Souvenir

ICPEP-5

Fifth International Conference on Plants and Environmental Pollution

24-27 February, 2015

Organised by

International Society of Environmental Botanists

&

CSIR-National Botanical Research Institute

Lucknow, INDIA

CSIR-National Botanical Research Institute, Lucknow
(Council of Scientific & Industrial Research)
(A Premier Institute Engaged in Advance R & D Work in Plant Science)

Technologies & Know-How

Microbial Technologies: *Bacillus* and *Trichoderma* based microbial technologies, *Rhizobium* and phosphate solubilising bacteria based technology

Biotechnologies: BT Cotton technology, Tissue culture protocols for trees, ornamental and medicinal plants

Herbal Technologies: Herbal dry colours, Herbal lipstick, Herbal health drink, Anti-arthritics, anticigarette, Anticough & antipyretic herbal formulation.

Societal benefit /technologies/Know how: Organic cultivation, Dehydration of flowers, High Tech Nursery technologies, Biomass generation, Improved varieties of medicinal and industrial plants (Opium poppy, Chrysanthemum, Gladiolus, amaranth, etc.), Betelvine cultivation, Phytoremediation, Ecotoxicology, Reclamation of polluted water bodies and sodic soils etc.

Our Motto : Where Plant Based Research Touches Life Through Innovation

- **Documentation, conservation & prospection of biodiversity**
- **Exploitation of microbial diversity for enhanced plant growth and environment health**
- **Agro-technology for rural development & wasteland utilization**
- **National Facilities: Herbarium and Botanic Garden**
- **Floriculture and Landscaping**
- **Phytoremediation for clean environment**
- **Developing transgenic plants for agriculture & industries**
- **Plants and plant-based products for human health**

For details please contact

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Welcome to Lucknow

The City of Culture

Fifth International Conference on
PLANTS & ENVIRONMENTAL POLLUTION
(ICPEP-5)
24-27 February, 2015

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Department of Biotechnology, Government of India, New Delhi

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Message

It gives me immense pleasure to learn that CSIR-National Botanical Research Institute (CSIR-NBRI), Lucknow and International Society of Environmental Botanists (ISEB) based at CSIR-NBRI are jointly organizing the Fifth International Conference on Plants and Environmental Pollution (ICPEP-5) during February 24-27, 2015 at CSIR-NBRI Campus, Lucknow, India.

One of the major problems faced by mankind today, the 'environmental pollution' has grown to alarming levels in the past few years. In the last century, the fast pace of industrialization, increasing demand for food, shelter and energy and over exploitation of natural resources, were mainly responsible for creating the problem of environmental pollution in developed countries. It's time now that this problem is addressed in right earnest and in an inclusive manner. Also, an enabling framework needs to be put in place for the same.

Vegetation plays an important role in cleansing the environment. There are research based evidences about the same. Further, deciduous plants are found to absorb about a third more of a common class of air-polluting chemicals than previously thought of. Thus plants have a very vital role in cleansing the environment. They being the natural resource could be gainfully utilized to address the pollution related problems faced by our ecosystem.

I hope that ICPEP-5 will provide an interactive platform for the in-depth deliberations on the burning problems of environmental pollution and the role of plants for its amelioration. This would be leading to learning as well from each other's experience.

I wish the ICPEP-5 a grand success and congratulate all the members of CSIR-NBRI and ISEB family for this extremely relevant and timely initiative.

New Delhi
February 25, 2015

(M.O. Garg)

Tel. : 91-11-23710472, 23717053, Fax : 91-11-23710618,E-mail : dgcsir@csir.res.in, dg@csir.res.in

सीएसआईआर-राष्ट्रीय वनस्पति अनुसंधान संस्थान
CSIR-National Botanical Research Institute
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद, नई दिल्ली)
राणा प्रताप मार्ग, लखनऊ – 226 001, उ.प्र., भारत
(Council of Scientific & Industrial Research, New Delhi)
Rana Pratap Marg, Lucknow - 226 001, U.P., India

डॉ. चन्द्र शेखर नौटियाल
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निदेशक

Dr. Chandra Shekhar Nautiyal
TATA Innovation Fellow, FNA, FNASc, FNAAS
Director

Welcome

It is indeed a matter of great pride for me that Council of Scientific & Industrial Research-National Botanical Research Institute (CSIR-NBRI) and CSIR-NBRI based International Society of Environmental Botanists (ISEB) have joined hands to organize Fifth International Conference on Plants and Environmental Pollution (ICPEP-5) at NBRI during 24-27 February, 2015. During the past, four conferences of this series were successfully organized with a sizable internal and overseas participation. My association with ISEB is from the day it was founded and for the past five years, I have the privilege of working as its President. I have developed a close rapport with them and have come to admire the significant contributions made by them through this symbiotic relationship. I am sure; ICPEP-5 will be a land mark success, which will leave a significant imprint on the participants in this Conference.

On behalf of CSIR-NBRI and ISEB, and on my own personal behalf, I extend a very warm welcome to our distinguished delegates from 27 countries of the world. I hope that your 4-day sojourn in Lucknow, the Science City of North India will be highly fruitful and enjoyable. CSIR-NBRI is an internationally reputed plant institute. I invite you to visit the sprawling garden campus of the Institute and well equipped laboratories, and interact with our scientists.

Date : 18th February, 2015

(C.S. Nautiyal)

V. S. Ramamurthy
Emeritus Professor
National Institute of Advanced Studies
Bengaluru 560012

Message

I am glad to know that National Botanical Research Institute, Lucknow is organizing jointly with the International Society of Environmental Botanists the fifth International Conference on Plants and Environmental Pollution in Lucknow during February 24-27, 2015.

Anthropogenic pollution is one of the negative offshoots of increasing population and rapid industrialization. It has always been recognized that nature has provided a complex feed back system to keep pollution under control using the plant diversity. However, we have perhaps reached a level where we need to learn from nature and design new interventions that could lead to a safer future for the entire humanity.

I wish the Conference all success.

V.S. Ramamurthy

प्रो. अनिल कुमार त्रिपाठी
निदेशक
Prof. Anil K. Tripathi
Director

CSIR-NBRI
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CSIR-Central Institute of Medicinal and Aromatic Plants
(Council of Scientific & Industrial Research, New Delhi)
Kukrail Picnic Spot Road, P.O. CIMAP, Lucknow - 226 015, U.P., India

12 February, 2015

Message

I am extremely delighted to learn that International Society of Environmental Botanists (ISEB) and CSIR-National Botanical Research Institute (CSIR-NBRI) will be jointly organising the Fifth International Conference on Plants & Environmental Pollution (ICPEP-5) at CSIR-NBRI from 24 to 27 February, 2015. It is also satisfying to note that various topics to be discussed during the conference include climate change, biodiversity, environmental biotechnology, plant response to environmental pollution, bio-indication and bioremediation, plant-microbe interaction, among others. I am sure that the participants of ICPEP-5 would gain immensely through various presentations and interaction during 4-day conference to be attended by distinguished scientists and researchers from India and abroad.

I wish the Fifth International Conference on Plants & Environmental Pollution (ICPEP-5) a great success.

(Anil Kmar Tripathi)

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Message

My very best wishes for the success of Fifth International Conference on Plants and Environmental Pollution (ICPEP-5). I was the Keynote speaker at ICPEP-4 and had a wonderful time. I express my deep gratitudefor the delightful hospitality that was offered to me during my visit. I made many good friends.

I want to congratulate National Botanical Research Institute in Lucknow and the International Society of Environmental Botanists for their vision in advancing scholastic interactions. I also want to congratulate the organizers for providing an international forum to discuss all aspects of environmental-biospheric interactions. I feel gratified that I have been a part of ICPEP.

Wherever we live, we are ultimately dependent on the global environment which influences, directly and indirectly, every aspect of our daily lives and the conditions of life on our planet. So there can be few more important tasks than to seek to understand and respond to the environmental changes including climate that appear already to be having a profound impact on the fine balance between the environment and the biosphere/ecosystems.From the Rig Vedas we learn the philosophy of "VasudhaivaKutumbakam", which means the whole universe is one family. This principal is crucial in guiding us to think of protecting the global commons whether it be the environment, or plants and vegetation, or climate, or maintenance of peace. If we are one family, then the Earth is our home. Learning to safeguard that home, to provide a healthy and a sustainable world, is perhaps the greatest gift we can give to the future generations. This International Conference represents a significant milestone in helping frame some of these critical, relevant, and timely issues.

I wish you every possible success with the ICPEP-5 and will look forward to hearing about your deliberations.

Viney P. Aneja

Dr. P.V. Sane
Principal Advisor
Agri Biotech R and D

Jain Irrigation Systems Ltd.
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Message

I am very happy to know that the International Society of Environmental Botanists (ISEB) is organizig the 5th International Conference on Plants and Environmental Pollution (ICPEP) at Lucknow in collaboration with CSIR National Botanical Research Institute from 24th to 28th February 2015. It is nice to see that this society that we founded some 20 years back continues to be active and has been successfully organizing these conferences at regular intervals. I have been a participant in all the previous ICPEP conferences and have seen how they strengthened the interaction amongst various groups for a common cause of improving the environment primarily through the use of plants. Over the past 20 years the environmental concerns have grown due to several factors and the proposed conference, I am sure, will address these concerns.

I wish all the delegates of the conference stimulating discussions and hope that the interactions at the conference will generate several inter institutional and international collaborative projects amongst the interested groups. It is through the joint efforts that scientists can accelerate the development of newer technologies to combat the environmental pollution.

I am particularly happy that CSIR-NBRI and its authorities continue to take keen interests in the activities of ISEB and provide valuable support for organzing various activities including the ICPEP. I wish all the participants a pleasant stay at Lucknow and fruitful discussions at the conference. I wish the conference a grand success.

Sane

P.V. Sane
Former Director, NBRI and Founder President ISEB

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Lord Mahaveer

Dr. David A. Grantz, Ph.D.
Plant Physiologist
University of California at Riverside
Climate Change-Air Quality-Biofuels

Message

Delegates-ICPEP-5

It is my pleasure to extend my best wishes and hopes for a very successful meeting of the Fifth International Conference on Plants and Environmental Pollution. Having attended this excellent conference in the past, I know of the great value that these international interactions hold for moving the science forward and for establishing long-lasting friendships and collaborations. Only through these types of interactions can truly global challenges be addressed.

In an era of increasing human pressure on the planet that we share, and as the ecosystem services upon which we all depend become increasingly strained, there is ever greater need for these interactions and the collaborative research that they can produce. I regret that I am unable to attend this conference, but I will look forward with anticipation to the results of the discussions that will take place.

Sincerely,

David A. Grantz

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FIFTH INTERNATIONAL CONFERENCE ON PLANTS & ENVIRONMENTAL POLLUTION (ICPEP-5)

24-27 FEBRUARY, 2015; LUCKNOW, INDIA

Organized by

INTERNATIONAL SOCIETY OF ENVIRONMENTAL BOTANISTS (ISEB)

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About Lucknow

Shaan-e-awadh

Lucknow is the capital city of Uttar Pradesh and it has always been a multicultural city. Courtly manners, beautiful gardens, poetry, music, and fine cuisine patronized by the Persian-loving Shia Nawabs of the city are well known amongst Indians. Lucknow is popularly known as the The City of Nawabs.

The Gomti River, Lucknow's chief geographical feature, meanders through the city and divides it into the Trans-Gomti and Cis-Gomti regions. Situated in the middle of the Indus-Gangetic Plain, the city is surrounded by rural towns and villages: the orchard town of Malihabad, Kakori, Mohanlal ganj, Gosainganj and Chinhat.

Lucknow has a humid subtropical climate with cool, dry winters from November to February and dry, hot summers from April to June. The rainy season is from July to mid-September, when the city gets an average rainfall of 896 millimetres. In winter the maximum temperature is around 25°C (77 °F) and the minimum is in the 3 °C (37 °F) to 7 °C (45 °F) range. Summers are extremely hot with temperatures rising into the 40 °C (104 °F) to 45 °C (113 °F) range, the average highs being in the high of 30s (degree Celsius).

History

"Lucknow" is the anglicized spelling of the local pronunciation "lakhnau". According to one legend, the city is named after Lakshmana, a hero of the ancient Hindu epic *Ramayana*. The legend states that Lakshman had a palace in the area, which was called Lakshmanapuri ("Lakshmana's city"). The settlement came to be known as Lakhanpur (or Lachhmanpur) by the 11th century, and later, Lucknow. Yet another theory states that the city's name is connected with Lakshmi, the Hindu goddess of wealth. It was originally known as *Lakshmanavati* ("fortunate"). Over time, the name changed to Laknau. There is another story that Lucknow was named after a very influential architect called "Lakhan Ahir" who planned and built the fort "Quila Lakhan". The "Quila Lakhan" later became "Lucknow".

