

National Conference on
“Recent Trend in Environment and Development”

(RTED-2011) August 6-7, 2011

Venue

*High Altitude Plant Physiology Research Centre (HAPPRC),
H.N.B. Garhwal University,
(A Central University),
Srinagar Garhwal-246174, Uttarakhand, India*

Compiled & Edited By

Dr. L.S. Kandari, Dr. A. Chandra, Dr. Vikram S. Negi
Mr. Shibaji Baghar, Mr. Deepak Kumar Choudhary and Ms. Puneeta Pandey



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*Petroleum Conservation Research Association (PCRA),
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“Raw material adulteration in Non timber forest products: a case of few commercially traded medicinal plants of central India”

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Abstract: Awareness regarding identification of raw medicinal plants is lacking due to several reasons in India. The local people mostly depend on faith of market traders (*Jari-buti* Merchants) and shopkeepers, while purchasing raw medicinal plants. During the survey of the NTFP collectors, traders, etc. in the markets of Nagpur, Katni and Indore, it was found that peoples are using substandard raw material for Ayurvedic medicine preparations. There were no strict rules, policy, Govt. check etc., in this regard. Most of the people involved in the trade are substituting costly Safed musli (*Chlorophytum borivillianum*), Satawar (*Asparagus racemosus*), Aonla (*Emblica officinalis*), Ashwagandha (*Withania somnifera*) Baibidang (*Embelia ribes*), Kali haldi (*Curcuma caesia*) etc. with other similar type of inferior medicinal plants. Due to lack of proper post collection care, the collected medicinal plants loose their pharmaceutical efficacy. After collection from the field, the medicinal plants are sold in local markets, ‘mandi’ sooner or later. It was also observed, that the adulterators were not only mix similar species, but also cheap and inferior quality produces such as rotten or substandard products which can be procured at very cheap rates. Medicinal plants are collected from the wild are contaminated by other similar looking species or plant parts through misidentification, accidental contamination or intentional adulteration, all of which may have undesirable health consequences. The present paper suggests appropriate ways and means to combat the problem of adulteration & substitution in selected medicinal plants. Consumer level awareness can solve the problem up to an extent besides strict follow up of rule as prescribed by World Health Organization (WHO) i.e. GCP, GHP (Good collection & harvesting practices) to meet quality standards of raw herbs.

Keywords: Medicinal plants, Adulteration, Quality, Market, Traders.

Soil nematode diversity in traditional agro ecosystem of Central Himalaya

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Abstract: In the present study soil nematode diversity was examined across the cropping season in a paddy (*Oryza sativa*) –foxtail millet (*Setaria italica*) intercropping system. The experiment was laid out in completely randomized block design with five treatments, paddy and foxtail millet sole cropping and paddy and foxtail millet sown in intercropped ratio of 4:2, 3:3 and 2:4. Soil was sampled at regular intervals of 25- 30 days across the cropping season in triplicates. Nematodes were isolated and identified by the *Baermann* funnel and centrifugation method called the double maximum method. The nematodes identified belonged to five orders: *Rhabditida*, *Tylenchida* and *Aphelenchida* belonged to class *Secernentea*. *Dorylaimida* and *Mononchida* belonged to class *Adenophorea*. Based on their feeding habits they were classified into five trophic groups namely Bacterivores, Fungivores, Herbivores, Omnivores and Predators. According to c-p (colonizer-persistor) ranking with values 1-5 all c-p class nematodes were present in soil. Cp1 indicated presence of colonizers mostly bacterivores, presence of cp class 4 and 5 nematodes indicated a stable ecosystem as they are very sensitive to slightest disturbance. The nematode channel ratio (NCR) was highest for soil planted to paddy foxtail millet in the ratio of 3:3 followed by soil planted to paddy foxtail millet ratio of 4:2, 2:4, paddy sole cropping and foxtail millet sole cropping. Thus paddy foxtail millet sown in equal proportion supports a faster bacterial driven decomposition channel and foxtail millet sole cropping with lowest NCR ratio indicates a slower fungal driven decomposition channel. Diversity indices showed high nematode diversity ($H' = 2.52$) and high values of maturity indices (1.84 – 5.05) depicted fewer disturbance. The study indicates that paddy and foxtail millet sown in equal proportions supported maximum nematode diversity and faster decomposition channel that probably created a better synchronization of soil faunal structure and function.

Keywords: Agro ecosystem; diversity; *Oryza sativa*; paddy; nematode channel ratio; traditional

Rainwater harvesting in the wake of Climate Change: a Case Study from Shimla city, Himachal Pradesh

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Abstract: Shimla city faces water shortage in every summer leading to huge demand and supply gap. Due to rapid development of the city along with the increasing tourist inflow, there is an increase in the trend of urbanization which is highly water intensive. This situation is further expected to get worse in the face of climate change that will exert additional pressure on the water resources of the city. This paper explores the technology of Rain Water Harvesting (RWH) in Shimla city, in order to deal with the problem of water scarcity in the area. The city depends mainly on surface water, available in the form of springs and streams to fulfill its water demand. The sources of water are located quite far from the city and due to high temperatures during summers; the flow of water from these sources gets reduced. Also, the century old system of water supply is now wearing out, with increased distribution losses, due to leakages in old and worn out pipes. Furthermore, the water supply system of the city was meant to support a small population, but the population has now increased many folds. In this regard, RWH has come out as an adaptation strategy that the city could undertake in order to cope with present and future water shortages. The study found that topographically, Shimla city is suitable for rainwater harvesting and roof top harvesting is the best way to capture rain water and then retaining it into the reservoirs (either overhead or underground) to supplement water needs. The city receives a good amount of rainfall from June-September which constitutes almost 70% of the total rainfall in the region and amounts to a total of 25373.43 million liters. The current demand of the city is approximately 17000 million liters (during peak summer season) and therefore, it clearly shows that RWH has high potential for minimising the water scarcity in the region. Although, RWH structures are mandatory for all new constructions within the city, but the use is limited. It is therefore necessary to educate people and spread awareness about the potential benefits of rain water, so that it could be used on a larger scale.

Keywords: *Climate change; Rainwater harvesting (RWH); Shimla; technology*

Toxic Trace Metals in Sorghum plants irrigated by sewage water

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Abstract: Use of untreated sewage water for the irrigation of crops close to urban areas is a widespread practice. Unregulated and continuous irrigation with sewage water leads to environmental problems such as salinisation, phytotoxicity (plant poisoning) and soil structure deterioration (soil clogging), which in India is commonly referred to as 'sewage sickness'. The wastewater also provides an irrigation source during the dry season, which enables farmers to sell their produce for three to five times the kharif (monsoon) season prices. While its high nutrient load increases crop yields and also reduces the need for costly fertilizer inputs. This farming practice alleviates poverty for many urban and peri-urban farmers, but simultaneously it places them, the consumers of their products and the environment at risk. In the present study an experiment was conducted to know the effect of sewage water irrigation on sorghum crop. The area for the experiment was selected at farm of CIRB Hisar. Total of sixteen plots of same size were selected on randomized block design basis for control group (canal water irrigated crop) and treatment group (sewage water irrigated crop). After maturation of crop sorghum sample were taken and estimated for various trace elements. Concentration of Nickel and Cadmium was high in control group while for Cobalt, Chromium, mercury, iron, and Manganese was found to be high in treatment group.

Keywords: *Deterioration; Irrigation; Unregulated; sewage water*

Pattern and composition of timberline vegetation in Rudranath Region of Western Himalaya

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Abstract: The dynamics of plant diversity in the timberline region of Garhwal Himalaya (30° 28' 03.39" -30° 28' 32.25"N Latitudes and 79° 20' 35.36" -79° 21' 39.02" E Longitudes) with an altitudinal range of 3140 to 3394 m asl. Four types of forest of the area were identified as *Acer-Rhododendron* (AR), *Abies-Quercus* (AQ), *Quercus-Quercus* (QQ) and *Rhododendron-Sorbus* (RS). Sites were given the name with prefix PNR (for PANAR) with forest types as PNRAR, PNRAQ, PNRQQ and PNRRS (Table 1.2). Details of the sites are given in following lines. The soil pH of all four forest stands was acidic. The structure of vegetation for ligneous and herbaceous layer was moderately instable and uneven as few species such as *Quercus floribunda*, *Q. semecarpifolia*, *Rhododendron campanulatum*, *Duchesnea indica*, *Viola serpens* dominated the vegetation. Density was found to be ranged from 640-1240 and 56000-111000 for ligneous and herbaceous species respectively. TBC was found to decrease with increasing altitudes in case of herbaceous species while there was no correspondence in case of ligneous species. Among all Quercus spp. was dominant in two sites for ligneous species while in herbaceous species *Duchesnea indica* was found in all forest stands. However, the distribution of species was mainly contiguous, few species showed random and regular distribution. Species richness was found in between 2-4 and 8-10 for ligneous and herbaceous species respectively. Furthermore, the analysis of vegetation pattern revealed that timberline zone ascends higher on southern slopes and descends down on northern slopes in the western Himalaya. To cope with this, they undergo certain morphological modifications. The tree bend towards leeward side, the tips of the trees are damaged due to overloading of snow and high intensity of wind. The timberline zone in the present study exhibits very low floral diversity in comparison to temperate forests of the area and tropical zone. However, detailed analysis of forests and regeneration studies are needed and both extensive and intensive field studies at timberline zone are required to be taken as major research areas in the Himalaya.

Keywords: *Forests; Garhwal Himalaya; High altitude; Plant diversity; Timberline.*

Forests and Climate Change: A Global Concern

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Abstract: Climate change is the greatest global threat and long-term challenge, as it can significantly cause damage to water resources, land resources, ecosystem, food security and health. The impacts of climate change are likely to be aggravated by many anthropogenic stresses like increasing industrialization, habitat fragmentation and destruction, invasion, transportation and deforestation. With a predicted rise in temperature, altered precipitation pattern, more frequent and extreme weather events, an international collective action to mitigate climate change is urgently required. Climate change and forests are intrinsically linked. The global forest sector produces an estimated 5.8 GtCO₂ annually as a result of deforestation, around 96 per cent of which is estimated to come from developing countries in the tropics. To avoid the worst effects of climate change, tackling the loss of global forests must be central to a comprehensive framework for stabilizing levels of atmospheric greenhouse gases at 445-490 parts per million CO₂e or less. Sustainable forest management can be a promising tool to achieve this stabilization with social, economic and environmental goals. It embodies many of the activities that will be required to respond to the effects of climate change of forests. Keeping in consideration the thematic areas like extent of forest resources, biological diversity, forest health and vitality, productive, protective and socio-economic functions of forest resources and legal framework, the balance between society's increasing demands for forest products and benefits, and the preservation of forest health and diversity along with mitigation of climate change can also be achieved.

Key Words: *Deforestation, Climate change, Carbon emission, Sustainable forest management.*

Quantification of CO₂ sequestration capacity of different cement types found in India: Means of CO₂ mitigation

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Abstract: The field of mineral sequestration for the long-term storage of carbon dioxide is a Carbon dioxide Capture and Storage option that provides an alternative for several other sequestration options like geological, terrestrial and ocean, presently known. It gives a leak free CO₂ fixation that needs no post-storage monitoring and the potential of operating at a zero net energy input. Approximately 5% of global carbon emissions (GCE) can be attributed to the manufacturing of cement, with roughly half of the CO₂ coming from the calcining process, and the remaining originating from the burning of fuels used to fire the kiln. The calcining process releases CO₂ from the conversion of calcium carbonates to lime. Cement production generates a world carbon emission of approximately 0.80 kg CO₂ per kg cement produced. The information presented here in the present research paper shows that CO₂ sequestration capacity of different cement types: Ordinary Portland Cement (OPC), Portland Pozzolana Cement (PPC) and Portland Slag Cement (PSC). Sequestration capacities were calculated based on the elemental composition determined by X-ray fluorescence (XRF) of various cement types. The technical investigations presented in this research forms a proof of feasibility of CO₂ sequestration capacities of selected cement types. The variation in sequestration performance among different cements types indicates that the available oxide content plays a vital role in sequestration capacities. Highest CO₂ capture capacity was Portland Slag Cement accounted for highest CO₂ capture capacity of 49.15% followed by OPC, accounting for 43.01% and lastly PPC, having a capturing capacity of 30.40%. Thus, for every 1kg of PSC, OPC and PPC has potential to capture 0.49, 0.43 and 0.30 kg of CO₂ respectively.

Keywords: Mineral Carbonation, Cement, Ordinary Portland Cement (OPC), Portland Pozzolana Cement (PPC) and Portland Slag Cement (PSC), CO₂ capture

Genotype-Environment (G x E) interaction in wild silkworm, *Antheraea mylitta* Drury and its impact on the sustainability of tropical tasarculture

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Abstract: The semi-domesticated and wild ecoraces of tropical tasar silkworm, *Antheraea mylitta* Drury (Lepidoptera: Saturniidae) contributes for vanya raw silk in India. This activity currently depends on limited ecoraces, which require yield optimization through hybridization and matching environment of crop rearing seasons to make tasarculture commercially feasible. The F₁ hybrids made among Daba (semi-domesticated), Jata and Raily (wild) ecoraces were evaluated during different crop rearing seasons to study the impact of Genotype-Environment (G x E) interaction on silk yielding traits. The Jata x Daba hybrids have shown better performance in all the commercial traits during both crop rearing seasons indicating their compatibility to varied environment over Raily x Daba hybrids, which could record better only in shell weight and silk ratio, irrespective of the season. The heterosis as G x E interaction was better in all hybrids for larval and silk traits than egg number and cocoon weight. The higher heterosis and heterobeltiosis in the silk related traits apart little improvement in fecundity and cocoon weight with extended larval span were recorded in Jata x Daba F₁ hybrid in commercial crop rearing season followed by the same hybrid in seed crop rearing. The study infers that, there is scope to exploit the G x E interaction in tasar silkworm genotypes to augment silk yield through superior phenotypes for making tropical tasarculture sustainable and commercially viable.

