo + established pasture	17.2
Hardwickia binata + natural pasture	16.2
H.binata + established pasture	17.0

(source: Rai *et al.* 2001)

Soil carbon

Introducing trees in agricultural farms may be useful technique to increase the soil carbon status because the presence of trees. Various interacting factors which influence carbon stock in the soil under agroforestry are addition of:

- Litter
- Maintenance of higher soil moisture content
- Reduced surface soil temperature
- Proliferated root system.
- Enhanced biological activities.
- Decreased risk of soil erosion.

In this system tree species are widely accepted by farmers which have minimum interaction with agriculture crops. Cultivation of fast growing trees with arable crops under agri-silviculture systems help in improving S.O.C. and sequestering carbon particularly in highly degraded barren lands.

Conclusion

Agroforestry practices play an important role to influence biomass level, carbon storage as CO_2 mitigation potential. It is evident from the foregoing that different agroforestry systems can sequester more carbon as compared to sole agricultural land use systems. Tree component in agroforestry systems can be significant sinks of atmospheric carbon due to their fast growth and high productivity. Area specific agroforestry models should be promoted a measure for mitigating climate change through higher C sequestration in addition to other benefits like improved socioeconomic condition and sustainable management of the land resources.

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El-Niño, La-Niña and their impact on monsoon

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Introduction

Global warming and climate change are the most extensively discussed issues in 20th century affecting environment and also rainfall (Loo *et. al.*, 2014). El-Niño and La-Niña play a major role in monsoon. El-Niño and La-Niña both are two opposite atmospheric phenomenon which severely affect the global air circulation pattern. Both El-Niño and La-Niña are caused due to extremely uneven heating and cooling of water over Pacific Ocean. Sometimes it is misunderstood that the warm episode of Eastern Pacific region is due to global warming. While it is due to El-Niño that was recently experienced during 2014-2015, after a gap of 2-3 years, also called El-Niño year. El-Niño and La-Niña both caused due to the meteorological parameters like- incoming solar radiation, temperature, atmospheric pressure and air circulation. So, for this El-Niño and La-Niña are experienced on Pacific Ocean only. As we all know that, Pacific Ocean is the largest ocean on the globe, hence it receives maximum amount of solar radiation, which leads to increase in temperature creating a low pressure. It affects the trade winds and disturbs the normal global circulation pattern, causing El-Niño and La-Niña. El-Niño is the warming of surface water of the eastern Pacific Ocean which affects the atmospheric circulation to a very great extent. As the warm water arrives in the eastern pacific region during Christmas, the fishermen of that region named it so, as per the definition it refers to a situation where five consecutive three month moving average oceanic Nino index average values exceeds 0.5°C (Bhattacharaya and Narsimha, 2007).Variation in rainfall has a huge impact on agricultural output of a country. Both the extreme flood and drought affects adversely food security inflation and GDP of the country (Gadgil and Gadgil, 2006). Keeping the importance, the purpose of this study is to provide information about El-Niño and La-Niña impact on monsoon.

El-Niño

El-Niño is a Spanish word which means *"the little boy"* in reference of baby Jesus. In normal condition, the easterly trade winds blow from east pacific region to west pacific region due to high pressure in the east and low pressure in the west. The movement of ocean water and trade winds depend upon each other. Both of them accompany each other while moving from one place to another. In the mid ocean, the water gets heated up due to the solar radiation; as a result, the warm water finally gets accumulated in the western Pacific Ocean. A deep thermocline is created in this region. Upwelling of cold water at the surface takes place in the eastern Pacific Ocean which results in the rise in nutrients which helps in fisheries. The warm moist air rises up and condenses to form clouds and also the air carrying moisture from east Pacific Ocean refuels the clouds of western Pacific region. These clouds bring rainfall to the western pacific regions like parts of India, Australia, Indonesia and Philippines. In an El-Niño condition, the sea surface temperature of east Pacific rises above normal temperature and a low pressure is created. The easterly trade winds weaken or diminish, causing the trade wind to flow in reverse direction i.e. from west to east. This causes the sea water to move towards eastwards (South America- Peru, Ecuador).The atmosphere over the east Pacific Ocean gets heated up due to the warm sea water. The warm and moist air rises up adding more moisture to the clouds and results in heavy rainfall with thunder storm in the South American regions (Peru, Ecuador). Heavy rainfall results in severe flood in these regions. Meanwhile, the western Pacific regions (Australia, Indonesia) face drought with a reduction in annual monsoon in India. El-Niño has a negative impact on agriculture and country's economy. Agriculture is completely dependent on water. Due to less rainfall, drought occurs which affects agriculture adversely with downfall of country's economy. Also, it causes damage to property and loss of lives. El-Niño usually occurs every 3-8 years and lasts for 9-12 months (Ranatunge *et. al.*, 2003).

La-Niña

La-Niña is the opposite of El-Niño which means *"the little girl"* or "anti- El-Niño". Unlike El-Niño the warm episode, La-Niña is the cold episode. During La-Niña, the sea surface temperature cools down below the normal temperature in the eastern Pacific Ocean. This creates a strong high pressure over the eastern pacific and results in strengthening of easterly trade winds. The strong easterly trade winds push the warm water towards the western pacific region. Thermocline deepens due to increase in sea surface temperature. The atmosphere over this region gets heated up creating a low pressure. More warm and moist air rises up adding moisture to clouds, resulting in heavy precipitation. La-Niña somehow has both positive and negative impacts in western pacific regions. It brings good rainfall in India. While places like Australia, Indonesia face severe flood (Billa *et. al.*, 2004). Monsoon flooding has impacted many people in terms of loss of lives and property damage. In eastern pacific regions, due to low temperature and high pressure, the amount of rainfall decreases to minimum. While more upwelling of cold water results in rise of nutrients level, facilitating fisheries. La-Niña usually lasts for 1-3year.

Table.1 Impact of El-Niño and La-Niña on Indian monsoon from 2004-13

Year	Occurrence	Impact	Monsoon
2004	El-Niño	Drought	88%
2005	Neutral	Normal	101%
2006	Neutral	Normal	103%
2007	La-Niña	Excess	110%
2008	La-Niña	Above normal	105%
2009	El-Niño	Severe drought	79%
2010	La-Niña	Normal	100%
2011	La-Niña	Normal	104%
2012	Mild El-Niño	Below normal	92%
2013	Neutral	Above normal	106%

(source: Skymet)

Conclusion

This study has given some insights on the connection between El-Niño and La-Niña creating an impact on Monsoon. El-Niño results in reduced rainfall with drought while La-Niña brings good rainfall in India with heavy rains and floods in Australia and Indonesia. Eastern Pacific regions faces drought. They have long term effects on food security, agriculture and economy.

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Sunspots and climate change

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Sunspots are dark areas of irregular shape on the surface of the Sun. It has been observed that they vary in numbers in both short-term and long-term. An average sunspot cycle lasts 11.1 years. During the cycle the average sunspot count varies from around 15 at minimum to well over 100. Spots are often big enough to be seen with the naked eye.

Sunspots

Direct observation of the Sun in a clear sky is painful and dangerous. Sunspots are storms on the sun's surface that are marked by intense magnetic activity and play host to solar flares and hot, gassy ejections from the sun's corona. Scientists believe that the number of spots on the sun cycles over time, reaching a peak every 11 years or so.

Some studies indicate that sunspot activity overall has doubled in the past century. The apparent result here on Earth is that the sun glows brighter by about 0.1 percent now than it did 100 years ago.

Solar wind consists of magnetized plasma flares and, in some cases, is linked to sunspots. It emanates from the sun and influences galactic rays that may, in turn, affect atmospheric phenomena on Earth, such as cloud cover. Some skeptics of human-induced climate change blame global warming on natural variations in the sun's output due to sunspots and/or solar wind. There is no coincidence that an increase in sunspot activity and a run-up of global temperatures on Earth are happening concurrently. The regulation of carbon emissions as folly with negative ramifications for our economy and tried-and-true energy infrastructure.

Many climate scientists agree that sunspots and solar wind could be playing a role in climate change, but the vast majority view it as very minimal and attribute Earth's warming primarily to emissions from industrial activity – and they have thousands of peer-reviewed studies to back up that claim.

Solar astronomer Peter Foukal of the firm Heliophysics Inc., who has tracked historical sunspot intensities at different places around the globe dating back four centuries, also concludes that such solar disturbances have little or no impact on global warming. Nevertheless, he adds, most up-to-date climate models incorporate the effects of the sun's variable degree of brightness into their overall calculations.

Ironically, the only way to really find out if sunspots and solar wind are playing a larger role in climate change than most scientists now believe would be to significantly reduce our carbon emissions. Only in the absence of that potential driver will researchers be able to tell how much impact natural influences have on Earth's climate.

Leading scientists, including a Nobel Prize-winner, have rounded on studies used by climate sceptics to show that global warming is a natural phenomenon connected with sunspots, rather than the result of the man-made emissions of carbon dioxide.

The researchers – all experts in climate or solar science – have told The Independent that the scientific evidence continually cited by sceptics to promote the idea of sunspots being the cause of global warming is deeply flawed.

The issue has gained new importance in the light of opinion polls showing that nearly one in two people now believe global warming is a natural phenomenon unconnected with CO2 emissions. Public distrust of the accepted explanation of global warming has been exacerbated by emails leaked from the Climatic Research Unit at the University of East Anglia, which appeared to suggest that scientists were engaged in a conspiracy to suppress contrarian views.

Many sceptics who accept that global temperatures have risen in recent decades suggest it is part of the climate's natural variability and could be accounted for by normal variations in the activity of the Sun. Powerful support for this idea came in 1991 when Eigil Friis-Christensen, director of the Danish National Space Centre, published a study showing a remarkable correlation between global warming and the length of sunspot cycles.

A further study published in 1998 by Mr Friis-Christensen and his colleague Henrik Svensmark suggested a possible explanation for the warming trend with a link between solar activity, cosmic rays and the formation of clouds.

However, many scientists now believe both of these studies are seriously flawed, and that when errors introduced into the analysis are removed, the correlations disappear, with no link between sunspots and global warming. Peter Laut, a former adviser to the Danish Energy Agency who first identified the flaws, said there were practically no observations to support the idea that variations in sunspots played more than a minor role in global warming.

Mr Laut's analysis of the flaws is accepted by most scientists familiar with the research, including Paul Crutzen, an atmospheric chemist at the Max Planck Institute in Germany, who won a Nobel Prize for his work on understanding the hole in the ozone layer. "There is definitely a problem [with these studies]. Laut has really pinned it down but the [sunspot] argument keeps reappearing and its quite irritating," Professor Crutzen said.

Professor Stefan Rahsmstorf, of Potsdam University, agreed: "I've looked into this quite closely and I'm on Laut's side in terms of his analysis of the data."

Some scientists believe the flaws are so serious that the papers should be retracted or at least the authors should acknowledge that their work contains problems that question the correlations they have apparently established.

