IGCS BULLETIN

From the Editors' Desk

Dear Colleagues,

Since our last bulletin in July 2012, the IGCS has grown. We are now very happy to have Visiting Professors in all four research fields of IGCS, namely water, waste, energy and land use. Dr. Christopher Martius, who joined us at the end of August will stay till November and return to relocate to Chennai around January 2013. His mandate at the IGCS is to bring land use expertise to the team, develop research towards the introduction of conservation agriculture and carry out investigations on challenges to land use in the transformation to a biomass-based economy.

During summer we had two exciting Summer Schools – one at TU Berlin and another at IIT Madras – focusing on sustainability and energy systems and integrated water management, respectively.

The next important IGCS event – apart from the regular IGCS lectures – will be a Winter School in February 2013 focusing on sustainability and growth in peri-urban areas of southern Chennai (see IGCS Teaching on page 10).

Apart from IGCS news, this Bulletin has two interesting features: The first summarizes the findings of the "Sustainable Water and Waste Management in Chennai Basin" project carried out by IGCS members. The second provides a student's perspective on the IGCS summer school in Berlin.

Enjoy reading - yours sincerely,

P. Fiener, K. Steger, S. Petrak & C. Martius

IGCS
INDO-GERMAN Centre for SUSTAINABILITY

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IGCS Lecture Series

October 8, 2012

Dr. Srikanth Mutnuri (Birla Institute of Technology and Science, Zuarinagar, Goa) will deliver a lecture focusing on Biodegradation of Hydrocarbons by Enhancing Bioavailability using Cyclodextrins.

November 5, 2012

Our new IGCS visiting professor for land use, Dr. Christopher Martius, will make a presentation of his previous research activities.

Sustainability Conferences

Select International Conferences focusing on Sustainability

25-27 October 2012, Goregaon, Mumbai

8th Biennial International Workshop Advances in Energy Studies Energy Security and Development - The Changing Global Context Details at *http://oii.igidr.ac.in/forms/conf2012/IGIDR-oct25-27-2012.htm*

26–30 November 2012, New Delhi

Third International Agronomy Congress on Agriculture Diversification, Climate Change Management and Livelihoods Details at *http://www.isa-india.in/*

20 - 23 January 2013, Singapore

2nd Water Research Conference Details at *http://www.waterresearchconference.com/*

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IGCS News

IGCS Lecture Series

Since the beginning of the new academic year we've had an extended series of interesting lectures by highly reputable speakers visiting IGCS.

- Dr. Brajesh Dubey (Guelph, Canada) started with a lecture on sustainable resource management. Dr. K. Schneider's talk (Cologne, Germany) focused on environmental modeling and remote sensing.
- Dr. L. Tranvik's (Uppsala, Sweden) lecture dealt with the importance of lakes within the global carbon cycle.
- Around the end of August, Dr. S. Petrak, gave a lecture on solar resource assessment and biophysical economics.
- Mid-September we had an inspiring lecture by Dr. M. S. Wong (Houston, USA) dealing with groundwater remediation.

The lecture series will continue through the last quarter of the year. As always, the lecture will take place at 4 p.m. in the Visveswaraya Seminar Hall at the Civil Engineering Department of IIT-M. Further details and an invitation will be sent via the IIT-M 'Announce' mailing list. For those not on the IIT-M list but interested in receiving details and invitations for the lecture series please send an e-mail to fiener@igcs-chennai.org

Steering Committee Meeting

Prof. Behrendt (Area Coordinator Energy) hosted the IGCS Steering Committee Meeting this time at our partner university TU Berlin.

Erratum (Conferences – Workshops)

In the last issue of our bulletin (No. 3, July 2012) the Solar Workshop on Large Scale Grid-Connected Photovoltaic Power Plants was erroneously listed under the heading of IGCS Conferences - Workshops.

The editors would like to clarify that this workshop was organized solely by the Electrical Engineering Department of IIT-M and its partners and did not involve the IGCS.

We sincerely apologize for any confusion that may have resulted from this.

