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The potential impacts of climate change on water supply in Johannesburg

Matuszewska, Ewa

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2 PLANNING AND CLIMATE CHANGE

"Problems created by man can be solved by man."
– John F. Kennedy (Hall and Pfeiffer, 2000, 103).

Planning, in the design of urban and rural areas, is used to schedule both existing and future projects. Therefore, planning uses existing information to plan in the present and to plan for the unknown future. Climate change, which is an irrefutable phenomenon that occurs on a continuous basis, will keep impacting cities in a variety of ways in the future. Thus, climate change will have an effect on the scope and limitations of planning. This chapter presents and examines the concept of planning, and its relationship to climate change. This section provides the basis for this report, as it shows the importance of planning for climate change. Firstly, planning in a context of uncertainty and different planning scenarios are examined. Secondly, the link between climate change and planning is shown. Thirdly, definitions are provided before a conclusion to this chapter is presented. In view of the fact that this report focuses on the city of Johannesburg, the factors used in this report are based on or related to urban planning. The thought process followed in this chapter is based on selecting information that is appropriate and relevant for the link between planning and climate change.

2.1 PLANNING DESPITE UNCERTAINTY AND SCENARIO PLANNING

Planning is a profession that plans and designs the existing and future use of land in urban areas. Many factors and physical features such as topography, the availability of water, the population, services, the environment and climate influence the intended function and subsequent development of land. These factors and features are significant issues in planning, since they shape and determine the way in which plans are designed for present and future cities.

Planning is a discipline that envisions and plans for the future; therefore it is based on our unknown or limited knowledge of the future.

Planning, as argued by Lein (2003), will never be ideal or fixed, as it is founded on the notion of taking into account various possible options and results. Lein (2003) suggests that planning is used to avoid potential problems by concentrating on supposed problems. He adds that planning is meant to identify possible risks and look at the future, when trying to predict what will happen. Accordingly Abbott (2005, 237) demonstrates this essential point by stating that, "planning is about changing the future, or at least the expected future".

An important every day function in planning is to establish, evaluate and tackle uncertainty, and ultimately decrease uncertainty (Christensen, 1985; Donaghy, 2007). That's why a big component in planning is the element of uncertainty, possibly in the present, but most definitely in the future (Abbott, 2005). For this reason, prediction as revealed by Lein (2003), is one of the main features of planning. Planning and hence planners need to rely on existing knowledge and experience, whether it be primary or secondary, to formulate successful plans for both present and future scenarios (Kartez and Lindell, 1987). Therefore, Marris (in Abbott, 2005) emphasises that planning is about organising present or future activities, in an attempt to control uncertainty. In that case it would be feasible to say that planning incorporates and is based (to some extent) on uncertainty.

Furthermore Abbott (2005, 241) emphasises that "if planning is about changing the expected future, then it is about understanding and changing these links between the present and the future". Thus, planning has to utilise and take into account past and present information in order to predict and speculate about the future (Abbott, 2005). So for this reason, Flinn and Grant (1992, 111) emphasise that, "when planners peer into an uncertain future they have to base their mathematical predictions on certain assumptions over which they have little or no control. . . . Planners have to accept this constraint on their work as a fact of life".

As planning integrates the component of uncertainty, while relying on the constant use of existing knowledge and experience to plan for the unknown future, the planning concept of scenarios or alternatives develops. A scenario as

Lein (2003,145) demonstrates, presents possible flexible futures, and they are based on the belief that the future is unclear and almost impossible to predict. Scenarios come about by using known information to develop feasible outcomes. What is more, they indicate possibilities, not certainties (Bridgman, 1998). Since scenarios are derived from trends and likely future events (Lein, 2003), planning develops and predicts scenarios that might occur at some time in the future. It is about considering the unthinkable and preparing for any possible event (Ilbury and Sunter, 2001).

