ENVIRONEWS

INTERNATIONAL SOCIETY OF ENVIRONMENTAL BOTANISTS

Newsletter

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IN THIS ISSUE

World Environment Day 2018: Fight against Plastic Pollution

This year, the World Environment Day is planned to be organized all over the world with the theme 'Beat Plastic Pollution'. 'Plastic' is a major environmental pollutant present as a micro-, meso- and macro debris. Due to their chemical nature, they are highly durable and inexpensive to produce. In last decade the plastic production has surpassed the total production reaching 335 million metric tonnes in the year 2016. China alone produces a quarter of total plastic produced in the world.

Its' production and usage has broad range i.e. packaging wrappers, biomedical devices, toys, stationery material and storage containers. Millions of tons of plastic finds its way into water reservoirs, public places and marine regions through irresponsible disposal and public littering. Its fumigation evolves harmful dioxins, volatile organic chemicals (VOCs), nitrogen oxides, sulphur dioxide, polycyclic organic matter (POM) and heavy metals. It consists of 10% of the total waste generated by humans.

UN wants to spread awareness against plastic pollution due to its hazardous nature, affecting millions of people and environment. About one lakh living organisms die because of this environmental pollutant alone. Around 11.1 billion plastic items were found poisoning marine environment along with damage due to high temperature resulting into depletion of 50% of coral reefs (World Environment Day-Global). Therefore, the world plastic production is a potential nemesis of life on Earth.

UN recommends government agencies, industry and municipal committees to promote Green Social Responsibility (GSR) and spread awareness to avoid littering plastic material and always try to use plastic bags and articles manufactured from biodegradable and recyclable material. Many programs are planned to be launched in India, which has the highest plastic recycling rate in the world. Thus, our Environment is our responsibility and we should take the responsibility for our sustainable future.

ICPEP-6

Registration of ICPEP-6 has been started. Please visit our website (www.isebindia.com) for detailed information.

LETTERS

India, being a mega-biodiversity nation has huge natural resources and rich biodiversity with spectacular species of flora and fauna. However, till date a significant part of the nation is either under explored or unexplored in terms of comprehensive surveys with significant details about her natural resources. This is quite unacceptable in lieu of advanced technology and tools now being made available for various survey works for identifying, locating and mapping natural resources. India's vast land borders adjoining Pakistan, Tibet, Nepal, Bhutan, Bangladesh and Myanmar are grossly under developed with poor infrastructure even seven decades post independence. As a consequence, several rich biodiversity hotspots along these sensitive border areas have always remained vastly under explored with respect to surveying and mapping.

It is necessary for the major natural resource survey agencies (ZSI, BSI, GSI, ASI) of India to cooperate and coordinate with Central, State and Union Territory governments, intelligence agencies, border security forces and the highly capable Indian armed forces to join hands in exploring border regions for conducting comprehensive land and aerial surveys with modern technological gadgets. Vast sections of Kashmir Himalayas, Ladakh Plateau, Kumaon and Garhwal Himalayas, Kinnaur and Lahaul and Spiti districts of Himachal Pradesh, the Nepal Himalayas, Bhutan Himalayas, Darjeeling Himalayas, Sikkim Himalayas; and the entire NE India with specific emphasis to Arunachal Pradesh, the Andaman and Nicobar Islands, Lakshadweep, all small and big offshore islands of India, the Sunderbans are grossly neglected in terms of comprehensive natural resource and biodiversity survey data.

Even within the country, the Eastern and Western Ghats, the Deccan peninsula, vast areas of Madhya Pradesh, Chhattisgarh, Jharkhand and Orissa need detailed survey and mapping. Several unexplored premier habitats rich in biodiversity, massive virgin forests and wildlife together with trapped natural resources could thus be identified and mapped for future use for the purpose of ecological conservation and economic development.

Cooperation and coordination with adjacent nations will be necessary too for collecting information during the survey; but, the prize will be none the less in identifying huge natural resources for the nation that is hiding from modern science. Such surveys will enrich the biodiversity and natural resource map of India in future; if conducted sincerely and diligently and with proper planning and management. The survey agencies will need central budgetary allocations for this massive task, but will pay back the country in terms of rich dividends for future. The initiatives is necessary to make this happen.

