

IGCS BULLETIN

From the Editors' Desk



Dear Readers,

It would be an understatement to say that the last month was turbulent. Demonetization (Nov 8th), Honorable Chief Minister Jayalitha's demise (Dec 5th), and cyclone Vardah (Dec 12th) are testing the resilience of people in India, Tamil Nadu and Chennai, the latter coping with all three events accumulated.

The next reason why this issue comes out rather delayed is that I, Christoph Woiwode, will leave the IGCS as long-term Visiting Professor at the end of this year. It has proved very difficult to wrap up home with family

and job after more than three years with so much disruption. However, I will continue working with the IGCS from my new base at Bath Spa University in the United Kingdom and promise to be a frequent visitor at IIT Madras and Chennai in the future.

Apart from this, this bulletin demonstrates that the IGCS is as vibrant as ever. We held several workshops, were present at the Cityscapes Conference in New Delhi and UN Habitat III Conference in Quito, among others.

Thanking you,
**B S Murty and
Christoph Woiwode**
Editors

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Prof. B. S. Murty



Prof. Chr. Woiwode

IGCS NEWS

3rd Multi-stakeholder Workshop on Peri-urban Dynamics of Sriperumbudur

Around 20 participants including former Government officials from Chennai Metropolitan Development Authority, academics, civil society groups, research scholars and students joined this workshop on August 25 at ICSR in IITM. Prof. Sudhir Chella Rajan, coordinator of IGCS and principal investigator, introduced the status of ongoing research on 'Peri-urban Dynamics and Sustainability: A case study of Sriperumbudur' to participants. He

was joined by Dr. Christoph Woiwode, IGCS Visiting Professor, who provided initial remarks on some of the ongoing work at IGCS.

The meeting was intended to both convey progress on the ongoing research and exploration as well as to solicit feedback from various stakeholders and partners. Senior staff of the project and masters students presented their research related to the project. The first presentation focused on understanding historicity of maps and how this could be applied to the case of Sriperumbudur to capture the various developments that had taken place over the years. The second was on understanding traditional water bodies and their potential for better water and disaster (flood) management in the region, especially in light of the recent Chennai floods, and trying to understand upstream-downstream dynamics. The third presentation addressed using agent-



based models as one tool for analysis, an area marked out for future research in our project.

There were also presentations made by institutions the project collaborates with – CSTEP, the partner organization in Bangalore also conducting research on peri-urban dynamics and one member of the GIZ team who described the goals of their project to study the feasibility of integrated land use planning in India. Tamil Nadu is one of two states that they focus on.

It was a successful meeting with rich discussions and feedback on the research which also brought out ways on what future directions to take.



1st Stakeholder Visioning Workshop in Sriperumbudur

The first 'stakeholder visioning workshop' held in Sriperumbudur on October 3, 2016, with our partner at the Rajiv Gandhi National Institute of Youth Development. The workshop aimed to bring together various stakeholders in the Sriperumbudur region – residents and local administrative officers, labour and youth empowerment groups – to share with them the findings of the research conducted by the IGCS team as well as to solicit their views on existing problems, solutions and visions they had for a future scenario in 2030 in Sriperumbudur.

The session opened with members of the IGCS team sharing their research findings, alongside a backdrop of on-going global changes in regions similar to that of Sriperumbudur. This was followed by a discussion with the stakeholders. Once the discussion session started, the participants were eager to share their understanding of the changes in the region through anecdotes. A local election had affected the participation, holding back mainly the youth, who had joined the festivities that accompany all local elections. A. Ramachandran, analyst and GIS expert with IGCS, opened the session with a presentation on the 'Evolution of Sriperumbudur'. Apart from such unusual occurrences that affect the residents once in a while, Ramachandran also highlighted issues such as

open defecation that adversely affect their daily lives.

Following Ramachandran's presentation, A.A. Amrutha, senior project officer at IGCS who works on data modeling, suggested ways of re-imagining a sustainable future through her presentation, 'Envisioning a Sustainable Future – Illustrative Examples'. She shared inspiring examples of sustainability from around India as well as across the world. Amrutha encouraged participants to re-think their future. The floor was then opened to the participants.

This productive session was followed by a more focused discussion, where the participants were divided into groups, with each group facilitated by at least one IGCS representative. Each group was then asked to deliberate on the positive and negative aspects of the changes in the region as well as how they would reimagine Sriperumbudur in 2030 based on themes such as educational reforms, livelihood, and political reforms.

While during the open discussion session, the participants shared specific personal anecdotes, the last session was designed to encourage the participants to think in terms of a larger picture and to see themselves as part of a larger society, in this case the region of Sriperumbudur.