Messrs Svensmark and Friis-Christensen stand by their studies and continue to believe there is evidence to support their sunspot theory of global warming, despite the doubts first raised by Laut.

"It's not a critique of the science or the correlations, it's a critique of person," Mr Friis-Christensen said. "It's a character assassination. [Laut] is not interested in the science, he's interested in promoting the idea Henrik did something unethical."

Differences in the rotation between the Sun's equator and poles amplify the solar magnetic field until it bursts through to the surface as "sunspots". The activity follows an 11-year cycle, which may vary by a few years. High sunspot activity is associated with a strong solar winds and slightly higher radiation intensity – about 0.1 per cent higher than a sunspot minimum.

Stellar explosions in deep space give off cosmic radiation that continually bombards Earth. The energy, however, is very weak (equivalent to starlight). Some scientists believe that cosmic rays may influence cloud formation by aerosol "seeding".

The Milankovitch Cycles are small changes in the configuration of the Earth's orbit around the Sun which induces slight changes in seasonal insolation (amount of radiation received per unit time at any one location). These changes initiate the 100,000 year glacial-interglacial periods. Sunspots increase the intensity of solar radiation over short periods of time. One school of thought is the current global warming is only due to the Milankovitch Cycles and sunspots. In this school of thought, anthropogenic forces (human induced) such as the release of carbon dioxide into the atmosphere from the burning of fossil fuel are not responsible for the current global warming trend.

There are three Milankovitch Cycles that alter the Earth's orbit around the Sun. In the first cycle the Earth's orbit around the Sun is not circular but is an elongated orbit which means the distance of the Earth from the Sun is not constant. The shape of the ellipse becomes slightly more elongated, then slightly more circular then back again. A full oscillation in the elongation takes about 100,000 years. When the Earth is closest to the Sun more solar radiation reaches the surface of the planet and the planet is warmer. When the Earth's orbit is farthest from the Sun the planet is colder.

Tilt of the Earth axis of rotation is the second Milankovitch Cycle. The tilt varies from 21.1 to 24.5 degrees and back again every 41,000 years. The greater the tilt the more intense is the winter and summer seasons in both hemispheres.

The third cycle is the precession (rotation of a planet's spin axis around a line drawn perpendicular to its orbital plane) of the Earth every 23,000 years. In other words the axis of the spin itself rotates around another axis (similar to the axis of a spinning top rotating around a second axis). This means that the Northern Hemisphere receives more solar radiation when precession points the North Pole toward the Sun at the same time the Earth's orbit brings the Earth closest to the Sun.

Glacial and interglacial periods are triggered by the combined effect of the three Milankovitch Cycles. However, the Sun's insolation from these combined cycles is too small to account for the dramatic climate changes seen between the glacial and interglacial periods. Other environmental forces must amplify the climate change the Milankovitch Cycles set in motion. Arctic feedback factors, regulating the atmospheric level of carbon dioxide by rock weathering, cloud formation and volcanic eruptions are some examples of environmental forces (my postings entitled The Arctic Feedback Factor and Climate Change, The Carbon Cycle and Clouds, Volcanoes, Water Vapor and Climate Change). The Milankovtich Cycles are the trigger of glacial-interglacial periods while environmental factors are the amplifier.

Sunspots affect the climate on a much shorter time scale than the Milankovitch Cycles. Decadal variability of solar output can be seen in the abundance of sunspots on the Sun. The strength of each cycle (11 years) is determined by the number of sunspots seen at the peak of the cycle. The more sunspots the more energy the sun radiates to the planet. Conversely, with fewer sunspots the radiation output diminishes.

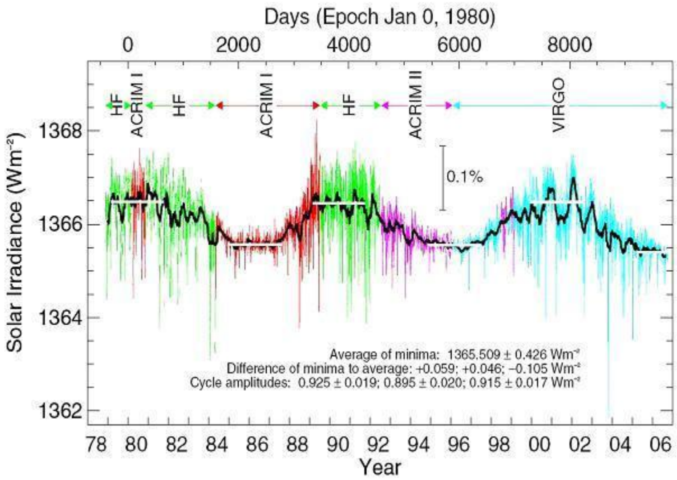

Fig. 1: Record of minimal variation in sun's energy

(Image courtesy of SOHO consortium a project of international cooperation between ESA and NASA.)

The period from 1650 to 1715 known as the "Little Ice Age" saw very few sunspots. Glaciers advanced into valleys and growing seasons were shorter. The period from 1910 to 1919 saw an increase in the number of sunspots along with a 0.90F increase in the average global surface temperature. The last four decades of the 20th century saw a decline in the number of sunspots and in 2008 the number of sunspots was the lowest in the past half century. The low sunspot numbers in the last four decades of the 20th century suggest the global temperature should be cooling.

Satellites have measured the incoming solar radiation to our planet since 1978. Like the number of sunspots, satellite data demonstrates solar radiation has been declining in the last part of the 20th century and the first part of the 21st century. However, the Earth's temperature has continued to climb over the same interval (my posting entitled The Carbon Cycle).

Clearly, the activity of the Sun is not causing current global warming trend. Anthropogenic forces (burning of fossil fuels, deforestation and methane/nitrous oxide emissions from agriculture) created the current atmospheric carbon overload (my posting entitled Fossil Fuel and Atmospheric Levels of Carbon Dioxide). This carbon overload triggers the greenhouse effect that is responsible for the current global warming trend which is amplified by environmental factors (my posting entitled Solar Activity, Greenhouse Gas Levels and Climate Change on our Earth).

The sun is the source of most of the energy that drives the biological and physical processes in the world around us—in oceans and on land it fuels plant growth that forms the base of the food chain, and in the atmosphere it warms air which drives our weather. The rate of energy coming from the sun changes slightly day to day. Over many millennia in the Earth-Sun orbital relationship can change the geographical distribution of the sun's energy over the Earth's surface. It has been suggested that changes in solar output might affect our climate—both directly, by changing the rate of solar heating of the Earth and atmosphere, and indirectly, by changing cloud forming processes.

Over the time-scale of millions of years the change in solar intensity is a critical factor influencing climate (e.g., ice ages). However, changes in solar heating rate over the last century cannot account for the magnitude and distribution of the rise in global mean temperature during that time period and there is no convincing evidence for significant indirect influences on our climate due to twentieth century changes in solar output.

The rate at which energy from the sun reaches the top of Earth's atmosphere is denoted by the term "total solar irradiance" (or TSI). TSI fluctuates slightly from day to day and week to week. Superimposed on these rapid short-term fluctuations is a cycle related to sunspots in the outer layers of the Sun that lasts approximately every 11 years.

The current TSI varies with season, time of day, and latitude. Yet it is thought that small changes in this relatively small amount of absorbed solar energy can make a difference to our climate. Might changes in the rate of solar absorption, called radiative forcing (RF), be influencing our climate today?

The average increase in solar radiative forcing since 1750 is much smaller (~ 0.12 W m-2) than the increase in RF due to heat-trapping gases (~2.6 W m-2) over that same time period. The slight increase in solar absorption is, moreover, more than offset by natural cooling. The twentieth century witnessed the eruption of major volcanoes— the most recent, Pinatubo, in 1991—that spewed tiny reflective particles into the atmosphere. Incoming energy from the sun that encountered these particles was reflected back into space. In other words, natural processes alone would have brought about slight late twentieth century cooling—not the warming we have experienced.

The variations of the rate of emission of solar radiation on the 11 year time scale, as well as the small long-term increase in TSI over the past few centuries appear in some studies to be correlated with variations in cloud patterns. These changes in absorbed solar energy appear to be far too small to explain the major changes in our climate.

Two different hypotheses have been proposed to test whether solar radiation can explain climate change. The first relies on the fact that in both the 11 year cycle and, in the longer term, the changes in solar energy are highest at ultraviolet (short) wavelengths. The short wavelength radiation is particularly effective in modifying ozone concentrations in the level of the atmosphere above where typical weather occurs. According to this hypothesis, modifications in the ozone layer could in turn filter down to that level of the atmosphere where our weather is formed, potentially modifying clouds and temperatures there.

The second hypothesis relies on the fact that changes in solar activity also change the flow of small, charged, highly energetic particles (known as galactic cosmic rays) that travel through the atmosphere toward Earth. These particles in turn create more ions (charged atoms or molecules) from air molecules in the atmosphere, and it has been suggested that these ions might modify cloud formation, causing large changes in weather and temperatures below.

So far, there is no convincing evidence that either of these ideas adequately demonstrate a causal links between small changes in solar irradiance and the relatively large, measurable changes in Earth's surface temperature over the past century.

The rate at which solar energy reaches the Earth's surface in any location depends on the season, time of day, cloudiness and the concentration of small aerosol particles in the atmosphere. During the late twentieth century, the average amount of solar energy reaching the surface decreased slightly due to atmospheric particles (aerosols), particularly in urban locations that reflect the sun's energy back into space. This pollution did not cause net global cooling because it was more than counteracted by the increasing concentrations of heat- trapping gases in the atmosphere.

In its Fourth Assessment Report, IPCC scientists evaluated simulations of twentieth century climate variables using a number of numerical models. They first assumed no increase in heat-trapping gases over this period, so that the temperatures calculated were those that would have been achieved if only solar variability, volcanic eruptions, and other natural climate drivers were included. The temperature results were similar to observed temperatures only for the first half of the century, but the models did not accurately show the general warming trend that has been recorded during the second half of the twentieth century. However, when the human-induced heat-trapping gases were included in the computer model, it accurately reproduced the observed warming during the twentieth century.

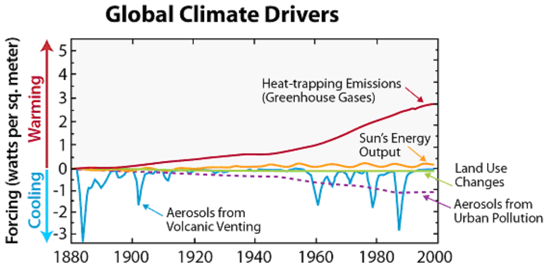

Fig. 2: Twentieth century history of climate drivers

Heat-trapping emissions (greenhouse gases) far outweigh the effects of other drivers acting on Earth's climate. Source: Hansen et al. 2005, Figure adapted by Union of Concerned Scientists. *[Hansen et al., 2005]*

Thus, although fluctuations in the amount of solar energy reaching our atmosphere do influence our climate, the global warming trend of the past six decades cannot be attributed to changes in the sun (Fig. 2).