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Spitting "Pan" is a common practice in all parts of India. Walls, and the stair case corners, of most public buildings are full of red spits. At some places tiles with pictures of different gods and goddesses are fixed to dissuade people from spitting. It may interest the readers to know that spitting saliva with tobacco was common even in the United States of America in the eighties. Charles Dickens travelled in America in 1842 and published his observations on the habit of saliva. For him the practice of chewing and expectorating were most offensive and sickening. He further says that "In the hospitals, the students of medicine were requested by notices upon the wall, to eject their tobacco juice into the boxes provided for that purpose and not to discolor the stairs." Spittoons were provided at public places. This filthy custom was officially recognized in courts, the judges, prisoners, witnesses and the jury and spectators were provided with their own spittoons.

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NEWS FLASH

Dr. D.K. Upreti, a Life member and Treasurer of International Society of Environmental Botanists has been awarded the prestigious Fellowship of Indian National Science Academy, New Delhi. Dr. Upreti has recently retired as Chief Scientist at CSIR-National Botanical Research Institute, Lucknow. He is one of the foremost and internationally acclaimed plant taxonomists. He has published more than 350 research papers and 13 books on different aspects of Lichenology. His pioneering contribution on pollution monitoring, particularly heavy metal and polycyclic aromatic hydrocarbons, biodeterioration and bioprospection utilizing lichens is widely recognized. He has also shown the impact of environmental pollutants on the lichen flora of Antarctica.

Dr. Rana Pratap Singh, Dean, Academic Affairs & Professor, Department of Environmental Science, Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow and Executive Councilor of ISEB has been nominated as Chairman, Ecology and Environment Research Committee for 41st Social Science Congress, 2017 held at Periyar University, Salem, Coimbatore (TN) during 18-22 December, 2017. It provided him a rare opportunity to bring the fellow scientists from Natural Sciences, Physical Sciences and Social Sciences at one platform which will help to develop the true inter discipliners in the field of Environmental Botany.

Dr. Upreti has guided more than 35 doctoral scholars in different aspects of Lichens. He has earned several fellowships and awards including FNASc, K.S. THIND, B.A. Razi and E.K. Janki Ammal National Award for Plant Taxonomy. Currently he is President of Indian Lichenological Society.

Dr. Seema Mishra, Life Member of ISEB has been conferred the "Young Women Leadership Award 2016-17" from PHSS Foundation for Science and Society, Lucknow. The award was given by Prof. Asis Datta, FNA, Distinguished Scientist, NIPGR, New Delhi in the Inaugural Ceremony of National Conference on Impact of Climate Change on Indian Agriculture and Plant Productivity at JNU, New Delhi.

Dr. Sanjay Dwivedi, Life Member of ISEB received First Prize by the Hon'ble Mayor of Lucknow Dr. Sanyukta Bhatia for Best Educative Stall on "Role of Plants for Mitigation of Environmental Pollution" during Flower Show of Nagar Nigam at E-Park, Mahanagar, Lucknow.

WELCOME NEW LIFE MEMBERS

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Indian Agriculture: Tradition in Transition

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Introduction

India is second most populous country in the world, next only to China. According to 1950 Census, population of India was 1.02 billion and as per the 2016 census, its population rose to 1.34 billion. India has 17.2% of the total world population (so one in every six people in the world is an Indian), but in terms of land area, India holds the seventh place with only 2.42% of total land area of the world, while land area of U.S.A. is about 4.8%. Nonetheless, India's population is about three times that of U.S.A., twenty-one times that of Canada and about six times that of Japan. The population of India continues to grow rapidly and great pressure is being placed on the natural resources. Most parts of India have subsistence agriculture. This type of agriculture has been practiced in India for several hundreds of years and is being practiced even now in a large part of India in spite of the large scale change in agricultural practices after independence. Despite increase in urbanization and industrialization, about 70% of population is still directly or indirectly dependent on agriculture. We had experienced a "Great Bengal Famine" due to shortage of food grains.

Indian Agriculture: from Evolution to Revolution

In the eighteenth and nineteenth centuries, agricultural growth in the region was slow compared to the rates achieved in the past thirty years. The agriculture of India has moved from evolution to revolution. It is associated with unfavorable or difficult areas that are mainly rainfed, often undulating and with fragile or problem soils. Traditionally, the third category of agriculture in Asia is practiced by groups that reside in the hills and on the fringes of the deserts, at the edges of the main lowland civilizations. In South-east Asia these groups are mainly ethnic minorities; in the Indian subcontinent they are known as tribes (Wangpan et al., 2017). Some of these groups may have been the original inhabitants of the lowland areas, and may have been driven into the forested highland by more dominant civilizations. The type of cultivation associated with these areas is either rainfed or swidden cultivation that involves the clearing of new forest plots every 2-3 years when the natural fertility on the old plots, derived from the burning of the forest, is exhausted. Agriculture in Asia also falls in the above three categories. Industrial agriculture that was alien to the region emerged in the context of the political colonization by the European powers. Until World War II it was largely manifested in the region in the form of large plantations, particularly in the relatively land-rich areas of equatorial South-east Asia. Green revolution agriculture is found in well-endowed areas of the developing world and in areas that are either irrigated or receive adequate and reliable rainfall. It includes large and small farms and uses high-yielding varieties with complementary inputs. The traditional subsistence rice cultivation in the riverine