IGCS at Cityscapes Conference in Delhi

The German House for Research and Innovation (DWIH), organized this Indo-German Conference from 29th Sep to 1st Oct at India Habitat Centre in New Delhi.

In collaboration with the resident representatives of TU Munich, Ms Hanna Kriebel, and Heidelberg University, Mr. Radu Carciumaru, Prof. Chella Rajan and Dr. Christoph Woiwode, IGCS Visiting Professor, hosted the session “For a future sustainable peri-urban India”. The main aim of this panel was to shift the focus of peri-urban development towards issues of their future perspectival development pathways. In the light of climatic change, it is essential not only to understand past and current drivers of urbanisation but also to identify various options of future scenarios, their implications and how they might be put to practice. The panel featured distinguished experts from both India and Germany, Prof. Dr. Peter Struss (TU Munich), Dr. Sumetee Pahwa Gajjar (Indian Institute for Human Settlements), Prof. Dr. N. Sridharan (School of Planning and Architecture), and Prof. Dr. Ashwani Kumar (CEPT University).

It was the first conference of its kind, bringing to-



gether a wealth of Indian and German scholars who work on issues of urban development. The wide spectrum was reflected in the topics that ranged from the transformative power of cities, smart energy and construction, the environment, migration, citizen's participation to cybersecurity and the social media.

Therefore it was just natural that this event provided an excellent opportunity for critical discussions, to meet colleagues and make many new contacts.



Panelists (l.t.r.): Prof. A. Kumar (CEPT), Prof. Struss (TUM), Prof. Sridharan (SPA), Dr. Gajjar (IIHS), Prof. Rajan (IGCS/IITM), Dr. Christoph Woiwode (IGCS/IITM)

IGCS at the UN Habitat III Conference in Quito

Habitat III is the United Nations Conference on Housing and Sustainable Urban Development that took place in Quito, Ecuador, from 17–21 October 2016. This was the third conference after Habitat I in Vancouver in 1976 and Habitat II in Istanbul in 1996. This Conference resulted in the document the New Urban Agenda aiming to create a pattern of sustainable urban development fostering a new model of city.

With funding from and in close collaboration with the team of Cities Fit For Climate Change (GIZ), IGCS hosted a Networking Event on 20th Oct. “Integrated urban planning for resilient cities: How cities can cope with the challenges of urbanization and climate change”. This networking session’s intention was to offer a space for delegates from cities to interact with and learn from each other various approaches to address the threat of climate change and climate related disaster risks.

The session was inaugurated by Dr. Daphne Frank, GIZ project director, with a welcome address by Dr. Oliver Weigel, Head of the Urban Development Division, Federal Ministry for the Environment, Nature Conservation. Dr. Christoph Woiwode, IGCS Visiting



At the German Pavillion

Professor, provided an introduction to the theme, drawing from the work of IGCS in Chennai. The following panel discussion, facilitated by Dr. Woiwode, saw lively interaction between the four invited speakers from India, South Africa, Chile, and Germany, representing some of the partner cities or countries in the CFFCC project to meet for the first time.

Habitat III provided a unique opportunity to interact with a global community concerned about sustainable urban development of the future.



Panelists during the Networking Event at the UN Habitat 3 Conference (l.t.r.): Torben Heinemann (City of Leipzig), Adrian Peters (eThekweni Municipality), Camila Sepulveda (Providencia), Kirtie Shah (India), Christoph Woiwode (IGCS)



Embrace Our Rivers - Chennai Water Forum

IGCS was invited to partner with and contribute to this unique event organized by the Goethe Institute Chennai between October 6—8 at Kalakshethra Foundation.

According to its Director, the Chennai Water Forum meant to be a multidisciplinary and participatory platform – open to everyone. Three days of workshops, discussions, presentations, exhibitions and concerts sought to a) bring together people from a cross-section of varied backgrounds as well as experts in water management; b) create a new dialogue on water, urbanization and ecology - in Chennai and beyond; c) change mindsets and imagination; and d) encourage action: for a city with clean water and beautiful rivers!

Prof BS Murty, IGCS Centre Coordinator, and Balaji Narasimhan made a presentation on “Practices/Experiences: What Lesson to be Learnt from Chennai Floods 2015”. The devastating floods last year have claimed many lives and caused enormous economic damages which have posed a challenge to the scientific community in developing a comprehensive understanding of the event. In cooperation with IIT Madras and IIT Bombay, IISC Bangalore published an assessment on the Chennai floods in 2015. The objective of the report is to provide a compilation of data and information along with an informed rapid assessment of the event based on

IGCS in the News..

Unscientific land use hits ecology: Experts

TNN | Oct 7, 2016, 04.14AM IST

CHENNAI: Successive state governments' disregard for land use based on credible hydrological data has put residents at the mercy of natural disasters. The damage cannot be undone unless a scientific urban planning formula is evolved, according to German research scholars.

