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CONNECTIVE CITIES

Connective Cities Practitioners' Workshop

Proceedings of the Connective Cities Practitioners' Workshop on Developing Flood Vulnerability and Risk Analysis for Local Flood Management Planning

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Partners of Connective Cities

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CONNECTIVE CITIES

International Community of Practice for Sustainable Urban Development

Cities are gaining increasing importance globally, and urban actors the world over are facing similar urban development issues. Although local solutions are required, these are becoming increasingly relevant at the global level. While many innovative solutions for sustainable urban development exist at local level, for example in energy efficiency, mobility or municipal services, frequently these are not widely known. Often there is a lack of systematic access to these practical solutions. The pressing challenges posed by worldwide urbanisation call for efficient and innovative approaches, especially in the areas of good urban governance, integrated urban development and local economic development – our three focal themes.

Connective Cities is a joint venture between the Association of German Cities (Deutscher Städtetag), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and the Service Agency Communities in One World (a division of Engagement Global). This International Community of Practice for Sustainable Urban Development is supported by the German Federal Ministry for Economic Cooperation and Development (BMZ).

Connective Cities provides demand-based services designed to improve cooperation among urban practitioners at global level. The platform enhances the sharing of good practice examples, expert knowledge and solution-oriented peer-to-peer consulting, and creates opportunities for partnerships among its stakeholders.

Connective Cities addresses questions of how to achieve sustainable development through innovative strategies and practices. It highlights good practice examples in the overarching fields of good urban governance, integrated urban development and support of local economic development strategies. Connective Cities creates a base for knowledge sharing and the development of transformative solutions in local contexts that are customised to local requirements for sustainable urban development.

By conducting dialogue events, Connective Cities facilitates exchange among urban practitioners on relevant themes, and functions as a platform for a networking strategy. To implement the strategy Connective Cities also organises trainings, study tours, project workshops and virtual discussion forums. Working within Connective Cities can result in new forms of cooperation among the actors involved. The platform also aims to facilitate the initiation of joint projects among urban stakeholders from various local settings.

This brochure describes the Connective Cities Practitioners' Workshop, which was held at Sanepar –Compahia de Saneamento do Paraná, City of Curitiba, Paraná, Brazil, from 19 to 21 August 2015, and documents its results.

Executive summary

The Connective Cities Practitioners' Workshop on Developing Flood Vulnerability and Risk Analysis for Local Flood Management Planning fostered the continuity of the dialog initiated at the 6th Connective Cities Dialog Event, which took place in February 2015 in Cologne, Germany. Participants from the Cologne event were reunited in the city of Curitiba, Brazil, to share knowledge regarding the development of Vulnerability and Risk Analysis (VRA) in the municipal and regional context.

Participants representing local and state governments and institutions, as well as members of research institutes, shared their experiences by means of keynotes, working groups and peer-to-peer consultations during the 3-day event. They also agreed on joint projects for further cooperation.

Key messages are that data availability and community involvement are key factors for the development and application of VRA. Communication with communities and decision-makers was identified as an important aspect in ensuring the effectiveness of VRA and its integration into a broader urban master plan. With regard to illegal settlements in risk areas, participants highlighted the need to remove people from these areas, which should be revitalized and turned into public spaces such as linear parks. Finally, participants underlined the importance of the Connective Cities events for strengthening the network. To facilitate the necessary continued sharing of best practices and knowledge, they also proposed an online platform.

Background & objectives

"It was very interesting to get to know each other better. At the last event the theme was broader but now we are working concretely on VRA."
Heinz Brandenburg, SteB, City of Cologne, Germany.

Between 19th and 21st of August 2015 the city of Curitiba, Brazil, hosted the Connective Cities Practitioner's Workshop on "Developing Flood Vulnerability and Risk Analysis for Local Flood Management Planning". The workshop was carried out in cooperation with the Civil Defense Department of the State of Paraná, and participants included representatives of local and state governments and institutions, as well as members of research institutes from Germany, Brazil, Peru, Colombia and Mexico.

The workshop was a follow-up event to the 6th Connective Cities Dialog Event "Challenges of Organizing Flood Management", which took place in Cologne in February 2015. On this occasion, the need for further cooperation on "Developing a Flood Management Plan" was highlighted and therefore the workshop focused on sharing lessons learned with the first step required when developing such a plan: conducting a Vulnerability and Risk Analysis (VRA).

Thus, this Connective Cities workshop aimed to foster collaboration among practitioners and work on tangible results of sustainable urban development in the sector of vulnerability and risk analysis for local flood management planning. Specifically, our objectives were to:

- Make local experiences from the participating cities available to others.
- Use the participants' expertise to strengthen the competences of the other participating cities and help them to improve their vulnerability and risk analysis for local flood management planning.
- Identify methods, procedures and strategies to develop vulnerability and risk analysis locally, taking into account the reality and challenges faced by the participant cities.
- Support the initiation/improvement of vulnerability and risk analysis.
- Support networking in the area of flood risk management.

Introduction to the topic

"The tools and methodologies for Vulnerability and Risk Analysis, together with the exchange of practical experiences, are essential for the conception and elaboration of good plans at the national, state and especially at the municipal levels, where the actions are effectively implemented."
Agostinho Ogura, Institute for Technological Research, São Paulo, Brazil

Flood risk management requires a cross-sectional, multidisciplinary and regional approach to be organized. In this context, municipalities play an important role in developing local flood management plans that are integrated with other municipal development strategies, and in creating coordinated action to cope with flood events together with neighboring municipalities and with higher government levels. On the first day of the workshop, this reality was presented from a state and a municipal perspective.