lowlands of Asia could be considered to be a primitive form of Green Revolution agriculture. These systems are associated with irrigation, sometimes with local water lifting, and constitute the productive base for the indigenous civilizations. Not all the lowlands are irrigated, with the important exceptions of China and India.

The Green Revolution

The introduction of high-yielding varieties of seeds and the increased use of fertilizers and irrigation under the 'Green Revolution' initiative in late 1960s resulted in rapid expansion of agricultural land and boost in agricultural production. The Green Revolution continued with the policy of expanding cultivable land. The striking feature of green revolution was the planting of two crops per year on the same agricultural land (double-cropping). The earlier practice of one crop per year was dependent on monsoon rainfall. For the second crop huge irrigation facilities such as dams were created. Dams were built to arrest large volumes of natural monsoon water which were earlier being wasted as run-off. Simple irrigation techniques as the digging of tube- wells for extracting groundwater were also adopted on a massive scale. The Indian Council for Agricultural Research (ICAR) under the Ministry of Agriculture played a crucial role in the Green Revolution era of the late 1960s. ICAR developed new strains of high yield value seeds, mainly wheat and rice, millet and corn. The most noteworthy seed was the K68 variety for wheat which pushed up food grain production significantly during the

subsequent decade. The 'Green Revolution' resulted in a record grain output of 131 million tons during 1978-79. This established India as one of the world's biggest agricultural producers. No other country in the world which attempted the Green Revolution recorded such levels of success. India also became an exporter of food grains during the same time. Yield per unit of farmland jumped by more than 30% between 1947 -1979 when the Green Revolution was considered to have delivered its goals in the short term. However, the thrust on policy approach to agriculture since the 1990s has been to secure increased production through subsidies on inputs such as power, water and fertilizer, and by increasing the minimum support price (MSP) rather than through building new capital assets in irrigation, power and rural infrastructure. This has shifted the production base from low-cost regions to high-cost ones, causing an increase in the cost of production, regional imbalances, and an increase in the burden of storage and transport of food grains. Besides, ground water particularly in northern Indian states of Haryana and Punjab and in western Uttar Pradesh is being rapidly depleted. The situation in the state of Punjab is alarming. It has exhausted its upper layer of groundwater and farmers are now using high-horsepower pumps to get groundwater from the deeper layers. Agricultural scientists have advised against growing water intensive paddy in Punjab and Haryana. Scientists agree that Indian agriculture must move to a more sustainable way as far as water usage-based ecosystems are concerned to meet the food and non-food needs of a growing population. As agriculture is the largest user of water in India (using more than 80 per cent of usable freshwater) and a large proportion of the population derives its livelihood directly or indirectly from it, we need to build efficient irrigation systems and water conservation strategies, especially in semi-arid regions, through conjunctive use of surface and groundwater. Three decades ago, the collective response to the spectra of hunger resulted in what became known as the Green Revolution. In Green Revolution agriculture, the major change has been the improvement of irrigation systems, with upstream storages allowing the extension of cultivation into the dry season. This has enabled intensification and specialization, typified by the introduction in the 1960s of improved high-yielding varieties that require large inputs of chemical fertilizer. At their most intensive, such systems have been producing two or three crops per year, often incorporating a short duration legume between cereals. Because of the excellent resource base of the Green Revolution agriculture, smallholders who have expanded their enterprises have achieved a size of operation difficult to distinguish from industrial agriculture. The resulting expansion of food production has brought Bangladesh, Pakistan, Indonesia, India, the People's Republic of China, the Philippines and others from the brink of starvation to the threshold of National food-grain self-sufficiency. It has stimulated industrial growth and fostered political stability. And, unlike many previous rural development efforts, the majority of the beneficiaries of the Green Revolution have been small-scale producers. The Green Revolution has been based on a package of technological inputs-fertilizers; pesticides and irrigation - that have allowed the full expression of the yield potential of new crop varieties. The Green Revolution has indeed transformed the agriculture scene and provided the impetus for agricultural development in the region. The productivity gains in Asia due to Green Revolution is obvious from the fact that between 1965 and 1990 the cereal production increased by an average of more than 3% annually in many of the high-population countries. In some it was 4% or more (e.g. Pakistan and Indonesia), whereas some traditional agricultural systems had been able to sustain only 0.5-1.0% increases in production in the past. For the most part, the high growth rates did not bring new land into production. With only a few exceptions, growth in area under agricultural production was less than 1% annually in most countries of the region. In fact land area under agricultural production actually declined in a few countries, such as People's Republic of China and Japan. This implies that the productivity gains came from increases in yields per hectare, which is what the Green Revolution was all about. People's Republic of China and Indonesia had yield increases averaging nearly 4% annually from the mid-1960s to 1990, and annual increases greater than 2.5% were achieved in several other countries including India, Republic of Korea, Pakistan and the Philippines (Doobs 1994). As stated above, increased land under irrigation was part of the Green Revolution story. Several large countries (India, Indonesia, and the Philippines) increased their areas under irrigation by more than 2% per year. In addition, the effectiveness of irrigation was substantially enhanced on many already irrigated tracts when tube wells were installed to augment or replace irrigation supplies from