There are no accounts of when the modern name (Lucknow or *Lakhnau*) was first used Ibn Battuta, in his writings during 1338-41, mentions the town as "Alakhnau", when it was a part of Muhammad bin Tughluq's empire. Abdul Halim Sharar, in his book *Guzishta Lucknow*, mentions that the present name of the city was not in use before Akbar's reign

The Nawabs of Lucknow, in reality the Nawabs of Awadh, acquired the name and rose to prominence when Asaf-ud-Daula, the fourth nawab, shifted his court to the city from Faizabad in 1775. The city became North India's cultural capital, and its nawabs, best remembered for their refined and extravagant lifestyles, were patrons of the arts. Under their dominion, music (Thumri, Khayal, Dadra, Qawalis, Ghazals and Sher-O-Shairi) and dance (especially Kathak) flourished, and construction of numerous monuments took place. Of the monuments standing today, the Bara Imambara, the Chota Imambara, and the Rumi Darwaza are notable examples. One of the Nawab's enduring legacies is the region's syncretic Hindu–Muslim culture that has come to be known as the Ganga-Jamuni tehzeeb.

During the First War of Indian Independence in 1857, the Indian Mutiny according to the Britisher's, the patriotic rebels seized control of the state, and it took the British 18 months to reconquer the region. During that period, the garrison based at the Residency in Lucknow was besieged by rebel forces during the Siege of Lucknow. Today, the ruins of the Residency and the *Shaheed Smarak* offer an insight into Lucknow's role in the events of 1857.

HISTORICAL MONUMENTS AND OTHER BUILDINGS OF TOURIST INTEREST

Lucknow's buildings show different styles of architecture with the majority built during British or Mughal rule. Most of these buildings lie in the old part of the city. Among the extant architecture there are religious buildings such as Imambaras, mosques, and other Islamic shrines as well as secular structures such as enclosed gardens, baradaris, and palace complexes. Styles of architectures from various cultures can be seen in the historical places of Lucknow. The University of Lucknow shows a huge inspiration from the European style while Indo-Saracenic Revival architecture is prominently present in the Uttar Pradesh Vidhan Sabha building and Charbagh Railway station.

The Bara (big) Imambara: Bara Imambara in Hussainabad is a colossal edifice built in 1784 by the then Nawab of Lucknow, Asaf-ud-Daula. It was originally built to provide assistance to people affected by the deadly famine, which struck the whole of Uttar Pradesh in the same year. It is the largest hall in Asia without any external support from wood, iron or stone beams.The monument is said to have required approximately 22,000 labourers during construction.

The Rumi Darwaza: The Rumi Darwaza, was also built by Nawab Asaf-ud-daula in 1784, it is 60 feet (18m) tall and served as the entrance to the city of Lucknow. It is also known as the Turkish

Gateway, as it was erroneously thought to be identical to the gateway at Constantinople. The edifice provides the west entrance to the Great Imambara and is embellished with lavish decorations.

The Chattar Manzil: The Chattar Manzil, which served as the palace for the rulers of Awadh and their wives is topped by an umbrella-like dome and so named on account of *Chattar* being the Hindi word for "umbrella". Opposite Chattar Manzil stands the 'Lal Baradari' built by Nawab Saadat Ali Khan I between 1789 and 1814. It functioned as a throne room at coronations for the royal courts. The building is now used as a museum and contains portraits of men who played major roles in the administration of the kingdom of Awadh.

The Chhota (small) or Hussaini Imambara: Situated to the west of *Bara* Imambara. It is a truly exceptional monument of Mughal architecture build by Nawab Mohammad Ali Shah (1837-1842), it is more ornate in design with exquisite chandeliers, gilt edged mirrors, silver mimbar and colourfull stuccos which adorn the interiors. A golden dome and fine calligraphy on the exterior of the building

Hussainabad Picture Gallery: Built by Nawab Mohammad Ali Shah as a *Baradari* (a rest house) literally meaning "having 12 doorways" and situated at a short distance away from the *Chhota* Imambara. It is now a gallery for display of life size portraits of the Nawabs of Avadh.

The Hussainabad Clock Tower: Situated between the two Imambaras, but across the road. It was constructed in 1887 to mark the arrival of Sir George Couper, 1st Lieutenant of the United Province of Avadh. Tower is 221 feet and a fine example of British architecture in India.

The Residency: The construction of this complex overlooking the river Gomti, was undertaken by Asaf-ud-Daula and completed by *nawab* Saadat Ali Khan in 1800. Originally meant to be a rest-house for the English visitors, the whole campus became an exclusive European settlement. It was the scene of dramatic events during the first war of independence.

The Shaheed Smarak (Martyrs Memorial): Thoughtfully constructed opposite the Residency and in a well laid-out park along the Gomti bank, this candle-shaped tower of pure white marble was erected in the memory of the martyrs who laid their lives during the freedom movement of India.

The Shah Najaf Imambara: Situated is adjacent to the CSIR-National Botanical Research Institute on the bank of river Gomti. This imambara was constructed by Nawab Ghazi-ud-Din Haider during 1814-1827 and designed as a replica of Hazrat Ali's tomb at Najaf in Iraq. The Nawab lies buried here with three of his begums, Sarfaraz Mahal, Mubarak Mahal and Mumtaz Mahal.

The Dilkusha Palace: Built in Gothic style in the midst of a garden by *nawab* Saadat Ali Khan it served as an out-of-town recreational palace (hearts delight) for the *nawab* and his friends. A major part of this palace was

destroyed during the uprising of 1857.

The La Martiniere College: It was built around 1800 by Lord Claude Martin, a French general, turned architect. It incorporates the features of Italian architecture, fusing with native attributes of Hindu and Mughal architecture. He had willed the building to be used as a model educational institution and that is what it has come to be.

The Vidhan Bhavan or the Council House: A very fine and impressive example of fusion of eastern and western styles of architecture made of sand stone. The foundation for it was laid in 1922 by Sir Harcourt Butler and the construction was completed in six years. It houses the bicameral legislature and the secretariat of the State government and lies in the heart of the city on the railway station road.

The Charbagh Railway Station: It is the main rail junction of Lucknow, constructed around 1914. It is considered to be one of the most beautiful among those of the other railway stations of the country. Build in Rajasthani and Mughal architecture, with symmetrical small minarets and domes of different sizes, make it a very attractive and impressive building.

Tombs of Saadat Ali Khan & Khurshid Zadi: The imposing twin tombs of Nawab Saadat Ali Khan and his wife Khurshid Zadi are examples of Avadh architecture.

Dr. Ram Manohar Lohia Park: It is one of the most famous parks of the city spread over an area of 87 acres of land at Lohia Path in Gomti Nagar. Dedicated to the renowned thinker and mass leader Dr. Ram Manohar Lohia, the park houses a grand staue of Dr. Ram Manohar Lohia and lush green atmosphere. The rare species of trees, artificial lake, fountains, huts, swings, boating and the gallery dedicated to the famous socialist leaders are the other attractions.

Dr. B.R. Ambedkar Samajik Parivartan Sthal: The Samajik Parivartan Sthal, spread over 107 acres of land in Gomtinagar, is dedicated to the memory of Dr. Ambedkar.

Kukarail Reserve Forest: On the outskirts of lucknow, Kukrail Reserve Forest has been developed by the Department of Forest. It houses a deer park and one of the nurseries of the endangered species of crocodiles in India. One of the favourite picnic spots in Lucknow, it boasts of a Chilren's Park, Cafeteria and Rest House.

CUISINE, ARTS, HANDICRAFTS AND LITERATURE

The Awadh region has its own distinct "Nawabi"-style cuisine. The best-known dishes of this area consist of various kinds of biryanis (a rice dish made with spices, and meat or vegetables), kebabs (dish of pieces of meat, fish, or vegetables roasted or grilled on a skewer) and breads. Kebabs are served in a variety of styles; *kakori*, *galawati* , *shami*, *boti*, *patili-ke*, *ghutwa* and *seekh* are among the available varieties. The reputation

of Lucknow's kebabs is not limited to the local population and the dish attracts people not only from other cities but also from other countries.

Lucknow is also famous for its delicious chats, street food, kulfi, paan and sweets. Nahari, a dish prepared using meat, is very popular among non-vegetarians. Sheermal is a type of sweet bread (paratha) prepared only in Lucknow. Some restaurants in the city are around 100 years old.

Lucknow is known for embroidery works including chikankari, zari, zardozi, *kamdani*, and *gota* making (goldlace weaving). *Chikankari* is a popular embroidery work well known all over India. This 400-year-old art in its present form was developed in Lucknow and it remains the only location where the skill is practised today. *Chikankari* constitutes 'shadow work' and is a very delicate and artistic hand embroidery done using white thread on fine white cotton cloth such as fine muslin or chiffon. As a sign of recognition, in December 2008, the Indian Geographical Indication Registry (GIR) accorded Geographical Indication (GI) status for *chikankari*, recognising Lucknow as the exclusive hub for its manufacture.

The classical Indian dance form Kathak took shape in Lucknow. Wajid Ali Shah, the last Nawab of Awadh, was a great patron and a passionate champion of *Kathak*. Lachhu Maharaj, Acchchan Maharaj, Shambhu Maharaj and Birju Maharaj are some of the legendary exponents of this dance form who have kept this tradition alive.

Lucknow is also the home city of the eminent gazal singer Begum Akhtar. A pioneer of the style. Bhatkande Music Institute University at Lucknow is named after the musician Vishnu Narayan Bhatkhande. Bhartendu Academy of Dramatic Arts (BNA), also known as Bhartendu Natya Academy, is a theatre training institute. It is a deemed university and an autonomous organisation under the Ministry of Culture, Government of Uttar Pradesh.

The manufacturers of *itrs* and scents made mostly from the natural sources and blended in non-alcoholic bases in various combinations have cast a spell of their perfumes all over the eastern world. S*hamamat-ul-itr* or *Itr-e-shamama* being a special favourite with the middle-eastern countries where it is known as the king of perfumes.

Along with the artistes and artisans, writers and poets of Lucknow have also created a niche for themselves in the fields of Hindi and Urdu literature.

CENTRE OF EDUCATION

Lucknow is home to a number of prominent educational and research organisations. Indian Institute of Management Lucknow, Institute of Engineering and Technology, Dr. Ram Manohar Lohia National Law University, Sanjay Gandhi Post Graduate Institute of Medical Sciences and King

George's Medical University and Babasaheb Bhimrao Ambedkar a central university, established in 1996.

A SCIENCE CITY

Setting up of the Birbal Sahni Institute of Palaeobotany at Lucknow during the late forties started a chain reaction, the following two decades witnessed the establishment, of a host of national laboratories and institutes in the various fields of R & D. Prominent among these institutions are the four Council of Scientific & Industrial Research institutes,

CSIR-Central Drug Research Institute, CSIR-Indian Institute of Toxicology Research, CSIR-National Botanical Research Institute and the CSIR-Central Institute of Medicinal and Aromatic Plants, Indian Institute of Sugarcane Research (IISR), Central Institute of Sub-tropical Horticulture, Railways Research, Design and Standards Organization, Geological Survey of India (Northern Region), Sanjay Gandhi Post-graduate Institute of Medical Sciences (SGPGIMS) and National Research Laboratory for Conservation of Cultural Property (NRLC). The chain reaction seems to be still on as the city is witness to the establishment of the National Bureau of Fish Genetic Resources (NBFGR). Besides, there are several other research institutions and Ayurvedic, Homoeopathic and Unani medical colleges belonging to the State Government. Many of these laboratories are multi-disciplinary in character and command an international repute. Consequently, Lucknow has, over the years, become a major centre of scientific research, particularly, in the field of biological sciences. The Regional Science Centre, established during the

mid-eighties, is doing a noble service in inculcating an interest in science among school-going children and educating them about science around them in their daily life.

Of late, Lucknow has become a major I.T. hub of northern India and has added another dimension to the R & D character of the city. A Cyber Park is being developed and soon Lucknow may acquire the status of a cyber city as well.

CSIR-National Botanical Research Institute

Where plant-based research touches life through innovation

Established in 1953 as National Botanic Gardens (NBG) under the umbrella of Council of Scientific & Industrial Research (CSIR), the institute was renamed as National Botanical Research Institute (NBRI) in 1978 to reflect its national impact and promote the R & D component. Botanic Garden at NBRI surrounds, within its limits, the historical Sikandar Bagh laid out around 1800 AD by Nawab Wajid Ali Shah, the last King of Avad who honoured one of his favourite queens "Sikandar Mahal Begum" and named this garden as "Sikander Bagh".