A state perspective: The State of Paraná

The State of Paraná, in Brazil, has many rivers divided into 16 water basins. Many of the 399 State's municipalities have problems with flooding, which in the last five years resulted in 118,889 homeless (sheltered) and displaced people, 24 dead, 521 injured, 85,847 damaged homes, 1,649 destroyed homes and economical losses of U$ 491,433,489.00.

Intending to protect people against floods and giving them time to leave their homes before the water reaches them, the State of Paraná started the development of a flood monitoring system and alerts emission.

The civil defense information system gathers the information about risk areas, geo-referenced location of hydrometereological stations and available facilities and resources that can be used in case of disaster from each municipality of the State of Paraná. This information is stored in an online system that monitors the precipitation levels and sends out alarms according to the disaster risk level for a specific location. In case of the detection of a threat, the state civil defense informs the regional and municipal units about the warning level (Attention, Alert or Alarm) by means of SMS and e-mail and commands the response action (previously defined in action protocols) to tackle the event. The information of weather radars are also obtained and integrated into the forecasting in order to provide more accurate information about rainfall level, and therefore provide reliable flood warnings.

Lt. Col. Edemilson de Barros, Coordinator of the Civil Defense Department of the State of Paraná (Brazil), highlighted the importance of municipal engagement in coordinating prevention and response actions at the state and regional levels. In his keynote "Disaster Risk in Paraná State: Threats and Vulnerabilities, Mapping and Managing Information", he explained how the state information system, which received a United Nations Prize in Sendai, 2015, integrates municipal and state actions.[1]

A municipal perspective: The City of Campinas

In the subsequent keynote, **Mr. Sidnei Furtado** from the Civil Defense Department of the City of Campinas (Brazil) presented the local perspective on this subject in his presentation on the "Challenges of Disaster Risk Reduction in the Municipality of Campinas". Campinas is the 3rd biggest city in the State of São Paulo (with 1.1 million inhabitants) and is an important economic center hosting major universities and research centers. A major flood event took place in 2003 after storms of exceptional intensity and since then the city took concrete actions to enhance its preparedness to such extreme events. These actions were coordinated by the

1 For additional information on disaster risk prevention in the State of Paraná please see the 'Connective Cities' good practice Flood Information System of the State of Paraná, Brazil

Civil Defense Department of the City and included an extensive upgrade of the city's early warning system paired with civil defense training classes (that started in 2005 and since then take place annually) and community training in flood prone areas including extreme events' simulations. Campina's operational process towards flood prevention builds upon the interconnection of several systems: TerraMA2, the system which provides early warning services, new risk maps and alerts by searching for current data over the internet and incorporating those into the warning system database; SIADEC, the Civil Defense Warning System which performs the adaptation and transmission of data to TerraMA2; GODC, the Civil Defense Events Management system, creating a new architecture system that allows web access of data in a decentralized manner; DONARE, an Humanitarian Action Management System, managing more effectively donations and their use in extreme event situations and CIMCamp, Campinas Monitoring Integrated Center, bringing together the various agencies of the Municipality of Campinas, the indirect administration, as well as other public security institutions and emergency services (at state and federal levels), aiming to promote city council consultations as well as community consultations with greater security and agility. The implementation of such an integrated system has resulted in concrete risk removal actions in flood risk areas and therefore in the drastic reduction of risk hotspots (from 75 in 2005 to 17 in 2013). Mr Furtado highlighted how important it is to have an automated information system associated to the municipal civil defense department, in order to ensure the continuity of data collection and improve VRA as well as to ensure preparedness and readiness for immediate response to extreme events.

"Disaster risk management and the elaboration of good risk management plans depend on the previous development of a good vulnerability and risk analysis."
Agostinho Ogura, Institute for Technological Research, São Paulo, Brazil

Vulnerability and risk analysis (VRA) as first step toward developing a flood management plan

Elaborating a comprehensive vulnerability and risk analysis (VRA) is the first step toward developing a flood management plan. To perform this analysis a great amount of data must be collected and harmonized. Once the data is available it serves as input for modeling tools that allow the identification of the vulnerable elements (conceptual and structural), vulnerability levels, and risk scenarios, which are used as background for the setting of objectives, priorities and protection actions needed to cope with flood events and reduce their risk. In this context, experts from Germany and Brazil were invited to present the tools they use to generate VRAs locally.

1) **Mr. Marco Follador** from WayCarbon (Belo Horizonte, Brazil) presented the Model for Vulnerability Evaluation (MOVE). MOVE is an integrated platform which evaluates the vulnerability and risks associated with climate change. It can be applied in different regions and industrial sectors, on multiple scales, and under different climate scenarios. The model produces georeferenced maps and basic statistics in order to support territorial and sectorial planning by means of robust and current scientific evidence. The results generated allow the identification of the major causes of vulnerability and risk to climate change in the analyzed context, essential information when defining and prioritizing adaptation strategies in both the public and private sector. This initiative integrates universities, governments and the private sector with a view to creating a systematized database for the development of VRA in Brazil. The model has already been developed for four sectors: water, cities, industry and agriculture, and the initiative expects to expand the approach to more sectors such as health, energy, etc. A pilot project was developed in the city of Goiania, Brazil, and currently the model is being implemented in the city of Belo Horizonte, Brazil. This tool is particularly interesting for a multi-risk and vulnerability analysis. [2]