Speaking at the Chennai Water Forum, German scholar Christoph Woiwode and his team of researchers pointed to the large scale industrial and residential expansion happening on the city's outskirts - Irungattukottai and the Sriperumbudur-Oragadam industrial belt - and said this had a severe impact on the use and distribution of water in the region.

"Sipcot is developing industrial estates, but is not looking beyond. The directorate of town and country planning grants building permits if projects comply with building regulations. This is a limited approach. We need to develop a regional scheme wherein we can know and understand which agricultural lands can be converted for residential or industrial purposes. We need to make a spatial plan on a larger scale. The solution lies in understanding this connectivity," he said.

Woiwode's team conducted a survey covering 300 households in Sriperumbudur in an attempt to formulate a flood management plan in conjunction with land use pattern observed in the area.

Source: <http://m.timesofindia.com/city/chennai/Unscientific-land-use-hits-ecology-Experts/articleshow/54726293.cms>

first-cut, untested results of preliminary analyses. It is prepared with a view to provide a rapid assessment of the event, useful for more rigorous scientific studies that should be taken up in the country to address the increasing urban flooding problems. The results of the report were presented at the Chennai Water Forum.

In a similar vein, Dr. Christoph Woiwode, IGCS Visiting Professor, together with Uthra Radhakrishnan, Arjun Bhargava and A. Ramachandran delivered an interactive workshop on “Perspectives on and Learnings from Urban Flooding”. This was concerned with the interface of urban development and flooding using the Chennai Flood 2015 as vantage point. In the workshop, researchers showcased their work on urbanisation and water conducted by the IGCS in Chennai, and then used maps for an interactive part to discuss issues about water in the region with the participants. The workshop was well received and drew also quite some interest by the media (see boxes).



IGCS in the News..

CMDA land plan change tied to Dec floods

By [C Shivakumar](#) | Express News Service | Published: 07th October 2016

CHENNAI: The devastation caused by the December last deluge was also partly due to the change in land use plans by Chennai Metropolitan Development Authority, according to water management expert Dr Christoph Woiwode, visiting professor at Indian Institute of Technology, Madras.

Experts believe that the redesignation of large tracks of land in the city, identified as low-lying in Chennai's First Master-plan, as residential areas in the Second Master-plan was a major cause for floods. "You build structures in the drainage system of the city, which is in low lying areas, and the flow of water gets blocked resulting in stagnation," he explained.

Woiwode is with the Indo-German Centre of Sustainability and is working on a project along with Professor Chella Rajan from the department of Humanities and Science in IIT Madras, funded by the Department of Science and Technology. The study is focusing on Sriperumbudur and Tambaram taluks, area characterised as low-lying Adyar river basin, the professor said. According to the study, Special Economic Zones designated by SIPCOT in Sriperumbudur had changed land use significantly. It has also found that capacity building regarding flood disaster risk management awareness in urban local bodies is hindered by the "regulatory-fuzziness" in peri-urban Chennai, and authorities do not enforce their responsibilities, he said. It was also found that hazard preparation in peri-urban Chennai is still based on Standard Operating Procedures (SOP) for responding to natural disasters.

However, the SOP does not cover long-term oriented mitigation measures. While blaming the failure to form State Disaster Management Policy though Tamil Nadu State Disaster Management authority was set up in 2008, he was also critical of the outdated Chennai Disaster Management Plan. "The city's master-plan also makes only fleeting remarks on flood risk management. There is a need to prevent filling agricultural land in low lying areas in peri-urban Chennai, and integrate water retention ponds into urban design," he said.

Source: <http://www.newindianexpress.com/cities/chennai/2016/oct/07/cmda-land-plan-change-tied-to-dec-floods-1525885.html?pm=home>

Upcoming IGCS Events

IGCS “Conference on Peri-urban Development: concept, emerging ideas, and notions of sustainability”, 27-28 January 2017 at IIT-Madras, Chennai

One major theme of the 21st century is intensifying global environmental changes, including climate change, with significant and often negative impacts on the environment, ecosystems, livelihoods, health and well-being. A second major theme is urbanisation, with the proportion of those living in cities and peri-urban areas projected to reach 66 per cent by 2050, with most of the million plus cities and megacities concentrated within the Indian sub-continent and China. This conference on peri-urban dynamics will examine various themes such as urbanisation, peri-urban ecosystems, water and their uses in the peri-urban, political frameworks and governance.

The conference is organized by IGCS and Centre for Study of Science and Policy, Bangalore, sponsored by the German Federal Ministry of Education and Research, Department of Science and Technology, and DAAD.