The Institute has grown from a Botanical Garden to an organization providing leadership in basic and applied research on various aspects of plant science. It has excelled in herbal biotechnologies, genetic engineering, bio pesticides, bio fertilizers, organic cultivation, conservation and biodiversity, bio informatics and industrial products. The institute is providing leadership by way of consultancies to industry, national and international organizations; participating in policy development. Institute is serving the society by women empowerment through

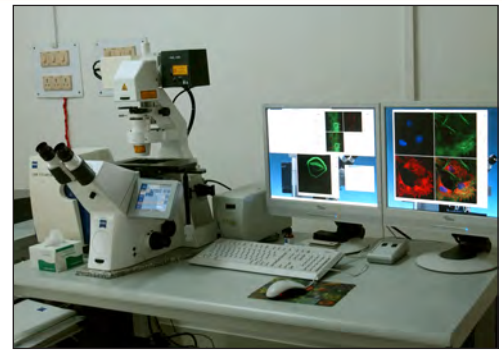
A Glimpse of its R&D Activities

CSIR-NBRI is a front ranking plant based multi-disciplinary national centre of excellence promoting both classical and cutting edge research in Plant Biodiversity & Systematics, Conservation Biology, Environmental Biology, Molecular Biology & Genetic Engineering, Bio-prospection of plant and microbial resources, Plant Microbe Interaction and Floriculture.

Conservation, Prospection of Plant Biodiversity & Systematics

The institute carries survey, collection, identification and documentation of the floral wealth of the country makes biodiversity assessment and also monitors the RET plants. Very few institutions work on conservation of lower plants such as Lichen, Bryophytes and Pteridophytes etc. CSIR-NBRI has made extensive surveys and developed inventories of lower as well as higher plants. It is one of the few institutions in the world to have a herbarium of lichens, apart from large herbarium of higher plants. NBRI has a unique distinction of being a pioneer in digitizing herbaria for electronic academic exchanges and on Bar coding the plants.

Exploitation of Microbial Diversity for Enhanced Plant Growth & Environment Health



The institute has developed a powerful blend of consortium consisting of novel microbes (*Pseudomonas*, *Rhizobium*, *Bacillus* and *Trichoderma*) which constitute a synergistic, stable blend of inoculants along with synergistic fermented plant growth promoting bio-control composition which can be applied to agronomic crops, flowers, vegetables, to digest organic wastes such as press mud and to recover degraded ecosystems. Most of these technologies have been transferred to industry. Training and demonstrations to U.P. State Government employees and farmers for the extension of biofertilizers to field level has also been undertaken by CSIR-NBRI

Designing Plants for future

NBRI possesses knowledge base and technical expertise in the area of plant molecular biology and genetic engineering of crop plants for basic research and industrial applications. The group has advanced expertise in the designing and chemical synthesis of genes and plant expression systems. Present activities aim at the development of genetically engineered plants for agronomically improved transgenic cultivars, industrially valuable proteins and basic studies on gene expression, metabolic engineering, plant development, environment responses and phytodiversity. The institute has developed know-how for promoting shelf life by delayed ripening in crops like mango and banana. Institute also aims to use biotechnological approaches for development of flowers that could show delayed senescence or abscission leading to longer vase lives.

Phytoremediation for Clean Environment

The Institute has developed expertise on phytoremediation, eco restoration, eco auditing, environmental toxicology, and abatement of pollution in polluted aquatic and land sites. It has developed models that are technologically and economically feasible for remediation of polluted soils and waters. Institute has also undertaken research in Plant responses to atmospheric pollution and climate change. CSIR-NBRI aims at development of low grain arsenic rice cultivars, safe for human consumption using molecular and chemical approaches.

Improved Varieties of Medicinal and Industrial Crops

NBRI is leader in promoting poppy cultivation by developing high yielding varieties and developing its agro technology. It works in collaboration with Department of Narcotics under a major national programme. The institute traditionally is known for R&D on ornamental plants. Its leadership in promoting Gladiolus cultivation is known to everyone. It has developed many new varieties of chrysanthemum and other ornamentals by inducing mutation, genetic selections, tissue culture, and breeding.

Agro-Technology for Rural Development & Wasteland Utilization

CSIR-NBRI has been working on development of appropriate agro-technology for economic plants in diverse cropping systems, aiming at economic utilization of partially reclaimed sodic lands. Over the years the scientists have developed competencies in the area of sodic soil reclamation in diverse land use systems, monitoring soil improvement, plant growth, yield and quality, agronomical and horticultural management. Institute is also conducting Training programmes for farmers and school children on medicinal, aromatic and other economic plants, their use, propagation and cultivation, followed by plantation in farmer's wasteland and/or in their existing cropping systems. Dry flower/cut flower technologies are also being disseminated for rural women empowerment.

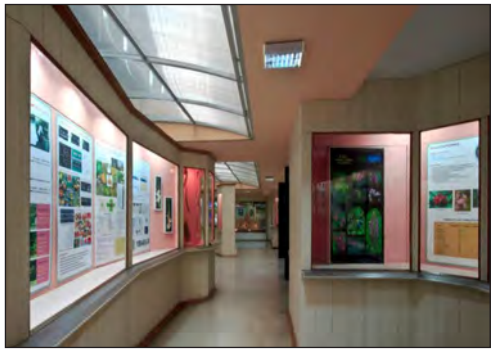
Plants and plant-based products for human health

Institute has expertise for standardization and quality evaluation of the herbal drugs/ formulations and devlop scientifically validated standardized herbal products. In the recent past CSIR-NBRI has developed Herbal technologies for Lip Balm; lipstick; Sindoor; Gulal; Chew a nicotine free herbal formulation; fermented drink; Anti-cough formulation; Soft health drink; Ointment for wounds; Antiulcer formulation etc.

State of Art Research Facilities & Services

The Botanic Garden is spread over an area of above 25 hectares and has a rich collection of indigenous, exotic and threatened plants totaling above 5,000 taxa. The Garden houses conservatories with a collection of Bougainvillea, Gladioli, Roses, Cacti, Succulents, Palms, Canna, Chrysanthemum, Orchids and many bulbous plants. The garden also has

a small garden with a collection of aromatic and plants with foliage of different architecture for the visually challenged. The Botanic Garden is open for teachers and students from schools and institutes of higher learning to enhance their knowledge of plant life and take up challenging researches to unravel the mysteries of plant growth, development and utilization. CSIR-NBRI houses a Herbarium with about 300,000 plant specimens. Acts as a Knowledge Resource Centre by providing more than 55,000 volumes; subscription to online and print versions of about 350 foreign and Indian periodicals.



NBRI has state of art laboratories in the field of Genetic Engineering, Molecular biology, Pharmacognosy, Tissue Culture, Microbiology, Environmental sciences, Natural products, Eco toxicology, Plant physiology and Bio-informatics. During the last decade there has been a tremendous upsurge in the study of plants as source of medicines, nutraceuticals, dietary supplements, cosmoceuticals, biopesticides and several secondary metabolites. In view of this, the institute has recently, established a CIF (Central Instrumentation Facility) with high tech and sophisticated instruments to cater the services to the institutes/ organizations/ individuals and developing projects in public private partnership (PPP) mode. CIF is National Accreditation Board for Testing and Calibration Laboratories (NABL) accrediated laboratory and well equipped for pysico-chemical and analytical analysis of various plant based products. Institute also has a Free Air Concentration Enrichment facility (FACE) for conducting research under elevated CO_2 concentrations.

ABOUT ISEB

K.J. Ahmad
Secretary ISEB & Organizing Secretary ICPEP-5

International Society of Environmental Botanists (ISEB), is a not-for-profit, non-governmental registered Scientific Society established at a meeting of some plant and environmental scientists held at CSIR-National Botanical Research Institute Lucknow (CSIR-NBRI) on 3 December 1994. ISEB aims to promote the cause of environmental pollution, biodiversity conservation, bioremediation of environmental pollutants and sustainable utilization of natural resources. The Society specially focuses on highlighting the role of plants in attaining aforementioned objectives.

Starting with 28 founder members, ISEB now enjoys a membership of over 450 individuals from all corners of India. Its membership also extends beyond the shores of India in several foreign countries. ISEB publishes a highly popular quarterly semi-scientific magazine, *ENVIRONEWS* of which 81 issues have been released so far. The basic objective of this newsletter is to disseminate scientific information on various environmental issues among non-specialist individuals interested in environment and plant science.

From time to time, ISEB organizes educational, awareness and training progrmmes, popular and scientific lectures, competitions and several other such programmes for students and common people.

ISEB and CSIR-NBRI had jointly organized four highly successful international conferences on Plants and Environmental Pollution in Lucknow in 1996, 2002, 2005 and 2010 in which leading scientists from over 30 countries across the globe had participated. It was recommended that the Fifth quadrennial ICPEP (ICPEP-5) needed to be organized to provide a forum for discussing scientific researches and for exchanging knowledge concerning current environmental issues.

As a follow up measure, ISEB and CSIR-NBRI are

jointly organizing ICPEP-5 Conference during 24-27 February 2015 at CSIR-NBRI Campus in Lucknow.

This Conference is aimed at providing a vibrant interactive forum for serious deliberations on the pressing problems of pollution and the role of plants in its amelioration. The deliberations during the Conference will focus on climate change, environment and biodiversity, environmental biotechnology, plant response to environmental pollution, environmental impact assessment, bio-indication and bioremediation, plant-microbe interaction and waste management. Promoting environmental education through outreach programmes also needs to be emphasized besides other emerging environmental issues.

Detailed technical reports and recommendations of the previous Conferences (ICPEP-1 to ICPEP-4) were forwarded to relevant International agencies, academic institutions and organizations (both government and non-government) for their perusal and implementation. These can also be accessed from ISEB website: http://isebindia.com.

An International Advisory Committee with some of the most reputed and highly distinguished environmental and plant scientists has been constituted under the chairmanship of Dr. C.S. Nautiyal, President ISEB & Director CSIR-NBRI to guide and advise us in planning and organizing this Conference.

ISEB extends a very warm welcome to all distinguished guests and delegates to ICPEP-5.

Brief Biographical Sketches of Keynote Speakers

Dr. V.R. Reddy

V. R. Reddy is presently the Research Leader and Supervisory Plant Physiologist for the USDA-ARS, Crop Systems and Global Change Laboratory (CSGCL), Beltsville, MD, USA. Over the years, Dr. Reddy served on various professional, and administrative positions, most recently as Acting Associate Director for ANRI during (2011-2012), and as Beltsville Area representative on the RL Advisory Council (2010-2012). Presently serves as the Members of Scientific Advisory Board(SAB) of the Organization for Economic Co-operation and Development (OECD), Paris, France. Dr. Reddy is a Fellow of the American Society of Agronomy, and Crop Science Society of America. He presently serves as a members of several Editorial Boards of the International Scientific Journals.

Dr. Reddy's research focuses on crop responses to climate change, especially processes like photosynthesis, respiration, transpiration, carbon and nitrogen metabolism and growth analysis of cotton, soybean, corn, and various other crops. He uses this process level data for the development of mechanistic, process level crop simulation models and computer-aided farm decision-support systems for major crops like corn, cotton, soybean, potato, wheat and rice. In addition to his research, Dr. Reddy provides both technical and administrative leadership for the Crop Systems and Global Change Laboratory.

Prof. Om Parkash Dhankher

Prof. Om Parkash Dhankher is a plant/agriculture biotechnologist in the Stockbridge School of Agriculture, University of Massachusetts, Amherst. Prof. Dhankher received his M.Sc. and M.Phil. from the Kurukshetra University, Haryana (India) and Ph.D. from the Durham University (United Kingdom). He was a recipient of the several awards and honors including the prestigious Commonwealth Scholarship from the United Kingdom. His research focus is multidisciplinary in nature ranging from crop improvements, environmental remediation to biofuels. Along with strong research in engineering plants for detoxification and phytoremediation of heavy metals, his laboratory is developing arsenic free and arsenic tolerant food crops in order to improve human health using both forward and reverse genetic approaches. Prof. Dhankher was the first one to develop the transgenic plant based approach for arsenic phytoremediation by combining the expression of two bacterial genes, arsenate reductase- ArsC and -glutamylcysteine synthase- ECS, in plants. His research team is also engineering crops via manipulating key pathways and network of genes responsible for enhanced tolerance to multiple abiotic and oxidative stresses and GSH homeostasis for improving crop yield under changing climate conditions. Additionally, his laboratory is involved in metabolic engineering of oil seed crops such as *Camelina sativa, Crambe abyssinica* and *Brassica juncea* for improved oil yields for biofuels production and specialized biopolymers for industrial uses. Prof. Dhankher has extensively published his research findings in high profile journals including *Nature Biotech*, *PNAS, The Plant Cell*, *Plant Physiology*, *New Phytologist*, *Plant Biotechnology J.* etc. and has several patents awarded to him based on his research findings. His research has been widely publicized in numerous leading national and international newspapers and science magazines. His research has also been featured in headlines on National Geographic Channel,

ABC, Reuters, and PBS online project "*How we Get to Next*" with Steven Johnson etc. Prof. Dhankher has several ongoing collaborations in India, China, Italy, Nigeria, and USA.

