

Steiner, Andrej; Bauer, Rudolf; Knezova, Jana

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Linking city development and adaptation to climate change

JEL: Q58, Q59

Andrej Steiner – Jana Knezova

Abstract

Climate change is happening, projected to continue and poses serious challenges also for cities' development. Extreme weather events resulting in hazards such as heat waves, floods and droughts are expected to happen more frequently in many parts of Europe. The United Nations Intergovernmental Panel on Climate Change (IPCC) predicts global temperatures to rise an additional 2-4°C by the end of this century and graduation of weather extremes.

While urban areas will generally experience the same exposures to climate change as surrounding regions, the urban setting can alter these local impacts. The replacement of natural vegetation with artificial surfaces and buildings creates unique microclimates altering temperature, moisture, wind direction and rainfall patterns. Moreover cities forms difficult dynamic systems with high density of people, hub of services and infrastructure so the climate change impacts have and will have potentially serious consequences for human health, livelihoods, and assets and ultimately influence the development of the entire city and its surroundings.

However, many city managements are still inactive in this field. It is caused mainly by lack of information, low awareness and knowledge and absence of positive good examples. On the other hand an increasing number of cities around the world have begun to plan for climate change by developing stand-alone climate plans or incorporating climate considerations into existing plans, policies, and projects to become more resilient towards existing and future climate impacts, thereby limiting their magnitude and severity.

City of Kosice, Slovakia namely, its largest city district West in cooperation with the research institution Carpathian Development Institute had implemented (as one of the first in Slovakia) the process of climate change adaptation in order to be better prepared and adjust proactively for the heat waves as the critical climate change impact on the city borough residents. The

adaptation strategy is built on the principle “low cost quick win” based on assumption that increasing resilience requires not only robust decision making and big investments, but also a strong web of institutional and social relationships that can provide a safety net for vulnerable populations. Through both formal planning activities and concrete measures preparations, city is building their capacity to adapt effectively to existing and future climate impacts, while also experimenting and innovating in policy making and planning. The paper highlights key lessons learned from planning and implementing climate adaptation process as a part of innovative and integrated city development policy.

Key words: climate change impacts, city development, adaptation process

Introduction

As climate change intensifies, it is expected that urban areas will need to navigate a host of challenges associated with grater variability in temperature and precipitation as well as increases in the intensity and frequency of storms, floods, droughts, and heatwaves. Disasters caused by these phenomena increased fivefold since the 1970s, UN finds.

Forget the future. The world already is nearly five times as dangerous and disaster prone as it was in the 1970s, because of the increasing risks brought by climate change, according to a new report from the World Meteorological Organization. The first decade of the 21st century saw 3,496 natural disasters from floods, land-slides, storms, droughts and heat waves. That was nearly five times as many disasters as the 743 catastrophes reported during the 1970s – and all of those weather events are influenced by climate change (see Fig.1). Some disasters – such as floods and storms – pose a bigger threat than others. Flooding and storms are also taking a bigger bite out of the economy. But heat waves are an emerging killer.