Features

Sustainable Water and Waste Management in the Chennai Basin

Prof. Ligy Philip and Prof. B.S. Murty
Environmental and Water Resources Engineering Division (EWRE) at IIT Madras

Introduction

Sustainable cities are fundamental to social and economic development. As stated by the National Planning Commission, sustainability is not an option but has become imperative. For a better world to live in, we need clean air, pure water, nutritious food, healthy environment and greenery around us. Without sustainability, environmental deterioration and economic decline will feed on each other leading to poverty, pollution, poor health, political upheaval and unrest. In India we have to improve our economic growth rate, provide basic minimum life support services to a large section of our population and deal with the problems of poverty and unemployment. At the same time, we have to pay attention to conserving our natural resources. Environmental deterioration is not a necessary or inescapable result of urbanization; what needs to be done is to strike the right balance - development in such a way that it is effectively attuned to environmental opportunities and constraints. This calls for a holistic and interdisciplinary approach to tackle the multitude of interactions between ecological, social and economic needs.

This feature presents the preliminary results of an interdisciplinary project focusing especially, but not exclusively, on sustainable water and waste management in the Chennai basin. The objective of the study is to evolve sustainable management practices for effective utilization of water resources in the entire Chennai basin for different uses, while focusing the attention on both water and waste management in the Adyar sub-basin. Studies for Adyar sub-basin will involve sustainable management of (i) wastewater (ii) flood water disposal and water quality, (iii) air quality, (iv) solid waste, and (iv) the Pallikaranai wet land. The interactions between the different components taken into account are illustrated in Fig. 1.

Sustainable water resources management

(This part of the study was carried out by K. Srinivasan, Balaji Narasimhan, K. P. Sudheer and G. Suresh Kumar.)

Due to the increase in population, urbanization and changing life styles, the municipal water demand of the Chennai Metropolitan

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31 January - 2 February 2013, New Delhi
13th Delhi Sustainable Development Summit
Details at *http://dsds.teriin.org/2013/index.php/component/content/article?layout=edit&id=22*

8 - 9 February 2013, New Delhi
International Humboldt College on Management of Water, Energy and Bio-resources in Changing Climate Regime: Emerging Issues and Environmental Challenges
Details at *http://knowledgesteez.wordpress.com/2012/09/20/jnu-humboldt-kolleg-international-conference-on-management-of-water-energy-and-bio-resources-in-changing-climate-regime/*

12 - 13 October 2013, Maharashtra
National Seminar on Managing Land Resources in Sustainable Agriculture
Details at *http://www.isslup.org/*

Sustainability Literature Updates

Literature

Bell, S. & Morse, S., 2008. **Sustainability Indicators: Measuring the Immeasurable?** Revised and Upd., Taylor & Francis Ltd.

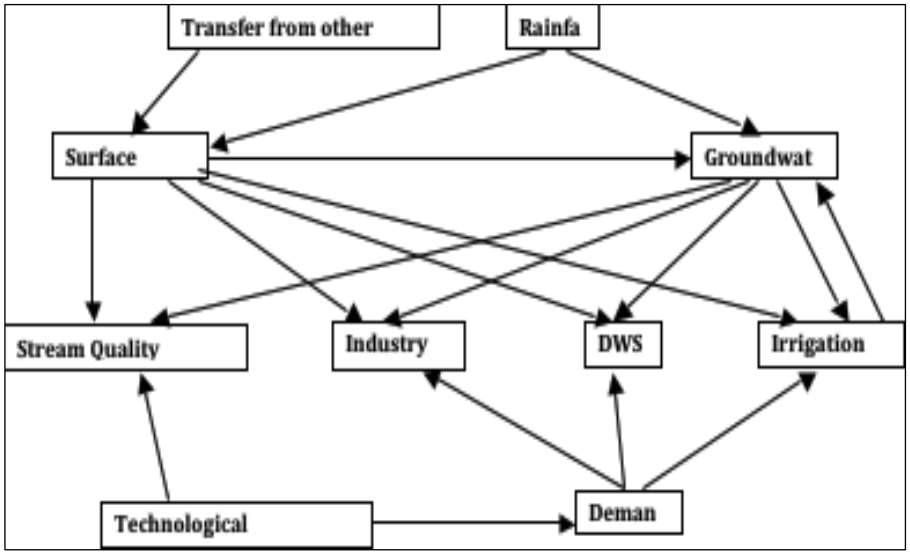

Figure 1: Schematic representation of interactions for water allocation in a sub-basin