2) **Mr. Agostinho Ogura** from the Institute for Technological Research (São Paulo, Brazil) presented the Niagrisk. Niagrisk is a geographic information system (GIS) based tool for natural disasters risk management, monitoring and warning. Natural disasters are triggered by extreme meteorological conditions and in Brazil in particular, the risks are closely related to land use and the

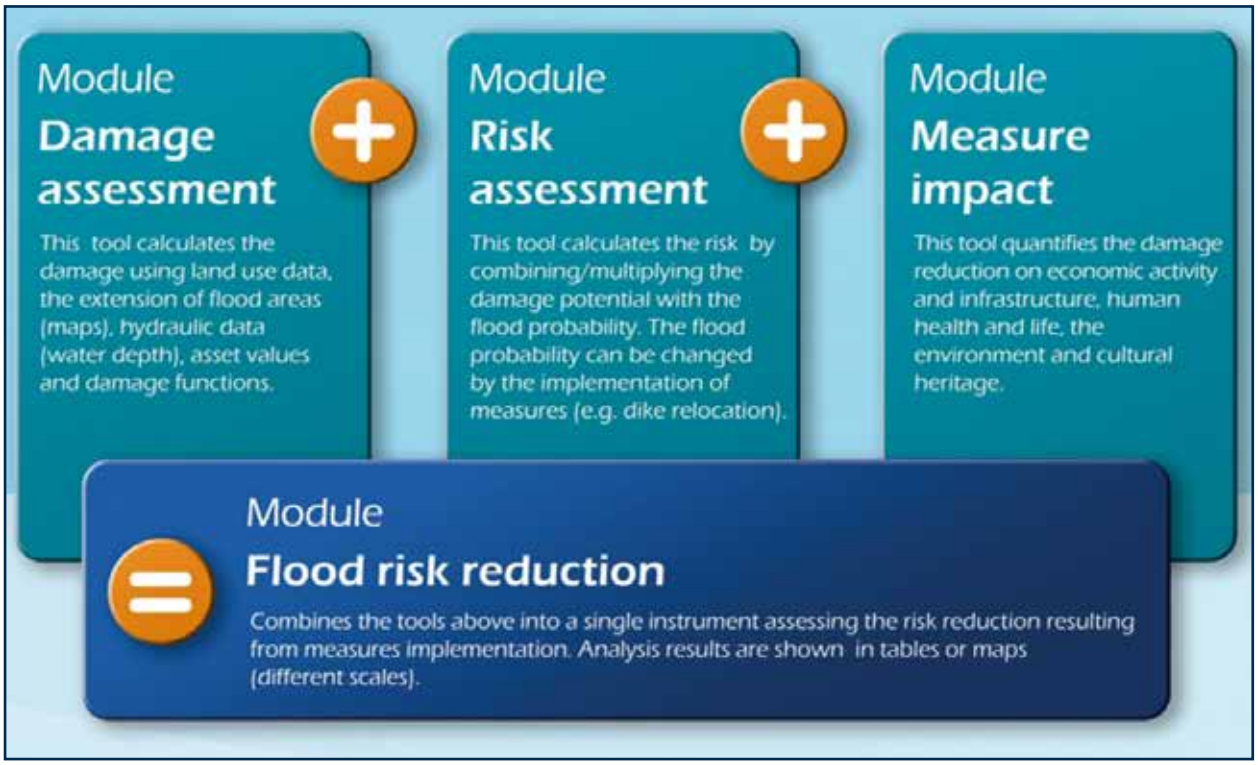
2 For additional information about move please see www.moveonadaptation.com

natural properties of the landscape and related dynamic processes. Niagrisk, as an automated information system, takes land use data from monitoring systems, and incorporates those with data on local physical and human environments, to create risk maps and scenarios based on the risk analysis with an underlying database. These maps are then cross-referenced with weather data (historical data as well as weather forecasts) and support the elaboration of contingency plans by the city's civil defense department. The levels of the contingency plans are 4 and range from green (observation) to red (maximum alert). The Niagrisk tool focuses on the development of VRAs for landslides caused by high levels of precipitation. It has already been applied in the city of Caraguatatuba (Brazil).

3) **Mr. Henning Werker** (Cologne, Germany) presented the Rhine Atlas, an interactive tool used for transboundary (9 States) flood risk management of the International River Basin District 'Rhine', localizing the kind and degree of danger for the main stream. The Rhine Atlas represents flood hazard and flood risk issues according to the European Floods Directive (FD)[3] for the main stream of the Rhine from the Alpine Rhine to the North Sea. While mainly focusing on floods, the tool also supports the implementation of preventive measures in the planning area.

The tool provides a uniform representation of flood areas and their flood risk for three flood scenarios (high, medium and low flood probability) for the Rhine main stream. The Rhine Atlas is made by simplified and aggregated national flood hazard and flood risk maps, available by clicking on any area of the atlas. It is used by the

3 The target of the EU directive on the assessment and management of flood risks (directive 2007/60/EC; Floods Directive - FD) which entered into force on 26 November 2007 is, to reduce and manage negative impacts of floods on human health, the environment, cultural heritage and economic activities (http://www.iksr.org/en/floods-directive/index.html). The directive includes an approach in three phases: Preliminary flood risk assessment (by end 2011 with updates every 6 years), Maps of flood hazard and flood risk (by end 2013, maps published in Rhine Atlas 2015, updates by necessary), Flood risk management plan (by end 2015, updates every 6 years).