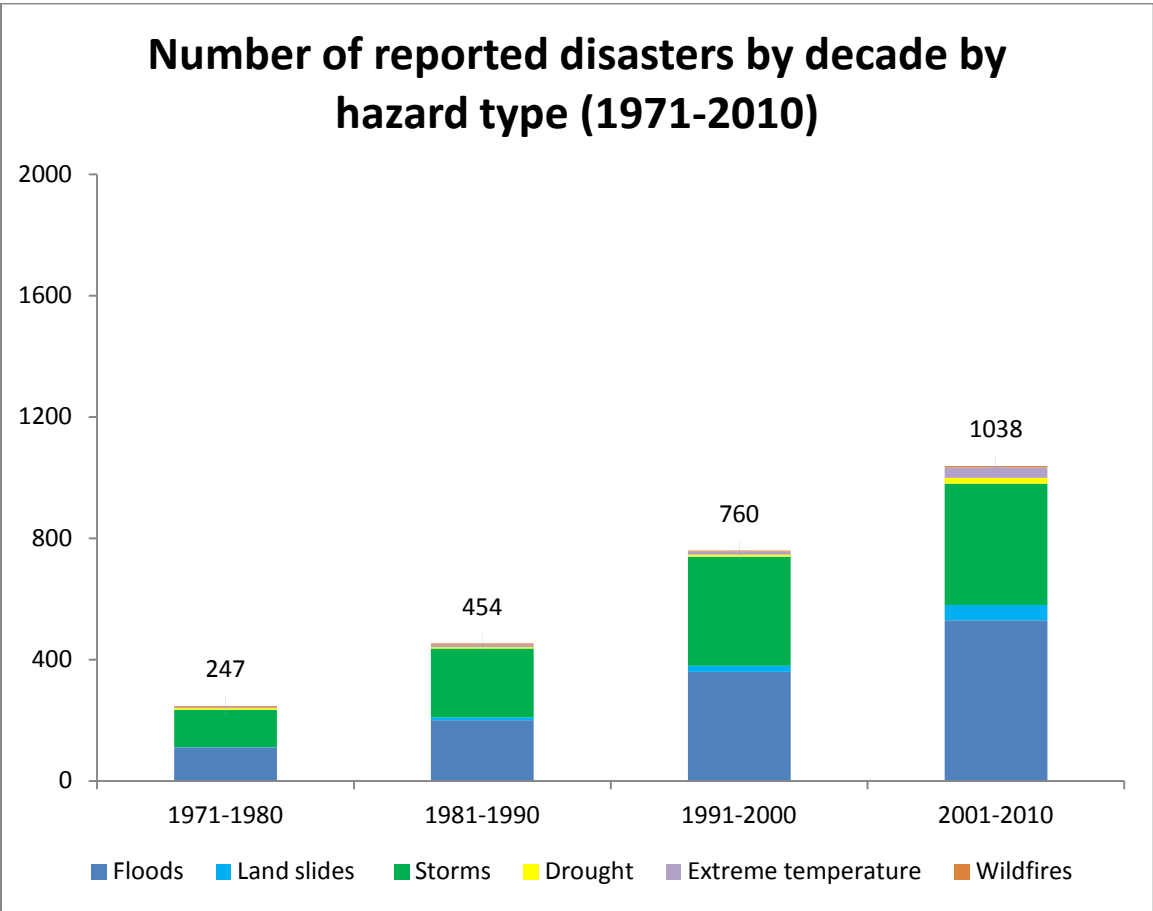


Fig. 1

Climate change impacts and cities

Conditions such as these have potential to endanger human lives and health, to overwhelm infrastructure, threaten urban plant and animal life, alter the habitability of many buildings, and stress existing infrastructure, emergency services, social services, and management in urban areas (Gasper et al.,2011). Already more than half of the global populations living in urban areas and, until the 2050, the number of people residing in cities is expected to increase from 3.6 to approximately 6.3 billions (UN 2012). This means that, as climate conditions change over the time, most of the world's population will be in risk from climate impacts (Dodman, D. and Satterhwaite, D.2008).

Minimizing the impacts that climate change will have on cities and their inhabitants requires that urban municipalities take steps to address the risks they face. To manage the threats associated with climate change, a widely held view is that urban adaptation planning and action should be predicated on locally conducted assessments rooted in scientific evidence. However, there is also widespread recognition that climate science cannot provide certainty about future conditions and that the best way to plan for climate impacts and identify appropriate measures is still an emerging area of knowledge (Morgan,2011). These challenges are not unique to the arena of climate change adaptation. Many policy decisions at urban and national levels have to be taken based on uncertain knowledge. Nonetheless dealing with uncertainty is of particular importance to urban adaptation given the emerging awareness that climate change will be a major force shaping economies and societies within cities in coming decades (Brugman 2012).