For further details kindly contact: Prof. Sudhir Chella Rajan at igcs@iitm.ac.in

News in Brief

7th International Sustainability Transitions Conference (Wuppertal, Germany)

Dr. Christoph Woiwode took part in the IST 2016 Conference by the Wuppertal Institute from 6-9 September, which coincided with the Institute's 25th Anniversary celebrations. Together with two colleagues from the German Development Institute in Bonn and the University of Lisbon, Christoph was a co-convenor of a dialogue session on "Inner Transitions: The role of religion, spirituality, consciousness and the self in urban sustainable pathways". Christoph was also a panelist in the dialogue session "International Cooperation for Sustainable Urban Transitions: linkages and learning between India and Germany". For the programme and book of abstracts visit: <http://ist2016.org/program/>

Indo-German Dialogue on Sustainable Water Resource Management

This event, organized by Heidelberg University and TERI University and in partnership with the IGCS among others, was held on 3-4 October at TERI University, New Delhi. It was the second of its kind after last year's Workshop on Sustainable Water Resource Management

where Dr. Christoph Woiwode had the pleasure to be invited as speaker. He presented on "Working with water in peri-urban Chennai: potentials and opportunities for flood risk management and water governance".



Guest Lecture at B.S. Abdur Rahman University, 22.9.2016

Dr. Christoph Woiwode spoke about "Disaster Risks and their Social Dimensions" at the "National Workshop on Urban Disasters—Natures Fury or Human Negligence?", which took place from 19-24 Sep. at B.S Abdur Rahman University, Chennai. The Workshop was attended by more than 100 students, practitioners and administrators.



GIZ Multi-stakeholder Consultation Workshop on Housing for All Mission

A multi-stakeholder workshop on housing for all mission was organized by GIZ-Inclusive Cities Partnership Programme (ICPP) in partnership with Housing and Urban Development Department (H&UDD), Government of Tamil Nadu (GoTN), Tamil Nadu Slum Clearance Board (TNSCB) and Coimbatore City Municipal Corporation (CCMC) in Coimbatore on 19-20 September, 2016. As part of a study conducted by IGCS for ICPP, IGCS Visiting Prof. Christoph Woiwode and Ramachandran A. participated in the two-day workshop. The workshop was to build consensus on the approach and activities needed for implementing integrated Housing for All Plan of Action (HfAPoA), In-situ Housing and Rental Housing. GIZ-ICPP has initiated planning and implementation of select components of Housing for All mission in the cities of Coimbatore and Chennai in partnership with Housing and Urban Development Department, Government

of Tamil Nadu (GoTN). The first day of the workshop was started with technical presentation by the government officials of Tamil Nadu and Odisha in the affordable housing sector and also the current status of housing policies and programmes. This was followed by group works on the possible intervention areas in Tamil Nadu (HfAPoA+, rental housing, and in-situ housing upgradation). On the 2nd day, an exposure visit to the Smart City area and a few rehabilitated colonies in Coimbatore was conducted. Various measures for the rejuvenation of water bodies and resettlement of slums located on vulnerable areas were also shown. The results of group discussions were presented to the Managing Director, TNSCB

and other delegates. The IGCS is partnering with GIZ for analyzing various processes adopted by the Tamil Nadu Slum Clearance Board (TNSCB) in implementing slum upgrading projects and its impacts at the city wide level.



IGCS Research scholars and Interns



Devika Herrmann came to IGCS in October 2016 and will stay until end of March 2017, working under the supervision of Prof. Sudhir Chella Rajan and Prof. Chrisoph Woiwode. Currently enrolled in the master's degree 'South Asian

Studies' at Heidelberg University, her studies focus on geography and politics on the Indian subcontinent. At IGCS, she is doing research on solid waste and its management, particularly in the context of municipalities and urban local bodies. So far, she has looked at the Indian legislation regarding the treatment of waste and has compared it to the current situation in Sriperumbudur, based on the 'Waste, Water and Energy survey' conducted by IGCS earlier in 2016 and other available studies. After having participated in the IGCS workshop on 'Current Sustainable Approaches in Waste Water and Solid Waste Management', she is now working towards developing a topic for her master thesis. For the current projects at IGCS, she will assist the team in research on different topics, aiming at getting a broad overview

of the work, and with the motivation of connecting them to the issue of waste.

Anna Huttunen is a student of M.Sc. Environmental Governance at the University of Freiburg. Her first master's degree she obtained in Social and Public Policy



at the University of Helsinki in Finland. Anna's current research interests lie in the field of sustainable urban development and mobility. In her master's thesis she is looking at the mobility practices and preferences of people living in the gated communities along the National Highway 4, a topic that until now hasn't been of broader interest in the peri-urban project. She is working on her topic from November – December 2016 at IGCS under the supervision of Prof. S. Chella Rajan (Dept. of Humanities and Social Sciences) and IGCS Visiting Professor Christoph Woiwode.