traditional dug wells, tanks and reservoir-fed canals. The real yield payoff, however, came from the combination of better irrigation facilities, improved cereal cultivars, and fertilizer use. Many countries in Asia experienced average annual growth rates in fertilizer use in excess of 10% in the last three decades. Increasing fertilizer use, often by subsidizing farm-level prices, was a major part of the agricultural development strategy in many of developing countries of Asia during the 1970s. Productivity gains associated with the Green Revolution in Asia have been greatest in wheat and rice areas with well-developed irrigation systems; productivity gains in the un-irrigated arid and semi-arid areas of Asia have been limited.

Transition in Traditional Patterns

Population growth and economic development that have occurred in the region have brought about considerable changes in the pattern of agriculture. The first one is the industrial agriculture, which existed as enclaves at the beginning of the colonial period, has disappeared, and the spatial separation between the second and third categories of agriculture also has been eroded by the expansion of cultivation frontier into the forests.

Changes in Industrial or Plantation Agriculture

Over the years, industrial or plantation agriculture in the region has become diverse (Conway and Barbeier 2013). Today, plantation crops are the mainstay of several economies in the region, contributing substantially to their foreign exchange earnings and providing employment for a significant proportion of their population. Continued viability of these crops has been recognized as being important for sustaining the economies of these countries. However, for most countries, the existing plantings, notably of coconuts and tea, are characterized by low productivity, a consequence of the large age of the stands, their inferior varieties, the non-optimal plant density, minimal input use and poor agronomic practices. Optimization is being achieved through rehabilitation and replanting of the crop concerned, and through inter-cropping with other crops; it depends on available technological innovations, the crop's responsiveness to improved practices and the extent to which the increased output will lead towards substantial income gains (Arunachalam, 2014). Land use considerations have played an important role in decisions to expand the cultivation of plantation crops. Many countries have areas with severe terrain constraints (steep slopes) and high rainfall, which will suffer extensive ecological damage if planted to annual crops (Ayyappan and Arunachalam, 2015). Consequently, plantation crops such as rubber, tea, coffee, cocoa, nutmeg, cloves and cardamom, which require minimal cultivation and provide continuous ground cover, have been successfully established in such areas. Expansion of certain crops has been based on their ability to overcome specific environmental constraints (Dutta et al., 2014), e.g. cashews, mangoes and cinnamon in dry and sandy areas, cardamom at high altitudes, and pineapple and coffee in organic soils (Arunachalam and Gohlani, 2013).

Changes in the Third World Agriculture

To continue the plantation pattern in the country it has been the need of third world agriculture. Consequently, there has been movement of surplus population from such areas onto more marginal lands. Third world agriculture has figured out the swidden cultivation and rainfed farming (Arunachalam and Maithani, 1995; Arunachalam, 2011). Rainfed areas constitute over 70% of the cultivated land in the region and support nearly two-thirds of its farmers. Yield increases still depend on the subtle interaction between soil, water, seeds, and sunlight, but the process is not as well understood in rainfed conditions as it is for irrigated land. Local conditions vary so much that to find solutions is often costly, and they can seldom be replicated elsewhere. Even with the current state of knowledge, however, there is scope for growth. New methods of tilling, new crop rotations, increasing use of fertilizers and pesticides, soil conservation and drainage all have a part to play. Soil erosion and declining fertility are the main threats to rainfed agriculture in the humid and sub-humid areas (Lama et al, 2017). The tackling of these challenges has required protection of the soil by continuous crop coverage and minimum tillage, as well as by drilling seeds and controlling weeds. This has been considered to provide a systematic approach that is being promoted in most countries. Increases in yields from rainfed land will therefore be relatively slow, and concentrated in regions with better rainfall and soil, but the gains could be considerable. If rainfed land could increase its yield by 500 kg/ha, the total increase in production would exceed what could be achieved by a rise of 2 t/ha in the yield of all irrigated land. Some formidable obstacles, such as flooding, stand in the way of such achievements: in many parts of Asia, normal rains cause widespread