Sunspots have a diameter of about 37,000 km and appear as dark spots within the photosphere, the outermost layer of the Sun. The photosphere is about 400 km deep, and provides most of our solar radiation. The layer is about 6,000 degrees Kelvin at the inner boundary and 4,200 K on the outside. The temperature within sunspots is about 4,600 K. The number of sunspots peaks every 11.1 years.

There is a strong radial magnetic field within a sunspot, as implied in the picture, and the direction of the field reverses in alternate years within the leading sunspots of a group. So the true sunspot cycle is 22.2 years. There is also a superimposed fluctuation with a period of 25 months, i.e. a quasi-biennial oscillation.

Sunspots were observed in the Far East for over 2000 years, but examined more intensely in Europe after the invention of telescopes in the 17th century. In 1647 Johannes Hevelius (1611-87) in Danzig made drawings of the movements of sunspots eastwards and gradually towards the solar equator. In 1801 William Herschel (1738-1822) attempted to correlate the annual number of sunspots to the price of grain in London. The 11-year cycle of the number of sunspots was first demonstrated by Heinrich Schwabe (1789-1875) in 1843.

There have been several periods during which sunspots were rare or absent, most notably the Maunder minimum (1645-1715), and less markedly the Dalton minimum (1795-1820) (Fig 2.8 in the book). During the Maunder minimum the proportional concentration of radio-carbon (^{14}C) in the Earth's atmosphere was slightly higher than normal, causing an underestimate of the radio-carbon date of objects from those periods. By means of the premise of excess ^{14}C concentrations in independently dated material (such as tree rings), other minima have been found at times prior to direct sunspot observations, for instance the Sporer minimum from 1450 to1540. Data from 8,000 year-old bristle-cone pine trees indicate 18 periods of sunspot minima in the last 7,800 years (Eddy, 1981). This and other studies have shown that the Sun (as well as other stars) spends about a quarter of its time with very few sunspots.

There is another well-known, super-imposed variation of annual sunspot numbers, of about 85 years. This irregular variation affects the length of the sunspot cycle, ranging from 9.8 to 12.0 years. Maxima of sunspot-cycle length occurred in 1770, 1845 and 1940.

Incidentally, the Sporer, Maunder, and Dalton minima coincide with the colder periods of the Little Ice Age, which lasted from about 1450 to 1820. More recently it was discovered that the sunspot number during 1861-1989 shows a remarkable parallelism with the simultaneous variation in northern hemisphere mean temperatures (Friis-Christensen and Lassen, 1991). There is an even better correlation with the length of the solar cycle, between years of the highest numbers of sunspots. For example, the temperature anomaly was -0.4 K in 1890 when the cycle was 11.7 years, but + 0.25 K in 1989 when the cycle was 9.8 years. Some critics of the theory of man-induced global warming have seized on this discovery to criticize the greenhouse gas theory.

All this evokes the important question of how sunspots affect the Earth's climate. To answer this question, we need to know how total solar irradiance received by the Earth is affected by sunspot activity.

Intuitively one may assume that total solar irradiance would decrease as the number of (optically dark) sunspots increased. However, direct satellite measurements of irradiance have shown just the opposite to be the case. This means that more sunspots deliver more energy to the atmosphere, so that global temperatures should rise.

According to current theory, sunspots occur in pairs as magnetic disturbances in the convective plasma near the Sun's surface. Magnetic field lines emerge from one sunspot and re-enter at the other spot. Also, there are more sunspots during periods of increased magnetic activity. At that time more highly charged particles are emitted from the solar surface, and the Sun emits more UV and visible radiation. Direct measurements are uncertain, but estimates are that the Sun's radiant energy varies by up to 0.2% between the extremes of a sunspot cycle. Polar auroras are magnificent in years with numerous sunspots, and the aurora activity (AA) index varies in phase with the number of sunspots. Auroras are faint and rare when the Sun is magnetically quiescent, as during the Maunder minimum.

The periodicity of the sunspot number, and hence that of the circulation in the solar plasma, relates to the rotation of the Sun about the centre of gravity of whole solar system, taking 11.1 years on average. Sometimes the Sun is up to a million kilometres from that centre, and sometimes it more or less coincides, leading to different conditions of turbulence within the photosphere. The transition from one condition to the other affects the number of sunspots.

Not only does the increased brightness of the Sun tend to warm the Earth, but also the solar wind (a stream of highly energetic charged particles) shields the atmosphere from cosmic rays, which produce ^{14}C. So there is more ^{14}C when the Sun is magnetically quiescent. This explains why ^{14}C samples from independently dated material are used as a way of inferring the Sun's magnetic history.

Recent research (Lane *et al.*, 1994)) indicates that the combined effects of sunspot-induced changes in solar irradiance and increases in atmospheric greenhouse gases offer the best explanation yet for the observed rise in average global temperature over the last century. Using a global climate model based on energy conservation, Lane *et al.* (1994) constructed a profile of atmospheric climate "forcing" due to combined changes in solar irradiance and emissions of greenhouse gases between 1880 and 1993. They found that the temperature variations predicted by their model accounted for up to 92% of the temperature changes actually observed over the period -- an excellent match for that period. Their results also suggest that the sensitivity of climate to the effects of solar irradiance is about 27% higher than its sensitivity to forcing by greenhouse gases.

We do not know why the Sun spends part of its time in a magnetically quiescent state, and whether the sunspot minima occur with a regularity that is sufficient to predict when the next quiescent episode might occur.

At present there is no concern about another Little Ice Age. Recent satellite measurements of solar brightness, analyzed by Willson (1998), show an increase from the previous cycle of sunspot activity to the current one, indicating that the Earth is receiving more energy from the Sun. Willson indicates that if the current rate of increase of solar irradiance continues until the mid 21st century, then the surface temperatures will increase by about 0.5°C. This is small, but not a negligible fraction of the expected greenhouse warming.

The relationship between cycle length and Earth temperatures is not well understood. Lower-than normal temperatures tend to occur in years when the sunspot cycle is longest, as confirmed by records of the annual duration of sea-ice around Iceland. The cycle will be longest again in the early 2020's.

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Medicinal plants based intercrops homegardens system

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Abstract

Homegardens ensures the sustainable traditional agroforestry system with positive ecological sound, economically viable, socioeconomic acceptable and culturally pragmatic systems that touch upon the livelihood security of millions people in the tropics. Homegardens have considered as a resource system of multiple functions and an important wheels of vehicle for biodiversity, environmental and ecological benefits, food security (either directly food grains, fruits, vegetables and root crops or indirectly improving soil conditions and there by promoting understory crop productivity especially on degraded sites), soil conservation potential, nutritional security, socio-cultural as well as mitigation of the impact of climate change and job creation in developing and under developed countries.

Introduction

Homegardens have considered as a resource system of multiple functions and an important wheels of vehicle for biodiversity, environmental and ecological benefits, food security (either directly food grains, fruits, vegetables and root crops or indirectly improving soil conditions and there by promoting understory crop productivity especially on degraded sites), soil conservation potential, nutritional security, socio-cultural as well as mitigation of the impact of climate change and job creation in developing and under developed countries (Kumar and Tripathi, 2016). The definition, structural and functional of homegardens varies from place to place according to the local physical environment, ecological characteristics, and socioeconomic and cultural factors (Kumar and Nair, 2004). The scope of definition of a homestead was widened by Nair and Sreedharan (1986), who define it as an operational farm unit in which a number of crops (including tree crops) are grown with livestock, poultry and/or fish production mainly for the purpose of satisfying the farmer's basic needs. Nair (1993) observed that all homegardens consist of a herbaceous layer near the ground, a tree in the upper layer, and intermediate layers with different crops. The lower layer may be partitioned into two, with the bottom layer (of a height less than 1 m) dominated by different vegetable and medicinal plants, and the layer above it (1-3 m in height) composed of food plants such as cassava, banana, yam, and so on. The upper layer of the homegardens, again divided into two, may comprise fully grown timber and fruit trees of 25 m height or more and medium-sized trees ranging from 10-20 m in height. The intermediate layer may hold fruit trees of a height of 3–10 m but which could potentially increase in height. This layered structure also includes tuber crops such as taro, cassava, yam and/or sweet potato, since these crops require less care and provide reasonable yields (Fig. 1).

Tropical homegardens is typically such unique land-use systems involving the deliberate management of multipurpose trees and shrubs in intimate association with herbaceous species (mainly annual, perennial, and seasonal agricultural crops), and livestock, all managed within the compounds of individual homes (Kumar, 2016a; Kumar, 2016b). Although several authors have tried to describe the term

Fig. 1: Tropical homegardens: Multistrata composition of various components (Coconut, Mahogany, Papaya, Banana with intercropping of medicinal plants).

'homegardens', none is perhaps universally accepted as the definition; but it is well understood that the concept refers to 'intimate, multistory combinations of various trees and crops, sometimes in association with domestic animals, around homesteads (Kumar and Nair, 2004).

Homegardens is traditional agroforestry systems with complex structure and multiple functions. In order to understand the structure and function of homegardens, it is necessary to analyse both socio-economic and biophysical aspects of these systems. A couple of studies has carried out on the complete inventory of homegardens have been done, including the structure, species composition (Shastri et al., 2002), socioeconomic aspects and management zones (Mendez et al. 2001). Homegardens have several functions: economic, social and cultural, esthetic and ecological (Wezel and Bender, 2003). Homegardens is multistory combinations of various trees and crops around household (Kumar and Nair, 2004), which provide the family with food and other goods, including construction materials, ornaments or additional income (Del and Mendoza, 2004). However, Homegardens ecological complexity, as well as the strong interaction that exists between the agroecosystem and the household, has made it difficult for researchers to conduct in depth studies that would make these claims conclusive (Wojtkowski, 1993). The biophysical attributes of sustainability that include biodiversity, soil quality, nutrient management, water management, control of weeds, diseases, and pests, pollination services, carbon sequestration, resistance and resilience to climate change, and crop productivity (Kumar and Nair, 2006; Saha et al., 2009; Kremen and Miles, 2012). Agroecosystems provide important supporting, cultural and regulating services such as carbon sequestration, wildlife protection, maintenance of soil fertility, maintenance of recreational areas for hunting and tourism, regulation of pests and diseases and water quality supply (Kumar and Tripathi, 2016) (Fig. 2).

Homegardens is unique in that they address all the three mechanisms that qualify agroforestry as GHG reduction strategy viz. carbon sequestration, carbon substitution and carbon conservation (Kumar, 2006). On a comparative scale homegardens sequester C much better than intensively managed crop lands (Nair et al., 2009).