Dr. Dipanker Chakraborti

Dr. Dipankar Chakraborti is the Director (Research), School of Environmental Studies - Jadavpur University. Dr. Chakraborti and his team, including medical personnel, have been working on the problems of groundwater arsenic and fluoride in West Bengal, Bangladesh, and other states of India since 1988. For roughly a decade, *Dr. Chakraborti* worked in western countries as a Research Fellow, Visiting Professor of Environmental Analytical Chemistry. After discovering the gravity of the arsenic problem in West Bengal, he decided to return permanently to India in order to actively investigate this issue. He holds three patents on arsenic removal, including one international patent, and he has published 20 book/monograph chapters and almost 200 papers (98 publications only on Arsenic & Fluoride) in international peer reviewed journals. Additionally, he has organized five international conferences (one in West Bengal and four in Bangladesh) on groundwater arsenic. Since 1994, the arsenic research unit of the School of Environmental Studies (SOES) - Jadavpur University, Kolkata has been self-funded. It sells its expertise and operates completely on the basis of the money it earns. Dipankar Chakraborti (Director Research) donates all award money, consulting fees, and his share of fees earned from environmental analytical analysis to the SOES development fund. During the last 25 years, this self-funded research unit of the School of Environmental Studies has spent the vast majority of its available resources for research and helping arsenic-affected families.

The SOES Arsenic Unit is jointly working with a large medical group on arsenic & fluoride groundwater contamination and its health effects. It has published around 100 publications (including book chapters) on only arsenic and fluoride research in international peer reviewed journals. Fourteen individuals have so far completed their PhD under Dr. Chakraborti, and all are well established all over the world. Research students from many countries including Harvard University, USA, John Hopkins University School of Medicine, USA, Asia Arsenic Network, Japan, have come to SOES for arsenic work. Director (Research) has been invited to many countries all over the world for lectures on groundwater arsenic contamination including Harvard University, MIT-USA. Director (Research) has also joined as a collaborator with Harvard University to mitigate groundwater arsenic contamination in Bangladesh. Dr. Chakraborti was invited from PR China to set-up an environmental analytical laboratory in Hebei University. Dr. Chakraborti was also advisor to Asia Arsenic Network, Japan. Director (Research) is at present an Advisor to the American Chemical Society's environmental journal, Environmental Science & Technology.

Prof. C.K. Varshney

Prof. C. K. Varshney is the former Dean and Professor of Ecology, School of Environmental Sciences, Jawaharlal Nehru University (JNU), New Delhi. He has taught at Benaras Hindu University (BHU), University of Delhi, JNU and was also a Visiting Professor at the Asian Institute of Technology (AIT), Bangkok. At present he has been appointed as "Distinguished Adjunct Professor" at Asian Institute of Technology (AIT) Bangkok.

In early seventies Professor Varshney served the Govt. of India as Secretary of the National Committee on Environmental Planning and Co-ordination (NCEPC), which was then the apex body for environmental matters in the central Government, prior to the formation of the Ministry of Environment and Forests. He was the founder Secretary of the Indian National Committee for UNESCO's Man and the Biosphere

programme (MAB). Prof. Varshney was the Member-Secretary of the official Indian delegation to the historic UN Conference on Human Environment at Stockholm in 1972 and the Leader of the Indian Delegation to the Inter-Governmental Meeting of Ramsar Convention at Groningen, The Netherlands.

He has been a member several Expert Committees for Environmental Appraisal of Ministry of Environment and Forest and has also served as Chairman, Environment Research Committee (ERC) of the Ministry of Environment and Forests. He has been associated with a large number of international organisations (UNEP, UNESCO, WHO, UNDP, ESCAP, IUCN, WWF, Rockefeller Foundation).

Professor Varshney has guided a large number of doctoral and post-doctoral scholars, has authored many books, published research papers in internationally reputed journals. He is widely travelled and a recipient of "Swami Parnavnanda Saraswati Award" for Environmental Sciences and Ecology.

Prof. Hendrik Küpper

Prof. Hendrik Küpper is born in Marl, Germany in 1974. After starting work on metal toxicity in plants in 1991 in his self-built basement lab together with his brother and a friend (leading to their first publications in scientific journals 1996-1998), he did his Ph.D at University of Konstanz, Germany and Czech Academy of Sciences, Třeboň, Czech Republic in 2001. He started his postdoctoral research in 2001 in University of Konstanz and later in 2002 he went to Cornell University, USA as Humboldt fellow. In 2004 he returned to University of Konstanz as Junior Professor where he continued till July 2014 as Heisenberg professor. At present he is head of the department, Biophysics and Biochmistry of Plants, at the Institute of Plant Molecular Biology, Biology Centre of the Czech Academy of Sciences, Czech Republic. His research interest involves interaction of higher plants and algae with trace metals in terms of metal uptake, transport, sequestration, complexation, deficiency, toxicity and detoxification. He has published 45 original research papers in highly reputed international journals, as well as 7 reviews. His research articles has been cited more than 2600 times with the h-index: 24 according to the "ISI Web of Science". Since January this year he is handling editor of Journal of Experimental Botany.

Dr. M.N.V. Prasad

Dr. Prasad is Professor, Department of Plant Sciences, University of Hyderabad. His areas of specialisation include Environmental Biotechnology, Plant Ecophysiology, Heavy Metal Stress in Plants, Bioresource Technology, Medicinal Plants. He was Elected Fellow – Linnaean Society of London, UK (1998), Elected Fellow – Andhra Pradesh Akademy of Sciences, Hyderabad (2003), Working group members (Only member from India) in COST action 859 (Phytotechnologies) (2005), supported by European Science Foundation.Pitamber Pant National Environment Fellow, Ministry of Environment and Forests, Government of India (2007). He also served as Visiting Scholar for summer school, Ghent University, Coupure Links 653 B-9000 Gent, Belgium and Visiting Professor, Ural State University, Faculty of Biology, Ekaterinburg, Russia, besides his assignments in other countries such as Australia, Finland, Sweden, Poland, Portugal, Canada, etc. Prof. M.N.V. Prasad made outstanding contributions to the field of “Plant-Metal interactions”, from molecular to ecosystem level (Phytoremediation). Bioresources, biomass energy sources, bioeconomy (including value chain and value addition products from plants used in phytoremediation) and bioremediation are his main areas of expertise. His work on Cadmium toxicity and tolerance in vascular plants received global recognition.

Freshwater Scarcity: quantity, Quality, Food Security, Health Effects and Management issues Mainly in Developing Countries

Dipankar Chakraborti & Bhaskar Das
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Most of the Holy Books wrote about the divinity of water and considered water as the elixir of life. Water is incomparable. The Holy Koran says water is most Gracious, most Merciful and God does not love the water wasters.

Over the past decades, it has gradually become evident to those dealing with water management that there is going to be a chronic crisis in the water world. Until 1940, drinking water in most of the developing countries meant water from rivers, ponds, dug wells, lakes and rainwater, except in a few major cities. Between 1950 & 1970 many developing countries promoted a green revolution using chemicals to cope with the population growth. The population increased unabated, poor sanitation continued; a large number of factories produced synthetic chemicals, dyes mushroomed. Waste generated from their activities and washings was released in the water and in the soil. Washings from agricultural fields rich in fertilizers, pesticides, insecticides, herbicides and other chemicals made traditional sources of drinking water unfit for drinking. Even the holy Ganges water once used as a source of drinking water in India was declared highly polluted due to discharge of municipal wastes and wastes from thousands of small and big factories. Water borne diseases increased because of the amplified presence of pathogens in the drinking water. Due to the rapid increase of the population, more food hence more water for irrigation and domestic purpose was required but both its quality and quantity deteriorated. In this scenario it was proposed that the underground water from tube wells should be used as drinking water source as it would be relatively free from pathogens, and groundwater, the biggest source of

fresh water in nature was also recommended for agricultural irrigation.

This underground water could bring a green revolution and many developing countries, like India and Bangladesh became self sufficient in food production. But during the last 20 years it has been found that ground water in many developing countries is arsenic / fluoride contaminated. The area and population of Ganga-Meghna-Brahmaputra flood plain (GMB-Plain) is about 600,000 sq. km. and over 500 million respectively. In India and Bangladesh (GMB-Plain) at present more than 100 million people are potentially at risk from groundwater arsenic contamination above the WHO guideline value (10 µg/L). In India alone above 62.5 million people are suffering from fluorosis. In general the drinking water quality of developing countries is pernicious. This is reflected by the high DALYs (Disability Adjusted Life Years) value (16%+). At present water scarcity exists all over the world. It has been estimated that by 2015 all countries with exception of Canada and Scandinavian countries will suffer water shortage in at least a part of their territory. Developing countries will be more affected by water scarcity. At present 1 billion people (out of present 6.5 billion world's population) from developing countries lack enough water to meet their minimum water demand. "Fierce competition for fresh water may well become a source of conflict & wars in the future."(Kofi Annan, March 2001). There are five 'hot spots' of water dispute. These are the Aral sea region, the Jordan, the Nile, the Ganges and the Tigris-Euphrates. The population of these regions is expected to increase by 30 % by 2025.

It is the common opinion of all the experts working on agriculture field that one of the main factors limiting future food production will be water. The question that is raised, is whether there will be enough water for the food production for almost 8 billion people on earth by 2025. It is estimated that a population of 3 billions in 1960 doubled to 6 billion in 1999 and at present 250 million hectares? are irrigated worldwide, nearly 5 times more than at the beginning of the 20th century. The total food demand is expected to almost double in the coming 10 years. We can not increase our existing land areas and the water quantity that we have on earth is insufficient to satisfy the need of our increasing population, which has grown from 2000 in 7000 BC to the present 6.5 billion and is expected to be 8 billion by 2025. Hence the crux of the problem is that we are forced to share the same fixed quantity of land and water with more people. Due to the increasing population a rapid increase in water demand started for agriculture, household and in industry. To which extent the water scarcity will jeopardize food security remains a big question. Water scarcity will obviously deteriorate the quality of water and increase diseases due to water contamination. From the present trend of deterioration it appears that the poor people of the developing countries will be the most severely affected. The world is more concerned about food security, but the health effects of the poor people in developing countries will be devastating due to ingestion of contaminated water and food both pathogenically and chemically.

The importance of Environmental Demand for Water (EDW) has only been recently realized. Water is integrally linked to the health of the environment. In order to ensure the health of the environment we need to keep some percentage of our available water (e.g swamp water) which under no circumstance can be used for domestic, agricultural and industrial purposes. For poor people of many developing countries where they can not get a square meal, this concept EDW is meaningless. A mother, who is considered as a symbol a love and affection, is at times driven to sell her child because of hunger.

It is to be noted:

- The earth's total water supply (approx. 1.4 billion cubic kilometer) is finite and will remain the same as it was at its creation. Out of this total water 97.4% is sea water and 2.6% fresh water. Out of this 2.6% fresh water (34,000 million cubic kilometer) only 11,000 cubic kilometer i.e., 0.77 % is available fresh water and the remaining fresh water is locked in ice-cap, permafrost and in areas not accessible.
- The world's population increased 300% in 20th century and the use of water increased 700%
- Water use is expected to increase 50% over 2005 level to 2035.
- The water crisis would be triggered due to unexposed phenomena like drought, ENSO, EL-NINO.
- In developing countries the average crop yield will decline from 1.9% per year to 1.2% per year.
- Fierce competition for fresh water may well become a source of conflict & wars in the future

In future the effect of water crisis will be more severe in developing countries than many atomic explosions

Climate Change Studies in India with Various Approaches, Simulation and Modeling

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The concentration of CO_2 in the atmosphere has risen 30% since the onset of the industrial revolution in the late 18th century. Change has been a consistent feature of the earth's climate. Periods of relatively cool temperatures caused the ice ages. That warm period almost exactly matches the period over which modern agriculture has evolved.

Genesis Technologies is having an energetic team of professionals with Doctorate, Post Doctorate, and Engineering background are closing working with all leading research institutes and developed many projects in the following areas.

- Climate Change studies
- Bio-based Energy and Products
- Emerging Technologies and Products
- Environmental Analysis
- Atmospheric and Aerosol Sciences

Simulation and modeling on:

- CO_2 elevated Open Top Chamber (OTC).
- Free Air CO_2 Enrichment (FACE).
- Free Air Temperature Enrichment (FATE).
- Temp. Gradient Tunnel (TGT).
- CO_2 elevated Elongated Tunnel.
- Free air CO_2 and Ozone Enrichment Technology

CO_2 ELEVATED OPEN TOP CHAMBER (OTC) TECHNOLOGY:

The purpose of Open Top Chamber (OTCs) is to study response of plants in high CO_2 and other gas in environment with precise control and regulation of desired CO_2, Temp and humidity inside the OTCs. Open Top Chambers (OTCs) is an innovative and cost effective approach to investigate effects of elevated CO_2, Temperature and Humidity response of plants.In this approach, CO_2 gas is supplied to the chambers through CO2 gas cylinders and maintained at set levels using manifold gas regulators, pressure pipelines, solenoid valves, sampler, pump, CO_2 analyzer, PC linked supervisory control and data acquisition (SCADA). The data generated by OTCs are more realistic for impact assessment analysis of rising atmospheric CO_2 and temperature on plants for developing models to predict the responses for future climatic conditions. The accuracy of the results depends on the system adopted and its maintenance of the required CO_2 levels with near natural and variable conditions for other parameters. On the growth dynamics and yield. Open Top Chambers for elevated CO_2 study are built with high quality multi layered Polycarbonate sheets (4mm thickness) of 3X3X4mt. dimensions with GI/MS structure with proper foundation and grouting. A suitable door of 6ft X3 ft. size is provided in each chamber. Multilayered clear polycarbonate sheet with 80-85% light transmission level to be used for OTC

structure. Flat and angle aluminium and rust free screws are used for mounting of polycarbonate sheet. Welding at four corners and inclination of 30° at top is provided to protect against high winds and moderate vibrations. Sealing of OTC is achieved using aluminium angles, plates at the top, corners and centre along with gaskets. Door is sealed using "U" type gaskets with overlapping of sheets to prevent loss of CO_2 through doors.