Key words: *Antheraea mylitta*, Genotype-Environment interaction, Sustainable tasarculture

Conservation, promotion and documentation of ethnobotanical knowledge among rural communities in and around Binsar Wildlife Sanctuary in Uttarakhand

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Abstract: Ethnobotanical knowledge has enormous storehouse of indigenous wisdom pertaining to conservation and utilization of natural resources. Since ages, the traditional communities have been in close harmony with the wild resources and have developed sound knowledge about their surrounding environment and have deep tradition embedded in their socio-cultural fabric. These traditions are often the hallmarks of conservation philosophy and an unquestioned respect for the nature. Traditionally, the local traditional herbal healers (*Vaidyas*) have known the secretes of the medicinal plants with respect to their curative and preventive uses. The existing knowledge base with the *Vaidyas* can boost the research and development initiatives and conservation aspects in entire Indian Himalayan region. An ethnobotanical study was undertaken to collect information from rural communities on the use of medicinal plants based on the extensive field survey performed over a period of 3 years in 14 villages in and around Binsar Wildlife Sanctuary of Pauri district of Uttarakhand state in India. The present study documents the indigenous knowledge of medicinal plants that are used in traditional health care system. Ethnomedicinal uses of 54 plant species along with botanical name, vernacular name, family, habit, conservation status, part (s) used and folk medicinal uses are documented and presented. The documented species falls under 38 families have been used to cure more than 47 types of different ailments without any side effects. In majority of the cases the underground parts of the plants are used in preparation of medicines for curing ailments and most of the diseases are cured from the plants belong to herbaceous community. The study reveals that approximately 70% population the study area dependent on herbal system of treatments and preferred to visit *Vaidyas* for curing common ailments. It was also noticed that majority of the elderly people in the villages possesses sound knowledge and experience on medicinal plants based treatments. The study emphasizes on the potentials of the ethnobotanical research, conservation aspects and need to document the traditional health care system for scientific validation before its commercialization.

Key Words: *Indigenous knowledge, medicinal plants, conservation, rural communities, Binsar Wildlife Sanctuary*

Biodiversity of Ethnomedicinal Plant Used by Traditional Users in Agra Regions Uttar Pradesh, India

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Abstract: Among the Angiospermic plants, 420,000 flowering plants were reported from the world and many tropical species are not yet named. More than 50,000 plants have been used for medicinal purposes. India is represented by rich culture, traditions, and natural biodiversity, and offer unique opportunity for the drug discovery researchers. Utilization of plants for medicinal purposes in India has been documented in ancient literature. India is blessed with two (Eastern Himalayas and Western Ghats) of the eighteen worlds' hotspots of plant biodiversity and is seventh among the sixteen Mega diverse countries, where 70% of the world's species occur collectively. In India, the main traditional systems of medicine include Ayurveda, Unani and Siddha use over 7,500 plant species have been reported. Traditional healers provide considerable information about the use of many plants or plant parts as medicine. The study of ethno botanical was carried out along with the ethnic groups (Agra district). In the present study, 46 plant species belonging to 31 families were included. In this assertion, the information collected from the traditional healers was used to compare with the already accessible literature on the ethnobotany of India. The conventional ethno medicinal plants were mostly used for fever, dysentery, skin diseases, poison bites, wounds, piles and rheumatism. The medicinal plants used by traditional users of Agra district are arranged alphabetically followed by botanical name, family name, local name and major chemical constituents, parts used, mode of preparation and medicinal uses.

Keywords: *Ethnomedicinal; Traditional; biodiversity; ethnobotany*

Impact of climate changes on the soil fauna

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Abstract: The global warming is one of the most alarming problems of the 20th century. Its importance has been recognized globally natural/ human induced increase in mean global temperature of earth surface has been established phenomenon. The green house gases (CO₂ water vapor, N₂O, synthetic CFC's and CH₄) trap heat and light from the sun in the earth's atmosphere. It plays a vital role in determining the earth's average temperature which leads to hazardous climate events.

Sequestering soil carbon and mitigating GHGs

- Addition of organic manures, minimal tillage, agro-forestry
- Alternate drying in irrigated paddies
- Management practices to increase nitrogen use efficiency
- Increasing fuel efficiency in agri. machines
- Improved management of livestock diet

In spite of above suggestions following policy options with climate change would be required:

1. Conservation of existing forests
2. Afforestation of degraded lands with stress on plant species adapted to GHG induced changes of climate as well as CO₂.
3. Research to identify plant species adapted to climate change for inclusion in afforestation programs. However, the capability of adaptation to climate change can not alone be the basis for large scale forest program.
4. Promotion of protected areas to conserve biodiversity. In India, already 12.67 m ha of forests are already under nature reserves.

We have to look for CO₂ emission in India for; Limiting sources that release CO₂ and Developing sink that assimilate CO₂

Following complementary strategies are also required:

1. Political commitment
2. Investment
3. Incentives
4. Information

Keywords: *Sequestration; soil fauna; climate change; global warming*

Use of Geo thermal energy and its comparison with other conventional energy

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Abstract: Now days, there is limited sources of energy on the earth. These are decreasing day by day. So geothermal energy is best choice of energy source. Geothermal energy is thermal energy generated and stored in earth. Geothermal energy is alternative source of energy than the conventional energy sources. With the help of this, electricity can be produced and cooling effect can be generated by using geothermal air condition system. This energy does not have any harmful effect on environment. This paper presents comparison between systems using geothermal energy and systems that produce thermal energy from fuel.

Keywords: *Geo thermal energy; conventional energy; environment*

Crop Rotation Strategy for the Management of Plant parasitic Nematodes

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Abstract: Nematodes are roundworms, and those that attack plants are microscopic. The damage they cause to plants is often subtle and is easily confused with nutrient problems. Although hundreds of different kinds of nematodes may infect plants, less than a dozen are economically serious root-feeding pathogens in Uttar Pradesh. The primary groups of nematodes that cause problems in U.P are the root-knot, cyst, burrowing, lesion, foliar, and reniform nematodes. Others, such as the spiral, pin, and lance nematodes, may occur in abundance but usually do not cause sufficient damage to warrant concern. Feeding by some nematodes causes abnormal plant growth, and consequently the plants can be stunted, discolored, or both controls of nematodes can be optimized by basing management decisions on the relationship between nematode biology and plant response. Lacking a well informed management plan, arbitrary selection of control practices can be costly and ineffective. Nematode management should be multifaceted. Since eliminating nematodes is not possible, the goal is to manage their population, reducing their numbers below damaging levels. Common management methods used include planting resistant crop varieties, rotating crops. Crop rotation involves growing a crop that is not a host for the nematode present before growing a crop that is susceptible. The non host or immune crop will cause nematode numbers in the soil to decline, giving the subsequent host crop a chance to establish a good root system. The success of this method depends on growing the non host crop long enough to reduce the nematode numbers. The rotation crop must be selected carefully because some nematodes (such as root-knot, reniform, and burrowing nematodes) have very wide host ranges. Also, crop rotation is difficult to use with most perennial crops but crop rotation is very effective tool for the management for plant parasitic nematodes. Variations on the crop rotation concept include fallowing, intercropping, and green manuring.

Keywords: *Nematodes; Crop rotation; inter cropping; green manuring*

Groundwater Contamination of Fluoride in Agra Districts

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Abstract: The past few decades, the ever-growing population, urbanization, industrialization and unskilled utilization of water resources have led to degradation of water quality and reduction in per capita availability in various developing countries. Due to various ecological factors either natural or anthropogenic, the groundwater is getting polluted because of deep percolation from intensively cultivated fields, disposal of hazardous wastes, liquid and solid wastes from industries, sewage disposal, surface impoundments etc. In India, fluoride is the major inorganic pollutant of natural origin found in groundwater. In this paper detailed review on sources, ill effects and techniques available for fluoride removal is done. Fluoride in minute quantity is an essential component for normal mineralization of bones and formation of dental enamel. Since then considerable work has been done in different parts of India to explore the fluoride laden water sources and their impacts on human as well on animals. The safe limit of fluoride in drinking water is 1.0 mg/L. In the present study, Agra district in Uttar Pradesh, India is one such region where high concentration of fluoride is present in groundwater. The fluoride water samples were collected from various regions of Panchgai, Khera, Sewala and Sikandra villages from January 2010 –June 2010. There were Most of people in this area suffer from dental & skeletal fluorosis such as mottling of teeth, deformation of ligaments, bending of spinal column and ageing problem. Overall all water quality was found unsatisfactory for drinking purpose without any treatment. The fluoride concentration in groundwater of this region ranged from 0.1 to 12.9 mg/l. So, an urgent need is to educate the people on the causes of fluorosis, encouraging rain water harvesting and defluoridation technique for providing fluoride free water in the study area.

Keywords: *Degradation; Groundwater; urbanization; industrialization*

“Decentralization of Renewable Energy Systems for Local Energy Sustenance”

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Abstract: Fossil fuel reserves are not infinite. Renewable energy resources are the need of the hour after decades of usage of resource-consuming oil and nuclear energies. Here the concept of new sustainable energy systems arises. Energy is a vital input in many economic, agro-enterprises and post-harvest processes. There is a need of energy supply which is both economically and ecologically compatible. The present study was therefore carried out analyzing the interrelation between technology, energy, ecology and economy. The study offers a holistic approach to the role played by the constraints in following stages: planning, investment of renewable energy, technical implementation and utilization. It also suggests the approach of decentralization of renewable energy systems for achieving better energy access and sustained economic growth. This paper explores the feasibility and potential of rural areas in moving towards a practice of more sustainable energy systems, and, in fact, to more stable food security conditions. It recommends the establishment of a new grid which implies networking of several regional systems and self-sustaining localities through information technology, emerging renewable energy technology and commercially proven energy products. The present study has an explicit focus to analyze the strategic gap between the technical and marketing aspects of renewable energy and the vision of sustainable development. Realizing the capabilities of emerging energy technologies, it explores necessary considerations in the choice of energy and their role for mass scale use, for better energy access locally is to be highlighted. The idea is to have a reliable and affordable rural energy model of self-sustainable human settlement through decentralized food and energy systems and mainly solar technologies that can be built locally.

Keywords: *Renewable Energy; economy; Decentralization; sustainable development*

In vitro evaluation of spermicidal activity of nimbolide in albino rats: A Dose dependent study

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Abstract: Since, there is only few documented evidence referring to assessment of the clear specific actions of medicinal plant source or active constituents in rodent model, the present study is undertaken to evaluate the effective concentration of nimbolide, an isoprenoid of leaves of *Azadirachta indica*, to immobilizes the cauda epididymal spermatozoa, within 20 seconds, in rats and also nimbolide effectively inhibits sperm motility, viability and plasma membrane integrity in a dose-dependent manner. Sander–Cramer test was used to study the spermicidal activity of nimbolide. Hypo-osmotic swelling (HOS) tests were performed to evaluate the effect of nimbolide on sperm plasma membrane integrity. Under the test conditions, the minimum effective concentration (MEC) of nimbolide for 100 % immobilization of sperm in 20 secs was around 3.50 µg/million sperm. No morphological changes were found in the sperm head, midpiece or tail and no viable sperm seen. Further, ultra study and sperm membrane integrity observations of nimbolide treatment shown that most of the principal pieces of treated sperm were without plasma membrane except outer dense fibres and axonemal component were normal and nimbolide exposed spermatozoa lost their response, by curling of the tail, to hypoosmotic medium in a dose-dependent manner, indicating the impairment of functional integrity of the plasma membrane. The present study therefore appears reasonable that nimbolide bestows the sperm-immobilizing effect of nimbolide either directly or by way of its synergism with blockage of some biochemical pathway like energy utilization. These findings using rat spermatozoa could provide insights into how this nimbolide may cause above consequences could guide us to develop an effective and potential candidate as a contraceptive agent and induction of infertility in humans.

Keywords: *Nimbolide, cauda epididymis, spermatozoa and rat*

A Study of the Seasonal variation of Urban Heat Island over Delhi using Satellite data

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Abstract: One of the major problems of the 21st century posed to human beings as a result of industrialization and urbanization is the phenomenon of urban heat island (UHI), which is defined in terms of difference of temperature between urban and non-urbanized rural environment. It is a well known fact that temperatures in the city centre are generally higher than the surrounding rural areas, mainly due to the modifications in land use/ land cover of the region. This results in the modification of climate at the local level, changing the climatic parameters such as wind, radiation, albedo and temperature. The higher temperatures in urban areas lead to increased demand for cooling, i.e., refrigeration and air-conditioning, thus, further aggravating the demand for energy consumption in urban areas. Most of the studies on UHI focus on the estimation of urban rural thermal contrasts. The satellite data have proved to be highly useful in estimating the spatial thermal structure of the city rather than ground based measurements at a few sites. The present study intends to study the formation of urban heat island over the Indian capital city, Delhi and its seasonal variations by using remote sensing techniques. The least- clouded day and night time MODIS scenes at 5km spatial resolution were acquired for the year 2009 for the pre-monsoon (May and June), monsoon (July and August) and post-monsoon season (November and December). The satellite imageries were processed in Digital Image Processing software and maps were generated in GIS software. The daytime surface temperature values were found to vary from 312 K-329 K in the pre-monsoon season, 303 K - 327 K in the monsoon season and from 296 K-305 K in the post-monsoon season. The night-time surface temperatures over Delhi were found to vary from 295 K – 302 K in the pre-monsoon season , 294 K - 304 K in the monsoon season and from 282 K-293 K in the post-monsoon season. Further, a distinct urban heat island was observed during night time in all the seasons with a difference of 5-8 °C between Central Delhi and the surrounding rural areas.

Keywords: *MODIS, Urban Heat Island (UHI), Delhi, GIS*

Environment & We: An Overview: (Study of Printing and Packaging Spheres)

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Abstract: Printing is the largest industry of India after auto-parts. It is an art, science & technology of reproduction of copies. Printing is declared as the “Greatest Invention of the Millennium” by Time magazine, USA. And the spectrum of Time magazine is very well known. Many of the solvents, shellacs and driers employed in Printing & Packaging presses for producing films, printing plates and cleaning the machines are toxic pollutants that can cause chronic health problems. We use a wide range of potentially hazardous chemicals, require energy, and generate wastes, the cumulative impact of which can be substantial, affecting air, water, and land. Paper production costs forests, water, and energy supplies. White paper is bleached via a chlorination process that releases dangerous chemicals and pollutants into the water. Petro inks can cause lasting damage to the environment, leaching volatile organic compounds (VOC’s) — which can cause cancer and birth defects — into the ground, contaminating soil, groundwater and evaporation in the air. Adhesives, bindings, used in printing and packaging can render the final product unrecyclable, virtually guaranteeing that it will end up in a landfill. Controlling the emission of VOC’s is an important part of pollution reducing strategies which can be done by incorporating different types of incinerators. But since incinerator causes pollution and requires lots of fossil fuels, choosing the right product for printing operation is very important. Paper recycling is the process of recovering waste paper fiber and remaking it into new paper products which saves landfill space, energy and prevents air pollution by means of saving trees. We do have alternatives like ECF, PCF & TCF Papers. Instead of using conventional petro inks, vegetable oil inks (e.g. Soy ink) which are low in VOC’s and bio-degradable can be a very good substitution.