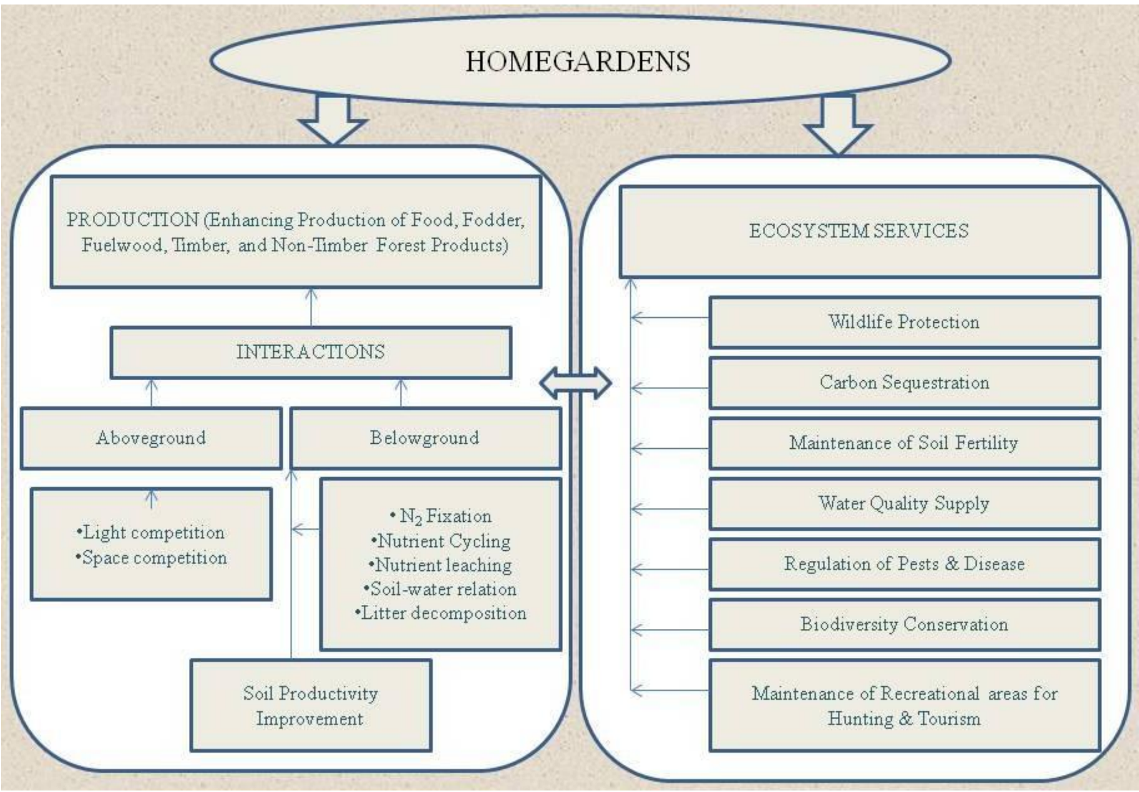

Fig. 2: A schematic presentation of the major mechanisms and processes involved in production and service attributes of sustainable Homegardens.

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Homegardens exhibit complex structure, both vertically and horizontally. Homegardens is also called as "Multi-tier system" or "Multi-tier-cropping" as it consists of different canopy strata. For instance, homegardens is composed of 4-5 canopy strata in the southern India (Fig. 1). The first layer lies within 2 meters high from the ground and is constituted by vegetables {*Cajanus cajan* (pigeon pea), *Arachis hypogaea* (peanuts), Phaseolus, Psophocarpus and Vigna species (beans and other legumes)}, tuber crops {*Colocasia esculenta* (taro), *Dioscorea alata* (greater yam), *Dioscorea esculenta* (sweet yam), *Ipomoea batatas* (sweet potato), *Manihot esculenta* (cassava), *Xanthosoma* species (tannia or cocoyam)), grasses (*Cymbopogon citratus* (lemon grass)}, spices {*Zingiber officinale* (ginger), *Kasthuri manjal* (kasthuri), *Piper methysticum* (kava), *Curcuma longa* (turmeric), *Cinnamomum zeylanicum* (cinnamon), *Areca catechu* (betel nut), *Piper betle* (betel vine)} and other herbaceous plants {*Ananas comosus* (pineapple), *Passiflora edulis* (passion fruit), *Saccharum officinarum* (sugarcane), *Zea mays* (corn or maize)}. The second and third layers (within 2 m to 10 m high from the ground) are almost continuous and overlapping each other. Some of the common constituents of these layers of homegardens is Musa species (banana), *Myristica fragrans* (nutmeg), *Carica* *papaya* (papaya), *Mangifera indica* (mango), *Theobroma cacao* (cocoa), young coconut palms and saplings of trees. The fourth canopy layers (10 and 15 m hight from the ground) species are *Areca catechu*, *Artocarpus chama*, *Artocarpus heterophyllus*, *Cassia siamea*, *Dillenia indica*, *Gmelina arborea*, *Lagerstroemia speciosa*, *Mangifera indica*, *Sterculia foetida*, *Sterculia villosa*, *Syzygium cuminii*, *Terminalia chebula*, *Zanthoxylum limonella*, and Bamboo sp. (*Bambusa cacharensis*, *Bambusa vulgaris*. The upper most canopy layer (above 15 m from the ground) species are *Anacardium occidentale* (cahew nut), *Artocarpus heterophyllus* (jackfruit), Citrus species (lemon, lime, orange and tangerin), Annona species (soursop and sweetsop), *Swietenia macrophylla* (mahogany), *Ailanthus triphysa* (tree of heaven), *Averrhoa carambola* (carambola), *Artocarpus altilis* (breadfruit), *Carica papaya* (papaya), *Psidium guajava* (guava), *Mangifera indica* (mango), *Azadirachta indica* (neem), Musa species (bananas and plantains), *Persea americana* (avocado), *Cocus nucifera* (coconut), *Spondias dulcis*, *Syzygium malaccense* (malay apple), *Tamarindus indica* (tamarind), *Hevea brasiliensis* (rubber), and other tall trees (*Artocarpus lakoocha*, *Tamarindus indica*, *Tetrameles nudiflora* and *Toona ciliate*). However the choice species is determined by the agroclimatic and farmers' socio-economic conditions. All the five layers were not present in all homegardens. The canopy, shrub and herb layers were common in all homegardens.

Medicinal plants as intercrops

It is a known fact that many traditional communities in the tropical and subtropical countries have several traditional knowledge and practices to conserve natural ecosystems and associated biodiversity (Chandrashekara and Sankar, 1998). On the other hand, once the multispecies, multicrop and multitier systems like that of homegardens have adopted, there is every chance to ensure food security of the local tribal community, uplift of their economic and social status and also improvement of ecosystem health (Kumar and Tripathi, 2016) (Fig. 3).

Figure 3: A typical Intercropping homegardens System: **A.** *Areca catechu* (Areca nut) medicinal plant intercropping system; **B.** *Cocus nucifera* (coconut) - *Kasthuri manjal* (kasthuri) intercropping system; **C.** *Cocus nucifera* (coconut) - *Myristica fragrans* (nutmeg), and **D.** *Swietenia macrophylla* (mahogany) - *Zingiber officinale* (ginger) intercropping system.

Many tropical medicinal and aromatic plants are well adapted to partial shading, moist soil, high relative humidity and mild temperatures (Vyas and Nein, 1999), allowing them to be intercropped with timber and fuel wood plantations, fruit trees and plantation crops. Some well-known medicinal plants that have been successfully intercropped with fuel wood trees (e.g., Acacia auriculiformis, Albizia lebbeck, Eucalyptus tereticornis, Gmelina arborea, and Leucaeana leucocephala) in India, include safed musli (Chlorophytum borivilianum), rauvolfia (Rauvolfia serpentina), turmeric (Curcuma longa), wild turmeric (C. aromatica), Curculigo orchioides, and ginger (Zingiber officinale) (Mishra and Pandey, 1998; Prajapati et al., 2003). Only 10 out of 64 herbaceous medicinal plants tried in intercropping with two-year old poplar (Populus deltoides) spaced 5 m apart gave poor performance (Kumar and Gupta, 1991), indicating that many medicinal plants can be grown in agroforestry systems. The trees may benefit from the inputs and management given to the intercrops. Short stature and short cycle MAPs and culinary herbs are particularly suited for short-term intercropping during the juvenile phase of trees. Wherever markets are established, MAPs are remunerative alternative intercrops to the traditionally grown annual crops (Maheswari et al., 1985; Zou and Sanford, 1990). The number of years MAPs can be intercropped with a given tree species depends on the size and intensity of its canopy shade, tree spacing and management, especially pruning of branches and nature of the MAPs.

In Karnataka and Kerala states, India, arecanut palm is commonly intercropped with ginger, turmeric, black pepper (Piper nigrum) and cardamom (Korikanthimath and Hegde, 1994). Some of these intercrops may cause small reduction in arecanut yields but the combined returns from both the components are greater than from arecanut alone. Another plantation crop intercropped with MAPs is rubber (Hevea brasiliensis), for example with Dioscorea floribunda in the state of Assam in India (Singh et al., 1998) and with Amomum villosum in Yunnan province of China (Zhou, 1993). In Sikkim, India, large cardamom (Amomum subulatum) is grown under 30 different shade tree species (Patiram et al., 1996). In Fujian Province, China, Cunninghamia lanceolata –an important timber tree - is intercropped with a variety of cereals, cash and medicinal and oil-producing crops (Chandler, 1994). Many of the medicinal herbs commonly grown in thinned forests can also be grown intercropped with trees (Zhou, 1993). In the Caribbean islands, there has been increased interest on alternative crops that have better economic potential than traditional crops. For example, in the U.S. Virgin Islands, a number of farmers are now opting for specialty crops such as the West Indian hot peppers (Capsicum chinense), thyme (Thymus vulgaris) and chives (Allium schoenosprasum) instead of vegetables (Crossman et al., 1999). The prospects of growing indigenous MAPs such as 'japana' (Eupatorium triplinerve), worrywine (Stachytarpheta jamaicensis), inflammation bush (Verbersina alata) and lemongrass (Cymbopogon citratus) in association with the medicinal trees noni (Morinda citrifolia) and moringa have been explored at the University of the Virgin Islands, St. Croix, (Palada and Williams, 2000). These local herbs are commonly used as bush teas and very popular in the Caribbean. Medicinal plants and herbs in intercropping produced similar yields to those in sole cropping at the first harvest, but they tended to be lower than in sole cropping at subsequent harvests. Recent study has carried out, Understorey productivity for ginger in terms of rhizome yield at final harvest followed the order treeless open (3.45 Mg ha-1), coconut (2.86 Mg ha-1), and homegardens (1.49 Mg ha-1). Turmeric rhizome production showed considerable variation with intercropping system with highest yield from open area (7.01 Mg ha-

1) and the lowest from homegardens (1.77 Mg ha-1). Highest Galangal yields were reported in the treeless open (3.05) while homegardens represented lowest production (2.04 Mg ha-1) (Niyas, 2015).

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Mycorrhizal biofertilizer for quality maintenance

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Among the microbial products, biofertilizers are widely used in agriculture to supply nutrients to the crops due to its eco-friendly nature and cost effectiveness. As the biofertilizers are microbial preparations, it is very important to assess its quality as per the standards available so that they are effective in their efficiency when released into the environment. In recent years, awareness among farmers on bioinoculants is increasing in the context of organic farming. It is reliably learnt from the farmers in Kerala that the inoculants does not give desired results in field which might be attributed to the poor quality inoculum.Hence, it becomes more important to check and monitor the quality of inoculants so that good quality inoculants are supplied to farmers and other stakeholders.