Planning practices tend to differ from situation to situation (Christensen, 1985). For this reason, planning scenarios will be different for each city, due to the variety of factors and physical features that influence the development of land in that city. So therefore in closing it can be settled that "the planner creates a scenario to describe the interaction of trends and events and to explore the possible course of alternative decisions on the future state of the planning area" (Lein, 2003, 146).

2.2 THE LINK BETWEEN CLIMATE CHANGE AND PLANNING

As presented above, the design, creation, development and sustainability of a city depends on its position and surroundings, its function, accessibility and size. Planning (and by implication city plans) are shaped and guided by these factors. The above points emphasise that planning is based on uncertainty in predicting the future, while relying on scenarios derived from past and existing knowledge. Therefore, the ability of planners and hence the capacity of planning are founded on knowing and understanding aspects related to an array of professions, including, amongst others, engineering and geography. This range of knowledge gives planners a wider view and understanding of aspects that affect planning.

In order to ascertain the link between climate change and planning, it is necessary to investigate the concept of environmental planning. Environmental

planning incorporates the notions of environment and earth science with planning (Lein, 2003). Our environment is important and necessary because we, as human beings, rely on that environment for food, water, land, oxygen, shelter and resources. The environment provides us with all the necessary requisites to survive in the present and in the future. Climate change falls within the boundaries of environmental planning, because it has to do not only with changes in the environment, but also the influence those changes have on urban areas. Climate is part of our environment, and therefore climate change can be categorised as an environmental problem – it brings about changes in our environment and hence changes in our lives.

Environmental planners, by investigating alternative scenarios, aim to maximise the benefits for humans and the environment, while concurrently aiming to minimise the impact of human development (Lein, 2003). Therefore, environmental planning ensures and protects our future and our children's future, because the environment is an important and limited resource. If environmental degradation continues at the present rate (due, for example, to climate change) it will have dire consequences for all life on earth.

Planners, by planning, as revealed previously, design our future cities. "All cities cause climate change, emitting toxic chemicals" (Hall and Pfeiffer, 2000, 106). Hall and Pfeiffer (2000) emphasise that climate change, as an environmental problem, is a dilemma that is being faced worldwide, and it is therefore everybody's shared responsibility. Consequently, any urban planning is and will inevitably be linked to climate change, as climate being part of the environment influences the design of future cities, and future plans are based and guided by the environment. Planners' play an important role in the future design, functioning and structuring of cities, and consequently their contribution to negating the effects of climate change, is vital.

"Climate change is fundamentally about degrees of uncertainty" (Jarman, 2007, 82), and in addition climate change is a challenging, uncertain issue with increasing ambiguity about its speed, influence and scope, and the possible scenarios that might develop. It is, therefore, necessary to investigate and research alternative scenarios, in order to envisage possible outcomes and

formulate meaningful interventions (Houghton, 2004; Donaghy, 2007; Du Plessis and Van Wageningen, 2007).

For the above reasons, climate change and planning are inevitably linked in that they both comprise a significant degree of uncertainty despite requiring calculated action. Harris (1978, 266) asserts, “The effects of many current decisions will have major long-term impacts”. Therefore, as long as climate change continues to have a worldwide impact on cities, urban planners will have to prepare for and anticipate the unknown future impacts of this phenomenon. They will also have to incorporate the envisaged impact of climate change in their present and future plans. Hence there is a link between (environmental) planning and climate change, given that planners design the future, and climate change as an environmental problem must, of necessity, form part of that design. In addition, human beings have to “learn to work with nature and to accept the basic ecological trade-offs between protection and production” (Boyan and Ophuls, 1992, 40).

Donaghy (2007) points out that due to events related to climate change, a number of impacts are foreseen, such as increased stress on emergency services and public utilities, and damage to infrastructure and housing. The stated impacts are all, in one way or another, linked to planning, since planning considers, incorporates or relates to these aspects in the design of cities. Subsequently, the envisaged impacts show a significant link between the actual impacts of climate change and their potential effect on planning.