Area (CMA) is poised to increase by 600 MLD from the current 1630 MLD. In contrast, the existing water supply source can safely yield only 1535 MLD. Therefore, there is an urgent need to study the sustainability of existing water supply resources, identify alternate sources, promote conservation technologies for irrigation and municipal water, and improve water harvesting through watershed management. This requires an integrated water resources management approach leading to sustainable river basin planning and management. Towards achieving this goal, a reliable and scientific assessment of the available surface and ground water resources in the Chennai basin (Fig. 2) has to be carried out. Hence, the objective of this sub-study was: (i) Development of a GIS database including weather, soil, land cover,

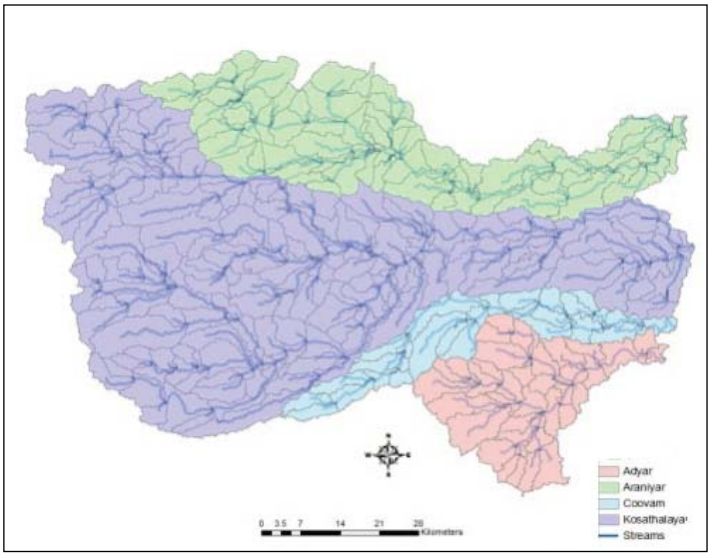

Figure 2: Chennai River Basin.

topography, drainage networks, geology and surface water bodies and (ii) gross estimates of annual and seasonal virgin yield for the Chennai basin using the Soil and Water Assessment Tool (SWAT). Necessary data sets needed for the study have been collated. A first cut assessment on the available water resources in Chennai river basin (spatially and temporally) is underway.

Management models for water quality in a tidal river

(This part of the study was carried out by B.S. Murty and Moltot Zewdie.)

The objective of this sub-project is to develop a model for managing water quality in a tidal river such as the Adyar river. The management model uses a simulation-optimization framework wherein a model describing the transient flow and transport processes is externally linked. Alternative management models are developed to ensure efficient and cost effective pollution control strategies for maintaining the water quality downstream of the pollution discharge points. An attempt is made to use the single objective optimization model for evaluating several alternative strategies for maintaining water quality in Adyar River including the creation of an upstream environmental reservoir, and using optimal releases from this reservoir, to maintain a minimum DO standard.

Wastewater management

(This part of the study was carried out by Ligy Philip and Bhuvanesh Kumar.)

Despite the high pollution levels, boating and fishing do take place in Adyar river. It carries high flood discharge for a short period of 2 months during the monsoons but the urban drainage and sewerage provide a continuous flow throughout the year, which makes it a major pollution threat to the city and the nearby coastline. Urban pollution, mainly contributed by wastewater disposal from within the city limits and industrial effluents entering the river through several outlets, make Adyar river one of the most polluted rivers in India. The overall aim of this sub-project is to improve the quality of water in all the waterways in Chennai and to ensure ecological base flows in the rivers through sustainable wastewater management. The river stretch has been divided into 20 sections for the monitoring work. The quality of water and out falls in each section were monitored twice to get necessary information to decide the sections where the interventions are essential. The data pertaining to population in Adyar river basin, water supply, wastewater generation, wastewater treatment plants capacity, and extend of treatment in each plant was collected. Based on this information along with data about topography and land availability, possible locations for wastewater treatment plants were identified based on the topography and land availability. Information regarding the industries located in Adyar River basin also was collected. Various available treatment technologies for wastewater management were also evaluated.