Keywords: *Printing, Packaging, VOC, Paper Recycling, ECF, PCF.*

Sustainability of Fresh Water Resources: Legal and Institutional Mechanism in India

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Abstract: The term “Sustainable Development” was born and developed in the world conservation strategy produced jointly in 1980 by the International Union for the Conservation of Nature and Natural Resource (IUCN), World Wildlife Fund (WWF) and United Nations Environment Programme (UNEP) and planned ‘to help advance the achievement of sustainable development through the conservation of living resources’. It declared that ‘conservation like development is for people’. Conservation includes conservation of all living and non living things, which are primarily for human use. Five elements namely Earth, Air, Water, Fire and Space constituted Universe. Today, all these life-sustaining elements are being used, misused and abused without much discrimination. Of all life sustaining elements water has a unique place- the total volume of water on this beautiful planet is about 1400 million km³ of which only 2.5 percent, or about 35 million km³, is freshwater. Most of freshwater occurs in the form of permanent ice or snow, locked up in Antarctica and Greenland, or in deep groundwater aquifers. The principal sources of water for human use are lakes, rivers and soil moisture and relatively shallow groundwater basins. Due to speed of economic reforms the environment is gradually becoming more overstressed. People now are transforming ecosystems throughout the world at a faster and more extensive pace. Some of the cultural and traditions practices of ours given to us wasteful use of fresh water resources. Regarding this context, this paper observes that bringing human use of water resources within sustainable limits will require a major collective effort. There is an urgent need to sensitize the people; to change their mindset and the worldview, and to direct their efforts to a serious thinking and action to change our present practices with an unsustainable development towards sustainable development. In this paper my attempt is to illustrate legal and institutional mechanism for the protection of fresh water resources in India for the benefit of present and future generations. I shall keep within my purview the efforts already carried out by our policy makers, activists, organizations and other agencies in this direction.

Keywords: *Institutional, Legal, Resources, Sustainability, Water; conservation*

Comparison between yield and essential oil composition in rhizomes and rootlets of *Hedychium spicatum* Buch.-Ham. ex J. E. Smith.

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Abstract: The present work represents the comparison between rhizomes and rootlets of *Hedychium spicatum* Buch.-Ham. ex J. E. Smith (Spiked Zinger Lily, family Zingiberaceae), a high value threatened medicinal and aromatic plant (M&AP) of the Himalayan region. On vegetative propagation of *H. spicatum*, planted mother rhizomes of 57.07±6.28g produced daughter rhizomes of 60.20±4.87g whereas biomass of rootlets was observed 67.77±7.64g per daughter rhizome. The essential oil from rhizomes and rootlets were extracted through Clevenger Hydro distillation process and analyzed through GC and only six major compounds viz., Limonene, Linalool, terpinen-4-ol, α -terpineol, germacrene B and 1:8 cineole were focused to find out variation in chemical composition. Germacrene B (5.58±0.13), Linalool (3.34±0.08), Terpinene-4-ol (2.56±0.10), and α -terpineol (3.23±0.16) were observed higher in rootlets as compared to rhizomes (2.00 ± 0.03; 2.49 ± 0.17; 0.23±0.02 and 1.53 ± 0.23, respectively), while 1, 8-cineole (29.91±0.53) and Limonene (1.58±0.11) were found higher in rhizomes as compared to rootlets (20.72±0.51 and 1.47±0.05, respectively). The work emphasizes the importance of rootlets to mitigate the over exploitation and biomass loss of *H. spicatum*. The increasing demand of rhizomes in several modern and traditional medicinal formulations, pharmaceutical companies, cosmetics and perfumery could be fulfilled by complementary consumption of its rootlets, which has equal qualitative and quantitative characters up to a considerable level.

Keywords: *Hedychium spicatum, rhizomes, rootlets, essential oil, chemical composition.*

Indigenous traditional knowledge of Irula tribes on medicinal plants from Nilgris Biosphere Reserve

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Abstract: The knowledge and use of medicinal plant species by traditional healers were investigated in Sigur plateau, Mudumalai Tiger Reserve, Nilgri Biosphere Reserve from June 2009 to April 2010. Twenty one traditional healers of the study area were selected using stratified random sampling and interviewed with the help of local field assistants to gather information on the knowledge and use of medicinal plants used as a remedy for human ailments in the study area. It was found that 75 plant species belonging to 65 genera and 41 families were commonly used to treat various human ailments. Most of the species (57.33%) used were wild and harvested mainly for their leaves (34%). Traditional healers use these plants for curing more than 28 ailments. More than one medicinal plant species were used more frequently than the use of a single species for herbal preparations. Plant parts used for remedy preparations and the methods of usage shows the depth and breadth of traditional knowledge and abundance of medicinal plant species in the study area. The natural forest in the study area consists of numerous trees, lianas, shrubs and herbs which are the treasure troves of medicines.

Keywords: *Traditional knowledge; human ailments; Biosphere; medicinal plant; Nilgri Biosphere Reserve*

Sustainable Use of Natural Resources through Successful Rain Water Harvesting in Sri Jawala Mukhi, Himachal Pradesh.

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Abstract: Freshwater – a major natural resource has been adopted as one of human rights which entitle “*everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses.*” But India's freshwater supply is rapidly dwindling due to surge in economic, agriculture and population growth with mismanagement of its water resources. Its per capita water availability has come down from 5177 CuM in 1951 to 1820 CuM in 2001; which is likely to touch 1140 CuM by 2050, providing 1000 Cubic meters of water stress. Hence, besides efficiently managing the available surface water resources, it becomes imperative to make rainwater harvesting indispensable in the country to ensure sustained economic growth, development and prosperity. Himachal Pradesh receives 1010 mm as average annual rainfall but drought-like conditions are experienced with its uneven topography. Such conditions can be abated by increasing the surface & sub-surface storage besides promoting artificial re-charge of groundwater. With multifarious objectives spanning from soil & water conservation, eco-restoration, enhancement of livelihood sources, Central Ground Water Board, Ministry of Water Resources, has undertaken a demonstrative scheme on ‘Water Harvesting & Artificial Recharge of Groundwater’ for water conservation and augmentation of the ground water resources through construction of *Check Dam cum Ground Water Dam* on Naker Stream, near Jawala Mukhi, Kangra District of Himachal Pradesh. Present paper deals with the construction of water harvesting structure and its impact assessment with a set of piezometers. The paper also highlights objectives & benefits which are likely to accrue to local population including enhanced availability of surface and sub-surface water.

Keywords: *Water Harvesting, Artificial Recharge, impact Assessment, piezometers, Check Dam cum Ground Water Dam*

Evaluating the effect of air pollutants on vegetation: A case study of Bengaluru

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Abstract: Vegetation in the Bengaluru city is greatly affected by urbanization over the past few years. The green area of a city and number of the species that are endangered are decreasing at a faster rate. Moreover, ability of plants to combat the air pollution also decreases with increasing air pollution levels. In order to protect vegetation and implement effective control strategies, there is an immediate necessity to quantify the damage done to the species by various pollutants. An attempt has been made to estimate the effect of the various air pollution sources on most frequently encountered species of vegetation and their ability to combat air pollution. The source apportionment study conducted for the Bengaluru has found that the transport, industrial and domestic sectors contribute to the air pollution in the city. The ISCST₃ model is used to predict the concentrations of the pollutants and these pollutant concentrations are used to estimate the change in the Air pollution tolerance index (APTI) value for the most frequently encountered tree species in Bengaluru. The effect of vegetation by the implementation of various alternative scenarios have also been discussed

Keywords: *Vegetation, ISCST₃, Source apportionment and APTI*

Algal oil analysis by GC & GC-MS techniques for elucidation of its biodiesel potential

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Abstract: As renewable energy plays a vital role in partially replacing the conventional fossil fuels, bio diesel from micro algae has become increasingly important in catering the global fuel market. Microalgae comprise a vast group of photosynthetic organisms which have an extraordinary potential for cultivation as energy crops. Micro algal strains with high oil or lipid content are of great interest in search for a sustainable feedstock for production of biodiesel. The present work was conducted to characterize lipid composition of bio diesel obtained from algal oil and to optimize hydrolysis procedure of algal oil by applying GC and GC-MS techniques to identify best algal strain for bio diesel production. Micro algal oils differ from most vegetable oils in being quite rich in polyunsaturated fatty acids with four or more double bonds. The lipid composition of 8 algal oil samples extracted from different algal strains (Autotrophic/ Heterotrophic) was investigated. The composition was determined at lab scale level by first hydrolyzing the lipids present in samples and then converting them into Fatty Acid Methyl Esters (FAME) by their esterification and after that, fatty acid constituents were identified by GC and GC-MS. The concept of using PTC (Phase Transfer Catalyst) helped to optimize hydrolysis method in minimum possible time which subsequently decreased the total time of analysis. This study revealed that the algal oil samples contained different fatty acid composition in each sample. Results obtained from GC and GC-MS analysis showed that most algal oil samples contained palmitic acid (C16:0) and linolenic acid (C18:3) as major fatty acids constituting 40-60% and 20-30% respectively of total fatty acids. Oils also contained small quantity (5- 10%) of very long chain PUFAs like arachidonic acid, eicosanoic acid & decosahexaenoic acid. The lack of some FAME standards restricted the determination of whole composition of some samples. The finding led to the conclusion that algae vary in their fatty acid composition to a large extent & have very complex structure. The present study introduced an integrated method for hydrolysis of algal oil. The reduction in hydrolysis time from 16 hours to only 1 hour was one of the big achievements. Both GC and GC-MS techniques provided a quick and desired method for estimation of lipid composition of bio diesel as algae contain complex lipid composition due to which, it is quite difficult to find out the complete lipid constituents. Further research should concentrate on developing more efficient method for characterization of bio diesel obtained from algal oil.

Keywords: *Bio diesel; Fatty Acid Methyl Esters; Hydrolysis; GC and GC-MS; Micro algae; Lipids; Bio fuels, Phase Transfer Catalyst.*

Secretion of keratinolytic enzymes and keratinolysis by *Scopulariopsis brevicaulis* and *Trichophyton mentagrophytes*: regression analysis

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Abstract: A survey on keratinophilic fungi from poultry-farm soils at Namakkal and from feather dumping soils at Chennai, India, revealed the existence of 34 species of fungi. Most of the fungi exhibited variable efficiency in producing extracellular keratinase when grown in plates with chicken feathers as the sole carbon and nitrogen source. The fungi *Aspergillus flavus*, *Aspergillus niger*, *Aspergillus versicolor*, *Chrysosporium* state of *Arthroderma tuberculatum*, *Paecilomyces carneus*, *Scopulariopsis brevicaulis*, *Trichoderma viride*, and *Trichophyton mentagrophytes* were efficient candidates to degrade the feathers. However, when cultivating the strains in submerged conditions in a medium containing chicken feathers as the sole nutrients source, *Aspergillus glaucus*, *Chrysosporium keratinophilum*, *Curvularia lunata*, *Fusarium solani*, and *Penicillium citrinum* also proved to be potent. Among all species, *S. brevicaulis* and *Trichophyton mentagrophytes* produced higher amounts of keratinase in both methods. Conditions for keratinase production were optimized by statistical design and surface plots. The highest keratinase activity was estimated by *S. brevicaulis* (3.2 KU/mL) and *Trichophyton mentagrophytes* (2.7 KU/mL) in the culture medium with chicken feathers and shows (79% and 72.2% of degrading ability, respectively).

Keywords: *keratinolytic enzymes; fungi.*

Comparative study of biomedical waste Management in Delhi and karnal Hospitals

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Abstract: Inadequate and inappropriate handling of healthcare waste may have serious public health consequences and significant impact on the environment. The current study dealt with the survey and documentation of Biomedical Waste Management in different hospitals of Delhi and Karnal. The Methodology of the study included the selection of Health Care Institutions, primary data collection comprising Questionnaire and secondary data collection. It was observed that the amount of Waste generated in different Government hospitals (bed/day/kg) of Delhi (0.2 kg) was 15% more than the Government hospital of Karnal (0.17kg) but the amount of waste generated in Private hospitals of both the cities was almost same. The provision of internal storage of waste, use of wheel barrows, daily supervision, availability of shredders, incinerators, autoclave, management of mercury waste, record of injury register, external audit was done in managed way in hospitals of Delhi as compared to hospitals of Karnal. More eco friendly techniques, strict policies related to waste disposal, awareness to sanitation workers regarding personal health and proper waste disposal need to be done in both the cities.

Keywords: *Biomedical waste, Incinerator, Autoclave, Shredders, external audit, Mercury waste.*

Application of Geo-informatics in Vulnerability Assessment of Tropical Forests in the Changing Climate for Sustainable Development.

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Abstract: Tropical forests are contributing significantly in ecological economical and socio-cultural development of developing country like India. These forests are repository of rich biodiversity and have vitality to reproduce. They support the livelihood of rural India. Over the years, the intense biotic pressure has degraded the tropical forest in terms of its extent and species composition and if degradation continues in the same level then we might lose this natural wealth in the coming 50 years or so. This loss is due to the vulnerability of forests to erratic change in climate. Therefore sustainable management of forest is the integral part of any country where more than 60 % of the rural population directly dependent on forests for their sustenance and livelihood. Understanding the vulnerability of forests in the changing climate is thus important for sustainable management of forest resources. The article is an attempt to assess the vulnerability of tropical forests at regional level in the changing climate and possible mitigation measures for sustainable management of resources. The application of geo-informatics is advantageous in assessing the trend of forests over the decades and correlating it with ground data to get site specific inferences. The study area was Marwahi Forest Division, Bilaspur (CG) and it was found that the forests are vulnerable to changing climatic along with induced biotic pressure on forest due to climate variability and weather extremes.