Mycorrhiza is one of the widely used bioinoculant in agriculture due its better adaptability and existence in soil. Mycorrhiza is a mutually beneficial relationship between plant roots and fungus. The fungal hyphae act as an extension of root system resulting in effective nutrient and water absorption. As far as its quality is concerned, it is very difficult to maintain the quality of mycrorhiza as it is an obligate symbiont.The quality of mycrorhiza has to be maintained till it is delivered to the soil. Even though, many mycorrhizal products are available in the market, majority of them are of poor quality. Most of the arbuscular mycorrhizal fungi available in the market by different companies are not based on the quality regulations (Saranya and Kumutha, 2012). This results in the poor performance in the field. In order to increase the popularity of mycorrhizal biofertilizer, it is essential to supply good quality mycorrhiza to farmers and other stakeholders.

The Government of India in its gazette notification dt. 8-11-2011 has included mycorrhizal biofertilizers under Fertilizers Control Order, 1985 (Yadav, 2011). As per FCO (1985) order, no person can manufacture any biofertilizer unless such biofertilizers confirms to the prescribed standards. For this purpose, the state govt. should appoint the registering authority at the state level. As per the schedule III of FCO (1985), the mycorrhizal biofertilizers have to satisfy the prescribed standards. The schedule III has been divided into *Parts* out of which Part A and Part B deals with the quality specifications where as Part C deals with sampling procedures for mycorrhizal biofertilizers.The quality specifications of mycorrhizal biofertilizers as per FCO, 1985 are given below:

PART- A.

Sl.No.	Parameters	Specifications
1.	Form / Base	Fine powder / Tablets / Granules / Root biomass with a growing substrate
2.	Particle size (Powder formulation)	90% should pass through250 micron IS sieve(60 BSS)
3.	Moisture content (%)	8-12 %
4.	pH	6.0-7.5
5.	Total viable propagules	Minimum 100 / g of the finished product
6.	Infectivity potential	80 infection points in roots / g of the inoculum used

PART- B.

The viable propagules should be minimum of 80 / g of the product

PART- C.

This part deals with the sampling procedures. The samples should be collected by trained and experienced person. The samples are to be collected in the following manner:

Lot / batch	Number of samples
Upto 5000 packets	3
5001-10000	4
> 10000	5

The above quality specifications will help in ensuring the quality of mycorrhizal biofertilizer.However, the presence of contaminants and pathogens in the formulation also needs to be included in the quality specifications as most of the inoculants are root based with growing substrates like soil or vermiculite.

The mycorrhizal biofertilizer are available in different formulations. Therefore, the inoculants have to be tested before they reach for use. In this regard, a mechanism should be put in place to test the mycorrhizal inoculant quality regularly so that the poor quality inoculants can be excluded from the market. A regular training can also be imparted to manufacturers on various quality parameters of mycorrhiza so that the quality can be maintained at source itself.

A strict quality control of mycorrhizal biofertilizer will go a long way in ensuring the availability of quality product for the farmers there by increasing its popularity.

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Ethno-medicinal plants used in the controlling of chronic disorder diabetics mellitus

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Abstract

In the present account is concentrated on the documentation and conservation of ethnic food plants used by rustic, ethnic people of southern districts of Telangana, India. A total of 11 species belongs to the 09 families were recorded as ethnic medicinal plants treating in Diabetics mellitus. Of those species, 11 species of each single family. The maximum, herbs were in the in sequence are considered. In the present results the importances of the ethnic plants insight have been observed. Except efforts are ended to educate the further generations about their significance, it may be misplaced in future. This variety of information might add meticulously in contemporary drug scheming or in government policies to advancement modern pioneering drug design systems in rural, ethnic areas, and in the enhancement of pharmaceutical and pharmacognostic formula with reference to ethnic medicinal pants.

Introduction

The importance of ethnic medicinal plants in treating diabetics mellitus have not been documented perfectly from rural, folkloric background from Indian society. As we know that India have been considered rich in biodiversity with special reference to medicinal plants and their indigenous knowledge. Diabetes mellitus is a chronic disorder of metabolism caused by a relative or absolute lack of insulin in the body. Its primary characteristic is a high level of sugar in the body, in the fasting or post meal stages. There are two types of diabetes mellitus, viz. Type I and Type II. Type II diabetes is the more common form of diabetes. The maximum of ethnic people in the study area rely on plants of ethnic extent as antidote for diabetes. The main reason of the present study was to document the ethnic use of medicinal plants for the treatment of diabetes mellitus (Singh, 2011). In the perspective of using ethnic medicinal plants for treating diabetes, widespread viewing ha s bee n performed in many ethno medical systems within the Indian subcontinent (Grover, 2002, Mukherjee, 2006). These are available, which have attempted to study and understand ethnic medicinal plants used in treatment of Diabetics mellitus. But there is no fundamental report on diabetic mellitus from Telangana state, so that the current work is an attempted to document and analyze the ethnic facts concerning the practices and uses of plants in diabetes.

Methodology

A numeral of countryside trips were undertaken in south districts of study area (Fig. 1). At each one time of trip, diverse ethnic and forest or rural people's information was collected in different seasons. The information was accrued after discussions with several users like village head, elder women and other local informants. Repeated interviews through questionnaires were made in diverse villages to substantiate the information. Plant specimens were collected and identified with regional floras (Gamble, 1928; Pullaiah and Chennaiah, 1997; Pullaiah and Moulali, 1997, Pullaiah, 2015).

The study area Telangana is one of the southern states of India. This region is situated in the central stretch of the eastern seaboard of the Indian Peninsula. Telangana has an area of 114,840 square kilometres (44,300 sq mi). The area is divided into two main regions, the Eastern Ghats and the plains. Telangana lies between 15 50' – 19 55' North latitudes and 77 14' – 78 50' East longitudes. Telangana is bordered by the states of Maharashtra to the north and north-west, Karnataka to the west, Chattisgarh to the north-east and Odisha to the east and Andhra Pradesh to the south. The state is drained by two major rivers, with about 79% of the Godavari river catchment area and about 69% of the Krishna catchment area, but most of the land is arid. It is an extensive plateau with an average elevation of about 400 m above sea level. This plateau consists mainly of the ranges of erosion surface: (i) above 600 mt, (ii) from 300 – 450 mt and (iii) from 150 – 300 mt. The State Telangana has the monsoon type of tropical climate. On the whole State enjoys warm climate. In northern Telangana tropical rainy type of climate prevails. Hot Steppe type of climate is noticed in the southern parts of the State. In Tropical Rainy type, the mean daily 0 temperature is above 20C with an annual rainfall of 150 to 200 cms, mostly in summer and South-West monsoon. In the Hot Steppe type, the mean daily temperature is 18C and less. In the state of Telangana Maximum temperature in the summer season varies between 37C and 44C and minimum temperature in the winter season ranging between 14C and 19C. The State has a wide variety of soils and they form into three broad categories - red, black and laterite. The type of forests met within Telangana, as per the classification of Champion and Seth are Tropical moist deciduous forests, Southern dry deciduous forests, Northern mixed dry deciduous forests, Dry savannah forests and Tropical dry evergreen scrub. In the Telangana there is about more than 20 tribes were recorded. Commonly they are located hilly and interior forest areas (Dr. Shivakumar Singh P and Dr. Rajender Singh D S R. 2016). The research report focussing on a number of the important ethnic medicinal plants, which need to be documented for diverse usages in future.

Results

Sums of 11 species were recorded as ethnic medicinal plants. Of these species, 07 species belongs to the 09 families representing single species from each of them. The maximum, herbs were in the information are considered. In the present results the importances of the ethnic medicinal plants wisdom have been observed. Except efforts are ended to educate the further generations about their importance, it may be vanished in future. This kind of reports could donate extensively in Government policies to progress medicinal plants knowledge conservation schemes in rural, folkloric areas, and in the improvement of ancestors insight protecting and its importance in innovative drugs system.

Figure 1: The study area: Telangana state.

Table 1: The important ethnic plants list in treating Diabetics mellitus of the study area.

Botanical name	Family	Habitat	Local name	Part Used
Abrus precatorius	Fabaceae	Climber	Guriginja (Telugu), Gunja (Hindi).	Leaf
Aegle marmelos	*Rutaceae*	Tree	Maaredu (Telugu), Beel (Hindi).	Fruit
Alostonia scholaris	*Apocynaceae*	Tree	Maddala (Telugu)	Leaf
Azadirachta indica	*Miliaceae*	Tree	Veepa(Telugu), Neem (Hindi).	Leaves
Echinops echinatus	Asteraceae	Herb	Bramhadandi (Telugu), Gokrhu (Hindi).	Leaves
Gymnema sylvestre	Asclepiadaceae	Climber	Madhu nashini (Telugu), Madhu nashini (Hindi).	Whole plant
Pterocarpus indicus	Fabaceae	Tree	Gandham (Telugu), Chandan (Hindi).	Ripened Leaves
Salicea oblonga	Celastraceae	Shrub	Yaknayk aaku (Telugu).	Leaves
Syzygium cumini	Myrtaceae	Tree	Nalla Nerdu (Telugu), Kaale Jaamun (Hindi).	Seeds

Tinospora cordifolia	Minispermacea	Climber	Thippa teega (Telugu), Amrutha (Hindi).	Leaf
Vinca rosea	Apocynaceae	Herb	Nithya malle (Telugu), sadabahar (Hindi).	Roots

Abrus precatorius

Azadirachta indica

Aegle marmelos

Echinops echinatus

Alostonia scholaris

Gymnema sylvestre

Pterocarpus indicus

Salicea oblonga

Syzygium cumini

Tinospora cordifoli

Vinca rosea

Conclusion

At this instant the population is escalating copiously, at the same time people are forgetting their fore fathers information. This will be effects on future health care. Therefore, steps are needed to undertake extensive education about their importance as a medicinally importance and as a direct and indirect source of maintenance in health care system for the poor families. A very few of the ethnic plants are available in the treating of bone fracture. So, efforts must be engaged to safeguard ethnic medicinal plants and also the rural intelligence for future health care systems.

Acknowledgement

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Silent actions for the conservation of flora

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Understanding the nature- its function and scope forms the fundamentals of science that to especially in field of botany and its allied sciences like agriculture, forestry… All these sciences aim at sustainable utilization of plant genetic resources for the betterment of present and future generations. The number of plant species on the earth is countless yet there are studies that says that total number of vascular plants estimated to be in the order of 400,000 (Paton *et al*., 2008). Ultimately it is the understanding of the individual plants that helps to save them from the peril of extinction (Butchart*et al*., 2010).