FEATURE

Climate Change Adaptation and Resilience in the Chennai Metropolitan Region

Dr. Christoph Woiwode

IGCS Visiting Professor, Indian Institute of Technology Madras, Chennai, India
woiwode@igcs-chennai.org

Urban Development Dynamics in metropolitan Chennai

Current urban development is very dynamic in Chennai. Rapid urbanisation can become a severe strain on its governance in terms of land use zoning and building control, environmental degradation, provision of essential infrastructure systems (water, sewerage, drainage, energy, transport), human security and development. Frequently, megacities in the making, like Chennai, find it difficult to keep up with the pace of expansion on its fringes and peri-urban areas. At the same time, climate change scenarios predict an increase and higher frequency of weather related disaster events. Thus a city's and its population's resilience depends on a number of interlocked factors, which together reduce or enhance the vulnerability.

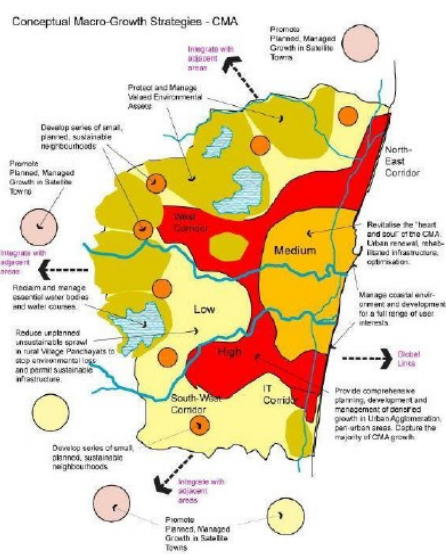
Especially the provision and access to essential services like water, energy, land for housing and economy or transport, is becoming increasingly fragmented and contested as a result of the increasing segregation of public and private space due to gated communities and SEZs in peri-urban areas (Homm 2014). Along with resource constraints and the consolidation of power, a central thesis posed here is that all these

factors are largely conveyed in terms of social and political drivers rather than only by physical or even economic ones. By

taking this view, resilience, as a counterpart of the discourses on vulnerability and livelihoods, needs to be characterized more broadly as well, involving normative elements of social and environmental justice as these connect to practices on the ground.

Some key challenges in the current development of Chennai:

1. **Absence of an integrated regional planning perspective** due to lack of a regional development plan and governance structures: To protect environmentally and ecologically sensitive areas in the peri-urban districts of Chennai the CDP (City Development Plan) developed a growth pattern (Fig. below). The current growth of Chennai takes place in these peri-urban areas where many water bodies and wetlands exist (CDIA and COC 2009: iv). But this is not pro-actively implemented anywhere.



Source: CDIA and COC 2009: iv

2. Suburban and peri-urban development: Many of those areas added to the Greater Chennai Corporation in 2011 and those lying on the fringes of the metropolitan area suffer from infrastructure that has not kept pace with the construction. A majority of localities lack sewerage networks, satisfactory number of footpaths, reliable water supply, adequate provisions for playgrounds. Poor lighting and road infrastructure as well as poor public transport are common problems. These areas are also characterised by deep social divisions.



Fig: Water body in peri-urban Chennai

3. Waste management: Two disposal sites in Kodungaiyur and Perungudi are nearing the end of their lives, while the proposal for a new site in Koothambakkam faces opposition from residents. The Corporation does not seem to have a clear policy to manage the garbage, lacking technical expertise and sufficient manpower and an appropriate institutional mechanism. The situation is characterised by ineffective management just dumping garbage with no State-level solid waste management policy in place.
4. Water logging and flooding: As the Chennai floods 2015 painfully demonstrated, management of water bodies, drinking water resources, natural drainage, appropriate land use zoning and control is fundamental for a city's existence as well as resilience towards natural disaster and climate risks.
5. Highly vulnerable population groups in under-serviced areas: According to Census 2011 data, among the metrocities in the country, with a proportion of 28.5 % slum population the Chennai Corporation ranks third after Mumbai and Kolkata and even before Delhi (14.6%). This relatively high number of low income population with little assets to cope with shocks and disasters in poorly serviced settlements is an indication for high risk zones spread across the city, which potentially may have a negative impact on the city at large in case of disaster (spread of diseases from there, disruptions of water provision, source of drinking water contamination, etc.). Noteworthy, while traditional slum hotspots such as Mumbai and Kolkata have seen a fall in slum population over the past decade, slums have increased rapidly in Chennai and Hyderabad, cities with fewer slums till 2001 (Chennai 17.7 %). Such figures illustrate how rapid urbanisation severely compromises the resilience of cities.