Keywords: *Climate change, Forests, Geo-informatics; livelihood; vulnerability*

Lack of community participation in forest fire: a case study of Himalayan state, Uttarakhand

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Abstract: Scientifically forest fire can be defined as exothermic chemical reaction between the fuel and atmospheric oxygen. Every year forest fire causes great losses to the forest ecosystem, diversity of flora and fauna, economic wealth and also become a grave danger for the people living near the forests. No one knows the forest better than the local community and Local communities' plays a very important role in different phases like Pre Forest Fire Phase, During Forest Fire Phase and After Forest Fire Phase. The physiographic condition is very diverse in Uttarakhand because of great elevation. Himalayas influences the metrological conditions of Uttarakhand The extension of the state (Longitude 77°34'27" E to 81°02'22" E & Latitude 28°53'24" N to 31°27'50" N). Uttarakhand encompasses a geographical area of 53,483 sq. km and the total forest cover is 34651 sq.km. A large area of Uttarakhand is surrounded with forest and every year because of inadequate administrative set up, adverse management plan and lack of local participation we faces a serious demolishment of forest fire. For methodology we use PRA (Participatory Rural Appraisal) tools to collect local perceptions for an effective strategy development plan. Statistical analysis also adopted with the help of GIS (Geographic Information System)/ RS (Remote Sensing). This main purpose of this paper is to show how important role of local community participation in different phases of forest fire, why the lack of local involvement in Uttarakhand, and how we can engage the community in forest fire related strategies and plan for better future.

Keywords: *Community participation, remote sensing and geographic information system, forest fire, pra tools.*

Strategies to mitigate climate change through sustainable agricultural practices

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Abstract: Climate change has emerged as a major challenge in achieving goals of sustainable agriculture. The impact of climate changes is multi dimensional and it can cause a threat to agriculture, food security and biodiversity with adverse implications for forest dependent communities. Climate change is a reality and agriculture is both a sufferer and contributor, and cannot ignore this reality. Amongst elements of climate change, the most important relate to increasing uncertainty in availability of water due to increasing frequency of drought and / or excess water events resulting in uneven water availability over time and space. The rise in temperature and its implication for the whole range of agricultural practices is yet another critical element of climate change. In this context, conservation agriculture offers the promise of a locally adapted, low-external-input agricultural strategy that can be adopted by the poorest and most vulnerable farming communities, as well as by those that can afford varying levels of mechanization and external inputs. The farming community also currently faces multiple severe challenges associated with land degradation, desertification, rapid population growth which also brings pressure to the subject of food security. Conservation agriculture has generated substantial benefits for farmers. Agricultural yields generally increase in the long-term (after 3-7 years), and very often increase in the short-term as well. It also helps to improve soil fertility and structure, capture and retain rainwater, and reduce erosion. Through such mechanisms, it can increase the ability of smallholder farmers to adapt to climate change by reducing vulnerability to drought and enriching the local natural resource base on which farm productivity depends. Conservation agricultural systems for crops and pastures also sequester carbon from the atmosphere into long-lived soil organic matter pools; they maintain and increase productivity, promote a healthy environment, and strengthen rural communities. Potentially one-third of the carbon emitted in current fossil fuel use could be offset by implementing conservation agriculture globally in the next decade. Conservation agriculture reduces pollution by avoiding greenhouse gas emissions, improving energy efficiency, avoiding nutrient loss and protecting water quality. Soil health and biodiversity are also enhanced. Soil carbon trading is a financial incentive for encouraging environmental goods and services. For these reasons, conservation agriculture should be considered to be a preferred approach to agricultural development for smallholder farmers in most regions of India.

Keywords: *Climate change; sustainable; Conservation; agriculture*

Geographical Information System (GIS): A Technique in vulnerability assessment to natural hazards

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Abstract: The natural hazards tradition in vulnerability assessment typically focuses on assessment of levels of ‘risk’. This approach integrates biophysical indicators of risk with socio-economic data to determine current vulnerability based in large part on past losses. Conversely, the climate change community has developed a more future-oriented tradition in vulnerability assessment. Vulnerability to climate change scholars approach assessments with the assumption that future hazard events cannot be predicted based solely on past trends. Rather, vulnerability to climate change assessments integrate the notion of adaptability; the ability of a social-ecological system to adapt over the long term. Both traditions face common challenges in accurately assessing the complexity of relationships and processes. This analysis reveals implications for Geographical Information System (GIS) applications and interpretations in vulnerability assessments.

Keywords: *Geographical Information System, Vulnerability; Natural hazards; climate change*

Laws - Key For Development of Forest and Agriculture'

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Abstract: Environment is the natural surrounding which includes Land, Water, Forest, Air. Environment in the past years was greener and healthier as compared to today's era. Industrialization and Urbanization have led to cutting down of forests and the Earth has been made concrete. Now when all is gone, we all have started living in vacuum and the need for going green is felt, due to which new trends are developed for conservation. "AGRICULTURE is the backbone of the Indian economy, but because of the environmental issues the share of agriculture in GDP declined from 24.4% in 1996-1997 to 18.7% in 2007". Government measures:

1) The Protection of Plant Variety and Farmers Rights Act 2001- protection of agricultural interests in industrial countries.

2) Accelerated Irrigation Benefit Programme.

3) Strengthening of local bodies like Panchayat, Zilla Parishads.

4) Contingency plans for disasters like drought, flood.

"FOREST is the second largest land used in India next to agriculture. Growth coupled with aspirations of a billion people is a challenge for conservation of forest, therefore, responsible policies have been put in action by the Government, Organisations."

1) Indian Forest Act, 1927- penal provisions.

2) National Forest Policy, 1988

(a) Ecological balance

(b) Increase of tree cover.

(c) Efficient utilization of forest produce

(d) Substitution of wood

(e) People's involvement

3) Forest Conservation Act, 1980-stringent provisions for preventing use of forest land for any other purpose.

Being citizens of this country, it is our duty to share the burden of the Government to fulfill the "dream of going green, the environment needs you now."

Keywords: Forest, Agriculture, Industrialisation, Measures, Acts, Policies, People's involvement.

Ethno-medicinal Use of Plant species in Malwa region of Punjab

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Abstract: The Malwa region of Punjab is rich in floral biodiversity and especially the medicinal plants. The benefits of medicinal plants taken for the study were enlisted with their botanical names, local names, status and folk medicinal uses. The traditional knowledge seemed to vanish over time as the written documents were limited and the low income earned by people from those plants. The objective of this paper is to review the valuable medicinal plants in the Malwa region of Punjab and the indigenous and commercial uses of this resource. *Azadirachta indica* (Neem) had been used as antihelminthic, antiseptic and for skin diseases. *Cassia fistula* (Golden shower, Amaltas) is being used for rheumatism and constipation. *Zizyphus nummularia* (Ber) and *Ficus palmata* was used against insomnia and kidney stones respectively. The unriped flowers of *Calotropis procera* (Akk) was used for malaria and cholera. A considerable number of medicinal plants with anticancerous property are found endemic to this region namely *Cannabis sativus*, *Plumbago zeylanica*, *Withania somnifera* (ashwagandha), *Albizia lebbeck*, *Asparagus racemosus*, *Zizyphus mauritiana*, *Melia azadirachta*, *Acacia arabica* (Babul tree, Kikar), *Xanthium strumarium* (Chhota Gokhru) and *Terminalia bellerica* (Bahera) are few among them which have numerous other local uses. The documentation of indigenous knowledge of the use of these plant species helps in its effective utilization.

Keywords: Floral biodiversity, medicinal plants, indigenous knowledge

Y-chromosome and mitochondrial DNA study among four caste populations of Kurukshetra region

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Abstract: The origin of the culturally and genetically diverse populations of India has been subject to numerous anthropological and genetic studies. It remains unsettled whether the genetic diversity seen between different Indian populations primarily reflects their local long-term differentiation or is due to relatively recent migrations from abroad. The modern human originated in Africa and began their journey towards different parts of the world mainly via southern coastal route reaching upto Australia and northern land route to populate America, Europe and Northern Asia. It has been proved that India has played a major corridor for anatomically modern human migration. Further India is known for its diversity in languages, cultures, geography and its people. Therefore, its interesting to know the origin and affinity of all the castes, tribes and communities inhabiting India. Kurukshetra is one of the regions of importance in Hindu mythology as the great battle of Mahabharata was fought there. Hence to know reveal the origin and genetic structure of the people residing the sacred place, we have undertaken Mitochondrial DNA and Y- chromosome study among four different castes population of Kurukshetra region. The mitochondrial DNA analysis reveals the sub lineages of Indian specific M haplogroups along with lower frequencies of the branches of R haplogroups. This indicate that there is homogeneity in maternal genepool. Similarly Y- chromosome study showed the presence of M17-R1a haplogrouping higher frequency. The other haplogroups observed were M69-H, M11-L, M172-J2, M124-R2 AND M89-F*. Paternal lineage also observed homogeneity with India specific haplogroups. The Indian society is very particular about the marriage within the community, thus resulting in the evenness in their genepool. Our result showed the study population is strictly endogamous and retain the Indian specific gene pool.

Keywords: - Haplogroups, Mythology, Mitochondrial DNA, Homogeneity, Chromosome.

Ethno-botanical and Chemotypic Aspects of *Origanum vulgare* L. in Uttarakhand Himalayas

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Abstract: Ethno-botanical knowledge is one of the most important aspect for sustainable uses of plant biodiversity. In this context the different kinds of traditional uses of *Origanum vulgare* L. were documented from local inhabitants, vaidyas, local medicine men, healer of ten districts of Uttarakhand. Aerial parts of *O. vulgare* are applied in many traditional medicines in Uttarakhand Himalayas in the form of herbal tea, flavoring agents, natural preservative, cold and cough, healing wounds, itching problems, ear-ache, head lice infestation, fomentations in human beings and urine disorders in livestock. In higher altitude the foremost sustainable uses of Oregano in the field of aesthetic and herbal-tea is well recognized. On the basis of chemotypic study of essential oil of Oregano (0.17-2.07%), 07 major compounds viz. p. cymine (0.4-7.84%), Z β -Ocimene (0.07-2.6%), E β -Ocimene (0.11-1.64%), γ -Terpinene (0.14-29.09%), Linalool (0.23-16.87%), Thymol (0.42-85.87%), and Carvacrol (0.02-63.6%) were identified. The chemical constituents of the essential oil are widely used in various ethno-botanical aspects such as antimicrobial, antifungal, antineuralgic, antitussive, anthelmintic, anti allergic, diuretic, stomachic, carminative and expectorant properties by pharmaceutical units. The present study will help to identify promising genotypes on the basis of ethno-botanical notes and chemotypic aspects for domestication and wide cultivation for raising economic status of inhabitants.

Keywords: *Origanum vulgare*, aerial parts; essential oil; chemotypic study.

Industrial Applications of Natural Fibers: Retrospect and Prospects

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Abstract : Natural fibers are usually cellulosic elements that are extracted from trees, straw, bamboo, cotton seed, hemp, sugarcane and other sources. Fibers made of almost pure cellulose derived from wood pulp have been manufactured since the late 1800s. Rayon, the most widely known was developed in France in the 1890s and was originally called 'artificial silk'. It has been commercially produced in the United States since 1910. In rayon production, purified cellulose is chemically converted into a soluble compound that is then passed through a 'spinneret' to form soft filaments that are chemically treated or regenerated back into almost pure cellulose. The fibers are then used to produce cloth, cord, or other products. High-performance cords, such as those used in tires, were developed in the 1940s. At one time, rayon and cotton competed for similar end uses, but cotton's lower price gave it a competitive advantage. Rayon is moisture-absorbent, breathable, and easily dyed for use in clothing. It has moderate resistance to acids and alkalis and is generally not damaged by bleaches. As a cellulosic fiber, rayon will burn, but flame-retardant finishes can be applied. It is now manufactured primarily in Europe and Japan. Lyocell is a more recently developed cellulosic fiber, which entered the consumer market in 1991 and was designated as a separate fiber group from rayon due to its unique properties and production processes. Lyocell is both biodegradable and recyclable and virtually all of the chemicals used in production are reclaimed, making it a very environmentally friendly fiber. Industrial uses of lyocell include conveyor belts, cigarette filters, printed blankets, abrasive backings, carbon shields, specialty papers, and medical dressings. Now-a-days, natural fibers are the most widely used as biodegradable filler. Intrinsically, these fibers have a number of interesting mechanical and physical properties. With their environmentally friendly character and some techno-economical advantages, these fibers motivate more and more different industrial sectors to replace synthetic fibers. In recent years, biocomposites are becoming increasingly important in the wood products industry for biomedical applications and the potential for growth is large. Biocomposites are obtained by the combination of biodegradable polymer as the matrix material and biodegradable fillers (e.g., lignocellulosic fillers). Since both components are biodegradable, the composite as the integral part is also expected to be biodegradable. For short-term applications, biocomposites present strong advantages. The primary markets for biocomposites are in the construction and transportation markets. Advanced products continue to be developed in biocomposites, particularly in the realm of nanotechnology. Changing social and economic trends are increasing pressure on the forest products industry to improve performance of wood-based building products, implement environmentally appropriate technology and keep pace with global demand for wood products. The paper focuses on latest trend and future avenues in application of plant fibers in high-end industrial products. Financial incentive for encouraging environmental goods and services. For these reasons, conservation agriculture should be considered to be a preferred approach to agricultural development for smallholder farmers in most regions of India.

Keywords: *Fibres; Biocomposites; biodegradable*

Removal of Hexavalent Chromium from Synthetic Solutions by Distillery Sludge and Sewage Sludge as Low Cost Adsorbents

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Abstract: Batch mode experiments were conducted to study the removal of hexavalent chromium from synthetic solutions using distillery & sewage sludge. Influence of various experimental parameters like initial pH, contact time, initial concentration of adsorbate and adsorbent dosage on the adsorption of Cr (VI) were studied. Optimum condition for Cr (VI) removal by distillery sludge & sewage sludge adsorbents were found to be pH 2, dose 3g/l, contact time 90min and initial concentration 10mg/l. This study followed pseudo second order kinetics. Langmuir and Freundlich adsorption isotherms were also applied and showed good fits to the experimental data. Equilibrium and kinetics results have showed that distillery sludge is more efficient adsorbent as compare to sewage sludge adsorbent for removal of Cr (VI) from synthetic aqueous solutions.