©ICPR International Commission for the Protection of the Rhine

municipalities, which integrate the Rhine river basin, to support an integrated approach for flood risk analysis and management. The Rhine Atlas uses GIS-instruments for assessing flood risks and effect of measures as shown in the picture. The data integration and monitoring provided by this system can serve as an example of international river basin management worldwide. [4]

Although each presented tool has a singular approach to elaborate the VRA, one common challenge reported is the lack of data (particularly harmonized data), and lack of continuity of data collection, especially in rural areas. As an alternative to the use of complex models, Mr. Follador mentioned the possibility of using a proxy model[5] (morphometric model) to launch the development of VRA in areas with a lack of data. He mentioned that this approach could motivate such municipalities to start collecting data for further development of the VRA, and could be used as a starting point for the development of flood risk management strategies.

Integration is a key word in the context of flood management. Integration requires data and systems standardization, continuity of data collection, good communication and good governance. In this sense it is clear that the municipalities play an important role, since they are responsible for providing the local data for the development of precise VRAs and are key actors in the response to a flood event. Nonetheless the role of a regional/state/river basin institution was highlighted, due to its potential for coordinating actions and strengthening partnerships between municipalities, thus enabling them to act together in avoiding and coping with a disaster. To close the last day of the workshop, **Dr. Sylvia Pratzler-Wanczura** introduced the concept of Good Risk Governance as a prerequisite for local flood management planning. She highlighted the interdependence between risk management, risk communication and risk assessment (which is closely related to VRA), and the importance of integrating the dimensions of hazard & exposure, vulnerability and coping capacity in the analysis.

The keynotes brought many insights to the participants, and some common issues did emerge from the plenary discussions. The existence of illegal settlements in risk areas, the lack of data in rural municipalities, and the difficulty of communication between technical professionals and decision-makers were identified as common challenges not only for cities in Latin America, but also those in Germany (notwithstanding the specificities of each region).

4 For additional information on the Rhine Atlas please see www.iksr.org/en

5 A proxy model (or light model) involves a simpler representation of reality, which is designed initially to approximate to more complex model behavior. A proxy model is less accurate than a detailed model (heavy model), but it is more agile and is able to run in harsh scenarios (data scarcity).

Methodology

"Participating in international events like this one is very interesting because you get in touch with new experiences and new perspectives of common challenges"
Marcelo Schrubbe, City of Blumenau, Brazil.

The workshop was attended by a total of 26 participants. These represented cities (n=17) and state institutions (n=5), and the remainder were scholars and consultants (n=4).

Prior to the workshop a questionnaire had been sent to all participant cities in order to obtain some basic information on the overall context and status of their VRA.

This information was gathered and presented on the first day of the event, so that participants were aware of conditions in the cities represented. This data was presented by Dr. Sylvia Pratzler-Wanczura, and included information on the components of the VRA, the represented countries, the population size of the cities, the types of flood hazard and the legal framework, etc. This presentation served as a kick-off for the workshop and paved the way for the introduction of the participants.

The workshop was structured across three days. The participating cities were invited to present their experiences in this area within working groups. Each working group included representatives of three or four cities, plus at least one scholar/consultant and one state representative. The event also included keynotes on: i) the municipal and state perspectives on the development of VRA; ii) tools to support the elaboration of a VRA, and iii) how to integrate VRAs into local flood management plans.

A peer-to-peer advisory session was held on the second day of the event in order to enable knowledge sharing between the participants.

A peer-to-peer advisory session forms the core of each Connective Cities dialogue event. In addition to the challenges resulting from the presentation of good practices, concrete problems are gathered in the plenum or proposed by individual participants in advance. Thus it is real-life challenges from the immediate environment of the practitioner with a focus on solutions that are addressed in the peer-to-peer advisory session. The aim is to commonly develop practice-oriented solutions for a concrete issue. For this purpose, guided by their respective interests, the participants then form groups of various sizes and the municipal practitioners assign themselves the respective roles of the case presenter, moderator and consultant. Within the group, implicit knowledge is turned into explicit knowledge through openness and practical relevance that is mobilized and shared through peer-to-peer advice. People from similar fields of activity give each other qualified advice on key sustainable urban development issues at eye level and based on their own experiences, and together, they develop innovative solutions for concrete challenges facing them in local practice.

In this step, participants identified particular issues arising in the course of their practical work, and shared them with the group in order to obtain feedback in the form of ideas, recommendations and possible solutions to their challenges. To organize this, two groups were created, which once again included a mix of representatives from cities and states, plus scholars and consultants.

To enable the participants to see some activities involving the core theme of the event under practical conditions, the host city – Curitiba – organized a field trip to Barigui Park. This is a linear park that was created to retain rain water and to avoid illegal settlements in flood risk areas.

Local experiences

"Whenever we talk to our colleagues we learn something. In the presentations and in the discussions we can see many initiatives that we can adapt to our context." Marcelo Schrubbe, City of Blumenau, Brazil

Three working groups were created to provide a platform for the presentation of municipal experiences with Vulnerability and Risk Analysis. Each presentation is described briefly below.

Proposal for urban mapping including strategies for risk prevention

Group I

Moderator: Fernanda Del Lama Soares

City of Cologne, Germany:

Cologne (1 million inhabitants) pursues four lines of action to reduce flood risk and vulnerability given its vulnerable position along the river Rhine:

- building protection structures including activities such as dike reinforcement, flood protection walls (stationary as well as mobile);
- protection of high-risk areas for example through controlled flood plains and with a particular attention to cultural heritage and critical infrastructure;
- establishment of risk protection forecasts for example abiding by international risk management and nationwide protection schemes (such as the Rhine Atlas, see above) and implementing local flood, storm water and groundwater risk management;
- protection management through national and international knowledge exchange as well as public relations of the ongoing activities for flood protection though media and public notices in the city.