Climate Change Risks in Chennai

To extract the impacts of climate change from all the extreme weather events in Chennai is a challenge. A high number of these weather events, which can have different appearances, threaten Chennai.

A significant change in climate is the increasing temperature in urban areas, known as heat islands. This is caused by the emission of greenhouse gases from the growing amount of vehicles, industrial pollutions, and high population. To put the projected changes into Chennai's perspective, the mean temperature maximum, in the time period from 1901 to 2000 is about 28.4°C in December and 37.4°C in May, whereas the mean temperature minimum is about 20.4°C, in January and 27.6°C in May (World Meteorological Organization Website 2014).

The results of a Tamil Nadu study (mentioned in Jeganathan et al. 2013: 705) concerning climate change scenarios predict a **temperature trend** of

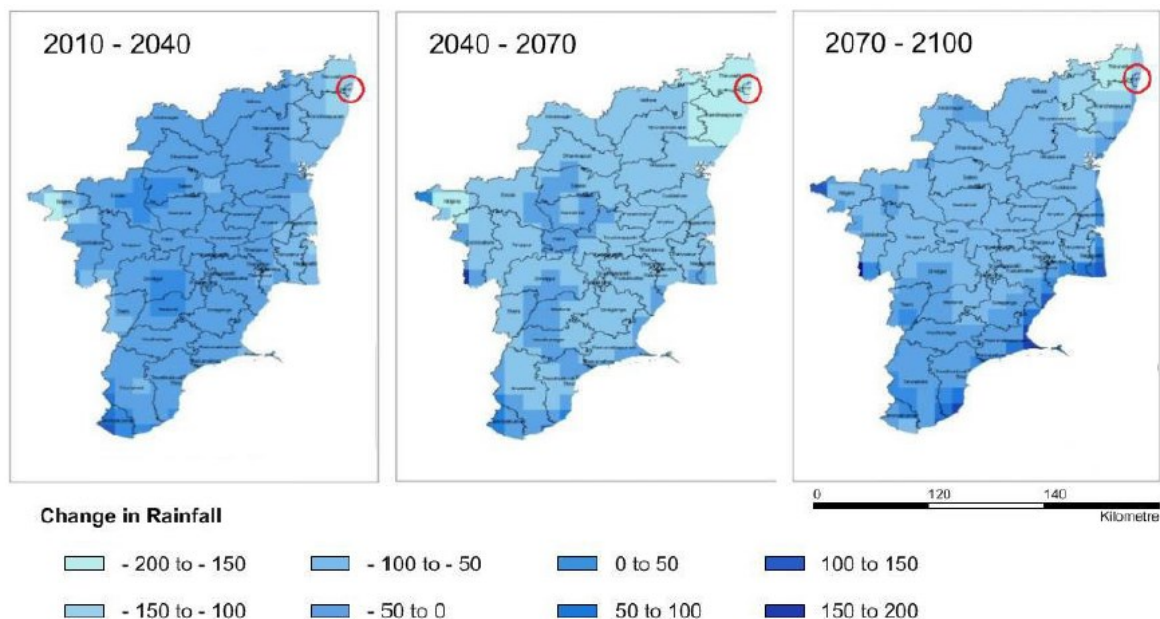


Fig: Change in Annual Rainfall (mm) Projections for 2040, 2070 and 2100 with Reference to the Baseline from 1970 to 2000 (source: Department of Environment 2014: Ch. 4.3)

+0.5°C by 2020 and a trend of +1.6°C to 2.7°C by 2080. The time period, which will be most affected by this future trend, is from March to May, whereby the North-Eastern and Western districts of Tamil Nadu will show a greater temperature increase (Jeganathan et al. 2013).

Initially, Chennai and its susceptibility towards temperature trends is relatively small, due to its location near the Bay of Bengal. Particularly, a permanent global temperature rise will warm up the water temperature of the neighbouring sea and therefore enhance the temperature of the coastal city. In addition, in their Fourth Assessment Report on Asia, the Intergovernmental Panel on Climate Change (IPCC) projects an increase of 3°C of the average annual mean temperature for Asian regions by 2050 (Jeganathan et al. 2013).

The State Action Plan on Climate Change of Tamil Nadu (SAPCC) is based on a projection of an increase by 1.1°C in 2040 and 3.4°C in 2100 (Department of Environment 2014: Chapter 4.3). In sum, every study on climate change predicts a temperature rise. They may have small variations caused by different meth-

odologies, but the trend is always positive.