Keywords: *Distillery; Hexavalent Chromium; concentration*

Land-Use/Land-Cover Change and Its Impacts on Climate and Environment

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Abstract: Economic development and population growth have triggered rapid changes to Earth's land cover over the last two centuries, and there is every indication that the pace of these changes will accelerate in the future. These rapid changes are superposed on long-term dynamics associated with climate variability. Land Use Land Cover Change (LULCC) can affect the ability of the land to sustain human activities through the provision of multiple ecosystem services and because the resultant economic activities cause feedbacks affecting climate and other facets of global change. Urban areas are hot spots that drive environmental change at multiple scales. Material demands of production and human consumption alter land use and cover, biodiversity, and hydro systems locally to regionally, and urban waste discharge affects local to global biogeochemical cycles and climate. LULCC plays a major role in climate change at global, regional and local scales. Land cover changes that alter the reflection of sunlight from land surfaces are another major driver of global climate change. Land surface changes can affect local precipitation and temperatures not only in forests or agricultural land but also in urban areas. Vegetation patterns and soil composition can influence cloud formation and precipitation through their impact on evaporation and convection. Because of the strong links between energy use, greenhouse gas emissions and climate change, rates of new construction are strongly related to rates of climate change. New construction not only increases rates of GHG emission, it reduces the amount of Carbon that is stored in areas with vegetative cover. The effect of climate's impact on land cover refers to the direct and indirect influence that climate has on the vegetation, or other features that cover the land (Ecosystems). Climate change produces alterations in water, energy and carbon fluxes. It could also produce environmental disturbances that directly or indirectly affect land cover. Overall, the paper addresses some pressing research issues related to the study of LULCC and its impacts on weather and climate.

Keywords: *Land use land cover change, urbanization, climate change.*

Antibacterial activity of leaf extracts of *Wrightia tinctoria*

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Abstract: Antibacterial activity of *Wrightia tinctoria* leaf extract was evaluated against selected pathogenic bacteria. Gram positive (*Staphylococcus aureus*, *Bacillus subtilis*) and Gram negative (*Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae* and *Micrococcus luteus*) were tested for their response towards the leaf extracts. Antibacterial susceptibility was screened using the well diffusion method and disc diffusion method. The selected plant leaf extracts were prepared with different organic solvent such as hexane, chloroform, ethyl acetate, acetone, ethanol and aqueous. The leaf extracted with ethyl acetate aqueous, acetone and ethanol showed maximum inhibition against both Gram positive and Gram negative bacteria. The minimum inhibition was observed hexane, chloroform, petroleum ether extracts irrespective of the plant material. Phytochemical from the leaf extracts exhibited significant anti-bacterial activity against tested microbial strains; however, inhibitory activities of the extracts were both solvent and test organism dependent. Phytochemical extracts limited the growth of both Gram-positive and Gram-negative bacterial species tested. Hexane, Chloroform and ethyl acetate extract exhibited negligible activity against *E. coli*. On the other hand growth of *Micrococcus luteus* was not affected by hexane, chloroform and petroleum ether leaf extract of *W. tinctoria*. Further, the results depicts that leaf extracts *W. tinctoria* of could be used as a potential source of antimicrobial agents against the bacterial strains tested.

Keywords: *Wrightia tinctoria; Antibacterial activity; well diffusion; disc diffusion.*

Climate change: impact on vegetation

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Abstract: People always have a great need to articulate weather news, for economic reasons, such as agriculture, fishing and transport, for leisure activities, such as sport or cultural events, as well as for reasons of exceptionality during spectacular disasters or extreme events. Seasons and weather cycles are often idealized and simplistic, but they give people the feeling of predictability and reliability, and offer room for planning. Climatic conditions are major factors in agricultural production in terms of plant growth and productivity. Some stages of plant growth are more sensitive than others. Yield of any crop is related to environment conditions in critical stages of plant growth. The variability of climatic factors brings fluctuations on crop yields. Climate variability has been, and continues to be, the principal source of fluctuations in global food production in the arid and semi-arid tropical countries of the developing world. The impact of climate change often associated with extreme weather events, has become very serious challenge; triggering disastrous soil erosion, landslides and floods. Throughout history, extremes of heat and cold, droughts and floods, and various forms of violent weather have wreaked havoc on the agricultural systems in these regions. In conjunction with other physical, social and political-economic factors, climate variability and change contribute to vulnerability to economic loss, hunger, famine and dislocation. In recent decades, land surfaces over the Northern Hemisphere experience a general warming, which was model led to continue in the following future. This climate warming can cause and have caused detectable ecosystem changes because climatic fluctuations are usually of great importance to vegetation dynamics at both global and regional scales. Several countries in tropical Asia have reported increasing surface temperature trends in recent decades. Agricultural productivity in tropical Asia is sensitive not only to temperature increases, but also to changes in the nature and characteristics of monsoon. Simulations of the impacts of climate change using crop simulation models show that crop yield decreases due to climate change could have serious impacts on food security in tropical Asia. Therefore, agricultural production is influenced by climate factors such as the amount of rainfall, distribution of rainfall among seasons and heat. Climate change is likely to cause environmental and social stress in many areas of the world. Hence, it is imperative that these aspects should be well understood in order to formulate more sustainable policies and strategies to promote food production in the arid and semi-arid tropics. Although farmers cannot control these climatic factors, some factors such as soil, seed and agricultural techniques can be controlled and affected. Hence, the climate is an important and independent factor in the agriculture due to its effect on crops in terms of quality and quantity.

Keywords: *Climate change; Agricultural productivity; impact*

Environment v/s Development-Where do the Indigenous people stand

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Abstract: In a society torn between the choices of environment and development- it's generally the marginalised strata of the society that stands affected. From Sardar Sarovar to Posco, it has been a story of environment being at loggerheads with the development. Necessity of growth, coupled with a lack of farsightedness on the part of the Government has resulted in indiscriminate reduction of forest cover. Whatever be the long term effects, lack of concrete sustainable development agenda means it is the tribes or indigenous people who are directly affected in the short term. The Archaic and capitalistic Land Acquisition Act of 1894, coupled with the imperialistic Forest Act of 1927 meant that any land in the country, including reserved forest land, could be acquired by the Govt. after paying a meagre compensation. Demand for land for apparently 'developmental purposes' meant that the tribal population was forcibly evicted from the land where it had lived on for generations. It was only in 2006 that the Government came in with the Forest Dwellers Act. The act goes some way to ensure that the rights of indigenous people residing in forest for generations are recognised and guaranteed by the government. But it still is but a small step in the right direction, and much needs to be done to ensure dignity and survival of the indigenous people living in forests. The current research paper would dwell upon the current challenges facing the indigenous people, especially eviction from traditional forest habitat. Further, it tries to work towards a conclusion to concurrently satisfy the needs of development while minimising the costs towards environment.

Keywords: *Indigenous; development; environment*

Impact of climate change on shifting of natural vegetation

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Abstract: Climate change is causing shifting of species spatial distributions that average 6.1 km per decade towards the poles. Past changes in the global climate resulted in major shifts in species ranges and marked reorganization of biological communities, landscapes, and biomes over the past century, vegetation has been gradually moving toward the poles and up mountain slopes, where temperatures are cooler, as well as toward the equator, where rainfall is greater. Moreover, an estimated one-tenth to one-half of the land mass on earth will be highly vulnerable to climate-related vegetation shifts by the end of this century. Increases in atmospheric CO₂ concentration for affect how plants photosynthesis, resulting in increases in plant water use efficiency, enhanced photosynthetic capacity and increased growth. Increased CO₂ has been implicated in ‘vegetation thickening’ which affects plant_community structure and function. Average, minimum or maximum temperature can be important determinants of plant distribution. Rainfall is also an important determinant: for example it affects the balance of grasses to woody vegetation. Species with long life cycles and/or slow dispersal are particularly vulnerable. Plant genetic composition may change in response to the selection pressure of climate change. Some plant communities or species associations may be lost as species move and adapt at different rates. Some isolated species are particularly vulnerable, as they may have nowhere to go. These include arctic and alpine species, and island endemics coastal species which will be 'squeezed' between human settlements and rising sea levels. Like other species medicinal and aromatic plants are not immune to the effects of climate change. Climate change is causing noticeable effects on the life cycles and distributions of the world’s vegetation, including wild medicinal and aromatic plants. Some medicinal and aromatic plants are endemic to geographic regions or ecosystems particularly vulnerable to climate change, which could put them at risk. Concerns regarding the survival and genetic integrity of some medicinal and aromatic plants in the face of such challenges are increasingly being discussed within various forums.

Keywords: *climate change; vegetation; CO₂ Concentration; vulnerable*

State of the art a mini review on Bioelectrochemical systems (BES) for wastewater treatment

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Abstract: Wastewater treatment systems irrespective of being domestic or industrial demand a lot of energy. Approximately 1.5% of the total energy consumption is directed to wastewater treatment systems. In fact wastewater has lot of chemical energy in the form of organic matter and is alleged to have 9.3 times more energy than the treatment consumes. This necessitated the need for energy efficient treatment systems. Bioelectrochemical systems (BES) have gained considerable interest in the recent years in the context of wastewater treatment due to its high energy conversion efficiency, low cost, ability to treat wastewater which is difficult to be treated by other processes and production of value added byproducts like electricity, biohydrogen, methane and chemicals. In BES, microorganisms are used as catalyst for the oxidation of organic matter in the anode chamber, delivering electrons to the anode. The electrons from the anode can be captured by cathode with electron acceptors like oxygen. The anode and cathode are connected by an external circuit. When the electrical power generated is harvested then it becomes a microbial fuel cell (MFC), if the electrical power is used to produce hydrogen then it is microbial electrolysis cell (MEC). Microbial desalination cells (MDC) are those which desalinate the water along with electricity generation. Recently, microbial cells coupling electrolysis and desalination are also under research. Thus the versatility of the BES makes it a promising option for various applications. The paper aims at reviewing the current state of the art in research and development of energy production from wastewater using BES. The basic principles, major obstacles, factors affecting its performance and the bottlenecks for scaling up the process are outlined briefly.

Keywords: *Bioelectrical systems; wastewater; energy; biohydrogen; microbial fuel cells; microbial electrolysis cells.*

A Call for Sustainable Use of Natural Resources

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Abstract: Man has, continually and at an increasing rate, been changing the forms and mode of its interaction with the environment. On one hand, population of earth is growing rapidly while on the other hand, with the technological and scientific revolution developmental activities have been accelerated to such an extent that in certain areas they have become a threat to the environment. The utilization and consumption of natural resources whether slow or at a fast rate, shall finally result in exhaustion of our non-renewable resources at some point of time in future. Clearly, such a state of rapid consumption of our natural resources, a steady impoverishment of our biological system and deterioration in the quality of our environment cannot continue for long. It is unsustainable. At any point of time in future, the system could collapse, leaving the mankind with acute shortages of food to eat, clothes to wear, and scarcities of all types. Human life in developed countries of the world requires large amounts of energy and material input, while in under-developed countries strives to survive on a meager share, fighting for the basic necessities and in ignorance or desperation often damages the very resource base on which rests the entire life support system of our planet. We have to build a sustainable world- a world which should last forever. Everyone in this world should get at least the basic requirements in such a way that there could be no damage to other life-forms and the environment. This would only be possible when man learns to sustain the natural resources. *Sustainable means management and conservation of the natural resource base in such a way as to assure the attainment and continued satisfaction of human needs for the present and future generation.* For a worldwide sustainable development, there is a need for efficient and effective management of available resources. Without a grasp of the need or the will to change awareness, one will not succeed in realizing the principle of sustainability.

Key words: Conservation, Environment, Natural resources and Sustainable development.

Trend analysis of temperature over Andaman & Nicobar Islands

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Abstract: The present study attempts to explore the trend in monthly, seasonal & annual mean maximum temperature (Tmax) and mean minimum temperatures (Tmin) over Andaman & Nicobar Islands. The temperatures data of 7 surface observatories namely Maya Bandar, Long Island, Port Blair, Hut Bay, Car Nicobar, Nancowry and Kondul of India Meteorological Department (IMD) has been used for this study. Study shows that annual Tmax and Tmin of Andaman & Nicobar Islands are 30.5° C and 23.8 ° C respectively. Station wise analysis of data of the region shows that the annual Tmax is highest over Long Island (31.2° C) and lowest over Kondul (29.3 °C). On the other side, annual Tmin is highest over Nancowry (24.3° C) and lowest over Long Island (23.4° C). In general, annual Tmax decreases towards the southern latitudes of the Andaman & Nicobar Islands and vice-versa in case of annual Tmin. Monthly Tmax is highest in April (32.5° C) and it is lowest (around 30.0° C) from June to February. On the other side, monthly Tmin is highest in June (24.5° C) and it is lowest (around 23.0° C) from January to March. Analysis of last 107 years data shows that there are statistically significant (95% confidence level) increasing trends in annual Tmax over all the stations except Maya Bandar and Port Blair, where the non-significant increasing trends are found. In the case of annual Tmin, the trends are not uniform; it is non-significantly increasing over Maya Bandar, Long Island, Car Nicobar and Nancowry. It is decreasing over Port Blair, Hut Bay and Kondul with statistically significant over Port Blair and Hut Bay. In monsoon season also, there is a statistically significant increasing trend in Tmax over all the stations except Port Blair and Nancowry, where the non-significant increasing trend is found. In post-monsoon season, there is also a statistically significant increasing trend in Tmax over all the stations except Maya Bandar and Port Blair, where the non-significant increasing trend is found. The results are discussed in detail in the paper.