floods. Standing water often more than 30 cm deep makes many paddy fields of Asia unsuitable for high-yielding dwarf varieties of rice. Small-scale flood protection and effective drainage have enabled modern rice technology to expand into parts of Bangladesh, Myanmar, India and Thailand.

Closer integration of Agriculture in the Overall Economy

A change of considerable importance which has gathered pace over the past two and a half decades is the increasing integration of agriculture in domestic economies and in the international economy. Farm families' sales and purchases of their food production or requirements have steadily encroached on largely subsistence agriculture, although production for home consumption still remains a basic part of developing country agriculture (Arunachalam and Ayyappan, 2013). The importance of off-farm inputs to production has grown steadily in developing countries. Institutional credit has become more important in the financing of farm operations. Off-farm sources of income have provided a rising share of the total income of farm families, reaching some 40-50% for very small farmers and landless labourers in developing countries in the early 1980s and later. As developing country agriculture has become more monetized, its linkage with industry also has become more prominent. Rural purchases have provided a significant - often the largest part - of the market for goods produced by domestic manufacturing industries, while the processing of food and agricultural raw materials has typically been the basis of developing country industrialization (Ayyappan and Arunachalam, 2014). At the same time, the food and agricultural sector has become more closely integrated in the international economy, following the rising share of output which is traded internationally and the increased links to the monetary economy. Exchange rates, interest rates and the availability of capital are strongly affected by the international environment. The latter, therefore, influences directly or indirectly the cost of finance to the sector, the prices of imported inputs and those of the commodities exported or competing with imports in the domestic market. Economic and financial developments, especially in recent years, have thus meant that agriculture too, has become more affected by macroeconomic policies and general economic conditions, both within the country and internationally. However, the full bearing of this increasing interdependence has not been widely appreciated until recently.

Issues related to Sustainable Management of Forests of Northeast India

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Introduction

Forests of India are a source of a variety of goods and services, which range from medicinal herbs and leafy vegetables for the rural poor to timber for the construction purposes; from sources of drinking water for the rural communities and megacities to sequestration of carbon contributing to mitigation of global climate. Environmental economists are increasingly realizing that, in regions with high forest cover, forests play an important role in the livelihoods of local communities even more than estimated by conventional methods of economic survey, because a significant portion of goods and services provided by forests are non-commercialized and non-marketable. The north-eastern region of India comprises eight states (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura). The region is considered a geographical entity as it shares many commonalities of geographical features, political history, and culture of the people. The region is joined with the rest of India through a 20 km wide passage called the Siliguri Corridor, or chicken's neck. As a result, the region appears to be geographically separated from the rest of India. North-east India is primarily inhabited by people having predominance of Mongoloid elements. The states of the region have some other common characteristics: the infrastructure is poor; agriculture is subsistence and traditional; and except for Assam, the region has no large industries. The region is hilly or mountainous and predominantly inhabited by tribal people. Except for Assam, all the states have very high forest cover and they together account for about 25 percent of India's forest cover. The region is very rich in biodiversity and as much as 50 percent of India's biodiversity can be found in these states. The region is also rich in endemic flora and fauna but the

biodiversity is experiencing severe anthropogenic pressure.