Additionally to the change in temperature, there is a substantial **increase in the amount of rainfall** in Chennai. Usually, the annual precipitation is influenced by the South-West-Monsoon (SWM) in June, the North-East-Monsoon (NEM) in October and November, and the pre-monsoon season, whereby 51 per cent of the annual rainfall occurs in the NEM-season (Department of Environment 2014: Chapter 4.2). Coastal regions like Chennai might even reach a percentage of 65 to 75 of the annual rainfall during NEM season. According to the results of the Tamil Nadu study, which has been mentioned above, there is an increasing trend of yearly precipitation all over Tamil Nadu (Jeganathan et al. 2013: 712). By 2020 the amount is predicted to increase by approx. 1.6 to 4 percent and by 2080 about 6.6 to 16.5 percent (see Fig.).

Because of different scenarios there are variations in the prediction. Scientists developing the State Action Plan on Climate Change (SAPCC) assume that in the period from 2040 to 2070 rainfall is going to increase about 70 mm and in the period from 2070 to 2100

about 90 mm. The reference of these projections is the base mean from 1970 to 2000 (cf. Department of Environment 2014: Chapter 4.3; see Fig.). Figure above represents the projected changes in the annual rainfall on the data base of the SAPCC. In these maps, light colourings represent decreasing rainfall and dark ones increasing rainfall. For Chennai, marked by the red circle, it means initially less rainfall and in 2070 a higher amount of precipitation. However, statistics do not represent the pattern of rainfall. While many scientists are talking about an obvious trend of increasing rainfall, the Head of Chennai's Regional Meteorological Centre diagnoses an enormous variation within the yearly amount of rainfall. However, a noticeable tendency is seasonal variation. While the highest increase is going to be in NEM-season, there is a decreasing trend from December to May (cf. Jeganathan et al. 2013: 712). Whereas the annual rainfall is going to enhance, the number of rainy days is going to decrease (cf. Department of Environment 2014: Chapter 6). This tendency causes more extremes such as droughts from December to May and heavy rainfall events in October and November. Northern and central coast regions in Tamil Nadu, like Chennai, are mostly affected by these significant extreme rainfall events (cf. Department of Environment 2014: Chapter 4).

Chennai's location at the Bay of Bengal makes the city prone to **sea-level rise** as well. The IPCC estimates a global sea-level rise about 1 to 2 mm per year. For India's coast in particular, a rise of 15 to 38 cm by 2050 and 46 to 59 cm by 2100 is projected (Khan et al. 2012: 1). The SAPCC projects a sea-level rise of 1.1 to 1.25 m by 2100 on Tamil Nadu coast (cf. Department of Environment 2014: ch. 4.3). A sea-level rise of one metre implies an inundation of 1091 sq km for Tamil Nadu (Khan et al. 2012: 2). Moreover, coastal regions like Chennai also may be affected by storm surges or cyclones. A higher frequency of storm surges is diagnosed. Concerning cyclones in the Bay of Bengal, the frequency is going to decrease whereby the number of severe cyclones is going to

increase (Department of Environment 2014: Chapter 4.3).

Urban Climate Change Adaptation Policies and Plans—a brief overview

India adopted a National Climate Change Action Plan in 2008, which covers several sector areas including Sustainable Habitat. The National Mission on Sustainable Habitat (NMSH) "seeks to promote sustainability of habitats through improvements in energy efficiency in buildings, urban planning, improved management of solid and liquid waste including recycling and power generation, modal shift towards public transport and conservation. It also seeks to improve ability of habitats to adapt to climate change by improving resilience of infrastructure, community based disaster management and measures for improving advance warning systems for extreme weather events" (NMSH: 80).

Subsequently states were requested to formulate their own State Climate Change Action Plans. Tamil Nadu State Climate Change Cell (TNSCCC), Department of Environment, Government of Tamil Nadu, is in charge of the State Action Plan on Climate Change (SAPCC) which was prepared in 2014. Therein Chapter 10 deals with sustainable habitat. However, formulating a Climate Change Action Plan for the city of Chennai failed between 2011 to 2013 due to changing political circumstances.

But the Corporation engaged the Climate Disaster and Resilience Initiative (an international consortium incl. Kyoto University) to conduct research on the city's resilience against climate change-related hazards. A result of this research is the Chennai Zone Profile which measures and compares the resilience of the administrative zones in the city boundaries until 2011 (cf. Shaw 2010c: 5). There is the intention to expand this work to the current enlarged boundaries.

Way Forward: Research, Policies, Action

Although there are statistics that show a noticeable trend in changing climate conditions, there is no

agreement on the existence of climate change related impacts in Chennai. Even the Chennai Regional Meteorological Centre confirms a slow process with statistical outliers.

Given the above outlined complex issues faced by Chennai in terms of its current and projected urban development in the face of climatic changes, there is a need to study the conditions and underlying causes from a comprehensive perspective at the city's macro level in combination with locality specific in-depth studies. The Zone Profile is a beginning in this regard.