Keywords: Andaman & Nicobar Islands, mean maximum temperature, mean minimum temperature and trend

An Ethnobotanical account of ‘Tejpat’

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Abstract: Man has always made use of flora to alleviate suffering and diseases. As per WHO 70% population of the world depends on Traditional Health Care System for curing various diseases. These lines outline the information on various therapeutic applications of ‘Tejpat’, botanically known as *Cinnamomum tamala* (Buch.-Ham.) Nees and Ebermaeir (Family, Lauraceae). It is a medium-sized evergreen tree and found in India along the North-Western Himalayas, in Sikkim, Assam, Mizoram and Meghalaya from near Indus to Bhutan. It is also found in tropical and sub-tropical Asia, Australia, Pacific region and South Asia. Commonly occurs on moist-shady ravine slopes, often associated with Oak-Rhododendron forests, from 500 m to 2200 m altitude in sub-montane and montane Himalaya. Its leaves and bark are aromatic and traded as a spice throughout the world since ancient times. Along with several medicinal and aromatic properties, the species finds mention in several ethnobotanical studies. For example, the leaves are used as carminative and stimulant; expectorant, in cough; rheumatism; scorpion sting; fever; colic pain; diarrhea; diabetes; severe headache and tension, for temporary birth control; promoting appetite, to avoid laziness; vomiting tendency and applied on pimples. Powdered bark is used in cough and cold; gonorrhea; bronchitis; rheumatism; enlargement of spleen; colic pain; piles; asthma; coryza; uterine troubles; throat and heart trouble, as narcotic; expectorant; carminative. Parts of the tree are also used on sores. Thus *C. tamala* is widely found as common ingredient of *Ayurvedic* formulations such as *Trijata*, *Chandraprabhavati*, *Sudarshan Churna*, and in various *Asava* and *Arista*. In view of the wide range of its uses the species is harvested from the wild under different systems of regulations that vary with the states. This has put great pressure on the natural resources of the species. Therefore, there is an urgent need to force up conservation and cultivation strategies of the species.

Keywords: *Ethnobotanical uses, Cinnamomum tamala, Conservation and Cultivation.*

Urban Heat Island Effect: Linking Urbanization and Climate Change

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Abstract: Climate change and urbanization are amongst the most fundamental challenges in India and the world faces. Most greenhouse gas (GHG) emissions contributing to global climate change come from urban areas resulting in both local and global weather and climate alteration. Simultaneously, cities are susceptible to the impacts of climate change due to their concentration of population and infrastructure assets. This paper explores the bilateral relationship between the rapid urbanization and climate change with focus on Urban Heat Island effect and its impacts in Indian scenario. Urban systems including institutional, physical and ecological systems for energy, transport and communication are exposed to the direct (such as extreme temperatures, storms or floods in cities) and indirect effects (such as changes in global food crisis) of climate change. In both the scenarios – the challenges for urban administrations are massive. This stands apt in Indian context. Urban heat island results due to alteration of land surface materials having different thermal bulk properties during urban development. Urban heat island is very small- scale phenomena and covers only a tiny fraction of the Earth’s surface area but is still significant. This phenomenon impacts the environment by fabrication of pollution and the alteration of the physical and chemical properties of the atmosphere. This unplanned urban growth results in environmental and ecological problems. However, climate change mitigation can be achieved by recognizing significance of sustainable urban development through various urban and environmental institutional systems.

Keywords: *Urbanization; Climate Change; Sustainable Urban Development; Urban heat island*

Capacity Building for Promoting Rural Technologies and Sustainable Livelihood Improvement, Central Himalaya

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Abstract: The traditional societies of Himalaya are facing a wide range of socio-economic and environmental problems to achieve some sort of sustainable development criteria. Further, the landholdings are marginal and fragmented resulting into low agricultural production. All these factors force to local poor to migrate and explore better options of livelihood earning in the urban and semi-urban centers located in the plains from of this natural bioresource rich region. After understanding the hardships and problems faced by the hill/mountain farmers it was realized to develop their capacity and skill for harnessing the potential of local bioresources with simple science and technology interventions for improving their livelihood. The new approach to hill area development that has been emerging in present times is an acknowledgement that location specific, appropriate and cost-effective technologies hold greater potential for sustainable rural development as compared to the conventional technological models prescribed hitherto by various development agencies. The new approach, on the one hand, may be able to diversify livelihood earning options for local communities and may also help conserve natural resources on which these options depend on the other. With this background, the Garhwal Unit of the G.B. Pant Institute of Himalayan Environment and Development (GBPIHED) at Srinagar Garhwal established a Rural Technology Demonstration and Training Centre (RTDTC) at Triyuginarayan, in the district of Rudarparyag. This center are expected not only to develop location-specific technologies and suitable intervention mechanisms but also play a catalytic role to bridge the information gap between technology developers and the local resource users. To begin with, developing capacities of key farmers/local institutions in using appropriate technologies to strengthen organic farming, honey bee rearing, medicinal plant cultivation, protected cultivation (polyhouse, shade house and polypit), value addition of agro based local and wild resources, followed by gradual but large-scale extension activities through demonstration and training programmes would certainly help improve local livelihoods as has been observed during the present endeavor. Participatory learning and sharing of knowledge was the method adopted during the present field-based programme with capacity building of local people. The participants were given on-site demonstrations, training and technical knowhow on various technologies, to enable farmers to better understand problems faced during implementation of new technologies for sustainable management of natural resources.

Keywords: *Rural technology; Capacity building; Empowerment; Livelihood, Natural resource management.*

Economy growth and sustainable Development: An integral Approach towards climate change

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Abstract: The developed nations are currently in the process of economic stagnation primarily due to market saturation resulting from the decline of consumer demand. Therefore, the need of the hour for developed nations is to revive the economic growth and development. This can be achieved by creating sustainable development in developing nations, where demand is far from saturation. The sustainable character of development requires new technologies which must be environmentally acceptable, ecofriendly and avoid replicating wasteful model. Development work therefore, has to be directed towards, (i) reduction of use of raw materials and energy per unit of product (ii) reduction of cost of putting in under the old sites of production and (iii) reduction of greenhouse gases (GHG) and effluents. Developed or rich countries contribute a bigger proportion towards GHG emissions in the atmosphere as compared to developing nations. Deforestation and land use change is the single largest source of GHG emission in developing countries. The developed nations therefore focus more on carbon sequestration, reduce green house gases and support developing countries for Reducing Emissions from Deforestation and Forest Degradation (REDD) and REDD⁺. The developing countries should protect, better manage and save their forest resources, and contribute to the global fight against climate change mitigation. However, REDD⁺ in developing countries like, India, Brazil, Papua New Guinea and Indonesia will benefit local communities as it explicitly safeguards the rights of indigenous people and the local community.

Key words: *Deforestation; Green House Gases (GHG); Indigenous; Reducing Emissions from Deforestation and Forest Degradation (REDD); Sustainable*

Conservation of Bryophytes for Saving Ecosystem

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Abstract: In reference to present day condition, Bryophytes have an important role with respect to environmental conditions. It is proved that these are the first colonies of the terrestrial habitats and represent a bridge between the Pteridophytes on one hand and the Algae on the other. Bryophytes are ecologically significant and play a key role in ecosystem dynamics. They cover the barren soil and conserve the soil and nutrients, provide habitats for invertebrates and maintain water balance in the forest. Bryophytes help to balance an ecosystem in many ways (i) bryophytes have a great capacity to stabilize soil (ii) they have great water holding capacity and potential to tolerate desiccation. They form a moist wet ground to form a cushion; which ultimately helps to grow the other vascular seedlings later. At present, the impact upon these lower plants is more adverse due to global problems, which is governed by several factors like; global warming, shifting of monsoon, drought, landslides, earthquakes or we can say climate change along with man-made pollution and habitat distraction by broad constructions and post effect of tourism. In recent years, we have witnessed a sharp decline in biodiversity, mainly due to urbanization and other anthropogenic activities, which results in loss or fragmentation of natural habitats. In the Himalayan region, disturbances in the form of removal of small fraction of forest biomass through grazing, lopping, and surface burning are common. These factors posed a serious threat to many species of bryophytes. Since conservation strategies are meant only for attention-getting ‘keystone’ plant or animal species, their ‘in situ’ protection can only be assured by helping to establish sufficient large nature reserves needed by these keystone species. Therefore it is recommended that more bryo-exploration is essential for the unexplored areas and necessary steps should be taken up for their conservation. Conservation of bryophytes is important as their ecological importance is critical in human habitats and their scientific use is great because of their presence at particular area can give suitable information about taxa and minerals.

Key words: *Bryophytes, Climate change, Conservation, Ecosystem*

Fodder banks: A novel approach towards reducing women drudgery and interferences in forests

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Abstract: In India, forests meet nearly 40% of the energy needs of the country. About 30% of it is used for fulfilling fodder needs of the cattle population. In Garhwal fodder is collected by lopping the vegetative biomass. Present study was carried out to understand the fodder utilization pattern, quantity of fodder biomass removal in traditional hill agro-ecosystems of Kedarnath Wildlife Division. The quantity of fodder collected by each sample household and time taken for this collection was calculated over a 24 h by adopting weight survey method. The total green fodder collection ranged from 64.4±3.60 to 84±6.23 kg/household/day whereas, total dry fodder collection ranged from 62.4±1.66 to 80.4±5.11 kg/household/day. Fodder collection was varied in summer (March-October) and winter months (November-February). Women walked at least 1-2.5 km one way for harvesting fodder while, during winters they had to walk more than 3-4 km one way. Their backloads affect their health and are cause of many accidents. The problem has led to resource extraction conflicts, malnutrition of women and their children, increase in health related hazards, accidents and improper education of girls. Study reveals about the utility of fodder banks and improved feeding systems to be introduced in these high altitude villages of Indian Himalayan Region. Fodder bank model developed in Garhwal part of Uttarakhand is discussed that is developed by using fast growing, high biomass yielding, nutritious fodder trees and shrubs by active participation of women folk of the area. The study aims to help forest department to develop suitable policy to lessen the impact of degradation of forests for fodder by incorporating the idea of developing fodder banks and introducing fast growing and high biomass yielding plants in cropland bunds of local farmers across all Himalayan states of India.

Keywords: *Garhwal Himalaya; fodder extraction; Women drudgery; fodder bank*

Removal of Hexavalent Chromium from Synthetic Solutions by Distillery Sludge as Low Cost Adsorbent

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Abstract: The present study deals with the adsorption of hexavalent chromium on adsorbent prepared from distillery sludge. Cr (VI) is considered to be potentially toxic and carcinogenic to human and environment. Batch mode experiments were conducted to study the removal of hexavalent chromium from synthetic solutions. Influence of various experimental parameters like initial pH, contact time, initial concentration of adsorbate and adsorbent dosage on the adsorption of Cr (VI) were studied. Optimum condition for Cr (VI) removal by distillery sludge adsorbent were found to be pH 2, dose 3g/l, contact time 90min and initial concentration 10mg/l. This study followed pseudo second order kinetics. Langmuir and Freundlich adsorption isotherms were also applied and showed good fits to the experimental data. Equilibrium and kinetics results have showed that distillery sludge acts as a efficient adsorbent for removal of Cr (VI) from aqueous solutions.

Keywords: Hexavalent Chromium; Distillery Sludge; Freundlich adsorption.

Is cultivation a feasible conservation approach for high altitude high value medicinal and aromatic plants?

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Abstract: *In-situ* and *ex-situ* conservation are two important methods to conserve any RET plants. In situ conservation is one of the best approach but problematic in present situations e.g. land availability, slow growth in natural habitat, anthropogenic disturbances; etc. In the short term, collection of medicinal plants from the wild will continue whether the resource is declining or not; demand is likely to persist and other income-generating activities are unlikely to become available to any significant degree in rural areas. Conservation of the rare, endangered and threatened (RET) medicinal and aromatic plants (MAPs) is one of the burning issues at present. Cultivation of such MAPs is one of the important methods to conserve these species by decreasing pressure on overharvesting in natural habitats. This argued to lead to conservation of the wild plant populations, assured supply of raw materials to the industries and economic return to local populations. The Government of India has established different structures for growing and processing of MAPs. Even after many efforts, none of the traded species are commercially cultivated, though cultivation techniques are being developed for a few species. Depending on the resources availability in the wild, cultivation may seen at small scales. In the medium term, if demand persists, the availability of wild resources will depend on the ability of local systems to balance harvest and growth, at least for products of which harvest is necessarily destructive. This may be tempered by new income generating activities and a substitution away from extraction. If no substitutes are found, and supply curve is assumed inelastic, cultivation may eventually take place to a larger degree. There are no reports of medicinal plants sold from community forests in this region. Given the perceived benefits of, and official emphasis on cultivation, why is it so rare? Therefore, it must be the assumption that market forces will induce individual farmers to cultivate medicinal plants. On the other hand, from the farmer's perspective, cultivation apparently is not attractive and economically viable. Several reasons can account for this: 1. If there are relatively abundant resources, the unit cost of extraction will be low compared to cultivation. 2. The required investment may be too high in terms of land, labour, and/or knowledge acquisition. 3. Other crops /works may be more profitable. Thus, it appears that whether cultivation is initiated or not depends on the investment required by individual farmers. However, cultivation will substitute wild harvesting in the long term, and may not serve to protect currently exploited plant populations.

Keywords: MAPs, RET Plants, In-situ & Ex-situ Conservation and Market Force.

Induction of Systemic Resistance and Growth Performance of Paddy among Trichoderma Fungal Biocontrol Agent

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Abstract: Trichoderma species have long been recognized as agents for the control of plant disease and for their ability to increase plant growth and development. The use of microorganisms that antagonize plant pathogens (biological control) is risk-free when it results in enhancement of resident antagonists and 90% percent of such applications have been carried out with different strains of the Trichoderma which have long been recognized in agriculture as agents of plant disease control and plant growth development. Morphologically characterized thirty rhizospheric isolates of Trichoderma (*T. harzianum* and *T. virens*) from different locations of Uttarakhand were evaluated under glass house condition for their ISR activity against sheath blight and plant growth performance activity on paddy crop. High quality ISR activity was recorded with isolates PB 22, 21, 3, 1, 4, 23, 2 and 16 as they reduced more than 34% disease. Isolate PB 22 was found to induce maximum resistance in paddy crops against sheath blight as minimum disease severity (13.6%) was recorded in the treatment where seeds were treated with PB 22. Maximum root and shoot growth performance was achieved with isolate PB 15 (80.3%) and PB 8 (38.5%) respectively in paddy. Maximum fresh and dry weight was recorded with isolates PB 18 (10.2g) and PB 23 (2.0393g) respectively.