During the presentation the speaker highlighted the fact that the city already has a significant amount of structures to protect against flood events, but there is still room for improvement in the area of citizen mobilization/participation and capacity-building.

City of Comitán de Dominguéz, Mexico:

When the city of Comitán de Domínguez (140,000 inhabitants in Southern Mexico) developed its Municipal Plan for Urban Development (MPUD) it paid particular attention to flood and landslides risks, bearing in mind the Municipal Risk Atlas that had already been developed by the federal government. This Atlas needed to be integrated into the municipal planning context in order to prevent risk-prone areas from being occupied by illegal settlements.

The Federal Law of Civil Protection and the State Law of Civil Protection and Integrated Disaster Risk Management of Chiapas support the application of the MPUD, and provide the legal basis for the risk reduction actions. Comitán de Dominguéz has therefore already developed a VRA and mapped the risk areas. Nevertheless, the main challenge faced is the spread of illegal settlements in risk areas. The lack of enforcement of federal law in the municipalities (which prohibits construction in these areas and considers such practices criminal), and the lack of information for the population are the main reasons why people keep settling in these areas. Currently there is a program to raise awareness of the risks, which targets the population that lives in risk areas in the city such as educational campaigns to raise awareness among the population settled in risk-prone areas

and enforcement of the Federal Law of Civil Protection that makes settlement in risk-prone areas a crime.[6]

City of Curitiba, Brazil:

Curitiba has a population of approximately 1.8 million people and is located in Brazil's South Region. The representatives of the city presented the "Núcleo Comunitário de Proteção e Defesa Civil" (NUPDEC, Communitarian Unit for Protection and Civil Defense). This unit is designed to integrate all actors of the civil defense system, such as the private sector, educational institutions, citizens and institutions of public security, in order to guarantee joint action for public safety.

The NUPDEC promotes cultural and behavioral change in two directions: participation and prevention. Within this framework, debates on the safety and security of the population regarding accidents and disasters are carried out locally, with the participation of community members who are engaged in this field. The Civil Defense Unit acts as the interface between the community and the public authority, by sharing information and acting as mediator in discussions on the problems faced by the community and the available intervention measures. This approach works as a municipal strategy to involve citizens settled in vulnerable areas in the development of contingency plans and to engage them in prevention activities.

This measure is being implemented in conjunction with the decentralization of the municipal administration into nine regional offices that are more responsive to the population in matters of risk reduction. This strategy has resulted in positive effects for the city. Additionally, the city is building linear parks in vulnerable areas to retain rain water and to avoid the establishment of illegal settlements in risk areas.[7]

City of Manaus, Brazil:

Manaus is the capital city of the state of Amazonas in northern Brazil. It is situated at the confluence of the Negro and Amazonas rivers and is home to more than 2.0 million people. Due to the city's location in the inundation area of the Rio Negro, the population is affected by high water levels every year. The challenge associated with this is the increase in the frequency of such events due to climate change: extreme events that used to hit the city every 10, 20 or 50 years are now an annual occurrence. This drastic change in extreme events is exhausting the coping capacity of the city and its ability to support the population living in these areas. Thus, the municipality has been working together with the State and the Federal governments to invest in a strategy with long term solutions to minimize the impact of floods. The actions included in this strategy range from public policies to concrete measures such as a resettlement program in which residential units are being built to provide the population with safer homes, recovery of degraded areas and social inclusion projects. The creation of new residential units will also avoid the spread of waterborne diseases caused by inadequate sewage infrastructure and inappropriate storage of solid residues.

6 For additional information on the activities of the city of Comitán de Domínguez in this area please see the 'Connective Cities' good practice *Municipal Plan for Urban Development of Comitán de Domínguez, Chiapas: tools to prevent illegal settlements in risk-prone areas*

7 For additional information on the activities of the city of Curitiba please see the 'Connective Cities' good practice *Involving civil society in disaster risk management: Municipal Unit for Protection and Civil Defense in Curitiba, Brazil*

Group II

Moderator: Susanne Luithlen

City of Hagen, Germany:

Hagen is a city in Western Germany located on the south eastern edge of the Ruhr area where the rivers Lenne and Volme (met by the river Ennepe) meet the river Ruhr. The city has a population of around 189,000 people. The city of Hagen introduced its database for flood risk management including flood risk maps and flood danger maps. The contents of their flood risk management maps and the next steps to produce a concrete action plan for rivers with a basin area of more than 10 km² were described. The action plan of the city is about creating an integrated approach to flood protection working closely with stakeholders including neighboring towns, management members and municipal service provider but also setting up crisis management committees and planning units able to share openly the information coming from the measuring devices in place in the city. Moreover, the presentation also included a best practice example showing how to deal with the threat posed by piped streams using measuring devices rather than by building dams.

City of Medellín, Colombia:

Medellin is the second-largest city in Colombia located in the Aburrá Valley in the Andes Mountains. The city has an estimated population of 2.44 million with a metropolitan are home to more than 3.5 million people. The main challenges faced by the city are the dense water network with 4260 streams and 56 direct tributaries to the river Medellin in addition to the illegal settlements in these stream withdrawal and therefore risk areas. Since the city cannot eliminate the threat, it has adopted a preventive approach that aims to reduce exposure by developing land use plans, resettlement programs and recovery projects for setback areas with linear parks. Through the Administrative Department of Disaster Risk Management (DAGRD) the municipality of Medellin articulates strategies for the identification and analysis of vulnerability for extreme events such as floods and landslides, fires, earthquakes. Through the Early Warning System of Medellin and Valle de Aburrá[8] (SIATA) hydrological models are developed and Flashflood Models for critical basins, in addition to the monitoring of the main streams with level sensors, rain gauges and weather stations all with real time information. The SIATA early warning system was developed with municipal resources and its real time character is achieving savings in equipment costs, communication and interpretation, as well as timely and quick maintenance actions in case of damages in monitoring equipment. Its implementation is an experience that can be replicated at the national and international levels, showing how in-house development can be achieved with the support of undergraduate and graduate students, and how hardware and software as well as hydrological and meteorological models are created.