In the northeast India the forests are under severe pressure due to population growth, encroachments on forest lands, loss of forest cover for non-forest uses, shifting cultivation practices and degradation caused by illicit felling, lopping for fuelwood and fodder, removal of forest cover for litter, forest fires, and expansion of human habitations. Given the rich biodiversity of the region, dependence of people on the forests and the ecological services emanating from the forests`, as well as forest conservation and sustainable management are prime concerns. A number of strategic actions are required at various levels to address the underlying causes of forest degradation and to ensure that important environmental services are sustained and the livelihoods of 45 million people of the north-east are not undermined. Some important issues that come in way of sustainable management of forests of northeast India and need to be addressed are discussed hereunder.

i. Sixth Schedule of Constitution of India

The states of Assam, Meghalaya, Mizoram, and Tripura enjoy certain rights and concessions provided to the tribal people of the region under Sixth Schedule of the Constitution of India. Most of the important provisions in the Constitution relating to forest management have been given to Autonomous District Councils (ADCs), which have power to formulate and implement Acts and Rules relating to forest management. The ADCs have control and jurisdiction on all forests of the states that have not been notified under the Indian Forest Act, 1927. For example, in the state of Meghalaya, less than 10 percent of the forests is under the control of State Forest Department, and the remaining forest areas are under the control of ADCs. This poses a great challenge for management of forests by the states. The irony is that the government, which has ample expertise and resources, has less area under its control, and ADCs with scarce resources control most forests of these states. It poses a challenge to the sustainable and scientific management of forests under the control of ADCs. The District Councils often exercise their authority through traditional institutions. At least two-thirds of the region's forests are officially under the legal authority of the ADCs and maximum degradation of forests is taking place in these forests.

ii. Forest Governance and Community Institutions

Forest administration in northeast India sharply differs from the rest of India because vast area of forests are under “community control” and “community ownership”. It is difficult to generalize the capacity of local and indigenous resource management institutions in northeast India. Not all forests under the control of communities are in good condition; however, not all are experiencing deforestation and degradation. It has been observed that the weakening of local community institutions is occurring in many places across the region due to changing values and belief systems. Other major changes have been the commercialization and privatization of land resources once held by the community, both of which have led to unsustainable forest management. To ensure sustainable management of community forests, it is necessary to grant formal recognition to all the community forest areas and to enhance their growth by supporting and strengthening the traditional and customary laws for forest conservation. Further, external support in the form of financial and technical assistance to indigenous community institutions from government agencies will help conserve the forests under community ownership for many years.

iii. Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights Act) 2006

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights Act) (FRA) 2006 was notified on December 29, 2006. The FRA extended to the entire country except the state of Jammu and Kashmir. The FRA seeks to recognize and vest rights for habitation and occupation in forest land for forest-dwelling Scheduled Tribes, as well as for Other Traditional Forest Dwellers who have been residing in such forests for generations but whose rights could not be recorded. The Act was considered an enabling legislation to undo the historical injustice done to these communities.

In the northeast region, the Act has been implemented in the states of Assam and Tripura. Large areas of forest lands have been allotted, through patta, to the forest dwellers in these states. While this may have a positive impact on the livelihood of the people, this has resulted in further encroachments, along with conversion of forest land into agricultural fields and human habitations. The Act contained provisions with noble objectives and included language about sustainable management of forests by involving the forest dependent people in the process; however, it has emerged as a tool for giving patta of forest lands to people living in and near the forests.

The Rain Forest Research Institute, Jorhat, revealed in a study that the Act has not achieved its objective relating to conservation of forests.

iv. Shifting cultivation

According to MoEFCC, 600,000 families are practicing shifting cultivation on 3.8 million hectares of land (Kishwan et al. 2007). According to FSI (2015), shifting cultivation was the major cause of loss of forest cover in north-eastern states during 2013 to 2015. Even in areas such as Sikkim, where shifting cultivation has not been officially reported, the reason for loss of forest cover has been determined to be shifting cultivation. It is often described as "cafeteria system of cultivation" where dozens of varieties of cereals and vegetables, together with tree crops, are grown in a single field. Shifting cultivation continues to remain an important food production system in the hill regions of north-east India. Through their experiential knowledge gained over thousands of years, people of the region have found that in their climatic, edaphic, topographic, and socio-economic settings, this form of agriculture was the most appropriate. Further, shifting cultivation is prevalent because the modern agriculture, characterized by high input of energy and extraneous materials, does not fit into the socio-ecological system of the region.