The battle for climate compatible development – mitigating climate change and managing its impacts, while achieving human development – will be won or lost preferably on subnational level mainly in cities and their surroundings. Many national governments, including the Slovak one, are striving to tackle climate change by passing climate legislation, setting national targets and developing climate action plans. To be effective, national climate policies and plans need local implementation. It should happen through multi-tiered structure of provincial and city governments, and combination of public and private actors – the key players in meeting national goals. The 19th Conference of the Parties to the United Nations Framework Convention on Climate Change in Warsaw, Poland, in 2013 made an effort to harness this momentum for change when it marked the first UNFCCC Cities Day. This high-

profile event recognized the importance of cities leadership on climate change, by words of its president Marcin Korolec saying “(Cities) are crucial in our effort to tackle climate change”.

Climate compatible development at the city level has particular characteristics. It is distinct from national or regional level and it is also distinct from conventional development processes. Following challenges for climate compatible development are particularly acute at the city level in Slovakia but also applicable in other countries:

- City institutions and leaders face intense pressure to act in the face of negative climate impacts. They are typically city communities’ first port of call for relief and recovery following extreme weather events such as heat waves, flooding, drought and thunderstorms. In addition the impacts of such events may undo the development gains of recent decades, damaging people’s health and well-being, livelihoods, assets and infrastructure. Local governments with limited funds should see first-hand the imperative of building climate resilience into their investment decisions.
- People have high expectations for city authorities to respond to climate change. These expectations may be out of sync with the official powers and resources that authorities have at their disposal. There is often disparity between the need for political and financial authorities, resources, and capacity to respond to climate-related challenges at the city level and the actual power, resources and capacity available. This can limit local authorities’ options for action.
- City governments mutually and central government agencies acting in or around the cities may struggle to coordinate among each other. Lack of coordination makes it harder to respond effectively to climate change impacts and forge long-term solutions. Local authorities typically face the challenge of “horizontal integration” that is needed to cooperate efficiently across jurisdictional boundaries to address broader problems. Some climate adaptive solutions flow across political and administrative boundaries and action taken in one jurisdiction can affect negatively situation in another, for instance, action (or lack of action) to manage flooding. Further challenges arise when the policies and actions of different entities operating in the area are not well integrated because people, goods and services move across boundaries with knock-on effects for economic and social activities.

- City leaders and city administration are overwhelmed by the “day job” of immediate service delivery. Pressing development needs are the reality for them, especially in rapidly growing urban areas. Political pressure from the electorate is likely to focus on short-term concerns. Many of the greatest climate change impacts will emerge only years from now. The decision taken now (or not taken) may affect people’s lives not immediately but in the next decade (s). It is difficult for leaders to justify spending time and resources on longer-term planning without explicit popular support for such a vision.
- Cities’ location may be particularly climate-vulnerable, It is not only due to the fact that majority of cities sited at strategic points along the rivers, so they are more prone to floods, but also because of municipal policies not taking into account climate threats (e.g. excessive surface pavement, incorrect urban design, obsolete water management etc.) which makes a pass to higher damages from extreme weather events.

Preparing for the impacts of climate change requires that cities develop plans and implement adaptation programs. However, since urban adaptation is a nascent policy domain, there are an increasing number of programs and guidebooks but no established best practices or norms for planning and implementation they can follow. Nevertheless some cities have initiated planning, either for the entire urban area or for specific sectors or departments. For some cities, it is a realization of being vulnerable that compels them to take action, while for others; it is the recognition that adaptation is a means to advancing local goals and priorities, such as sustainability or economic development.

Although cities are following a variety of trajectories in their planning, with respect to timing and approach to assessments, the advice provided by many professional organizations is that, they should create a foundation for their adaptation efforts by obtaining climate data that project expected changes and assessing the impacts of anticipated change through models and scenarios.

The majority of Slovak cities have already met with the impacts of climate change such increase of frequency and intensity of torrential rains causing fluvial and pluvial floods,

thunderstorms, changes in precipitation manifested in long droughts or heatwaves. They had to deal with significant negative consequences of these events on human health, infrastructure, services and last but not least on their development intentions. Despite of this fact the vast majority of the cities in Slovakia are in this field inactive, not doing any systematic climate adaptive steps. This is mainly due to low awareness of risks resulting from climate change for urban development but also due to lack of applicable methodologies and capacities to implement them.