City of Duque de Caxias, Brazil:

Duque de Caxias is a city in southeast Brazil with a population of around 900,000 inhabitants. The city lacks regional studies and a cartographic database that would support the development of a VRA. They just began collecting data and are involving the citizens in this process. They aim to overcome these obstacles by seeking external technical cooperation, and by revising urban laws to incorporate non-structural measures for territorial and urban management, as well as social participation and the integration of a cartographic database.

8 Additional information on the SIATA early warning system is available under the presentation reports from Group III

Group III

Moderators: Dr. Sylvia Pratzler-Wanczura and Isabela Santos

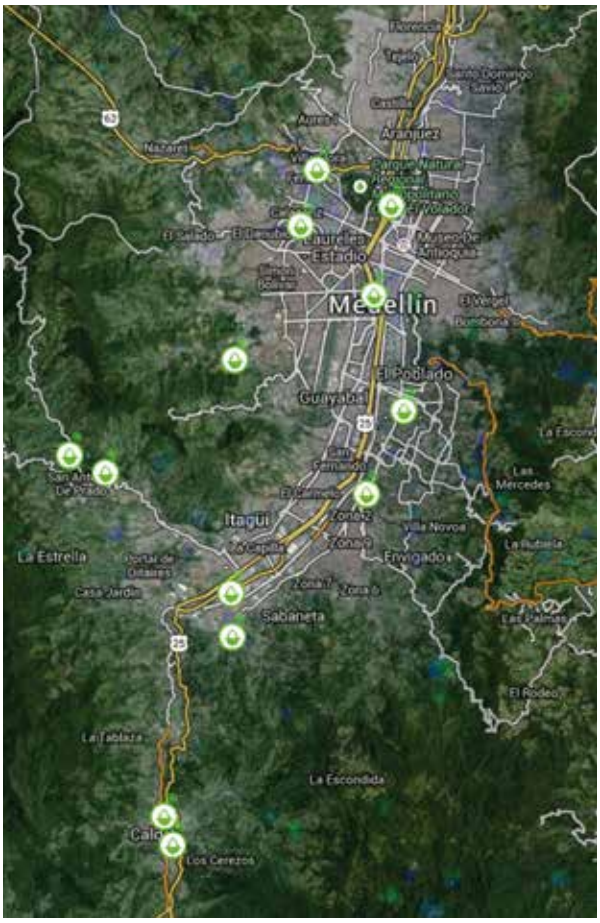
City of Dortmund, Germany:

Dortmund is a city in Western Germany with a population of around 600,000 people. Dortmund is located in the catchment area of three river-systems: Ruhr, Emscher, Lippe/ Seseke however so far there have been no relevant problems concerning floods resulting out of these rivers. The main challenge face by the city is instead coping with flash floods. After a flash flood occurred in 2008, during which in 3 hours the amount of precipitation reached the level of 200 mm, the city began addressing vulnerability along three lines of action: i) administration and planning (flood protection working group, civil protection emergency plan and appointment of a municipal flood prevention officer); ii) public information measures for prevention; iii) coping capacity and structural concepts (a hydrodynamic sewer network calculation to assess the flood risk of the urban sewer system, flood prevention plan, improvement of technical facilities). In order to reduce vulnerability a flood-checklist for land-use plans was also developed, specifically looking at water bodies and sewer systems.

Metropolitan area of the Valle de Aburrá, Colombia:

The Metropolitan Area of the Aburrá Valley is the second most important and populated metropolitan area in Colombia. The total population of the 10 cities (including Medellin) and municipalities part of this metropolitan area is close to 4 million inhabitants.

This presentation covered the early warning system (SIATA) created to cope with flooding in the metropolitan area of the Valle de Aburrá. SIATA is a research, innovation and technology project that emerged in the context of risks and natural hazards, with a view to achieving sustainability and developing Smart Cities. The project is sponsored by the Metropolitan Area of the Aburrá Valley, the city of Medellin and non-governmental entities such as Public Utilities Enterprise (EPM) and Hydroelectric Power Generation (ISAGEN). SIATA is a key risk management project, and is one of the main strategies for monitoring the Medellin River and its watershed.