Furthermore, policies and existing plans (master plan, climate change adaptation, disaster risk management) are currently not integrated, and they do exist at various levels. As pointed out, a city level climate change action plan is absent, and the recent flood in 2015 brought to light the fractured existence of disaster management in the state. Moreover, it has become obvious that it is insufficient to conceive the city merely in its formal boundaries. Adopting a regional planning perspective and governance approach with an integrated character will be an essential task to tackle the number of interdependent issues of urban development, climate change adaptation, disaster risk reduction and resilience planning.

References

- CDIA and COC (Cities Development Initiative for Asia and Corporation of Chennai) 2009: Chennai City Development Plan 2009 Volume 1: Main Report. Chennai
- Department of Environment 2014: SAPCC (State Action Plan on Climate Change) Report. Retrieved from <http://www.environment.tn.nic.in/sapcc.html>
- Homm, S. (2014). *Global Players – Local Struggles: Spatial Dynamics of Industrialisation and Social Change in Peri-urban Chennai*, India. Stuttgart: Franz Steiner Verlag.
- Jeganathan, Anushiya; Andimuthu, Ramachandran 2013: Developing climate change scenarios for Tamil Nadu, India using MAGICC/SCENGEN. In: Theoretical and applied climatology. Vol. 2013, No. 114.3-4: 705-714
- Khan, A. Saleem; Ramachandran, A.; Usha, N.; Aram, I. A.; Selvam, V. 2012: Rising sea and threatened mangroves: a case study on stakeholders, engagement in climate change communication and non-formal education. In: International Journal of Sustainable Development & World Ecology. Vol. 2012, No. 19.4: 330-338
- Shaw 2010c: Chennai Zone Profile. Climate and Disaster Resilience. Kyoto, Chennai. Retrieved from <http://www.iedm.ges.kyotou.ac.jp/2011%0update%20files/new%20reports/2010/CDRI%20Chennai%20small.pdf>
- TU Dortmund (2014) Urban Resilience and Adaptation to Climate Change in Chennai, India. Student Project Report, School of Spatial Planning, Dortmund, Germany.
- World Meteorological Organization Website 2014: World Weather Information Service. Retrieved from <http://worldweather.wmo.int/066/c00527.htm>

Wind instead of Rain: Cyclone Vardah hits Chennai Coast

Ever since last year's flood the city's administration and its residents were making preparations to mitigate the impact of a similar monsoon as best as possible. Large scale projects have been started by donor agencies, environmental groups and citizens in conservation of water bodies, water engineering and desilting. And yet, it seems like nature is playing games with the city.

Even on Sunday 11th, the day before the cyclone arrived, the Greater Chennai Corporation convened a

meeting to discuss preparedness for cyclone Vardah: "The meeting attended by the heads of all civic agencies and the municipal administration secretary charted out mitigation measures to deal with rain the cyclone was to bring, but underestimated the wind that wreaked havoc on Monday" ('Corporation failed to get Wind of it; braced for floods, not storm', The Times of India, 14th Dec. 2016). The same article states "post Vardah carnage, the corporation deployed 18,000 workers to remove the fallen trees,

but the force did not have adequate tools such as electric saws". In spite of this criticism, the relief works, especially clearing of roads, seem to be progressing faster than after the flood. Nonetheless, from Monday afternoon most homes had no electricity any more, and mobile and internet networks were dysfunctional. While these infrastructures came back slowly on Wednesday evening, 14th, and Thursday 15th December, most of the major roads were open on Tuesday, residential roads though are still being cleared.

city, reported a huge loss. Tree cover accounted for more than 70% of the total campus area, IIT-M sources said, adding that at least 100 trees were uprooted and many more damaged. Workers clearing the trees said close to 1,000 trees had been affected on campus and they had been able to clear about 500 of these since Monday evening. Also, a number of big trees collapsed, due to which certain roads were partially blocked" ('Vardah snuffed out a chunk of Chennai's green lungs', The Times of India, 14th Dec. 2016).

"IIT-Madras, a crucial green lung in the heart of the

Compiled and photos by Christoph Woiwode



Residential roads on the day after the cyclone (December 13)



The IIT Madras exit gate (December 13)



IIT Madras campus - Delhi Avenue (December 13)



IIT Madras campus - Alumni Avenue (December 13)



IIT Madras campus - Delhi Avenue (December 13)

EDITORS

Prof. B.S. Murty
+91 44 2257 4262
bsm@iitm.ac.in

Prof. Christoph Woiwode
+91 44 2257 8446
woiwode@igcs-chennai.org



Postal address:

Indo-German Centre for Sustainability,
MSRC Building, IIT Madras,
Chennai 600 036, India
Website www.igcs-chennai.org

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