The extinction of species does occur naturally yet the anthropogenic pressure has accelerated the present status. In meantime, conservationist from all over the world was trying to reduce this accelerated rate of extinction of species. First effort of that kind was the Earth Submit the historical conference held on June 5, 1992 which paved way for the CBD- Convention on Biological diversity. It wasopened for signature in 1992 and has been signed by 193 Parties (Harrop and Pritchard2011). The CBD secretariat is responsible for supporting the development and implementation of policies to deliver the objectives of the CBD (Siebenhuner 2007). One programme of the CBD is the Global Strategy for Plant Conservation (GSPC), ratified by the convention of the Parties in 2002. The GSPC provides a framework for an internationally coordinated approach to plant conservation, which can be adopted and implemented by a variety of institutions (Wyse Jackson and Kennedy 2009). The ultimate aim of the GSPC is to halt the continuing decline of plant diversity. It has 5 objectives and 16 targets. These target were framed in such a way that it will have impact on

- Societies around the world would be able to utilize the plant genetic resources for greater common good.
- To reduce the impact of climate change and maintaining the resilient nature of the ecosystems.
- To preserve the genetic diversity and to reduce the extinction threat
- In a way, Evolution legacy will be used sustainably, for the wellbeing of humans.

Vision of GSPC

Without plants, there is no life. The functioning of the planet, and our survival, depends on plants. The Strategy seeks to halt the continuing loss of plant diversity.

Was there no effort to save the plant diversity? Will be the question in the mind of the readers. For which the answer is both yes and no. Yes, there were many regional and national level conservation programmes but there was NO global level effort to save the plant diversity. GSPC was first such combined effort that tried to create network among various institutional as well as conservation programs. This makes GSPC very unique and its formation history is little bit more interesting.

The initiative for plantconservation was first proposed at the International Botanical Congress in 1999, following it concerned group of botanists-the Gran Canaria Group) took the idea forward and developed the Global Strategy for Plant Conservation (GSPC) which, in 2002 was adopted.At the Convention on Biological Diversity meeting in Nagoya in October 2010, an amended and updated Global Strategy for Plant Conservation was endorsed by the world's governments. This follows eight years of the first Global Strategy for Plants. The following table provides a better understanding of the way in which we are moving towards the updated GSPC.

S.No.	GSPC Targets	Action Done
1.	Target 1:An online flora of all known plants	Creation of World Flora Online
2.	Target 2:An assessment of the conservation status of all known plants as far as possible, to guide conservation action	information from the IUCN RedList and national sources
3.	Target 3: Information, research and associated outputs and methods necessary to implement the Strategy developed and shared	on-line GSPC toolkit
4.	Target 4:Atleast 15% of each ecological region or vegetation type secured through effective management and/or restoration	55% of terrestrial ecosystems haveat least 10% coverage by protected areas
5.	Target 5:At least 75 % of the most important areas for plant diversity of each ecological region protected with effective management in place for conserving plants and their genetic diversity	Important plant area identification and proper management is being done
6.	Target 6: At least 75% of production lands in each sector managed sustainably, consistent with the conservation of plant diversity	Very difficult to manage the productivity sustainably
7.	Target 7: At least 75% of known threatened plant species conserved *in situ*	Loss of naturalhabitat means that the *in situ* conservation status of manyspecies is getting worse
8.	Target 8: At least 75% of threatened plant species in *ex situ* collections, preferably in the country of origin, and at least 20% available for recovery and restoration programmes	29% of the species listed on the 2013IUCN Red List are known to be in *ex situ* collections
9.	Target 9 70% of the genetic diversity of crops including their wild relatives and other socio-economically valuable plant species conserved, while respecting, preserving and	The Global Plan of Action on Plant Genetic Resources for Food and Agriculture addresses this Target

	maintaining associated indigenous and local knowledge	
10.	Target 10: Effective management plans in place to prevent new biological invasions and to manage important areas for plant diversity that are invaded	Restricted and save transport of genetic resources through Plant Quarantine programmes
11.	Target 11: No species of wild flora endangered by international trade	Action of CITES and a GSPC was adopted in 2013 by CITES COP 16.
12.	Target 12: All wild harvested plant-based products sourced sustainably	Introduction of the FairWild Standard
13.	Target 13: Indigenous and local knowledge innovations and practices associated with plant resources maintained or increased, as appropriate, to support customary use, sustainable livelihoods, local food security and health care	Progress towards this target is difficultto measure as baselines have not been quantified.
14.	Target 14: The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness	Interlinked with achievements of Target 1,2 and 5
	programme	
15.	Target 15: The number of trained people working with appropriate facilities sufficient according to national needs, to achieve the targets of this Strategy	Need Long term improvement programme
16.	Target 16: Institutions, networks and partnerships for plant conservation established or strengthened at national, regional and international levels to achieve the targets of this Strategy	GSPC is initiative of that sort that has led to certain others

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Ginko biloba Linn.: A promising species of potential importance

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Abstract

Gingko biloba Linn. (Order Ginkoales, Family Ginkgoaceae), commonly known as maidenhair tree or ginkgo tree, is considered to be a "living fossil". This is the only surviving species of its genus. This tree species is highly resistant to insects as well as bacteria, viruses and fungi due to the presence of hydroxylactones and aldehydes in leaves. It has medicinal, spiritual and horticultural importance worldwide. Adequate attention is necessary to ensure conservation of this living fossil tree.

Introduction

Ginko Linn. is a monotypic genus represented by *G. biloba* Linn. (Order Ginkoales, Family Ginkgoaceae), commonly known as maidenhair tree or ginkgo tree, originated from China (Anon, 1956) (Fig. 1, https://www.google.co.in /url?sa=i&rct =j&q =&esrc= s&source= images& cd=&ved= 0ahUKEwj04Y vA8 Mz NAh XJLI8 KHeQ 8ARsQj BwIBA&url=https%3A%2F%2Fwww.arb orday.org%2 Ftrees%2Fgraphics %2Ftrees %2 F162%2F162_lg_1.jpg& bvm =bv. 125801520, d.c2I &p sig= AFQjCNGgu Ws3ymAzXHR6d1xz5Vl9HCfWfQ&ust= 1467277407724760). It is stated to be the sole survivor of a genus which was extensive in the geological past. It is one of the oldest living trees of taxonomic class Gymnosperm on the planet with high medicinal properties (reviewed by Chakravarty *et al.*, 2016). The tree is considered to be a "living fossil", that it has continued to survive even after major extinction events (Pelton, 1998). The name *Ginkgo biloba* was given to this tree as their leaves have veins that fan out into two distinct halves (Fig. 2, http://www.herbalextractsplus.com/images /herbs/ginkgo-biloba-bsp.jpg). The leaves of *G. biloba* resemble the maidenhair fern, so as to known as the maidenhair tree.

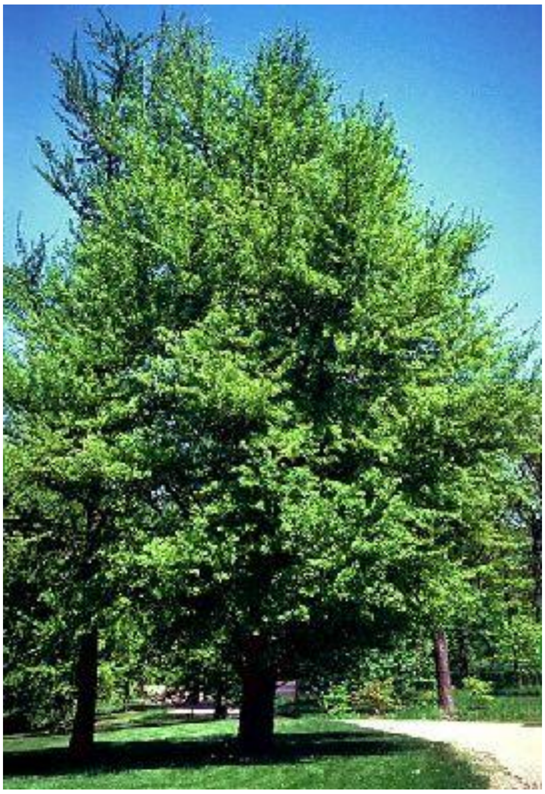

Fig.1. *Ginko bioloba*

Fig.2. Leaves of *Ginko bioloba*

G. biloba is a pretty, handsome, straight tree, sparsely branched when young, bearing clusters of fan shaped leaves, may live as long as 100 years, reached up to height of 100 ft and have a GBH of 3-4 ft (Anon, 1956). The tree is considered sacred in China and Japan and is cultivated in temple gardens. It has been introduced in India and is occasionally cultivated in gardens.

Distribution

G. biloba is an ancient tree native to China (Van Beek, 2000). However, *Ginko* species were once common in Asia, North America and Europe, faced extinction during Ice Age and survived with restricted natural distribution as a single surviving species (Wei *et al*., 2007). Currently, this tree species occurs wild only in China (Ana-Maria and Radu, 2011). Today, *G. biloba* can be found in almost every country across the world. In the central Himalayan mountains of India, this tree species has been reported at an elevation of 6000 ft (Bitencourt *et al*., 2010). Individuals of this species are growing naturally in Uttarakhand (Dehradun, Nainital, Mussoorie and Ranikhet), Himachal Pradesh (Kalpa, Manali and Shimla), West Bengal (Darjeeling and Kalimpong), Punjab (Patiala) and Meghalaya (Shillong) (Rai, 2012).

Genetic resistance to pests and diseases

The remarkable and perhaps the foremost example of genetic resistance in a tree species is that of the ginkgo tree, *G. biloba*. Apparently all individuals of this extremely old species are highly resistant, if not immune, to insects as well as bacteria, viruses and fungi (Major, 1967). The presence of hydroxylactones and aldehydes in leaves of the ginkgo tree is believed to be responsible for the apparent immunity of this ancient species to insect attack (Fig. 3). Although there is obviously no need for improved strains of ginkgo, this species offers a good example of the potential stability of genetic resistance to insects once achieved.

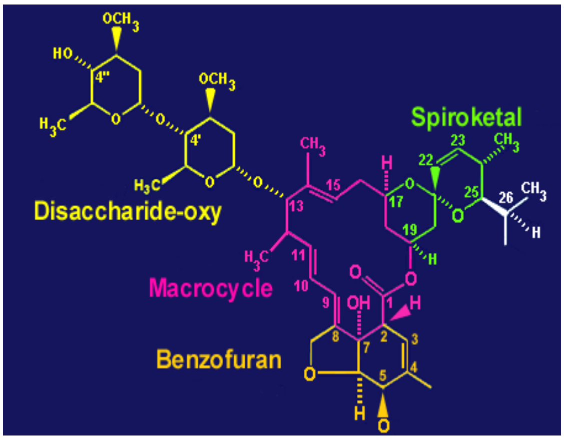

Fig. 3: The macrocyclic lactones

Uses

G. biloba has medicinal, spiritual and horticultural importance worldwide (Dubey *et al*., 2003; Purohit *et al*., 2009). Recent review of Chakravarty *et al*. (2016) has elaborated a large number of uses of *G. biloba*, which are summarized as hereunder. Ginkgo nuts are traditionally consumed as food and medicines throughout Asia. In traditional Chinese medicines, raw Ginkgo nuts used to treat asthma, bronchitis, kidney, bladder disorders and bacterial pathogens due to their antibiotic effects. Ginkgo is an effective treatment for arresting the development of vitiligo. It is also used for treating eye problem, altitude sickness, depression, headache, high blood pressure, stroke, edema, vasoocclusive disorders, cerebrovascular occlusion, aging, traumatic brain injury, male impotence, cardiovascular disease, inflammation and macular degeneration. Ginkgo is widely used for treatment of several nervous system diseases for its antioxidant and anti-platelet properties. It also has cognitive enhancing properties, reduces basal or stress-induced anxiety. *G. biloba* has reported to affect gene expression and can treat tinnitus of vascular origin. Antioxidant, antiangiogenic and gene-regulatory actions are anticancer (chemopreventive) properties of Ginkgo.