Since independence, the government of India, as well as state governments of the region, formulated policies and enacted laws to reduce areas under shifting agriculture. Shifting cultivation has been a contentious issue in forestry management in the north-east. The government considers shifting cultivation as "a privilege subject to control, restriction and abolition by the state government and not to be a right" (Assam Forest Regulation 1891, 1995). At the same time, the laws enacted by the Autonomous District Councils considered shifting cultivation as a right held by the communities. Thus, the two law-making bodies look at shifting cultivation differently. Conflicting laws and policies affecting land and forests are numerous in the north-east due to its complex legal history. There is a need to bring greater consistency to the legal framework operating in the region. Nevertheless, in recent times the policy makers and researchers have felt that, in addition to encouraging farmers for settled cultivation, it is important to adopt technology, such as site-specific innovations and inventions, to enhance productivity of land under shifting cultivation. Several national and international agencies have implemented schemes and provided funds through the state governments and non-government organizations to enhance productivity in shifting cultivation areas and to control the degradation of lands. However, little has been done to collate and compile the policies and alternative options to shifting cultivation being promoted and presently being practiced in north-east India. To summarize, in most cases, two departments of state governments look at shifting agriculture differently: while agriculture department considers jhum fields as a "jungle growth on agricultural land", the forest department considers the same land use as "agriculture on forest land". Thus, for sustainable management of forests of northeast India, the issue of shifting cultivation needs to be resolved.

v. Encroachments

Another issue hampering sustainable forest management in the north-eastern region is the ongoing dispute related to inter-state borders, which affects forest management. It is reported that the forests on the disputed land on the Assam-Mizoram, Assam-Nagaland, Assam-Arunachal Pradesh, and Assam-Meghalaya borders are degrading due to improper management. According to some estimates, about 2,500 sq. km. forests exist within those disputed lands.

vi. Smuggling of Forest Produce and Insurgency

The north-east region contains 4,500 km of international border land, which is still open in large stretches. Illegal trade and smuggling of forest products drain the scarce resources of several states. This is particularly serious in the states bordering Bangladesh. In addition, the insurgency prevailing in several states interferes with proper management of forests; there are many examples where militants have caused destruction to forest resources. Also, militant hideouts are mostly found in forest areas, inhibiting movement of forest officials in such forests.

Forests of northeast India are the most valuable asset of the country and deserve greater attention of the governments and public at large. The India State of Forest Reports of 2015 and 2017 have revealed that the region has lost 1258 sq km of forest cover during past 4 years. While in several states outside the region, the forest cover has increased during the same period most states of India's northeast region are steadily losing the forest cover. A serious analysis of causes and consequences and mitigation measures is required. The above analysis of issues relating to sustainable management of forests of the region puts the problem in perspective.

Arctic clouds highly sensitive to air pollution

A study by atmospheric scientists has found that the air in the Arctic is extraordinarily sensitive to air pollution, and that particulate matter may spur Arctic cloud formation. These clouds can act as a blanket, further warming an already-changing Arctic.

In 1870, explorer Adolf Erik Nordenskiöld, trekking across the barren and remote ice cap of Greenland, saw something most people wouldn't expect in such an empty, inhospitable landscape: haze.

Nordenskiöld's record of the haze was among the first evidence that air pollution around the northern hemisphere can travel towards the pole and degrade air quality in the Arctic. Now, in a study from University of Utah atmospheric scientist finds that the air in the Arctic is extraordinarily sensitive to air pollution, and that particulate matter may spur Arctic cloud formation. These clouds, can act as a blanket, further warming an already-changing Arctic.

The Arctic climate is delicate, just as the ecosystems present there. The clouds are right at the edge of their existence and they have a big impact on local climate. It looks like clouds there are especially sensitive to air pollution.

Early Arctic explorers' notes show that air pollution has been traveling northward for nearly 150 years or more. This pollution would naturally get blown northward because that's the dominant circulation pattern to move from lower latitudes toward the poles. Once in the Arctic, the pollution becomes trapped under a temperature inversion, much like the inversions that Salt Lake City experiences every winter. In an inversion, a cap of warm air sits over a pool of cold air, preventing the accumulated bad air from escaping.

Scientists have studied which regions contribute to Arctic pollution. Northeast Asia is a significant contributor. So are sources in the far north of Europe. They have far more direct access to the Arctic, Pollution sources there don't get diluted throughout the atmosphere.

Scientists have been interested on the effects of pollution on Arctic clouds because of their potential warming effect. In other parts of the world, clouds can cool the surface because their white color reflects solar energy back out into space. In the Arctic, the cooling effect isn't as large because the sea-ice at the surface is already bright, Just as clouds reflect radiation efficiently, they also absorb radiation efficiently and re-emit that energy back to warm the surface. Droplets of water can form around particulate matter in the air. More particles make for more droplets, which make for a cloud that warms the surface more.

The research team found that clouds in the Arctic were two to eight times more sensitive to air pollution than clouds at other latitudes. They don't know for sure why yet, but hypothesize it may have to do with the stillness of the Arctic air mass. Without the air turbulence seen at mid-latitudes, the Arctic air can be easily perturbed by airborne particulates.