Air quality management

(This part of the study was carried out by S.M. Shivanagendra and R. Ravi Krishna.)

In this sub-project, an attempt has been made to understand the source emission and air quality trend and suggestions were made for the air quality improvement in Adyar basin in Chennai city. Emission from vehicles is the main source of air pollution in Chennai city followed by industrial and domestic combustions. In addition, stagnant water bodies with high concentration of organic matter also contribute a significant amount of CH_4, CO_2 and NO_2. The important pollutants namely PM10, SO_2, NO_2, VOCs and CH_4 were monitored at four locations representing residential, traffic, industrial and background sites between October 2010 to January 2011. PM10 concentrations at traffic sites were found to exceed NAAQS limit. The SO_2 and NO_2 concentrations at the study sites were found to be well below the specified 24-hr average NAAQS limits. The analyzed CH_4 data showed high

concentrations (1 ppm) during morning and afternoon hours. The study confirms that motor vehicle emission is the main source of emissions at the Adyar Basin.

Baseline monitoring Pallikaranai marshland

(This part of the study was carried out by Indumathy M. Nambi, R. Ravi Krishna, G. Suresh Kumar and Raja Ganapathy.)

Objectives of this sub-project are: (i) to study and assess the surface and subsurface water quality in and around Pallikaranai marsh land, (ii) to study and monitor sediments and plant species to quantify contaminant accumulation in and around Pallikaranai marsh land, and (iii) to quantify the flows coming into Pallikaranai marsh land through surface and subsurface. Following are conclusions from studies conducted so far: (i) Water quality of the surface water samples is unacceptable in all the sampling locations. Ground water samples also do not meet the drinking water standards in 5 out of the 7 locations; (ii) ground water levels were fairly high throughout the year. Ground water flow direction was observed to be from North to South eastern side, which indicates further migration of the pollutants to the southern suburbs of Perungudi and Karapakkam. The Saibalaji and Saibaba Nagar are newly developed. Domestic wastewater is mixed with wetland, causing deterioration of water quality. The wetland surface water flow was north to southeast side. A dumpsite is located on northern side from sampling sites. It is evident that the dumpsite waste is mixed with marsh land. Ground water is also affected by leachate from the dumpsite. Total organic carbon and nitrogen percentage was high in all the sites in spite of the growth of reeds and other aquatic plants. Many organic compounds were present in two of the three compartments. This will have serious long term implications on the flora and fauna in the marshland.

Solid waste management

(This part of the study is being carried out by A. Dali Naidu.)

The objective of the sub-study is to evaluate the suitability of the locally available geomaterials as a cover and liner material, based on their hydraulic and sorption characteristics. For this purpose, the sorption characteristics have been determined using both batch sorption and laboratory column flow through experiments. Further, attempts were made to propose the generalized relationship to predict the equivalent column sorption characteristics of various geomaterial for different heavy metals based on the measured sorption parameters from the batch sorption experiments. The study cautions against the utilization of locally available low permeable clayey soils as cover and liner material without understanding their sorption characteristics, as the sorption characteristics only determines the long term performance of the liner in terms of contaminant impact on the surrounding environment.

Closure

The IIT Madras Research Foundation has provided the seed money for initiating this project. While the present work continues, several new proposals are also being formulated in this direction for further possible funding from external agencies. Going forward, the emphasis will be on analyzing the social, economic and political context of the Adyar basin alongside changes in its hydrological and environmental dimensions over the past two decades. This project will be an attempt to help arrive at meaningful policies for basin management.