Keywords: Paddy, Trichoderma, Sheath blight, Growth performance, ISR

Geological Carbon Sequestration: An analysis of the technological and legal challenges

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Abstract: The need for controlling climate change is undoubtedly imperative. However, controlling climate change is not only about sustainable use of natural resources, it also about mitigating the effects of by products which are potentially adverse for the earth's climate. If one stretches the aforementioned line of reasoning, it will be safe to say that the use of natural resources must be constantly complemented by judicious management of such by products. Carbon dioxide is one such by product which calls for judicious management. Around 24,000 million tonnes of CO₂ are released per year worldwide, equivalent to about 6500 million tonnes of carbon a year. For the problems of the greenhouse phenomenon to be addressed we must aim to reduce CO₂ emissions to pre-industrial levels. One of the ways of managing and mitigating the effect of carbon dioxide is carbon sequestration. Carbon sequestration is the process whereby carbon dioxide is captured from the atmosphere and stored somewhere else. It is a different approach to the greenhouse problem as it does not attempt to produce less carbon dioxide or stop the consumption of fossil fuels which are driving increases in greenhouse gases. Instead, this method aims at preventing carbon dioxide from entering the atmosphere. Geological carbon sequestration involves capturing the CO₂ and artificially piping or injecting it into large physical structures like depleted oil and gas reservoirs, landfills, coal seams, mines and saline aquifers under the sea-bed. While most approaches of controlling greenhouse emission, geological carbon sequestration is an attempt to control the repercussions of the carbon dioxide already emitted. This paper attempts to analyse the technological and legal challenges involved with geological carbon sequestration and discuss some aspects of its infinite and unexplored potential.

Keywords: Carbon sequestration; sustainable; climate; natural resources

Valeriana jatamansi Jones: Cultivation need

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Abstract: The Himalayan region is bestowed with a variety of natural resources which have been exploited by mankind since time immemorial. One of the major sectors of natural resources in the region is 'medicinal plants'. *Valeriana jatamansi* Jones is one such important herb of this region which belongs to the family Valerianaecae and is commonly known as Tagar. Rhizomes and roots of tagar have antipyretic and diuretic properties, and are used as hepatic and nervine tonic. They are cooling, stimulant, hypotensive, and sedative and also useful in epilepsy, hysteria, hypochondriasis, nervous unrest, and skin diseases. The roots of this plant yield a volatile oil (0.5- 2.12%). Fresh roots and rhizome also contain a group of monoterpenes derivatives called 'Valepotriates' up to 3.82 percent. Rhizomes of *V. jatamansi* are in high demand but short in supply and therefore all the underground part is used, graded and sold under different categories. Uttarakhand is one of the potent sources of this medicinally important plant and have number of natural pockets of *V. jatamansi*. The quality and quantity of active constituent in the medicinal plants decides the market price of the material and plant species are known to vary in their active constituent with respect to their populations. Species with wider region of distribution is likely to have more such variations. The pharmaceutical companies generally require quality plant material rich in active ingredient for various herbal preparations. Keeping this in view, various stands of tagar could be explored to find the elite population on the basis of high active ingredient content and then mass multiplication of superior genetic stock for commercial cultivation can be undertaken. With this approach scarcity of plant material to the pharmaceuticals companies could be reduced and also better raw material, which is free from any kind of adulteration, can be made available. Further it will also reduce pressure on the natural sources of the plant.

Keywords: *Valeriana jatamansi*, high market demand, elite population, cultivation.

***Corylus colurna*, a potential but less known high altitude multi-purpose tree species: Need for domestication**

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Abstract: *Corylus colurna* is an economically important deciduous forest tree species found throughout the Himalayas chiefly from Kashmir to Kumaon distributed over an altitudinal range of 1800-3300m. Seeds of this species yield edible oil and are collected from forest by the local people for their own consumption (eaten raw) as well as for sale in the market. Seeds of *C. colurna* are graded at par the almond as the vernacular name also indicates (bohtia- a tribe, badam-almond) and considered of high nutritive value owing to the presence of edible oil. It is a good fodder tree and natural dye is also obtained from this plant. The species has high commercial value but the natural resources of the species are gradually diminishing possibly due to the over exploitation and poor natural regeneration. The species thus has been reported to belonging to threatened category of conservation status. Seeds of *C. colurna* exhibit physiological dormancy and failure of dormancy breaking conditions to prevail in the natural habitat region of the species could also impair the process of germination leading to failure of regeneration. Thus there is an urgent need to investigate the reasons for its poor regeneration in nature and devise agro-technology of the species that could facilitate its domestication. This will not only help in its conservation but will also give impetus to its commercial exploitation on larger scale.

Keywords: *Corylus colurna*, edible oil, natural regeneration, conservation, domestication

Spices the Neglected Constituents of Ethnobotany

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Abstract: Ethnobotany is just not documentation of knowledge about medicinal plants used earlier due to their effectiveness and lack of modern healthcare alternatives in the olden times but it also provides information regarding the cultural preferences. Herbal medicines are now playing an important role in health care programs worldwide, especially in developing countries, because of their no major side effects. Spices and condiments are those ingredients of ethnobotany which are used in food for improving flavor and also have high threuptic value. The well known spices from Garhwal Himalaya includes *Allium griffithianum* (Jambo), *A. humile* (Laadu), *Alpina calanga* (Kalji), *Angelica glauca* (Choru), *Bupleurum falcatum* (Kakjawan), *Cleome viscosa* (Jakhya), *Cinnamomum tamala* (Tejpat), *Mentha arvensis* (Pothya), *Selenium wallichianum* (Berhatu), *Zanthoxylum acanthopodium* (Timru), etc. All these plant species are now considered just as flavoring substance and facing deterioration due to change in arable land, tourist development, negligence of people, loping of tree species, etc. Therefore, urgency is needed to conserve these spices and condiments like any other drug plants and serious scientific efforts are required along with planned and protected cultivation, so that these can be available with their everlasting taste.

Keywords: *Ethnobotany; spices; condiments; herbal.*

Non Timber Forest Products collection: A source of rural economy

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Abstract: The pressure on forests for the collection of Non Timber Forest Products (NTFPs) has motivated conservation biologists and forest managers to find ways to harvest NTFPs in a sustainable way. NTFPs constitute an integral component of the food for many tribal communities. The present study was conducted in Keonjhar district of Orissa on various NTFP products. The NTFPs are mainly traded in the local markets and collection is one of the main sources of livelihood for people who live below poverty line (BPL) in the district. The tribal and local people prefer to collect those NTFP species which give them maximum returns. The popularly collected NTFPs by majority of people reported in the study includes *Shorea robusta* (Sal leaves), followed by mushrooms, mango (*Mangifera indica*), kendu (*Diospyros melanoxylon*), Sal seeds (*Shorea robusta*), oil seeds (kusum seeds) (*Schleichera oleosa*) silai leaves and Mahua flower (*Madhuca indica*). Mahua flower, as well as Kusum knots. The commonly collected NTFPs are drugs, vegetables and oil seeds, transtuff and dyestuff, food items, and other miscellaneous items. Kusum knots are the main NTFPs collected in Keonjhar district and contribute around 36% of the total NTFPs collected by the household, while quantity of collection of other NTFPs is in the order, Mahua seed (9%), Amla (5%), Baheda (5%), Char seed (5%) and Harida (4%). It is observed that household prefers collection of Mahua flower and Kusum knots as compared to other NTFPs. However, collection of NTFP species also varies according to their market demand and availability.

Keywords: *NTFPs; Orissa; Traditional societies*

Effects of sowing depth and seed sowing position on germination, growth of *Cinnamomum tamala* seedling

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Abstract: Burying depth and orientation is a potential important for successfully germination and seedling development in any tree species. The effects of burying depth and orientation on germination, seedling development and biomass yield were examined in this study. Seeds of *Cinnamomum tamala* were placed at three different depths and three different orientations. The results of burying depth treatment indicated that less seed were germinate in deep burying depth. They appeared to have more difficulties to emerge above ground than the seedlings from shallowly buried seeds. Seed germinate earlier produce longer root. In upright orientation gives better germination as compared to other two orientation position. The shoot length and biomass was not affected by seed orientation. The results of presents investigation reveals that seed sowing in shallow and upright position were best for seedling germination and growth of *C. tamala* seedling.

Keywords: *Cinnamomum tamala*, germination, seed orientation, growth, biomass

Hydrological Investigation of springs in Lesser Himalaya from Pauri Urban Area, Uttarakhand

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Abstract: The High Mountain Basins of Indian Himalaya region though act as water tower to millions of people downstream but in recent times inhabitants of these mountain basins are facing the problems of water scarcity. Due to poor planning and management of the natural resources in Himalayan region, year round access to even drinking water is becoming a concern. Limited long term information at different spatial scale (ranging from catchment level to basin scale) is crippling the decision making on management or development of water resources in Himalayan region. The study investigates the applicability of the two of the most widely used methods, recession characterization and investigation of flow availability through flow duration curve (FDC) in the assessment of dependability of spring flow and design of optimum storage for effective water resource planning. The study examines the finding from one year data of spring outflow and rainfall. The simple linear model using exponential decay equation proposed by Maillet (1905) is found to be sufficiently accurate to model the recession characteristics of spring hydrograph during the winter recession period as winters are without significant rainfall in the present climatic conditions. The seasonal as well as monthly flow duration curve highlights the need for storage of the minimum dependable flow available during the low-flow period as well as appropriate storage structure should be designed for the surplus monsoon period to tackle seasonal water scarcity. The storage of surplus water is also considered by IPCC as one the prime coping mechanism to tackle the threat arising from climatic change.

Keywords: Mountains; Himalayan; flow duration curve (FDC); water scarcity

Forests and Climate Change: A Global Concern

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Abstract: Climate change is the greatest global threat and long-term challenge, as it can significantly cause damage to water resources, land resources, ecosystem, food security and health. The impacts of climate change are likely to be aggravated by many anthropogenic stresses like increasing industrialization, habitat fragmentation and destruction, invasion, transportation and deforestation. With a predicted rise in temperature, altered precipitation pattern, more frequent and extreme weather events, an international collective action to mitigate climate change is urgently required. Climate change and forests are intrinsically linked. The global forest sector produces an estimated 5.8 GtCO₂ annually as a result of deforestation, around 96 per cent of which is estimated to come from developing countries in the tropics. To avoid the worst effects of climate change, tackling the loss of global forests must be central to a comprehensive framework for stabilizing levels of atmospheric greenhouse gases at 445-490 parts per million CO₂e or less. Sustainable forest management can be a promising tool to achieve this stabilization with social, economic and environmental goals. It embodies many of the activities that will be required to respond to the effects of climate change of forests. Keeping in consideration the thematic areas like extent of forest resources, biological diversity, forest health and vitality, productive, protective and socio-economic functions of forest resources and legal framework, the balance between society's increasing demands for forest products and benefits, and the preservation of forest health and diversity along with mitigation of climate change can also be achieved.

Key Words: *Deforestation, Climate change, Carbon emission, Sustainable forest management.*

Decentralized Approach for Quality Planting Material (QPM) Production of High Altitude Medicinal Plants (HAMPs) in District Chamoli, Uttarakhand

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Abstract; Beginning of commercial cultivation of High Altitude Medicinal Plants (HAMPs) in district Chamoli dates back to 2nd to 3rd decade of 19th century. This was the time when natives of Himalayan region were accustomed to gather (excluding Kuth cultivation in Lahaul valley Himachal Pradesh) high altitude medicinal plants from wild to exchange them for daily need commodities through barter system. After 1950's to 2000, gradual prohibition on collection from wild, conservation of endangered and rare medicinal plants, sustainable development of HAMPs sector and attempts for commercial cultivation of medicinal and economically essential plants started in phased manner. Carving of Uttarakhand as a new State from erstwhile hilly districts of Uttar Pradesh in 2000 opened new vistas for regional development through wise use of original resources. Blessed with fertile environmental regime and variety and variability in the floristic wealth, medicinal plants were viewed as foremost resources of socio-economic relevance. Hence, on 18th March 2003, Uttarakhand was declared as *HERBAL STATE*. Cultivation of medicinal plants was key consideration in this venture. Till 2009, many attempts were made in this regard, like contractual farming, supply of planting material by related departments and free distribution of planting material. However, simplified mode to ensure availability of Quality Planting Material (QPM) still remained a practical hurdle, in addition to mortality of available stock in due course of planting from one to another area. Hence, it was realized that, nursery development at regional level with decentralized approach (it should be there where needed) was thought to be a vital aspect. Program like National Mission on Medicinal Plants (NMMP) and Rastriya Krishi Vikas Yojna (RKVY) with a shifted approach were utilized to develop nurseries at individual farmers' level in the remote and inaccessible localities in term of infrastructure but promising for cultivation of high altitude medicinal plants. It was anticipated that, this will be helpful in developing cultivation clusters and in reducing the mortality of planting material in due course of planting and transportation. Also it will be helpful in generating further innovations and applicability among local entrepreneurship. Under the NMMPs (a nationwide program supported by National Medicinal Plants Board, Government of India), and Rastriya Krishi Vikas Yojna (program being implemented with the financial assistance from department of Horticulture, Government of Uttarakhand) a total 37 small and model nurseries have been established or strengthened in Dasholi, Ghat, Joshimath and Dewal development blocks of district Chamoli. QPM of the species planned to be stocked in these nurseries includes Atis (*Aconitum heterophyllum*), Kuth (*Saussurea costus*), Kutki (*Picrorhiza kurrooa*), Faran (*Allium stracheyi*), Kala jeera (*Carum carvi*), Pushkarmool (*Inula racemosa*), Chippi (*Pleurospermum angelicoides*). It was also useful that, over Rs. 100.00 Lakhs financial assistance directly diverted to mountain farmers and innovative works as that was granted to 37 beneficiaries. In past two

years, adopting this approach has helped to assign encouraging output and outcomes. As, these private nursery holders are able to stack nearly 40 Lakhs plants of Kutki, Atis, Faran, Kuth, Chippi and Kala jeera. Also, as it is expected, approximately 400 Kilogram (Kg) seeds of Kuth and Kala jeera will be produced in commencing and subsequent years. Further, QPM produced this way will help in initiating cluster based cultivation in nearly 200 hectare (ha) in some high altitude villages, namely; Niti, Gamshali, Malari, Tolma, Khiron, Sutol, Kanol, Wan, Himni, Ghes, Urgam, Ghooni, Charbang, Ramni, Durmi and Jhelum in district Chamoli. This approach has helped innovative farmers, as the results of granting direct financial support to the farmers were encouraging. Once such nurseries are established in blossom the scarcity of QPM will be resolved and as well the nursery holders will be able to sustain on this activity if they are able to maintain nurseries even after project duration is over. Moreover, this approach seems to be helpful to overcome the barriers such as non-availability of QPM in remote areas coupled with high mortality in distant transportation. Attempt to initiate cluster approach oriented mass scale cultivation including judicial returns to farmers supported with ensured marketing and provision of support price, risk management strategies and development of marketing facilities are in progress. Development of QPM with the help of traditionally experienced farmers may be ever best approach. This approach still needs refinement, and further trials and error will help to overcome basic barriers in mass scale cultivation of high altitude medicinal plants in other identical regions of the state.