Particulate matter is an airborne pollutant that can be controlled relatively easily, compared to pollutants like carbon dioxide. Controlling current particulate matter sources could ease pollution in the Arctic, decrease cloud cover, and slow down warming. All of those gains could be offset, other researchers have suggested, if the Arctic becomes a shipping route and sees industrialization and development emissions from those activities could have a disproportionate effect on Arctic clouds compared to emissions from other parts of the world.

The Arctic is changing incredibly rapidly, much more rapidly than the rest of the world, which is changing rapidly enough?

Source: University of Utah (UNews)

No more pancake syrup? Climate change could bring an end to sugar maples

The trees that make maple syrup used in the pan-cakes will struggle to survive climate change, a new study reveals. Researchers had thought that pollution from cars, factories, and agriculture might buffer sugar maples against an increasingly warm and dry climate by supplying soils with fertilizing nitrogen. But the new analysis, which examined 20 years of tree and soil data, finds that extra boost of nitrogen won't be enough. Instead, the researchers report, lack of water will stunt the trees' growth. They ran two climate change scenarios specific to the region. In one case, driven by a decrease in carbon dioxide emissions, temperature would change

moderately, by less than 1°C over the next century. In the second, more extreme case based on current emission trends continuing into the future, temperature would rise by more than 5°C, and 40% less rain would fall in the summer. In both scenarios, the trees didn't grow as much as they do now, but tree growth in the second scenario nearly stopped, even with a bump from extra nitrogen. The researchers say sugar maples will eventually disappear if conditions from the second case hold true.

Source: Science

Land plants arose earlier than thought—and may have had a bigger impact on the evolution of animals

We have land plants to thank for the oxygen we breathe. And now we have a better idea of when they took to land in the first place. While the oldest known fossils of land plants are 420 million years old, researchers have now determined that pond scum first made landfall almost100million years earlier. This study has important global implications, because we know early plants cooled the climate and increased the oxygen level in the Earth's atmosphere, conditions that supported the expansion of terrestrial animal life.

For decades biologists have been trying to come up with a reliable birth date for land plants. Lacking backbones and hard shells, plants leave relatively little behind in the fossil record, so researchers suspect even the oldest plant fossils don't represent the first flora.

Vascular plants—which include the trees, crops, and flowers we are most familiar with—came along sometime after liverworts, hornworts, and mosses. Yet the order in which those three other groups appeared has been a mystery and has stymied molecular clock studies. The new analysis shows that the first land plants arose earlier than we thought, regardless of current uncertainties about which land plants evolved first.

Plant scientists once considered liverwort the most primitive existing plant because it lacks roots and pores for gas and water exchange, but a few recent studies had suggested that liver worm-like plants were not the earliest land plants. Liverworts are most closely related to mosses and once had roots and pores but lost those traits over time.

The assumption has been that the ancestral plant is physiologically like a liverwort. But recent analysis suggests that ancestor likely had rudimentary pores and roots, and thus might grow better, process more soil and more carbon dioxide, and therefore, have been more influential in Earth's biogeochemistry than researchers have thought.

This changes the entire time line for the origin of terrestrial life and the subsequent pace of evolutionary changes in plants and associated animal (and fungal) groups. Also, these earlier dates would mean that changes to the Earth happened at a slower pace than we might otherwise think.

Source: Science

Microwaves as bad as cars for environment

Microwave ovens across Europe alone emit as much carbon dioxide as nearly seven million cars, a study has found.

Researchers from University of Manchester in the U.K. have carried out the first ever comprehensive study of the environmental impacts of microwaves, considering their whole life cycle.

The study found that microwaves emit 7.7 million tonnes of carbon dioxide equivalent per year in the European Union (EU). This is equivalent to annual emissions of 6.8 million cars.

The study used life cycle assessment (LCA) to estimate the impacts of microwaves, taking into account their manufacture, use and end-of-life waste management.

Altogether, the research team investigated 12 different environmental factors, including climate change, depletion of natural resources and ecological toxicity. The research shows that the main environmental 'hotspots' are materials used to manufacture these microwave ovens.

The manufacturing process alone contributes more than 20% to depletion of natural resources and to climate change. However, it is electricity consumption by microwaves that has the biggest impact, taking into account its whole life cycle, from production of fuels to generation of electricity.

Microwaves across the EU consume an estimated 9.4 terawatts per hour of power every year. This is equivalent to the annual electricity generation by three large gas power plants.

Source: PTI

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