IGCS Summer School in Berlin

A Student Perspective of the Summer School in Berlin

Aviraj Datta and K.K. Sreejus IIT-M

The IGCS Summer School on Sustainable Energy Resources held in Berlin gave us a unique opportunity to get a firsthand experience on the very relevant contemporary topic of sustainable solar energy uses. For a fast growing developing economy such as India, sustainable energy resources for the coming decades, is a major challenge. It is up to our generation to come with solutions to meet this challenge. As Germany is a highly developed nation, with renowned expertise in technology, an Indo-German dialogue on the said topic invariably works as a platform to share ideas and experiences. The German energy scenario is going through a challenging phase as it is striving to find alternatives to the long trusted nuclear energy. The lectures at the summer school covered all aspects of non-renewable energy sources. All lectures touched upon the very latest in the respective technologies. Although it's difficult to pick one particular lecture as a favourite, the discussion on nuclear energy was enriching in that it dealt with the latest about the current state of fission and fusion reactors. The fact that fusion cannot make a contribution to electricity supply before the second half of this century was put forward by Dr. Alex Bradshaw in his lecture on the topic.

An interesting talk on the feasibility of small-scale vertical wind turbines was interesting and conceptually new. The really impressive part was that the researchers came up with a wind availability map for Berlin city, identified proper locations for installation, designed the proper dimensions of the turbine-blades through CFD modelling, actually installed them in five locations and generated data for about hundred odds days within a short period of two years. This revealed the pace at which it is possible to carry out research work in Germany.

One particular lecture, which was very popular among all students, was the lecture on hydroelectric power by Prof. B.S. Murty. We learnt many new things about hydroelectric power in that single fifty-minute lecture. The lecture fine-tuned our perceptions of hydroelectric energy.

The group project was on Performance, Economic and Environmental analysis of a 5 MW Solar PV power plant for Chennai and Berlin City. The group comprised a diverse set of engineers, some with specialization in environmental engineering and others with specializations in mechanical and energy technology. The project gave us the opportunity to learn about the economics of a solar PV for the given two cities. We formed sub-groups within the group; each sub-group of two persons was responsible for economic analysis, design calculations and carbon foot print calculation. Being part of this project, I gained knowledge outside my core study area, especially in economic analysis and how to make the basic design of a solar PV plant.

The industrial visits to Vattenfall and BSR were both very interesting. Thanks to Martin's bilingual skills, we didn't face the problem of communication during these visits. More than the superior engineering and regulations in place at these facilities, the firsthand experience of a noise-less power plant at Vattenfall needed to be experienced to be believed.

Surely our experience in Germany was much more than classroom lectures and technological revelations. From the moment we reached the TEGEL airport right up to the time of departure, the entire experience was something to cherish. From the welcome dinner at the Yogi House restaurant to the relaxing boat trip around Berlin, the summer school was full of fun times. Special thanks to Balin, Tim and Christina for helping us with every small detail, like compatible power plugs that we needed to transport know-how around Berlin. They were there to help us at each

Group photo of the summer school at TU Berlin.

moment of need. As this was the first international trip for many of the Indian students, we were each thrilled with different aspects of Germany. While the Mercedes showroom in Berlin mesmerized some of us, others just loved the historic places around Berlin. Personally, for us, the most unforgettable memory of Berlin was the wonderful people we met there, as research colleagues, faculty, and fellow professionals.

Special mention must be made of one student, Nitya who is unique because of his own distinctive vision of life and his passion for a better world.

IGCS Research

Thimmapuram project

Our research project at the Thimmapuram Lake focusing on coupled terrestrial and aquatic carbon fluxes continues. In August, together with our visitor, Dr. L. Tranvik, one of the leading lake experts of Europe, we collected more samples for study from the lake.

IGCS second project phase

The first phase of our joint Indo-German project IGCS ends on 31/12/2012. Despite some delay in starting the project, now all IGCS visiting professors have settled down at IIT-M. German funding for the second phase should be officially confirmed within the next few weeks and we are looking forward to expanding and improving our performance at the centre.

Swimming Lab at the Thimmapuram lake

IGCS Courses and Faculty

IGCS Teaching

Over the last three months our teaching activities have been mainly focused on the two summer schools.

***IGCS Summer School* - Berlin, 08/07/2012 – 18/07/2012**

Meeting the challenges of advanced energy systems for the Future

The Summer School hosted by TU Berlin was organized by RWTH Aachen, TU Berlin and IGCS, and was funded by the German Academic Exchange Service (DAAD). Ten Indian and ten German participants had an intensive learning experience with lectures, project works and field visits. Students' impressions are given in the features section.