Kosice city borough West – pilot approach

The earth's climate has been in a state of constant change throughout the ages, to which humans, animals and plants have had to adapt. Today such great societal assets have been created, particularly in urban areas, that protection of these areas against climate threats can pay for itself even in cases where extensive investments are required. Kosice city too will be affected by the global changes in the climate. It is therefore important for the city to be prepared for the climate of the future.

Kosice, particularly self-government of city borough West as one of the largest city parts of Kosice having more than 40.000 inhabitants had decided to prepare the climate change adaptation plan. The city part is relatively homogenous residential area – mainly blocks of flats, so far considered as the greenest part of Kosice city.

With the climate adaptation plan it wanted to outline the challenges the city faces in the short and medium terms as a result of changes we expect in the future climate. At the same time it also intended to identify those solutions that, based on our present-day knowledge, appear to be most appropriate and reveal the opportunities for development. Despite they do not yet know all the consequences climate change will have for Kosice-West, they are committed to continuously implement the measures required for their city part to be climate safe and attractive city part to live and spend time in.

To date climate change impacts, elaborated by climatologist, on the city of Kosice:

- Increase of average temperature (1881-2010) – 1,6°C
- 10 hottest years in the last 150 years since 1990

- Number of tropical days ($\geq 30^{\circ}$ C) have increased in last 20 years from 12 to 20 days (in the year 2012 it was 37 days) and maximum levels very often exceed 34° C
- Number of icy days decline deeply under 40 while in 1950-60ties very often this level was exceeded
- There are very variable (in comparison with 80ties) rainfalls while total amount of precipitation has not been changed significantly (more torrential rains causing floods)
- In the last 20-25 years Kosice and its vicinity are affected long-term droughts

As a priority impact to be addressed the heat waves have been selected for preparation of the adaptation plan.

The adaptation plan on the Kosice-West level was based on the following criteria

- Evaluation of adaptation measures (efficiency, costs, applicability to local conditions) in relation to vulnerability assessment
- Taking into considerations existing limits (disposable time, resources) so the strategy would be feasible
- Agreement on the selection of adaptation measures, which will be realized in the territory, communication with elected representatives of public authorities, other institutions and public.
- Elaboration of implementation plan (responsibilities, financing, time plan, monitoring and evaluation).
- Integral inclusion of goals and measures of local adaptation strategy into relevant development plan

Adaptation process to heat waves has had 3 stages:

A. Setting the scene

To maximize the success and effectiveness of adaptation actions there should be a joint understanding between people within communities, local authorities and other key stakeholders. This helps all parties to work together to develop adaptation pathways which are based on a mutual understanding of the issues relating to climate change, hazards and risk, and the needs of the different participants. Adaptation is a shared responsibility and partnerships are critical i.e., it is not something that any one

council or particular agency, or community, or discipline can do alone (Steiner, Hegyi at al.2012).

It requires:

- Detailed description of climate change impacts on selected territory (understandable not only for specialists but also for decision-makers and public)
- Education and other activities for gaining:
 - Political and professional support of public authorities
 - Support and participation of public
- Selection of leader who will lead the process
- Creation of cross sector, cross institutional, interdisciplinary expert group

B. Vulnerability assessment

Two basic approaches to assessment have emerged: hazard based and vulnerability based (Fussel 2007). The hazard-based approach, also referred to as the risk based, typically draws on scientific models to identify anticipated changes in climate system. Those changes are then examined with respect to how they will be experienced in the city – how they will affect a local area. Alternatively, the vulnerability-based approach evaluates climate change in the context of current stresses, placing and emphasis on social factors associated with exposure, sensitivity and adaptive (coping) capacity. Inherent in this approach is recognition that the nature of climate risk is shaped by development context and the climate vulnerability is linked to both development patterns and government behavior. The latter on has been used in case of Kosice following chart on Fig.2:

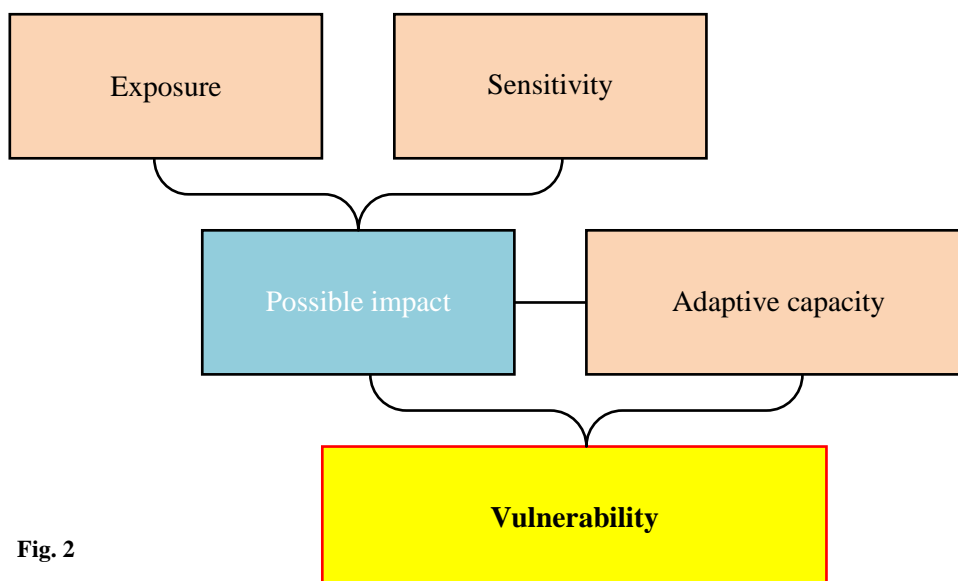


Fig. 2

- Exposure to heat waves was assessed in three ways (Fig.3)
 - Continuous temperature measurement in the car during a hot day
 - Continuous temperature measurement in the car during late evening
 - Discrete measurements on selected city spots

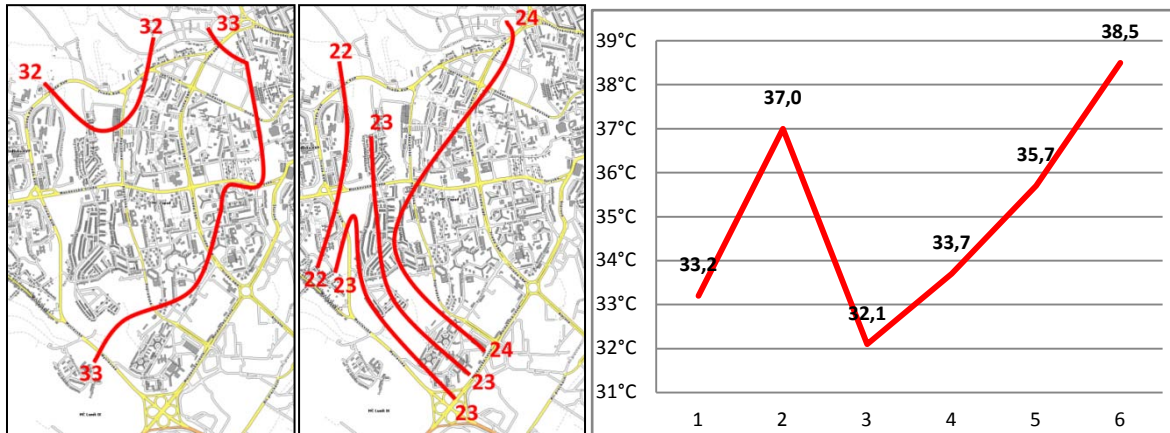
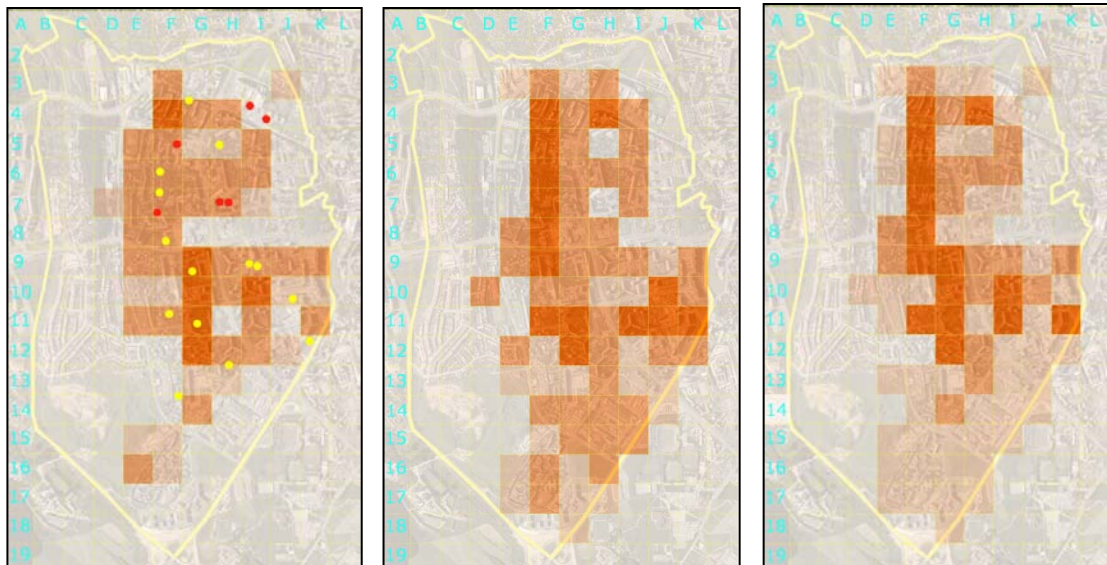