Fig, 1 Open Top Chamber with instrumentation

FREE AIR CO_2 ENRICHMENT TECHNOLOGY (FACE):

Both horizontal & Vertical GI pipes (C class) are used in hexagonal structure for CO_2 release in FACE Ring. Each ring is of 15 ft height and 10 m of diameter. On each arm of FACE ring manual operated valves at 5 ft gap are used to release CO_2 at different heights. Each horizontal and vertical section of each arm has CO_2 releasing nozzles with 0.4mm injection point to cover maximum area of FACE ring. CO_2 sampling tube is placed at three different locations in FACE ring to pull air sample through air pump to CO_2 analyser.

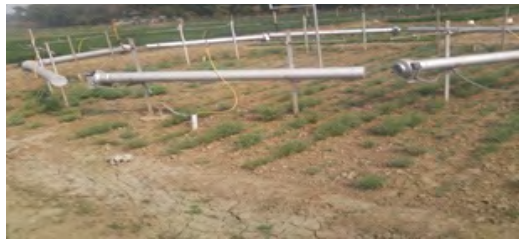

Fig 2. FACE at IARI (New Delhi)

Fig. 3. FACE system at NBRI, Lucknow to determine and control of CO_2 level/ concentration in each ring on real time basis.

Wind direction, wind velocity, and [CO_2] are measured and this information is used by a computer-controlled system to adjust CO_2 flow rate to maintain the target elevated [CO_2]. Online monitoring options for temperature, humidity, CO_2, wind speed, wind direction and photosynthetic active radiation (PAR) light intensity sensor are available with the system. Signal is obtained from these sensor transmitted toward control room through four core shielded cable The equipment for monitoring and

Fig. 4. FACE at ICRISAT, Hyderabad

Fig. 5 FACE at MSSRF, Chennai

Fig.06. FACE and FATE Control panel

controlling CO_2 in FACE ring is fully automatic and desired level of CO_2 is maintained throughout the experiment inside FACE ring. The system basically consist of CO_2 analyzer to measure CO_2 coming from field , motor/ aspirator to pump sample from field FACE ring, solenoid valves to regulate CO_2 in ppm, Air flow meter, air filter, CO_2 gas cylinder for supply of CO_2 gas, air compressor to maintain the uniformity of CO_2 gas at desired set point, anemometer is use to measure wind speed and direction, relay card is used to operate 230v operated solenoid valve, relay module is use as output of data logger, data logger, SCADA software and PC.

Free Air Temperature Enrichment (FATE) Technology:

Powerful and efficient infrared heaters with quartz IR heating element are used in hexagonal ring to, achieve temp. up to ambient +5Deg C across the open plot area. Temperature and humidity transmitter, portable CO_2 monitor, photosynthetically active radiation (PAR) sensor, wind speed and wind direction sensors are placed in each FATE ring. Signals from each sensor are obtained to control room through four core shielded cable for data logging and control option.

Fig 7. FATE at IHBT, Palampur

Fig 8: FATE system at IARI

Free Air CO_2 and Ozone Enrichment Technology:

Both horizontal & Vertical SS pipes are used in hexagonal structure for CO_2 and O_3 release in Rings. Each ring is of 10 ft height and 10 m of diameter. On each arm of FACE and Ozone ring Manual operated valves at 5 ft gap are used to release CO_2 and O_3. Each horizontal and vertical section of each arm has CO_2 releasing nozzles of 0.4mm injection point to cover maximum area of FACE and Ozone ring. CO_2 and O_3 sampling tube is placed at three different locations in FACE and Ozone ring to pull air sample through air pump to CO_2 and O_3 analyser to determine and control of CO_2 and O_3 concentration in each ring on real time basis. High volume blower (5000cfm) used to discharge O_3 through O_3 generator to ozone ring

Temp. Gradient Tunnel (TGT) with control and automation

Dimension of TGT is 15mt to 50 meter (Length). Sophisticated air blowing/heating facilities for achieving different gradient of 1 to 5 deg C from one end of the tunnel to another end. Polycarbonate sheet of 85% light transmission are being used for covering the system. Temp and Humidity sensors are being mounted at 3mt interval for data logging option and signals from each sensor are being recorded and monitored and controlled by PLC & SCADA system.

Elongated Tunnel and CO_2 Gradient Tunnel (ET and CGT):

The chamber is 1.2 m wide, 1.5 m tall, and 60 m long, divided into 10 compartments, each of 5mt long.. Each compartment is made of a rust proof metal structure to provide the above stated

Fig 9: CO2 and Ozone ring at IARI, (New Delhi)

housing dimension of uniform size covered by transparent polycarbonate sheet. The polycarbonate sheet is continuous and to provide air tight atmosphere within the chambers except for provisional exits at the two (north and south) ends. Each compartment is separated from adjacent compartments by 1m x 1m sheet metal duct containing chilled air. All the ten compartments are thus connected by joining of the two adjacent compartments, each connected by a 1-m sheet-metal duct connecting to a cooling system. Structure with MS and GI pipe and covered with a polycarbonate sheet of more than 85 % transparency. Sophisticated air blowing facilities for achieving different CO_2 gradient of 1 to 5 deg C from one end of the tunnel to another. A dedicated reliable control/ monitoring system are being installed for online monitoring of temperature & humidity with fixed monitoring option in different point across the tunnel.

CONCLUSION

The atmospheric CO_2 concentration increasing due to anthropological activities can influence the process of photosynthesis in C_3 plants which expected to alter the growth dynamics, structure and functions of terrestrial ecosystems including plant growth, yield, biomass, photosynthesis, transpiration and respiration and nutrient uptake also. It is also projected that changes in plants responsiveness in terms of physiological, biochemical and molecular to elevated atmosphere CO2 may happen. A number of technologies have been developed to study the impact of rising atmospheric CO2 on a plant system and also monitor the carbon exchange processes under changing climate. Here, we tried to focus on effects of elevated CO2 and temperature on forest tree species using OTC and other approaches which are strongly required for developing adaptation and mitigation strategies to address the potential impacts of future climate change. There are so many areas in forestry science such as breeding new varieties against abiotic stress and improved water and nutrient use efficiency, effects of elevated CO2 on host parasite interaction and on insect-pests and diseases and species and ecosystem levels and phyto-remediation potential of tree species under elevated CO2 which might be taken as priority basis with respect to effects of elevated CO2 on growth dynamics, structure and function of plants species using Open Top Chambers (OTCs)., FACE and FATE facilities.

Fig: 10 Temp Gradient Tunnel (TGT) and ET

Plants Adaptations in Different Habitats

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Adaptations build up in due course and production as a comeback to the ever changing environment. They allow an organism to reduce competition for space and nutrients, reduce predation and increase reproduction. There are however, several factors that can limit these adaptations: availability of water, light, predation and temperature (fig 1) (UNM Department of Biology). Desert plants look very different from plants that live near the ocean or in the mountains. Each type of plant thrives in a different type of environment.

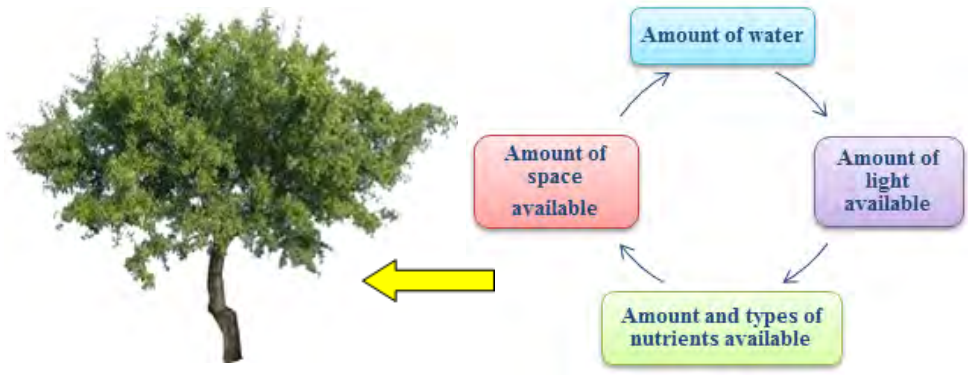

Figure1. The characteristics of the environment that influence a plant success to grow healthy

There are five main types of nutrients that plants use are: Nitrogen, Phosphorous, Potassium, Calcium, and Magnesium. Nutrients are substances that provide energy and materials for plants to grow. There are five main types of nutrients that plants use, but not all plants use them equally. For example:

- A pine tree might use a lot of nitrogen but not very much phosphorous, but
- A cactus might use a lot of phosphorous and not much nitrogen.

Plants have adaptations to help them survive (live and grow) in different areas. These adaptations might make it very difficult for the plant to survive in a different place. This explains why certain plants are found in one area, but not in another. For example: Desert plants grow far apart so that they can get water and nutrients from a larger area. The sharp spines of a cactus keep animals from eating it. Plants in the high mountains grow close to the ground as protection from the wind. The leaves, stems, roots, and reproductive parts of plants can be very different depending on where the plant lives. In the same way Mosses are soft cushiony plants that live in damp places. Mosses have few or no stems. They are non-vascular plants. They grow close to the ground. They hold soil in a forest and prevent it from being washed away by heavy rains. These plants have no roots so most of them grow close to the ground to keep from drying up. Some mosses, known as sphagnum peat mosses, absorb water like sponges and

hold the water in their stems. The mosses often form wet, spongy quilts between the trees in damp forests. Some of the adaptations plants in different environments are following:

Global distribution of tropical rain forest in the world
Source: http://www.blueplanetbiomes.org/rainforest.htm

The Tropical Rainforest

The rainforests are forests with tall trees, warm climates, and lots of rain. In some rainforests it rains more than one inch nearly every day of the year. **The rainforest are the Earth's oldest living ecosystems.** These forests are found in Africa, Asia, Australia, and Central and South America, Mexico and on many of the Pacific, Caribbean, and Indian Ocean Islands. The largest rainforest in the world is the Amazon rainforest in South America

Plants adaptation to rain forest

For better survive in the hot, wet tropics, plants of the tropical rainforest have had to develop special features called **adaptation.** Some adaptations of plants are following**:**

1. The weather of tropical rainforest is hot and wet; so that trees generally have a thin, smooth bark because they don't need thick bark to prevent moisture like plants in temperate deciduous forests. The smoothness of the bark makes it difficult for other plants to grow on their surface.
2. The leaves of rainforest trees have adapted to survive with the large amount of rain. The leaves are big, thick and waxy, and have 'drip tips' to let the rain drain off quickly. Plants need to shed water to avoid growth of fungus and bacteria in the warm, wet tropical rainforest.
3. The cover of rainforest is connected by creepers and ferns, and mosses grow on the trees. Lianas are climbing woody creeper that wraps rainforest tree. They have their roots in the ground and climbing high into the tree canopy to reach available sunlight.
4. Many large trees have huge ridges called **buttresses** near the base that can rise 30 feet high before blending into the trunk. Buttress roots provide extra stability and increase the surface area of a tree so that it can 'breathe in' more carbon dioxide and 'breathe out' more oxygen.
5. Some trees have above-ground roots called **prop** or **stilt** roots which give extra support to the trees. These roots can grow about 85 cm in a month.
6. Epiphytes are the plants that grow mainly on the twigs, trunks, and even the leaves of rainforest trees so that they can get sunshine. The roots of these plants are not in soil, because of this get their food from air and water. For example: orchids, philodendrons, ferns and bromeliads.
7. In the rainforests competition for light is intense so that plants arranged their leaves at different angles so that a plant avoids shading its own leaves.
8. Most stranglers (killer tree) are found in rain forest. The seed of the strangler starts their life as an epiphyte high in the trees. After some time they sends their seedling and long roots down to the ground from where it begins to surround the host tree. It grows quickly and finally

suffocates the host: when the host tree dies it leaves a huge upright strangler with a hollow core.
Source: http://www2.montes.upm.es/Dptos/DptoLinguistica/inglesI/RFalltasks07-08.pdf

9. Young rainforest plant may have red leaves to give them protection from the sunlight whilst their internal organs for photosynthesis are still developing. They act as a sunscreen by reflecting red light whilst the leaf is still young.