Keywords: *Decentralized Approach; Medicinal Plants; High Altitude, cultivation*

Estimation of granule particle size distribution in a UASB reactor

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Abstract: Granular sludge is key component for efficient operation of UASB reactor. In order to measurement of granularity of anaerobically digested sludge, the determination of granular particle size distribution (GPSD) is of very important. There are several techniques have been proposed by many scientists and engineers. However, they are either expensive, tedious or inaccurate. The technique involves determining the settling velocities of sludge sample and extrapolating the corresponding diameters using mathematical algorithm. In this algorithm, the granules density was calculated, the flow regime was examined and finally the granular particle size distribution (GPSD) was obtained. The granule density and diameter were strongly correlated with the VSS/TSS. The two UASB reactors were operated at different flow rate of 2, 4, 8, 16, 32 and 64 ml/min at room temperatures 30 ± 5 °C. The results reveal a significant reduction in all granular particle sizes with improving digestion conditions. Digestion leads to the transfer of bigger particles into smaller ones, which has a remarkable effect on the physical behavior of sludge. The majority of the raw and digested particles are smaller than 0.10 mm. The results reveal a significant reduction in all particles due to digestion. It clearly shows the transfer of larger particles into smaller particles and accumulation of particles in the smaller size. The VSS/TSS ratio indicates an increase of the inorganic content with a decreasing particle size. However, the VSS/TSS ratio of the smaller particles is always significantly higher than that of the raw sludge. The small particles from the influent are an important part hydrolyzed to dissolved products and replaced by new small particles produced by hydrolysis of the larger particles. This finding demonstrates the shift in granular particle size distribution (GPSD) of big particles to smaller particles where the main biodegradation took place. The results show that the majority of the particles in the raw as well as the digested sewage sludge are smaller than 0.10 mm.

Keywords: *Granular; UASB reactor; digestion*

Environmental Impact Assessment- A Tool for Sustainable Development

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Abstract : India, being developing country, on one hand laid emphasis on the developmental activities while on the other hand, being one of the mega diversity countries of the world, India cannot neglect the burning issues of Environmental Protection. Thus Environmental Protection and Sustainable Development have been the foundation stone in most of the policies and procedures governing the industrial and other developmental activities. Ministry of Environment & Forests has taken several initiatives and enacted environmental and pollution control rules to prevent indiscriminate exploitation of natural resources and to promote integration of environmental concerns in developmental projects. One such initiative is the Notification on Environmental Impact Assessment (EIA) of developmental projects issued on 27.1.1994 under the provisions of Environment (Protection) Act, 1986 making EIA mandatory for 29 categories of developmental projects. One more item was added to the list in January, 2000. EIA is a tool with an objective to predict the potential environmental impacts that are likely to arise during the course of activities related to developmental projects. It is followed at an early stage of project planning and design. EIA/EMP assists planners and government authorities in the decision making process by identifying the key impacts/issues and formulating mitigation measures. This paper is dealing with the different aspects that may help the planners to implement the outcomes of Environmental Impact Assessment effectively.

Keywords: *Environmental Impact Assessment, Sustainable development*

Converting Wood Biomass to Value Added Products

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Abstract : Besides conventional wood products like building materials, paper, resins, adhesives, coatings, roofing pitch, etc. and bioproducts including turpentine oil, rosin and cellulose derivatives, wood is a valuable raw material for the production of fine chemicals, nutraceuticals and pharmaceuticals. Wood has provided a variety of benefits to the society and obtaining food, chemicals and medicine from wood has a long history. Historically, such products have come from both conifers and hardwoods extractives. In New England, maple syrup had been a well known food product. Additionally, vanillin, a substitute for vanilla flavouring, was originally obtained from oak trees. Chemicals and dyes were another common product. Several native North American oaks remained traditional dye sources and used by dyers in the eighteenth and nineteenth centuries. Quercitron, a bright yellow dye occurs in the bark of black oak which is also rich in tannic acid. The bark of northern red oak produces another yellow dye. Wood can be converted to a multitude of products. Commercially important industrial chemicals viz., acetic acid, furfural, itaconic acid, lactic acid, succinic acid, methanol and hydrogen appear to have potential for production from wood. Foods and pharmaceuticals might come from both the foliage and bole of the tree. Estimates suggest that up to 10 percent of the dry weight of wood and foliage is composed of hydrophilic substances. Some of these hydrophilic substances include shikimic acid, stilbenes such as pinosylvin and flavonoids. Knot-wood which are unsuitable for pulping and papermaking have been reported to be the potential source of natural antioxidants. The type of chemical varies by tree species, with larger amounts of pinosylvins being found in some softwoods and flavonoids in some hardwoods. In recent years, rising oil prices and concerns about future energy and chemical supplies have encouraged researchers, policy makers and entrepreneurs to examine the potential for additional products from wood. Substantial resources are being brought to bear on the concept of biofuels and bioproducts. As gasoline and oil prices have increased, ethanol has received the bulk of the attention as a biofuel. However, other products, such as chemical and pharmaceuticals may also be produced in a biorefinery. It is likely and perhaps inevitable that an incremental approach to development of markets for chemicals and pharmaceuticals from woody biomass would crop up. As such concerted R & D input should be directed towards process development for obtaining useful chemicals. The production processes need to be economically viable in terms of cost and market. The number of chemicals and pharmaceuticals potentially produced from biomass is large, but much research remains on the suboptimal way to produce these chemicals and pharmaceuticals. The market for these materials will be a key component in their viability. The paper highlights the potential of wood biomass as a source of commercially significant fine chemical and healthcare products.

Keywords: *Bioproduct; Quercitron; biofuel;*

Contribution of Ethnobotany in Conservation of Biodiversity of Central Rajasthan

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Abstract: The present study is an attempt to conserve the Biodiversity (Plant diversity) of central Rajasthan by means of Ethnobotany. The traditional knowledge of medicinal plant species has been listed which are actively used for various ailments in rural areas of central Rajasthan. A field survey of the study area was carried out to enumerate the utility of these plants. Various parts of plants (roots, stem, leaves, bark, fruits, seeds etc.) or whole plant is used for medicinal purpose for various ailments. The short diagnostic description of plants is described in this research paper which is conserved by the local communities.

Keywords: *Biodiversity; Ethnobotany; Conservation;*

Importance of Soil Biota in Sustainability of Agroecosystem

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Abstract: Soil organisms play a prominent role in the breakdown, mineralization and decomposition of organic matter and maintenance of soil structure. Soil is an excellent habitat for different kind of organisms, however the rich biodiversity of soil is often overlooked because most of these organisms are microscopic, nevertheless and some organisms are extremely abundant in soil. Typically soil litter may contain bacteria, actinomycetes, fungi, algae, protozoa, nematodes, mites and insects, enchytraeid worms and earthworms. Many of these organisms are obscure and poorly known. Some of these groups contain species that are unknown and have not yet been described. It is likely that some quantity of soil will contain undescribed species of bacteria, actinomycetes, fungi, algae, protozoa, nematodes, enchytraeids and possibly mites. Almost 80% of the soil macro-pores could be affected by soil biota in integrated farming systems as compared to only 10% in conventional farming systems where mechanical intervention takes over a larger role in soil structure formation and maintaining soil processes that are essential to functioning of agroecosystem. The broad acceptance of the significance, has led to increasing consideration of soil biological properties within the wider context of sustainable management. Intensity of tillage also affects soil organic matter pools and hence the microbial pool and its associated activity. Soil is one of the principal components of our environment. It is important as irreplaceable pool for primary production that is fundamental not only for mankind but for the whole agroecosystem. Other functions played by soil biota in terrestrial ecosystems include decomposition processes, nutrient and energy flows, relationships with water and air. Unfortunately, in the last few centuries, there has been an increasing exploitation of this sphere due to chemical contamination, insensitive agricultural and forest management and also due to contact of soil with other "sick" compartments of the environment. The damage of the soil is often regrettably faster than its capacity to recover.

Keywords: *Soil biota; Agroecosystem; Microbial pool and Soil organic matter*

Litter dynamics of mid-altitudinal forest of Garhwal Himalaya, India

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Abstract: Pattern of litterfall and decomposition of dominant tree species were studied over a period of two years using litter bag method in the forest of Parkandi village. Total annual litterfall was estimated as 16.2 Mg ha⁻¹ with 75% of it occurred as leaf fall of the five tree species present in the forest as mature trees. *A. nepalensis* accounted for about 49% of total leaf litterfall. Peak litterfall of *A. nepalensis*, *L. ovalifolia*, *P. pashia* and *R. arboreum* was observed during winter and *M. esculenta* was during summer season. Carbon content in the litter varied from 44.45-48.34%, lignin from 15.3-28.23%, cellulose from 31.4-46%, N from 0.69-2.93%, P from 0.021-0.072%, K from 0.73-2.93% across species. Thus, carbon concentration seemed the most stable/least variable chemical attribute. N fixing *A. nepalensis* had the highest concentration of N but not of P while *R. arboreum* had the highest concentration of K. Annual decomposition constant varied from about 1 in *A. nepalensis* and *P. pashia*, 0.5 in case of *M. esculenta* and *R. arboreum*. Though *A. nepalensis* had higher concentration of N and lower concentration of lignin compared to *P. pashia*, the two species had almost similar half-life (0.7 years) suggesting the importance of attributes other than chemical characteristics in determination of decomposition rate. At the end of two years, 8% of incubated mass remained undecomposed in case of *A. nepalensis* compared to 9% in *P. pashia*, 20% in *R. arboreum*, 23% in *L. ovalifolia* and 28% in *M. esculenta*.

Key words: Litterfall, decomposition, carbon, nitrogen, annual decomposition constant

Ecosystem Based Adaptation in Himalayan Region.

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Abstract: Global climate change is already adversely impacting the world's ecosystems and the people that depend on them. Impacts are escalating as temperature and precipitation patterns change and extreme weather events and related conditions increase in frequency and intensity. Climate change directly threatens the services ecosystems provide including food, clean water, coastal protection, fuel-wood, soil stability, and pollination. People who depend directly on natural resources are affected most severely. Responses to climate change must now focus on reducing greenhouse gas emissions enough to avoid runaway impacts (“avoiding the unmanageable”) and on addressing the impacts that are already with us (“managing the unavoidable”). Adaptation is about “managing the unavoidable”. Ecosystem-based adaptation provides a cost-effective strategy that can be undertaken by Parties, and is especially effective at local levels with community involvement. It involves collective action among governments, communities, conservation and development organizations, and other stakeholders to plan and empower local action that will increase environmental and community resilience to the changing climate. Ecosystem-based adaptation policies and measures aim at reducing the vulnerability of ecosystems and their services to different threats (including climate change and land-use change). It provide multiple benefits to local communities like maintaining and restoring “natural infrastructure” such as mangroves, coral reefs and watershed vegetation as a cost-effective means for reducing vulnerability to storm surge, rising sea levels and changing precipitation patterns. It Protect and restore natural areas of cultural or religious significance, including areas critical for the cultural survival of indigenous groups. Ecosystem-based adaptation enhances the availability of natural resources as a source of food and other products important to livelihoods supporting indigenous peoples and local communities to adapt and enhance traditional knowledge systems and management practices to changing climatic conditions. This approach (EBA) to defend against Natural Disasters like landslide in china or avalanche in Switzerland are few success stories. In recent years, forests are being perceived as a provider of environmental and social services such as the conservation of biological diversity, soil and water conservation and carbon storage apart from their economic value. EBA aim at conserving specific forest ecosystem services that are crucial for societal adaptation, such as water-related services. Forest management can evolve towards a better conservation of water in places where the population is particularly vulnerable to changes in water quantity or quality.

Keywords: Ecosystem services; Resilience; Vulnerability and Adaptation

Soil macrofauna abundance and diversity in a mid-altitude landscape in Garhwal Himalaya

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Abstract: Agricultural intensification, including soil disturbance, increased fertilization levels and crop diversity reduction is known to affect soil macrofauna abundance and community structure. The present study was carried out to evaluate the impact of land use types differing in terms of land use intensity, season and soil depth on abundance and diversity of soil macrofauna in a mid-altitude landscape in Garhwal Himalaya. The land use types studied were: broad-leaved forest, rainfed agroecosystem and irrigated agroecosystem. Irrigated agroecosystem was more intensively managed as compared to rainfed agroecosystem. Soil macrofauna were collected following the methodology recommended by TSBF. A total of 16 macrofauna groups were identified in the collected sample. Isoptera, Coleoptera-larvae, Oligochaeta and Hymenoptera were the most abundant faunal groups in terms of density in all the land use types. Oligochaeta and Coleoptera-larvae were the dominant faunal groups in terms of biomass in all the land use types. Total macrofauna density and biomass were highest in rainfed agroecosystem and lowest in irrigated agroecosystem. Highest density and biomass of total macrofauna were recorded during rainy season in all the land use types. Highest density and biomass of most of the macrofaunal groups were recorded in 0-10 cm soil layer as compared to 10-20 cm and 20-30 cm soil layer. The study suggests that both land use type and land use intensity are strong drivers of abundance and diversity of soil macrofauna in the landscape.

Keywords: *Land-use; Agro-ecosystem; Agricultural intensification and Macrofauna.*

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