Conservation

Since, *G. biloba* has international importance, multi-strategic efforts are required for conservation of this tree species, involving all stake holders, such as local communities, scientists, foresters and NGOs for its micro and macro propagation and subsequent afforestation programmes (Chakravarty *et al*., 2016). In addition to its *in situ* and *ex situ* measures, planning is also essential to ensure sustainable conservation of this living fossil tree.

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व्यापारिक पुष्पः गुलाब

डॉ. ममता पुरोहित एवं डॉ. राजेश कुमार मिश्र

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मानव सभ्यता के विकास के साथ-साथ मनुष्य ने कृषि फसलों के अलावा पुष्पीय पौधों के संरक्षण एवं संवर्धन पर भी ध्यान देना प्रारंभ किया। इस बात का प्रमाण धार्मिक ग्रंथों में ऋषि - मुनियों, पीर-पैगम्बरों के आश्रमो, मंदिरों, मस्जिदों, गिरिजाघरों के चारों ओर लगे पुष्पीय पौधों के छायाचित्रों को देखने से मिलता है। पुष्पों का राजा गुलाब, रोजेसी कुल की झाड़ी है। इसके विभिन्न रंगों के आकर्षक फूल अपनी मन भावन सुगंध के कारण पुष्पीय जगत में अपना विशिष्ट स्थान रखते हैं इसलिए गुलाब को फूलों का राजा कहते हैं। भारत में गुलाब सर्वप्रथम अरब देशों से लाया गया है। विश्व में अमेरिका गुलाब के तेल का सबसे बड़ा निर्यातक देश है। तुर्की, बुलगारिया, रूस एवं मोरक्को भी गुलाब उत्पादक देश हैं। विश्व में गुलाब की लगभग 30,000 प्रजातियाँ पाई जाती हैं। भारत में लगभग 600 प्रजातियों का संवर्धन किया जा रहा है। वर्तमान में भारत में गुलाब के फूलों की खेती लगभग 35 से 40 हजार हैक्टेयर भूमि में की जा रही है। गुलाब की खेती उत्तरप्रदेश, राजस्थान, तमिलनाडु, कश्मीर एवं हिमाचल प्रदेश में की जा रही है। उत्तरप्रदेश के कन्नोज, अलीगढ़, आयोध्या, इटावा, गाजीपुर आदि भारत के मुख्य गुलाब उत्पादक क्षेत्र हैं। *रोजा इंडिका* एवं *रोजा अलबा* भारत में लोकप्रिय प्रजातियाँ हैं।

प्रजातियों का चयन

वर्तमान में व्यापारिक स्तर पर अधिक उत्पादन देने वाली 'नूरजहां' नामक प्रजाति की खेती की जा रही है जिसकी पुष्प उत्पादन दर 30 से 35 क्विंटल प्रति हेक्टेयर है। हिमालयीन जैवसंसाधन तकनीकी संस्थान द्वारा ज्वाला तथा हिमरोज नामक दो प्रजातियाँ विकसित की गई हैं जिनकी पुष्प उत्पादन क्षमता 40 से 50 क्विंटल प्रति हेक्टेयर है। इन प्रजातियों को पहाड़ियों पर एवं उबड़- खाबड़ जमीन पर सफलतापूर्वक लगाया जा सकता है। इन प्रजातियों से रोज आयल भी अधिक मात्रा में प्राप्त होता है। गुलाब की व्यापारिक खेती करने हेतु प्रजातियों का चयन करते समय क्षेत्र विशेष की आद्रता, तापक्रम, मृदा की संरचना, वर्षा आदि का ध्यान रखकर चुनाव करना चाहिए।

मृदा एवं जलवायु

गुलाब, दोमट मिट्टी से चिकनी मिट्टी तक अपनी उत्तम बढ़वार देता है। गुलाब की खेती के लिए मुख्य बात यह है कि जहाँ पर मृदा का पी.एच. मान 7.0 होगा तथा जल निकासी की उत्तम व्यवस्था होगी वहाँ गुलाब के फूलों का उत्पादन भी अधिक होगा । गुलाब को शीतोष्ण एवं समशीतोष्ण दोनों प्रकार की जलवायु में आसानी से उगाया जा सकता है। यह देखा गया है कि शीतोष्ण प्रदेशों में समशीतोष्ण प्रदेशों की अपेक्षा गुलाब की अधिक पैदावार होती है। कम आद्रता एवं साफ मौसम में इसकी वृद्धि अच्छी होती है।

संवर्धन

गुलाब को वर्धी प्रजनन द्वारा तैयार किया जाता है। वर्धी प्रजनन की निम्नलिखित विधियां है:

कलम द्वारा

गुलाब के स्वस्थ्य एवं औजपूर्ण पौधों से दिसम्बर माह में कलम काटी जाती है। कलमों का व्यास (गोलाई) 1 से 1.5 से.मी. तथा लंबाई 20 से 22 से.मी. होना चाहिए । कलम काटने के बाद कलमों को 0.5 प्रतिशत के मरक्यूरिक क्लोराइड के घोल में डुबाकर तुरंत बाहर निकाल लेना चाहिए जिससे सतही जीवाणु नष्ट हो जायें तथा वातावरण में पाये जाने वाले जीवाणु संक्रमण न फैला सकें। उपचार पश्चात कलमों को पानी से अच्छी तरह धो लेना चाहिए। पानी से धोने के पश्चात कलमों के आधार भाग को इन्डोल ब्यूटरिक एसिड (आई. बी. ए.) के 200 पी.पी.एम. के घोल में लगभग 30 मिनट तक डुबाकर रखते है । तत्पश्चात कलमों के आधार भाग को 20 से 25 दिनों तक मिट्टी में दबाकर रखते है। इस दौरान कलमों में जड़ें निकल आती हैं। जड़ों वाली कलमों को गोबर की पकी खाद, रेत तथा मिट्टी के 1:1:1 अनुपात से बने मृदा मिश्रण से भरी पोलीथीन थैलियों में लगा देते हैं। पौधे स्वस्थ्य एवं निरोग रखने हेतु इनका समय-समय पर उचित उपचार करते हैं।

बडिंग द्वारा

देशी गुलाब के पौधे पर बडिंग की जाती है । सर्वप्रथम स्वस्थ्य एवं औजपूर्ण देशी गुलाब के पौधों को चुन लेते है । तदोपरान्त हमें जिस प्रजाति व रंग के गुलाब के पौधे तैयार करने होते हैं उस पौधे (मदर प्लांट) से गुलाब की मुक्कुल (बड्स) निकलते हैं। इन मुक्कुल (बड) को देशी गुलाब के पौधों की मुक्कुल (बड) को धारदार चाकू से हटाकर उस स्थान पर बैठा देते हैं और पोलीथीन की पट्टी से इस प्रकार बाँध देते हैं कि मुक्कुल (बड) फिक्स किये गये स्थान पर पानी और वायु प्रवेश न कर सके। पॉलीथीन की पट्टी इस तरह बांधना चाहिए कि मुक्कुल (बड) दिखाई दे अन्यथा मुक्कुल (बड) सड़ जायेगी और पौधा नहीं बन पायेगा। सावधानी से लगाई गई

मुक्कुलों (बड्स) से 20 से 25 दिनों में शाखा निकल आती है और पौधा बनने की प्रक्रिया शुरू हो जाती है । इस विधि से हम एक पौधे पर अनेक रंगों के फूल प्राप्त कर सकते हैं ।

ग्राफ्टिंग द्वारा

गुलाब के जिस पौधे को ग्राफ्ट करना है उसकी पत्तियाँ लगभग एक सप्ताह पहले हटाकर पौधे को पत्ती विहीन कर देते हैं । अब जिस पौधे पर ग्राफ्टिंग की जाना है उस पौधे की टहनी को आधार भाग से धारदार चाकू से काटकर कटे स्थान को उसी धारदार चाकू से छीलकर छिले स्थान पर ग्राफ़्ट की जानेवाली पत्ती विहीन शाखा को फिक्स कर देते हैं ।फिक्स किये गये स्थान पर पॉलीथीन की पट्टी इस तर बाँधते हैं कि पानी और वायु का प्रवेश न हो सके अन्यथा ग्राफ़्ट की गयी शाखा सड़ जाती है । इस विधि से भी 2 से 2 1/2 माह में पौधा प्राप्त हो जाता है ।

पौध रोपण विधि

पौध रोपण से पहले खेत में 20 से 35 क्विंटल गोबर की पकी खाद व दीमक से पौधों को बचाने के लिये 30 से 35 किलोग्राम गैमेक्सीन पावडर प्रति हेक्टेयर की दर से डालकर अच्छी तरह से जुताई कर देते हैं । अब1 मी. x 1 मी. की दूरी पर 45 x 45 x 45 से. मी. माप के गड्ढे तैयार कर लेते हैं । इस माप के गड्ढों से एक हेक्टेयर भूमि में 1000 पौधे लगाये जा सकते है । वर्षा की पहली फुहार आने पर जब वातावरण में 80 प्रतिशत तक आद्रता हो जाती है, प्रति गड्ढा 5 ग्राम गैमेक्सीन पावडर तथा 5 किलोग्राम गोबर की पकी खाद, गडढे से निकली हुई मिट्टी में मिलाकर गड्ढे में भर देते हैं तथा पौधा लगा देते हैं।

सिंचाई

गुलाब की खेती में सिंचाई की जरूरत अधिकतर प्रथम वर्ष में ही होती है । प्रथम वर्ष में 7- 8 बार सिंचाई करना पड़ती है । द्वितीय वर्ष से 3 - 4 सिंचाई में ही अच्छे फूल प्राप्त होने लगते हैं । यही क्रम 8 - 9 वर्ष तक चलता है । परन्तु यह ध्यान रखना चाहिए कि यदि वर्षा ऋतु में वर्षा ठीक से नहीं हुई है तो 5 - 6 सिंचाई करना पड़ सकती है।