The Tropical Savannah:

Savannas are habitually a transitional zone between forest and desert or grassland. Savanna occupies half the global tropical zone (Lehmann *et al.*, 2014). In Savannas summer season is wet for about 6 to 8 month while winter season is dry. The dry season is marked by months of drought and fire but these conditions are essential for the maintenance of savannas. Savannas also maintain an open canopy despite a high tree density. The open canopy allows sufficient light to reach the ground to support an unbroken herbaceous layer consisting primarily of grasses.

Global distribution of tropical Savannah in the world
Source: http://www.blueplanetbiomes.org/savanna.htm

Plants adaptation to Tropical Savannah

Tropical savannas plants survive with dry soil, periodic fires and threats from herbivores. They are very well adapted for these extreme conditions. Some of these adaptations of plants are following:

1. During the time of sufficient water grasses in tropical savannas grow very quickly and when water becomes insufficient, they turn brown to minimize water loss. They store nutrients and moisture in their roots while waiting for rain. With food and water reserves stored below ground, the grasses are able to survive the effects of fire. This fire stimulates new growth and refills the soil with nutrients.
2. During the wet season the Baobab tree produce leaves in the form of tiny finger-like clusters. This small size of leaf helps to decrease water loss. The baobab tree can store **up to 120,000 litres** of water in its trunk and this stored water helps Baobab tree to survive in the long months of drought. **It also has thick bark which can protect it against fire and helps it to retain more of its moisture.**
3. The acacia tree can survive drought conditions because it has developed long tap roots that can reach deep, ground water sources. It is also fire resistant. Some varieties resprout from the root crown when the above ground portion of the tree is damaged by fire.
4. **The Kangaroo Paw has adapted to dry conditions so it requires less water than most other plants and it can also tolerate high temperatures.** These perennial plants are noted for their unique bird attracting flowers.
5. **The Kangaroo Paw has tiny woolly hairs also which hold onto water droplets.**
6. **Most of the trees of Savannah have the ability to drop its leaves during dry periods so it can conserve energy and water.**
7. **Savannah's trees have Hydrophilic root system which can extract water from deeper into**

the ground.

The Taiga:

The taiga is the world's largest terrestrial biome. The main seasons in the taiga are winter and summer. The spring and autumn are so short. There are some lichens and mosses are found in this area, but most plants are coniferous trees. There are not a lot of species of plants in the taiga because of the harsh conditions because not many plants can survive the extreme cold of the taiga winter.

Global distribution of Taiga in the world
Source: http://www.blueplanetbiomes.org/taiga.htm

Plants adaptation to Taiga

The plants that live in the Taiga are better adapted to life in a land of limited sunlight and poor soil nutrition.

1. Evergreens trees are conical in shape, allowing them to shed heavy snows with minimal damage to the trees' branches. The evergreens also tend to grow tall and close together, which helps protect them from cold and wind.
2. Lots of trees have very dark green needles which stimulate photosynthesis when temperatures rise.
3. The trees of Taiga have relatively small surface area of evergreen needles which helps to decrease water lose by evaporation, especially in winter when water is frozen and unavailable to plants.
4. Evergreen needles have a waxy coating that serves as a protectant against wind and drought.

The Mangroves:

Mangroves are a crossroad where oceans, freshwater, and land area meet. They are among the most productive and complex ecosystems on the planet, growing under environmental conditions that would kill ordinary plants very quickly. Mangroves are important wetlands that are found around the world but whose continued existence is under threat (Wang et al. 2014). They occur in tropical and subtropical intertidal estuarine zones and feature various salt-tolerant plants that fulfil a range of essential ecological functions and provide numerous valuable natural resources (Nagelkerken et al. 2008).

Global distribution of Mangrove forest in the world
Source: commons.wikimedia.org 1357

Plants adaptation to Mangroves

Mangrove trees can survive very well in the extreme conditions of estuaries with two key

adaptations like the ability to survive in waterlogged and anoxic (no oxygen) soil, and the ability to tolerate brackish waters. Some more adaptations of plants are following:

1. Mangrove soils are regularly water-logged and loaded with salt. High tides bring marine aquatic and estuarine conditions, while low tides expose mud and roots to aridity, heat and desiccation. To cope with these conditions plants have special vertical roots, called pneumatophores. The pneumatophores form from lateral roots in the mud, often projecting above soil. These roots permit some oxygen to reach the oxygen-starved submerged roots and also can exhibit development of air cavities in root tissues, designs that aid oxygenation of the tissues. The density, size and number of pneumatophores vary per tree. They are green and contain chlorophyll for example e.g. Avicennia, Sonneratia.
   Source: http://www.mangrovewatch.org
2. The major plant species forming the mangrove ecosystem have aerial roots, commonly prop roots or even stilt roots. Stilt roots are important in aeration and help to attach the plants for e.g. Rhizophora spp.
3. Production of viviparous propagule is a reproductive strategy in mangroves that contributes to salt tolerance (Zheng et al. 1999).
4. The accumulation of low-molecular-weight organic solutes such as sugars, some amino acids, and quaternary ammonium compounds involved in the adaptation to abiotic stress (Hibino et al. 2001).
5. Many mangrove species, such as the Grey Mangrove and the River Mangrove (common species along the Redlands coast), have leaves with glands that excrete salt.
6. Some species such as the Grey Mangrove can also tolerate the storage of large amounts of salt in their leaves – which are discarded when the salt load is too high.
7. Under salinity stress, accumulation of osmoprotectants, especially in the cytosol, chloroplasts and mitochondria minimizes water loss from the leaf cells (Heldt 1999).
8. Mangroves are able to turn their leaves to reduce the surface area of the leaf exposed to the hot sun. This enables them to reduce water loss through evaporation.
9. Mangroves with high levels of antioxidants are reported to have greater resistance to this oxidative damage (Jithesh et al. 2006).
10. Other mangrove species are viviparous. They retain their seeds until after it has germinated and a long, cylindrical propagule has formed. When it has matured to this stage, the parent tree drops it into the water, where it remains dormant until it finds the soil and is able to put out roots.
    Source: http://www.mangroves.godrej.com

The Tundra:

Arctic tundra is a huge and wide ranging biome characterized by short-statured plant population embedded in a thin layer of seasonally thawed soil underlain by permafrost (Walker *et al.*, 2005). Soils in the permafrost region, including tundra contain almost one-half of worldwide soil organic carbon (C), and the maximum percentage of this organic carbon seized in soils that have been perennially frozen since the last

Global distribution of Tundra
Source: http://www.blueplanetbiomes.org/tundra.htm

glaciations (Tarnocai *et al*., 2009; Hugelius *et al*., 2013). There are two different types of tundras, the "Arctic" and the "Alpine tundra." The Arctic tundra is located around the North Pole and the alpine tundra exists in mountains all over the world. They both have extremely cold climates as well as very low diversity of life, as not a lot of animals and plants are suited to survive in such severe conditions.

Plants adaptation to Tundra:

Tundra is a type of biome distinguished by its very cold temperatures, lack of precipitation, and absence of trees. Despite these harsh conditions, several plants have adapted to the tundra's climate. Some adaptations of plants are following:

1. Tundra also contains permafrost, or permanently frozen soil. The thicker active layer allows roots to penetrate deeper into the soil substrate and thus increases nutrient uptake (Schimel et al. 2004).
2. The tundra features strong wind (Wielgolaski *et al*., 1981), generally blowing 30 to 60 milesper hour, making it difficult for many plants to survive.
3. Plants adapt to the tundra by growing close to the ground, becoming dormant through the winter, reproducing through division, and growing protective coverings. For example Cotton grass, sedge, mosses, lichens, arctic dryads, arctic birches, and arctic poppies all thrive in the tundra
4. Plants are dark in color---some are even red---this helps them absorb solar heat like Arctic willow.

Source: http://tundrabiome5.weebly.com

4. Some plants are covered with hair which helps keep them warm.
5. Some plants grow in clumps to protect one another from the wind and cold.
6. Some plants have dish-like flowers that follow the sun, focusing more solar heat on the center of the flower, helping the plant stay warm for example Arctic poppy.
7. Small leaves help the plants retain moisture.
8. Because of the short growing season, most tundra plants are perennials. Perennials do not die in the winter.
9. Some plants, like lichens, can survive on bare rock because they don't need soil to grow.
10. Moss can grow in wet places or on bare rock.
11. Mosses are flowerless plants with very tiny leaves and no roots. Each plant has tiny threadlike rootlets (called rhizoids) that absorb moisture and minerals from the soil. On moist ground hundreds of tiny moss plants form spongy cushions or mats.
12. Some birds and small mammals use moss to line their nests.

Conclusion:

Plants have several basic needs for better survival. They need solar light, water, air and minerals or nutrients for good growth. They also need to be able to reproduce in order to ensure that their species survives. Some of the main threats to the survival of plants include a lack of sunlight, a lack of water, a lack of good soil and a proper space. In the same way an abundance of water, air, solar radiation (UV rays) and the activities of animals are also harmful for plants. There are many challenges that plants face in order to survive. How well plants adapt to their changing environments will determine their future. It is important to remember, that almost all other living things believe on plants in some way and we all believe on plants being able to adapt to their environments as well.

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नगर निगम, वाराणसी नगरीय क्षेत्र के निवासियों को समस्त आवश्यक सुविधायें उपलब्ध कराने में हमेशा तत्पर है।

हमारी उपलब्धियाँः–

- वाराणसी नगर हेतु जवाहर लाल नेहरू नेशनल अरबन रिन्यूअल मिशन (जे.एन.एन.यू.आर.एस.) योजना के अन्तर्गत क्रमशः रु.111.21 करोड़ की पेयजल योजना, रू. 86.10 करोड़ की पेयजल हेतु वितरण प्रणाली योजना, रु. 48.67 करोड़ की कूड़ा प्रबंधन योजना, रु. 191.62 करोड़ की जल निकाली योजना रू. 309.12 करोड़ की ट्रांस वरूणा क्षेत्र की सीवरेज, ट्रान्स वरूणा क्षेत्र के पेयजल परियोजना रू. 209.16 करोड़ की तथा नगर निगम, वाराणसी हेतु ई–गर्वनेन्स योजना रु. 3.51 करोड़ की परियोजना स्वीकृत।
- वाराणसी नगर हेतु (जे.एन.एन.यू.आर.एम.) योजना के अन्तर्गत शहर हेतु ट्रैफिक प्लान योजना शीघ्र स्वीकृत होने की प्रक्रिया में।
- नगर निगम, वाराणसी द्वारा नगर के भवन स्वामियों को भौगोलिक सूचना प्रणाली (जी.आई.एस.) आधार पर कम्प्यूटराइज्ड गृहकर बिल निर्गत।
- नगर निगम, वाराणसी के सभी पाँचों जोनो व नगर निगम मुख्यालय में टैक्स कलैक्शन सेन्टर स्थापित। किसी भी क्षेत्र का भवन स्वामी किसी भी टैक्स कलेक्शन सेन्टर पर अपना गृहकर जमा करने की सुविधा उपलब्ध।
- यू.एन.डी.पी. योजना में जी.आई.एस. के आधार पर किये जा रहे गृहकर सुधार हेतु शहरी विकास मंत्रालय, भारत सरकार द्वारा नगर निगम, वाराणसी को सम्मानित किया गया।
- जी.आई.एस. आधार पर निर्गत कम्प्यूटराइज्ड गृहकर बिल में किसी भी प्रकार की त्रुटि होने पर नगर निगम के सक्षम अधिकारी/कर्मचारी द्वारा त्वरित निस्तारण किया जा रहा है।

हमारी अपेक्षायें :–

1. वर्ष 2014–15 के गृहकर कम्प्यूटराज्ड बिल वितरित किये जा चुके हैं व सभी बिल जोनो पर स्थापित कम्प्यूटर पर उपलब्ध है। कृपया तत्काल अपने गृहकर का भुगतान करें व अक्टूबर के बाद प्रत्येक माह लगने वाले अतिरिक्त ब्याज से बचें।
2. जी.आई.एस. आधार पर निर्गत कम्प्यूटराइज्ड गृहकर बिल में किसी भी प्रकार की त्रुटि होने पर नगर निगम के सक्षम अधिकारी/कर्मचारी से सम्पर्क कर अपना गृहकर बिल ठीक करायें।
3. व्यवसायिक भवनों के स्वामी अपने व्यवसायिक भवनों का लागत मूल्य एप्रुव्ड वैलुअर से निकलवाकर संबंधित जोन में जमा कर अपने अनावासीय भवन को मूल्यांकित करायें।
4. नाले, नदियों पर कहीं भी अतिक्रमण न करें एवं इस प्रकार के अतिक्रमण करने वालों को बढ़ावा न दें तथा जल निकासी को अवरूद्ध न करें एवं सार्वजनिक स्थल को अतिक्रमण मुक्त रखें।
5. अपने समस्त देयों का भुगतान समय से कर नगर विकास में अपना योगदान दें।
6. कटे, बासी व खुले खाद्य पदार्थ का सेवन न करें।
7. कूड़े को कूड़ेदान में डाले अथवा में. ए 2 जेड वेस्ट मैनेजमेंट के सफाई कर्मी को ही उपलब्ध करायें।
8. पॉलीथीन का प्रयोग न करें, गंगा घाटों को स्वच्छ रखे, गंदगी न फैलायें।
9. आकस्मिक दुर्घटना से बचने के लिए जर्जर भवनों में आवास न करें।
10. जानवरों को छुट्टा सड़कों पर न छोड़ें।

निर्माण हमारा कर्म है, सफाई हमारा धर्म है।

(उमाकान्त त्रिपाठी)
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- जन्म–मृत्यु पंजीकरण आन–लाइन
- कम्लेन्ट रिड्रेषल सिस्टम
- कैष कलैक्षन आदि का कई कारणों में प्रषिक्षण
- फागिंग की वार्ड वार व्यवस्था करायी गयी।
- नगर निगम मुख्यालय में नागरिक सहायता केन्द्र की स्थापना तथा नागरिकों को कर/किराया शुल्क जमा करने हेतु सिंगल विंडो सर्विस की मुख्यालय के मुख्य द्वारा व्यवस्था।
- जन सहभागिता से घाटों की सफाई का घाट वार अभियान।
- कर्मचारियों के देयकों का समय भुगतान।
- शासन द्वारा निर्धारित सर्विस लेबल बेंच मार्क को प्राप्त किया गया।
- जनहित गारंटी अधिनियम के अंतर्गत नामांतरण एवं जन्म–मृत्यु के आवेदन पत्रों का समय निस्तारण।
- जेएनएनयूआरएम के अंतर्गत ई–गर्वेन्स के 23.61 करोड़ की योजना एनआईसी के माध्यम से लागू करायी जा रही है।
- वातावरण को स्वच्छ व प्रदूषण से मुक्त रखने हेतु वृक्षारोपण अभियान।

क्या आप जानते है?