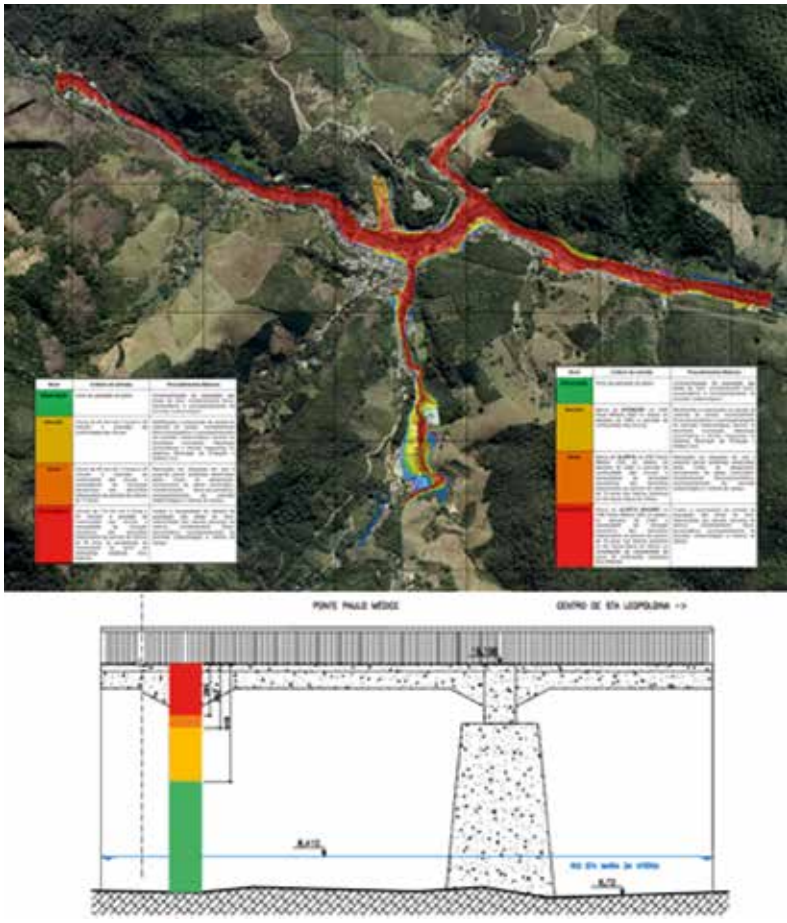


Gauging network

The SIATA operates one of the densest hydro-meteorological networks in Latin America. It is made up of 84 rain gauges, 29 level stations installed in the Medellin River and its tributaries, 16 measuring stations with weather information, a network of soil moisture with 5 monitoring stations, a network of disdrometers with 6 teams, a network of ceilometers, a network of electric field sensors, a meteorological radar C band, microwave radiometer profiler and radar wind profiler. It also operates the accelerograph network of the Aburrá Valley. In addition, a hydrological model has been developed. This is combined with communication activities to disseminate information in four important areas: digital, educational, corporate and institutional.

SIATA aims to deliver timely alerts to the response agencies and the community concerning the probability of occurrence of an environmental event that threatens human life, housing and the quality of life. It also provides relevant environmental information that is useful for decision-making on the Medellin River and management of its watershed.

The system was developed locally, which ensured low costs and operational continuity. It involved participation by the affected municipalities and population, who are actively engaged in monitoring the data that deliver real-time information to the system. Given its cost-effectiveness and participatory approach, the system has high potential to be replicated in other cities of the region and in Latin America.[9]



Mapped risk areas

City of Santa Leopoldina, Brazil:

Santa Leopoldina is a municipality on the Eastern coast of Brazil located in the State of Espírito Santo and counts around 12,000 inhabitants. The city area covers 724 square miles, 57% of which have a slope gradient between 30% and 100%. Furthermore the city is subject to floods from its river Santa Maria da Vitória. The main challenge faced by this city is the existence of illegal settlements in areas with risk of landslides. To cope with this risk, the municipality developed emergency plans, mapped the risk areas, created an educative project for risk prevention in schools and prepared volunteers to act in collaboration with the civil defense department. The municipality still faces problems such as the perception of low risk by the population and not really focused on prevention, a relatively new civil defense system (established in 2012) and a lack of financial and human resources.

City of Morretes, Brazil:

Morretes is a small historic city on the coast of the Brazilian state of Paraná. Its population is of around 18,000 people. The city presented an integrated monitoring and response system for floods that was developed to integrate all the levels of civil defense. The system is based on five methods: risk mapping, improvement of pre-existent weather monitoring, creation of an integrated response protocol, and training of the response personnel and the community. It highlights the importance of keeping the information simple and standardized in order to simplify communication of the alert.

9 For additional information on the activities of the Metropolitan Area of the Aburrá Valley and ist early warning system please see the 'Connective Cities' good practice *SIATA Early Warning System of Medellín and the Aburrá Valley*

Focus and outcome of the peer-to-peer sessions

"The State of Paraná has been developing Vulnerability and Risk Analysis for a long time, and we believe that the aggregated knowledge of the participants will help us to find solutions for challenges that we are facing."
Major Antonio Hiller, Deputy Head of Paraná State Civil Defense Department, Brazil

During the peer-to-peer session, around 12 questions/problems were raised for discussion. From these, four clusters of questions were selected as priority issues to be discussed in the workshop.

The metropolitan region of the Valle de Aburrá, the city of Medellín, and the city of Comitán de Domingúez raised the following issue: **How to deal with illegal settlements in risk areas?** Financial resources could be obtained from international and national funds, and technical cooperation could be requested in order to apply methodologies that have already provided good results in similar areas (e.g. resettlement in situ). Participation by the community was also highlighted as an important factor for successfully reducing illegal settlements. In connection with this, capacity-building and the creation of community risk management committees were suggested. Additionally, strict laws for territorial planning and the revitalization of risk areas to turn them into public parks or squares could prevent the emergence of new illegal settlements.