***Indo-German Summer School* - Chennai, 13/08/2012 – 03/09/2012**

Integrated water resources management in rural areas

The Summer School hosted by IIT-M and organized by the Department of Hydrology and Water Resources Management, Kiel University, the Environmental and Water Resources Engineering (EWRE) division at IIT-M and IGCS, was funded by the DAAD. Over a period of three weeks, twenty participants from all over India and up to ten teachers discussed issues of integrated water management in rural areas. The summer school was a great success and students presented their own modeling results.

Group photo of summer school teachers and students during a field trip to Krishnagiri

***IGCS Winter School* - February 25 - March 10, 2013**

Growth and Sustainability in a highly dynamic city - Exploring the urban development in Southern Chennai

The winter school will explore urban development in the city of Chennai, a bustling Indian metropolis with about 8 million inhabitants, a burgeoning car industry and an urban area rapidly expanding into the outskirts.

Chennai represents an excellent "field laboratory" for such a course. Students will study the potential and risks of urban development. They will be introduced to the theory and practice of interdisciplinary research on biophysical, economic and social drivers and constraints of urban sustainability. The program will consist of a series of key lectures by highly renowned scholars in the field from India and Germany, coupled with hands-on field research in the city, done by the students in work groups.

IGCS Staff & Scholars

Dr. Christopher Martius joined the IGCS in August 2012. He holds a Ph.D. in Biology (University of Göttingen, Germany) and is Lecturer in Agro-ecology at the University of Bonn. He has worked for more than ten years in the Center for Development Research (ZEF) at the University of Bonn, where he has guided some 25 Ph.D. students. He has also managed an international, interdisciplinary project on land and water resource management Central Asia. From 2009 to 2011, as Assistant Director for Science Programs at the Inter-American Institute for Global Change Research (IAI) in Brazil, he coordinated scientific collaboration on climate change issues in the American hemisphere. Before this, he has headed the joint CGIAR/ICARDA Program for Sustainable Agriculture in Central Asia and the Caucasus, in Tashkent, Uzbekistan, a program that won the "CGIAR King Baudouin Award for Outstanding Partnership" in 2008. Christopher has over 20 years of work experience in tropical ecology (Brazilian Amazonia, Africa) and in dry lands. His research interests are land management and climate change, development of integrated concepts for improving sustainability of land use and management of biological soil resources. He has published about 100 articles on tropical ecology, nutrient cycling, soil ecology and biodiversity in scientific journals, and has authored many policy briefs and other public communications. He is co-editor of several scientific books, most recently "Cotton, Water, Salts and Soums: Economic and Ecological Restructuring in Khorezm, Uzbekistan" (Springer, Dordrecht; 2012).

At the end of October, Katrin Premke (IGB, ZALF) will visit us again as IGCS Fellow to carry out another field survey at the Thimmapuram lake (Krishnagiri district).

We have also had to say goodbye to several of our IGCS fellows and scholars. Florian Wilken who worked on land use change analysis via remote sensing went back to Cologne to finish his Master's thesis. Alexander Strehmel who started his PhD at IGCS joined University Kiel (Germany) to improve his modelling skills within a larger project in China. And finally, Tom Gottfried who worked with us in the field of spatial distribution of soil carbon returned to Munich in September.

Conferences

The SSTCN (Students' Sea Turtle Conservation Network) in association with the IGCS organised a two-day Students' Symposium on Marine Conservation on the 28th and 29th September 2012.

The Students Sea Turtle Conservation Network (SSTCN) is a voluntary organization that has been carrying out turtle conservation on the beaches of Chennai since 1988. Over all these years, mainly students, with great dedication and passion, have carried on the turtle conservation work.

In 2013 the SSTCN will complete 25 years. To celebrate its silver jubilee they collaborated with IGCS and organized an inter-collegiate event involving students to discuss the future of marine conservation.

The two-day event had experts in the field sharing knowledge and expertise with the students and students interacting amongst themselves and coming up with new perspectives and ideas.

Nityanand Jayaraman, environmental activist, Shekar Dattatri, activist and wildlife filmmaker, Vivekanandan, National fishworkers forum, Dr. Kartik Shanker, Researcher and founder member of the SSTCN were some of the experts who participated in this two-day workshop.

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