नगर निगम कानपुर आपको क्या सुविधाएँ उपलब्ध कराता है।

- महानगर की अधिकांश सड़कों का निर्माण एवं मरम्मत कार्य।
- आपके द्वारा फेंके गये अस्पृश्य कूडे का कर्मियों द्वारा निस्तारण।
- आपकी रात्रिकालीन यात्रा सुगम हो इस हेतु मार्ग प्रकाश व्यवस्था।
- बारिश में महानगर को जल–भराव से मुक्ति हेतु नाला सफाई व्यवस्था।
- नगर के पर्यावरणीय स्वच्छता, सुन्दरीकरण हेतु पार्कों, चौराहों पर वृक्षारोपण।
- नगर के प्रमुख मार्गों पर वृक्षारोपण अभियान।
- कानपुर नगर में नरेन्द्र मोहन सेतु से नरौना चौराहे तक नो टेम्पो जोन की व्यवस्था लागू
- धार्मिक स्थलों एवं त्योहारों पर विशेष सफाई व्यवस्था।
- पतित पावन गंगा नदी के तट पर घाटों की विशेष सफाई।
- मच्छरों के रोकथाम हेतु फागिंग व्यवव्था ताकि संक्रामक रोग न हों।
- खेलकूद प्रोत्साहन हेतु क्रिकेट, बॉस्केट बाल, तैराकी के लिए स्टेडियम एवं तरणताल की व्यवस्था।
- नगर निगम द्वारा संचालित विद्यालयों के अन्तर्विद्यालयी खेल–कूद प्रतियोगिताओं का आयोजना।
- शैक्षिक, संगीत शिक्षा हेतु इण्टर कालेज, महिला डिग्री कालेज, संगीत महाविद्यालय का संचालन
- निर्वाध आवागमन हेतु सड़कों, फुटपाथों से अभियान स्वरूप अतिक्रमण हटाना।
- नागरिकों की स्वास्थ्य रक्षा हेतु अस्पतालों का संचालन
- पॉलीथीन के विरूद्ध विशेष अभियान।

क्या आपने अपना गृहकर (हाउस टैक्स) समय से जमा किया है।

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- घरों एवं घरों के बाहर पार्को, रोड पटरियों एवं अन्य सार्वजनिक स्थलों पर वृक्षारोपण कर पेड़–पौधों को संरक्षित करें।
- कूड़ा उत्सर्जन स्थलों पर कूड़ा हेतु डस्टबिन का प्रयोग करें एवं कूड़ा को निर्धारित कूड़ादानों में ही फेंकें।
- अपने घरों/प्रतिष्ठानों का कूड़ा, कूड़ा उठाने वाले ट्राली मैन अथवा सफाई कर्मी को ही दें।
- नगर निगम द्वारा प्रदत्त की जा रही उक्त सेवा के बदले निर्धारित यूजर्स चार्ज ससमय जमा करें।
- नालों एवं नालियों पर दुकान लगाकर, स्थायी निर्माण कर अतिकमण न करें, न ही कूड़ा फेकें।
- आइये! संकल्प लें कि न तो कूड़ा सार्वजनिक स्थल पर फेकेंगें एवं न ही किसी को ऐसा करने देंगें।

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'सार्वजनिक स्थलों एवं नगर में इधर-उधर कूड़ा फेंकना, गन्दगी करना नगर निगम अधिनियम 1959 के तहत दण्डनीय अपराध हैं।'

''कृपया गंगा नदी एवं नगर को स्वच्छ-निर्मल एवं प्रदूषण मुक्त रखने में अपना अमूल्य श्रमदान प्रदान करते हुए नगर निगम का सहयोग करें''

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मुरादाबाद नगर निगम द्वारा विकसित किये गये ई–गवर्नेन्स साफ्टवेयर यथा

- नगर निगम मुरादाबाद को यू.आई.डी.एस.एस.एम.टी. योजना के अन्तर्गत उत्कृष्ट कार्य करने हेतु नगर विकास मंत्रालय व भारत सरकार एवं उत्तर प्रदेश सरकार द्वारा प्रथम पुरस्कार के रूप में 01 ट्रॉफी एवं 04 लाख रुपये की धनराशि से पुरस्कृत किया गया। जिससे नगर निगम मुरादाबाद सम्पूर्ण भारत में प्रथम स्थान प्राप्त कर गौरवान्वित हुआ है।
- डबल एन्ट्री एकाउंटिंग सिस्टम।
- जन्म–मृत्यु पंजीकरण ऑनलाईन।
- फोगिंग की वार्ड वार व्यवस्था।
- नगर निगम मुख्यालय में नागरिक सहायक हेतु जलकल/गृहकर जमा करने हेतु सिंगल विंडो सर्विस की मुख्यालय के मुख्य द्वार पर व्यवस्था।
- कर्मचारियों के देयकों का ससमय भुगतान।
- शासन द्वारा निर्धारित सर्विस लेबल बेन्च मार्क का प्राप्त किया गया।
- जनहित गारण्टी अधिनियम के अन्तर्गत नामांतरण एवं जन्म–मृत्यु के आवेदन पत्रों का ससमय निस्तारण।
- जेएनएनयूआरएम के अन्तर्गत ई–गवर्नेन्स की योजना एन.आई.सी. के माध्यम से कराई जा रही है।
- जनता के लिये किसी भी समस्या के निदान हेतु नगर निगम मुरादाबाद द्वारा एक शिकायत कक्ष स्थापित किया जाना।
- वातावरण को स्वच्छ एवं प्रदूषण से मुक्त रखने हेतु 100 वृक्षों का वृक्षारोपण।
- भारत सरकार ऊर्जा मंत्रालय द्वारा नगर निगम मुरादाबाद को सोलर सिटी के रूप में चयनित किया गया है, जिसका कार्य प्रगति पर है।

क्या आप जानते है?
नगर निगम मुरादाबाद द्वारा आपको क्या–क्या सुविधाएँ उपलब्ध करायी जाती है।

- महानगर सीमान्तर्गत सड़कों का निर्माण एवं मरम्मत कार्य।
- आपके द्वारा फैंके गये अस्पृश्य कूडे का कर्मियों द्वारा निस्तारण।
- महानगर को पेयजल की समुचित व्यवस्था प्रदान करना।
- आपकी रात्रिकालीन यात्रा सुगम हो, इस हेतु मार्ग प्रकाश व्यवस्था।
- वर्षा ऋतु में महानगर को जल–भराव से मुक्ति हेतु नाला सफाई व्यवस्था।
- नगर के पर्यावरणीय स्वच्छता, सौनदर्यीकरण हेतु पार्कों, चौराहों पर वृक्षारोपण।
- धार्मिक स्थलों एवं त्यौहारों पर विशेष सफाई व्यवस्था।
- रामगंगा नदी के तट पर घाटों की विशेष सफाई व्यवस्था।
- मच्छरों के रोकथाम हेतु फागिंग व्यवव्था ताकि संक्रामक रोग न हों।
- निर्वाध आवागमन हेतु सड़कों, फुटपाथों से अभियान स्वरूप अतिक्रमण हटाना।
- पॉलीथीन के विरूद्ध विशेष अभियान।

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About ENVIS

Know about us

Background

Realising the importance of Environmental Information, the Government of India, in December, 1982, established an Environmental Information System (ENVIS) as a plan programme. The focus of ENVIS since inception has been on providing environmental information to decision makers, policy planners, scientists and engineers, research workers, etc. all over the country. Since environment is a broad-ranging, multi-disciplinary subject, a comprehensive information system on environment would necessarily involve effective participation of concerned institutions/ organisations in the country that are actively engaged in work relating to different subject areas of environment. ENVIS has, therefore, developed itself with a network of such participating institutions/organisations for the programme to be meaningful. A large number of nodes, known as ENVIS Centres, have been established in the network to cover the broad subject areas of environment with a Focal Point in the Ministry of Environment & Forests. Both the Focal Point as well as the ENVIS Centres have been assigned various responsibilities to achieve the Long-term & Short-term objectives. For this purpose, various services has been introduced by the Focal Point. ENVIS due to its comprehensive network has been designed as the National Focal Point (NFP) for INFOTERRA, a global environmental information network of the United Nations Environment Programme (UNEP). In order to strengthen the information activities of the NFP, ENVIS was designated as the Regional Service Centre (RSC) of INFOTERRA of UNEP in 1985 for the South Asia Sub-Region countries.

Programme on Environment Management Capacity Building (EMCB) of the World Bank

What is ENVIS

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Ministry of Environment & Forests
ISBEID User Manual
Proceedings of Training ISBEID Workshop
ENVIS Workshop Proceedings May 2011.
Utilization Certificate for ENVIS Centres

About ENVIS

The Environmental Information System acronymed as ENVIS was implemented by the Ministry of Environment & Forests by end of 6th Five Year Plan as a Plan Scheme for environmental information collection, collation, storage, retrieval and dissemination to policy planners, decision makers, scientists and environmentalists, researchers, academicians and other stakeholders.

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जिला नगरीय विकास अभिकरण (डूडा), वाराणसी

उ. प्र. शासन की लोक कल्याणकारी कार्यक्रमों की श्रृंखला में राज्य नगरीय विकास अभिकरण (सूडा), लखनऊ द्वारा शहरी गरीबी उन्मूलन हेतु विभिन्न योजनायें संचालित है। जिला नगरीय विकास अभिकरण, वाराणसी द्वारा निम्नलिखित उपलब्धियां हासिल की गई है–