The city of Cologne, the city of Santa Leopoldina, and the metropolitan region of the Valle de Aburrá raised

the following question: **How to convince politicians to invest in disaster risk management in accordance with technical advice and how to promote the integration of such practices into the various municipal departments?** Here good communication is a key factor. Participants advised the speakers to try to convince the decision-makers by referring them to the best practices of other cities, in order to motivate them to follow these good examples. Moreover, the technical information provided should also speak the language of politics. This means that it must include key data such as financial viability/financial losses, number of potential deaths in case of a disaster, etc. and use appropriate language to reach each department. Having a communication assessor in the civil defense department is a good strategy to allow a clear transmission of the message, not only for politicians but also for the citizens, who could pressurize the former to act preventively.

The representatives from the City of Campinas and from the consultancy company Practical Action from Peru asked: **How could citizens be involved in risk management and how could traditional knowledge be used to support it?** Involving the community in all stages of the risk management cycle is a key factor for promoting continuity of actions and for shifting the mentality of the population from victims to agents of risk reduction. To achieve this, capacity-building in schools and in informal educational arenas (such as radios, fairs etc.) will be essential. Communication with the community must be clear, simple and specific to each community. Taking into consideration local traditional knowledge, for example the daily experience of people living in flood-prone areas, has the potential not only to integrate the community in the monitoring process, but also to gather information where no data is available. The City

of Manaus mentioned their good experience with community members who possess such knowledge, and the information they provide is included in the formal monitoring procedure just like the data provided by a hydrological sensor.

The Civil Defense Department of the State of Paraná and the City of Duque de Caxias raised the following issue: **How to determine inundation levels based on rainfall patterns?** Modeling is the best mean to establish inundation scenarios. Nevertheless, to apply it, data must be available. If the municipality does not have historical series to use as an input for the model or is not able to calibrate this model, one alternative would be to use traditional knowledge (information provided by the people who live in risk areas) to try to connect rainfall patterns with inundation scenarios. The installation of real-time rainfall sensors can also achieve good results, as indicated by the city of Medellín, which uses such sensors in its early warning system.

"It was very helpful for me to see, not the technical aspects, but how to communicate with politicians and with inhabitants on flood protection and risk management. The problems faced by the participants are the same as those we have in Europe"
Heinz Brandenburg, SteB, City of Cologne, Germany.

Ideas for future cooperation and take-home messages

"The theme presented by the City of Hagen caught my attention. The inundation maps developed by the city are really good, and it would be interesting for us to develop something similar to complement our early warning system."
Jaime Zapata, City of Medellín, Colombia

On the last day of the event the participants expressed their interest in keeping in touch through an online tool (e.g. Internet platform provided by Connective Cities), in order to continue developing cooperation projects and sharing their knowledge. Participants emphasized how important the Connective Cities events were for creating a flood risk management network and for facilitating a joint learning process. This sharing of knowledge and lessons learned by practitioners will systematically improve the risk management strategies of municipalities, so it was argued. Many of the experiences exchanged were useful to the municipalities present, especially with regard to protocol standardization for warning systems, risk communication strategies and tools to develop local VRA.

In line with their interests, participants developed ideas for next steps for further cooperation through the Connective Cities network. Each of these is described briefly below.

1. **Standardization of signs for the alert system in Brazil**
   Proponents: Civil Defense Department of Paraná, SIMEPAR, City of Curitiba and SANEPAR
   The idea is to persuade cities from different regions in Brazil to hold a workshop in order to agree upon a standard for communicating levels of alarm in the country. The City of Cologne was invited and confirmed its participation in the event (which will take place in late November 2015), in order to demonstrate its experience with integrated flood management of the Rhine river basin.
2. **Knowledge sharing visit to the early warning** system in Medellin and Valle de Aburrá
   Proponents: City of Santa Leopoldina, City of Medellín, City of Cologne, Practical Action (Peru)
   The proposed idea is to visit the early warning system developed by the metropolitan area of the Valle de Aburrá.
3. **Development of a methodology to integrate disaster risk analysis and mapping into an urban master plan**
   Proponents: Institute for Technological Research (Brazil), City of Hagen, City of Cologne, City of Duque de Caxias, City of Comitán de Dominguéz
   The idea is to collate and review best practices in this area and to develop a workshop in the city of Comitán de Dominguéz, including a study visit. The expected outcome would be a report that could be presented to the mayor of this city in order to support the integration of risk management into the master plan for the city.
4. **Understanding the available software for risk mapping, risk management and early warning systems**
   Proponents: WayCarbon (Brazil), City of Manaus, City of Campinas, City of Cologne
   Development of an inventory of existing software, tools for data standardization and data management, and tools for knowledge transfer (bottom-up), and then sharing the information in a workshop.
5. **Support the establishment of volunteer brigades in the State of Espírito Santo**
   Proponents: Civil Defense Department of Espírito Santo (specifically in the cities: Santa Marta, Santa Leopoldina and Santa Teresa), City of Dortmund
   The idea is to arrange an exchange visit between one of the cities in the state of Espírito Santo and the City of Dortmund in order to define protocols, assess needs and build capacity.

The take-home messages that emerged from this workshop were:

- Data availability is a main issue for the development of VRA.
- Community involvement is important for supporting data collection and generating risk awareness.
- Illegal settlements in risk areas must be removed, and these areas should be revitalized and turned into public spaces, such as linear parks.
- Good communication is key to convincing decision-makers to support risk management strategies and to motivating the community to engage as agents of risk reduction.
- Sharing between practitioners should be made continuous by establishing an online platform to support the further development of joint projects.

"It is important that the municipalities have space, like they have at this event, to show what their needs are for the development of flood risk management plans. Only in this way we can interact and develop methodologies and tools that will be actually useful to them."
Agostinho Ogura, Institute for Technological Research, São Paulo, Brazil

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