पौधों की तरासी

पौधे से फूलों का अच्छा उत्पादन प्राप्त करने के लिए नवम्बर-दिसम्बर माह में 15 से 25 से. मी. की उँचाई से उपर वाले भाग की छटाई कर देते हैं इससे फूलों का उत्पादन अच्छा होता है । पौध रोपण से लेकर दो वर्ष तक छटाई से प्राप्त शाखाओं से कलम (कटिंग्स) बनाकर पुनः पौधे भी

तैयार कर सकते हैं । छटाई के तुरन्त बाद थालों की गुड़ाई करके थालों में पकी हुई गोबर की खाद 05 से 10 किलोग्राम तथा नाइट्रोजन 150 ग्राम प्रति पौधा डाल कर मिट्टी में अच्छी तरह से मिला देना चाहिये । गर्म जलवायु की अपेक्षा ठंडी

जलवायु में पौधों की छटाई कम अथवा आवश्यकतानुसार ही करना चाहिए।

पौधों की सुरक्षा

पौधों को बीमारियों एवं कीटों से सुरक्षित रखने हेतु निम्नलिखित उपचार किये जाते हैः

दीमकों से

यह देखा गया है कि गोबर की कच्ची खाद डालने से दीमक का प्रकोप हो जाता है । कभी-कभी पौधों की पूर्णतः सिंचाई नहीं करने से भी दीमक आ जाती है जो पौधों की जड़ों को नुकसान पहुँचाती है। यदि दीमक का प्रकोप फसल में कहीं भी दिखे तो उसकी रोकथाम के लिए थाले में कीटनाशक बी.एच.सी. पाउडर, फ्युरोडोन या सीमेंट डालकर, गुड़ाई कर देना चाहिए यह उपचार 15 दिन में 3 बार करना चाहिए ताकि दीमक पूर्णतः समाप्त हो जाये।

माहू से

गुलाब के पौधों पर जनवरी-फरवरी माह में माहू का आक्रमण होता है । मुख्यतः *मेक्रोसाइकस यूफोबी*, *मेक्रोसाइकस रोजी* तथा *मेक्रोसाइकस फाइसिस* नामक माहू का आक्रमण होता है। माहू हरे रंग के छोटे-छोटे जीव होते हैं जो कोशिकाओं के कोशिका द्रव्य का उपयोग करते हैं परिणामस्वरूप कलियाँ गिरने लगती हैं, पौधा रोगी हो जाता है और अंत में सूख जाता है । रोगर या मेटासिड 50 नामक कीटनाशक का आवश्यकतानुसार घोल बनाकर छिड़काव करने से माहू के प्रकोप से पौधों को बचाया जा सकता है।

माइट से

यह कीट सितम्बर से जनवरी माह तक आक्रमण करता है । इस कीट का नाम *टेटानिकस टिलेरियम* है। यह छोटे-छोटे कीट होते हैं। इसके आक्रमण से पत्तियाँ गिरने लगती हैं और पौधा डंठल के रूप में हो जाता है। यह कीट पत्ती की निचली सतह पर जाल बुनकर सुरक्षित रूप में रहता है। इसकी रोकथाम हेतु 3.4 मिली लीटर क्रेलटोन 1 लीटर पानी में मिलाकर छिड़काव करने से पौधा कीटमुक्त हो जाता है।

लाल राल

यह कीट लाल एवं भूरे रंग का होता है जो कि मुलायम तने को पूर्णतः ढंक लेता है और तने से ही भोजन प्राप्त करता है जिससे पौधा कुरूप हो जाता है। प्रकोप अधिक होने से पौधा सूख भी जाता है। इस कीट के आक्रमण का समय मार्च - अप्रैल या अक्टूबर -नवम्बर माह होता है। इस महामारी से निपटने के लिए प्रभावी तने को काटकर जला देना चाहिए या प्रभावित भाग को खुरचकर मिट्टी के तेल में डाल देना चाहिए । इसके नियंत्रण हेतु 2.3 मिली लीटर मेटासिड 50 अथवा मोनाक्रोटोफोस कीटनाशक के 1 लीटर पानी में बने घोल का भी छिड़काव कर सकते हैं।

रोज लीफ चेपर

यह कीट अधिकतर रात के अंधेरे में पत्तियों को खाता है तथा दिन में आसपास की खरपतवार में छिप जाता है । इसका प्रकोप जुलाई - अगस्त माह में दिखाई पड़ता है। इसके नियंत्रण हेतु 1.2 मिली लीटर रोगर या मेटासिड 50 नामक

कीटनाशक का प्रति लीटर पानी में घोल बनाकर छिड़काव करना चाहिए।

उपयोग

गुलाब के फूलों का उपयोग निम्नलिखित उत्पादों में किया जाता है-

- गुलकंद
- गुलाब जल
- रोज ऑयल
- सौन्दर्य प्रसाधन
- अगरबत्ती
- मिठाई
- औषधियाँ आदि।

पुष्पीय जगत में कमल के बाद गुलाब के फूलों का ही स्थान है। हमारे देश की जलवायु गुलाब के

पौधों के लिए अनुकूल होने के बावजूद भी बड़े पैमाने पर इसकी खेती नहीं की जाती है। वर्तमान में भारत, गुलाब का तेल अमेरिका, टर्की, बुल्गारिया, रसिया आदि देशों से आयात कर रहा

है जिससे बड़ी मात्रा में हमारे देश की पूंजी

विदेशों में जा रही है। गुलाब के संवर्धन एवं संरक्षण तथा इसके व्यापारिक उत्पादों का अपने देश में ही निर्माण करने से हम एक ओर जहाँ रोजगार एवं अपनी पूंजी को बचायेंगें वहीं गुलाब के फूलों से बने उत्पादों का निर्यात कर देश के राजस्व में भी वृद्धी करेंगें। बहुत सी निजी संस्थाएं गुलाब के संवर्धन व संरक्षण के प्रचार – प्रसार व प्रोत्साहन हेतु गुलाब प्रदर्शनियों का आयोजन कर विस्तृत जानकारी उपलब्ध कराती हैं।

Know your biodiversity

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Ceiba speciosa

Ceiba speciosa is one of the most beautiful trees of the world known for its large spikes protecting the trunk and limbs. It is commonly known as Floss-silk tree and Mexican silk cotton. It belongs to order Malvales and family Malvaceae. It is native to tropical and subtropical forest of South America. It is widely cultivated in tropical and subtropical climates around the world. It prefers a tropical climate with long dry season followed by heavy rain. Most trees begin to lose their leaves by mid-October in preparation for their stunning floral display and renew them in February. Humming birds, Sun birds, honey bees and butterflies are the some of the pollinators of *Ceiba speciosa.*

The species was originally named *Chorisia speciosa* in 1828. The generic name *Chorisia* was in honour of Louis Choris (1795-1828) a Russo-German painter and explorer who accompanied Otto von Kotzebue (1787-1846), the Baltic German navigator in Russian service on several expeditions across South America and Europe. The specific epithet *speciosa* means 'beautiful', or 'splendid' (Latin), alludes to its spectacular flowers. However, in 1998 the genus *Chorisia* was merged with the genus *Ceiba* (which is the Brazilian name for the tree). Thus, the currently accepted name for the species is *Ceiba speciosa.* In Bolivia Floss-silk tree is known as 'toborochi' because its swollen trunk resembles pregnant women.

It is a large deciduous tree. Bark bright green in young trees and grey in older trees. In young trees trunk is green because of the presence of chlorophyll which make it capable of photosynthesis when leaves are absent. Leaves palmately compound on a long leaf stalk, leaflets 5-7, toothed. Spines broad- based, conical, grey on young stems and shed when the tree grows older. Flowers showy pink, orchid like, large, appears when the tree is leafless. Petals 5 with rippled edges, pink. Purple stripes and blotches are seen on basal part of petals known as 'guide marks' which guides the pollinators. Fruits are large capsules up to 20 cm long green at first then turns grey-brown packed with white floss which helps in dispersal of the seeds.

Cotton inside the fruit pods are used to stuff cushions, pillows, mattresses, life jackets, car seats packaging, to make canoes, as a wood pulp to make paper and in ropes. Vegetable oil is obtained from the seeds. Wood is light in weight, soft. Although wood has little durability and susceptible to fungi and insect attack it used for making canoes, troughs, wooden bowls, clogs, boxes etc. In some parts of

South America the fiber is also used as fuel or to make candles, mixed with fat. It is cultivated mostly for the ornamental purposes and often planted for the beautification of streets, parks and gardens. It is propagated through seeds.

Ardea alba

Ardea alba is known as great egret, common egret and great white heron. It is distributed across most of the tropical and temperate regions of the world. It belongs to order and family Pelecaniformes and family Ardeidae. The species inhabits all kind of inlands and coastal wetlands and commonly seen in the marshes, swamps, streams, rivers, ponds, lakes, impoundments, lagoons, tidal flats, canals, rice fields and ditches. It is distinguished from other other white egrets by its yellow bill and black legs and feet.

It is a large white bird with long legs, neck, and bill, short, rounded tail, and long, broad wings. Wings white. Feets non webbed with very long toes. It is about 94-104 cm and the body mass is approximately 1 kg. Its scientific name *Ardea alba* is derived from the Latin word "*ardea*" means heron and "*alba"* means white. It is high tropic level predator feeds mainly on small fishes, frog, crayfish, birds, snakes, reptiles, small mammals and insects in the early morning and evening hour.

It is monogamous. Both males and females are similar in appearance but males are little larger. It breeds in colonies and the breeding season varies geographically. Temperate breeders nest in spring and summer and the tropical breeders nest in rainy season. It built bulky sticky nest. Nest is constructed from sticks and vegetation normally positioned over water at a height of 1-15 m in bushes or trees. The species usually nests colonially in single or mixed species groups where nest may be less than 1 m apart. During the breeding season the bill becomes darker and lowers legs become lighter in colour. Beside these changes delicate feathers are borne on the back. Female lays 3-5 pale green blue eggs and the incubation period is 23-28 days. Both the parents incubate the eggs.

It is given status of least concern in IUCN threat list category because of its extremely large range, and hence does not approach the thresholds for Vulnerable under the range size criterion (Extent of Occurrence <20,000 km^2 combined with a declining or fluctuating range size, habitat extent/quality, or population size and a small number of locations or severe fragmentation). The population trend is not known, but the population is not believed to be decreasing sufficiently rapidly to approach the thresholds under the population trend criterion (>30% decline over ten years or three generations). The population size is very large, and hence does not approach the thresholds for Vulnerable under the population size criterion (<10,000 mature individuals with a continuing decline estimated to be >10% in ten years or three generations, or with a specified population structure).

This species is threatened in its range by its habitat degradation and loss. Beside these several anthropogenic factors like drainage, grazing, clearing, burning, increases salinity, groundwater extraction, invasion of exotic plants, gathering of egg and hunting for its meat and plume also responsible for its decline. In the early 20th century, the long feathers of the great egret were used on ladies hats but now this practice is discouraged to protect great Egret. Hence for maintaining its population stable general public awareness is very necessary along with its in situ and ex situ conservation

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