1. **स्वर्ण जयंती शहरी रोजगार योजनाः**– स्वर्ण जयंती शहरी रोजगार योजना में वित्तीय वर्ष 2012–13 एवं 2013–14 में निम्नलिखित उपघटकों यथा शहरी स्वरोजगार कार्यक्रम में 315, शहरी महिला स्वसहायता कार्यक्रम में 148, शहरी महिला स्वसहायता कार्यक्रम में 70, शहरी गरीबों के बीच रोजगार बढ़ाने के लिए कौशल प्रशिक्षण में 2392 एवं शहरी सामुदायिक विकास नेटवर्क के अंतर्गत आर.सी.वी. और सी.एच.वी. को एक दिवसीय सशक्तिकरण सम्मेलन, तीन दिवसीय सुदृढ़ीकरण एवं क्षमता वृद्धि प्रशिक्षण कार्यक्रम एवं आर.सी.वी. के प्रशिक्षण कार्यक्रम में 2900 लाभार्थियों को लाभान्वित किया गया।
2. **राष्ट्रीय शहरी आजीविका मिशन (एन.यू.एल.एम.)** :– वित्तीय वर्ष 2014–15 से लागू इस योजना के अंतर्गत सूडा मुख्यालय लखनऊ द्वारा निर्धारित लक्ष्य के सापेक्ष लक्ष्य पूर्ण करने की सतत कार्यवाही की जा रही है। योजना के उपघटकों में समाजिक संघटन एवं संस्थान विकास, क्षमता निर्माण एवं प्रशिक्षण, कौशल प्रशिक्षण एवं सेवायोजन के माध्यम से रोजगार, स्वरोजगार कार्यक्रम, शहरी पथ विक्रेताओं को सहायता एवं शहरी बेघरों के लिये आश्रय योजना के अंतर्गत कार्यवाही प्रगति पर है तथा निर्धारित लक्ष्य पूर्ण कर लिया जायेगा।
3. जिला नगरीय विकास अभिकरण, वाराणसी द्वारा संचालित एवं क्रियान्वयन की जाने वाली अन्य योजनायें –
   - **बी.एस.यू.पी.**:– 28 मलिन बस्तियों में 5963 यूनिट आवास निर्माण एवं आधारभूर संरचनाओं के निर्माण हेतु 10 स्वीकृत परियोजना में से 6 परियोजना कार्यदारी संस्था उ.प्र. राजकीय निर्माण निगम, सूडा यूनिट, वाराणसी एवं 04 परियोजनायें की सी. एण्ड डी.एस., यूनिट 24 जल निगम, वाराणसी द्वारा क्रियान्वित कर रही है।
   - **राजीव आवास योजना** :– राजीव आवास योजनान्तर्गत वाराणसी के ''बजरडीहा, मुर्गियाटोला एवं फारूखीनगर'' के 822 निवासियों के आवास निर्माण हेतु परियोजना शासन द्वारा स्वीकृत हो गई है। इस योजनान्तर्गत निर्मित होने वाले आवासों में दो रूम, किचन, बाथरूम एवं शौचालय का प्राविधान है। प्रति यूनिट लागत रू. 3.725 लाख है।
   - **आसरा योजना** :– राज्य सरकार द्वारा वर्ष 2012–13 में नवीन योजना आरम्भ कर शहरी क्षेत्रों में अल्पसंख्यक बाहुल्य बस्तियों तथा मलिन बस्तियों में कम लागत के रिहायशी मकान चयनित पात्र लाभार्थियों को उपलब्ध कराने हेतु की गयी है। वाराणसी के अक्था, जोल्हा, सरायडगरी एवं ऐढ़े में कुल 216 आवासों की परियोजना स्वीकृति हेतु प्रेषित की गयी है। आवास में एक आवासीय कक्ष, एक बरामदा, एक रसोई घर, शौचालय एवं स्नान घर की सुविधा प्रदान की जायेगी।
   - **निजी स्वामित्व के रिक्शा चालाकें से उनकी मानव चालित रिक्शा लेकर उन्हें मोटर/बैटरी चालित अत्याधुनिक सिस्टम से निर्मित रिक्शा मुफ्त प्रदान किये जाने की योजना** :– पंजीकृत रिक्शा चालकों को उनके मानव चालित रिक्शा के बदले बैटरी/मोटर चालित रिक्शा प्रदान किये जाने की लोक कल्याणकारी योजना प्रारम्भ की गई है। इस योजनान्तर्गत ऐसे समस्त निजी स्वामित्व के रिक्शा चालक लाभान्वित होंगे, जो प्रदेश के नगर निगम/नगर पालिका/नगर पंचायत क्षेत्र के निवासी होने के साथ–साथ संबंधि नगर निकाय में औपचारिक रूप से 31.03.2013 तक पंजीकृत होंगे। जांच की कार्यवाही कर नगर निगम वाराणसी से 50 एवं छावनी परिषद वाराणसी से 28 कुल 78 रिक्शा चालकों की सूची भेजी गई है।
   - **शहरी क्षेत्रों के अल्पसंख्यक बाहुल्य बस्तियों तथा मलिन बस्तियों में सी.सी. रोड अथवा इण्टरलाकिंग, नाली निर्माण व अन्य सामान्य सुविधाओं की स्थापना योजनाः**– नगर निगम, वाराणसी क्षेत्र की 75 विभिन्न अल्पसंख्यक बाहुल्य बस्तियों तथा मलिन बस्तियों में इण्टरलाकिंग, नाली निर्माण व अन्य सामान्य सुविधाओं के कुल 37 कार्य आरम्भ है। जिसे शीघ्र पूर्ण करा दिया जायेगा।

(के.एस.परिहार)	(उमाकान्त त्रिपाठी)	(प्रांजल यादव)
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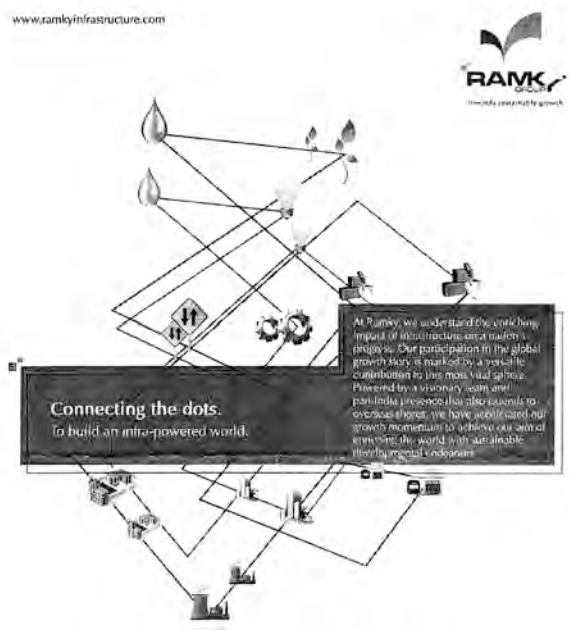

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आदर्श एजुकेशन सोसाइटी (रजि0) वसुन्धरा गाजियाबाद में लार्ड कृष्णा पब्लिक स्कूल (मान्यता प्राप्त) चला रही है। जहां पराश्रित, गरीब, पिछडे, दलित, अल्पसंख्यक, विकलांग आदि बच्चों को निःशुल्क शिक्षा दी जा रही है। संस्था का उद्देश्य समाज में शिक्षा से वंचित बच्चों की शिक्षा दिलाने व उनके सर्वांगीण विकास कराना है। संस्था सन 2001 से हर वर्ष निःशुल्क स्वास्थ्य परीक्षण कैम्प लगाकर बच्चों का सम्पूर्ण चैकअप कराती है। संस्थान बच्चों को शिक्षा के प्रति आकर्षित करने के लिए मेधावी बच्चों को आर्थिक मदद भी करती है।

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मा. आजम खाँ
नगर विकास मंत्री, उ.प्र.

शिकायत प्रकोष्ठ : जनता की सुविधा हेतु पूरे सप्ताह, 24 घण्टे कार्यरत।

कम्प्यूटरीकृत टैक्स कलेक्शन : जनता की सुविधा हेतु कम्प्यूटर से टैक्स जमा होता है।

मा. मुख्यमंत्री घोषणा : नगर के सौफुटा मार्ग, गांधी उद्यान से चौकी चौराहे होते हुए चौपला तक सड़क निर्माण चौराहे से बरेली कॉलेज तक होते हुए फोर लेन कार्य प्रगति में।

लोहिया पार्क : श्रद्धेय राममनोहर लोहिया की स्मृति में उनकी प्रतिमा लोहिया पार्क का सौन्दर्यकरण कराकर स्थापित करायी गई।

विभिन्न चौराहों का चौड़ीकरण : सिकलापुर चौराहा, श्यामगंज चौराहा चौड़ीकरण कार्य पूर्ण।

आर.सी.सी. डिवाईडरः प्रभा सिनेमा रोड, सर्किट हाउस रोड, स्टेशन रोड, चौपला रोड, स्टेडियम रोड आर.सी.सी. से डिवाईडर के निर्माण कार्य प्रगति पर।

हॉट मिक्स मार्ग : नगर में 114 मार्गो का हॉट मिक्स पद्धति से 14 करोड़ की धनराशि व्यय करके निर्माण कार्य अन्तिम चरण में।

जलापूर्ति : 39 करोड़ की धनराशि व्ययकर, 32 नये नलकूपों का निर्माण 236 किमी. लम्बाई में नहीं पानी की लाईन।

सीवर : 185.87 लाख की धनराशि व्ययकर 1670 मीटर लम्बाई में नई सीवर लाईन का कार्य पूर्ण।

नये वाहन : 218 लाख की धनराशि व्ययकर जे.सी.बी. मशीन लोडर, चेन एक्सेवेटर, टिपर ट्रक, ट्रैक्टर हाईड्रोलिक महिन्द्रा थ्री–व्हीलर, छोटी चेन एक्सेवेटर क्रय किये गये।

पथ प्रकाश व्यवस्था : 1 करोड़, 32 लाख व्ययकर 4200 नई सोडियम लाईटें व पुरानी लाइटें व हाई मास्क लाईटें सही करायी गयी।

सॉलिड वेस्ट प्लांट : 33 करोड़ की धनराशि व्यय करके प्लांट शुरू कराया गया, तकनीकि एवं विधि बाधाओं के दूर होते ही पुनः प्रारम्भ कराया जायेगा।

अन्य विभागों का सहयोग : बी.डी.ए. एवं आवास विकास परिसर द्वारा 26.90 करोड़ की धनराशि से नगर के मुख्य मार्गों का हार्ट मिक्स से निर्माण।

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1. नया कार्यालय भवन–धनराशि स्वीकृत।
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3. हजियापुर, संजयनगर, जोगीनवादा क्षेत्र की जल निकासी हेतु नये सम्पवेल की स्थापना।
4. पार्कों का सौन्दर्यकरण 1 करोड़ धनराशि स्वीकृत।
5. बदायूँ रोड, पीलीभीत बाईपास, परतापुर चौधरी, चौपुला रोड मुख्य मार्गों पर आर.सी.सी. से नाला निर्माण धनराशि आवन्टित।
6. टू लेन से फोरलेन– चौकी चौराहा से चौपला चौराहा तक, प्रेमनगर से सूद धर्मकांटा से डेलापार चौराहा तक, आई.वी.आर.आई. रोड, सलैक्शन टॉवर से शील चौराहा तक, परसाक्षेड़ा से किला ब्रिज तक।
7. फ्लाई ओवर–श्यामगंज चौराहे से शहदाना तक फ्लाईओवर।
8. चौराहों का सौन्दर्यकरण–पी.पी.पी. मोड के अंतर्गत सैलेलाईट, चौकी चौराहा, पटेल चौक, चौपला चौराहा, वियावानी, बीसलपुर चौराहा, नावल्टी सूद धर्मकांटा, श्यामगंज, शील चौराहा, डी.डी. पुरम, एकतानगर डेलापीर तालाब।
9. कामधेनु नगर– बी.डी.ए. के सहयोग से सभी डेयरियाँ शहर से बाहर शिफ्ट होंगी।
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Remediation of Ground Water Contaminated with Hexavalent Chrome at Lohianagar, Ghaziabad

Lohianagar is a residential colony of Ghaziabad. The Ground water of Lohia Nagar is contaminated with hexavalent chromium varying from 2.1 mg/1 to 16.3 mg/1 against permissible limot of 0.05 mg/1 for drinking water.

After hydrological study of the affected area following two methods were implemented for remediation of ground water.

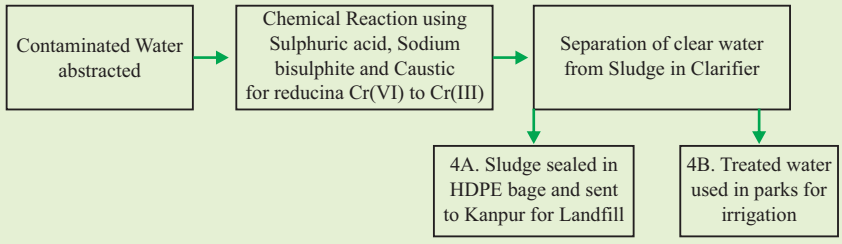
- Pump & Treat method
- Bio-remediation

1. Pump & Treat system

Remediation Plant operational since Jan 2012

Trivalent chrome sludge

The process sequence followed for treatment of ground water is shown below :



2. Bio-Remeidation

For faster remediation, a bio-culture was developed and patented by I.I.T.-Madras, who have MOU with Anant Udyog for implementing the project. This bio-culture is injected through feed wells (48 nos) installed at various locations surrounding the contaminated area. (Feed well is made by drilling and inserting 4" dia pipe into the ground up to 250 feed deep). Nutrient with water is fed into the feed well every 10 days, so that the bio-culture can grow. Monitoring is done for hexavalent chrome, pH and odour at every 10 days. The bio-culture reduces the hexavalent chromium to trivalent chromium which remains in undissolved condition into the soil. The water eventually becomes free of the hexavalent chromium. This process was implemented from 5th May 2013 onwards.

For effective bio-remediation, it is required that no ground water withdrawal should be done during bio-remediation period otherwise the bio-remediation process will not work efficiently and remediation period may increase due to the contaminated water drifting in uncontrolled condition.

After 2.5 years of operation, 128 Ton trivalent Chromium Hydroxide Sludge has been extracted and sent to authorized TSDF, Kanpur for secured landfill. There is a reduction of 40-45% in hexavalent chrome level in ground water which is less than our initial target of 70-75% because in-house submersibles were not stopped which was the requirement of bio-remediation process.