Fig. 3

Comparing all three types of measurements we can state that Kosice-west in general are equally exposed to the high temperature during the day (relatively flat results caused by mixing air) but in the night the west part is in better situation (result influenced by the katabatic wind stream and better air circulation). The spot measurements showed that general picture is significantly different in details (in the park, parking lot, urban forest, at the water area, blocks of flats without air circulation).

- Sensitivity and adaptation capacity to heatwaves
 - To assess the sensitivity crucial factors have been selected (e.g. density of the most endangered residents – 75+; 4-; green and blue infrastructure, including its quality; extent of paved/hard surfaces; surface roughness preventing air-circulation, people living in underroof flats with low thermal insulation etc.)
 - To assess the adaptive capacity selected important relevant factors have been collected (e.g. accessibility of green areas/cover of trees more than 60%, public transport, health emergency services, behavioral patterns of people etc.)
 - All factors have been weighted in terms of their seriousness for human health
 - Data projected on the maps and/or narratively described (see some examples on following pictures).



Incidence of population
in risk

Summary of
environmental factors

Summary of most
vulnerable areas

C. Elaboration of Adaptation strategy to address heatwaves

The main goal of the strategy aims at reducing vulnerability of people living or working in this part of Kosice city via decreasing sensitivity and increasing adaptive capacity. The basic principle is to concentrate on localities with the highest degree of threats taking into account existing limitations. Strategy is elaborated in following programs:

- Shielding program (by vegetation, by artificial shields)
- Cooling program of public spaces (increase of green areas, exploitation of climate appropriate trees, converting and reducing of paved/hard surfaces, channeling higher ventilation of the area, introducing blue elements etc.)
- Program of cooling indoor public spaces (thermal insulation, vertical greenery, shielding transparent openings, green/reflecting roofs, air conditioning...)
- Program for developing good patterns of behavior during heat waves (informative and educational activities for citizens)
- Program to enlarge and improve refreshing places (revitalization of existing parks, increasing number of parks, introducing new fountains with water spraying, places of potable water...)

Why to mainstream climate change impacts into sustainable development?

- Changes will have very serious, mostly negative, influence on development of territories and quality of life of its citizens
- Climate change is a result of unsustainable development patterns
- Climate change impacts cause difficulties for development activities
- Activities related to reaction on climate change may be considered as development activities
- Reaction to climate change impacts has to be complex in accordance with all urban development projections

Sustainable development makes territory more resilient to climate change. On the other hand the measures, which improve the resilience to climate change, can synergically contribute to development notions in territory.

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