The point emphasised in the previous section, namely of planners using their experience and knowledge to plan for the future, is an essential factor when it comes to climate change and environmental planning. In planning, environmental planners require the necessary knowledge on the land they are working with. They need to know how the land works to sustain life, what the purpose of the land is, and also how it changes from season to season (Lein, 2003). Climate change will, without question, unavoidably bring about changes to the land, which, in turn, will impact planning.

Inadequate or inappropriate planning may result in increased environmental risks to humans. One of these environmental risks may be a natural hazard, where hazard is the danger related to a potential problem, and risk is the possibility of being harmed by a hazard. Weather-related natural hazards include floods and droughts (Randolph, 2004). Natural hazards pose a constant threat to humans, and in one way or another most societies will be forced to deal with them at some stage (Lein, 2003). Climate change may bring about or increase such natural hazards.

Kartez and Lindell (1987) aver that planning (as described previously) has to utilise existing experience or available knowledge about disaster planning in order to plan for future disaster management. Therefore, skilful planning may reduce the risks posed by natural hazards (Randolph, 2004). Planning needs to work with nature in order to ensure sustainable hazard management and decrease human and environmental vulnerability (Lein, 2003). Having the knowledge and understanding of possible hazards will not only help planners plan, but will also help them evaluate current levels of vulnerability and concomitant future risk (Lein, 2003).

The United Nations Framework Convention on Climate Change (UNFCCC) (2000) and Alcamo et al. (2009) have identified a significant issue related to the link between climate change and planning. They reveal that any present development of infrastructure, has to be constructed with the knowledge that present infrastructure will function under altered climatic conditions in the future. This is owing to the fact that infrastructure takes years to be build, and has a duration in excess of 75 years, therefore during the construction period and its existence, the climate may possibly change and result in a variety of impacts on the infrastructure. Consequently, adapting to climate change is a necessary factor in planning and designing the built environment (UNFCCC, 2000; Alcamo et al., 2009).

“The natural tendency to tinker encourages us to seek greater powers of prediction and to incorporate the implications of forecasted climate impacts earlier in the planning process” (Jarman, 2007, 82). Therefore, planning in the

present and in the future needs to be “prepared in anticipation rather than after a natural disaster” (Randolph, 2004, 243).

In the past, planning as a profession “often proved too slow, too reluctant to intervene, or [was] based on unrealistically high standards which were ignored” (Hall and Pfeiffer, 2000, 108). In most instances, planning did not make provision for the need to incorporate climatic impacts, even thought the knowledge of such factors was considered when planning. Nowadays, planning has developed into a profession that requires the informed integration of all aspects of various related professions (geography, engineering, architecture). Most recently, planners have begun to accept the fact that worldwide environmental challenges and problems are occurring, and to accept the consequences of those impacts on planning.

Climate change is a relatively new issue worldwide, which has an affect on everyone and everything in some way or another. It has also developed into a global challenge that influences any proposed development in respect of urban planning. Therefore, climate change ought to be integrated and recognised in planning, as it will affect the way in which plans are developed, and also determine the manner in which cities will expand in future.

Hallegatte (2009) stresses that due to growing worldwide awareness of climate change, planners are increasingly worrying about its effect on their activities, in the face of heightened uncertainty about the actual impact of climate change.

2.3 DEFINITIONS

WEATHER

Weather is “the fluctuating state of the atmosphere around us, characterised by temperature, wind, precipitation, clouds and other weather elements” – IPCC (Leroux, 2005, 41). Weather occurs “at a given place and time” (Miller, 1996, 129).

CLIMATE

Climate is the average weather that includes wind, precipitation and temperature over a specific period of time (normally about 30 years) (Bates et al., 2008; Joubert, 2008). Climate consists of normal weather patters, weather extremes (long-term rain or drought and storms) and seasonal deviations (Miller, 1996). Climate varies from one area to another, thanks to specific factors such as topography, latitude, vegetation and distance from the sea. The climate may also change annually, seasonally or over decades (Leroux, 2005).

CLIMATE CHANGE

The IPCC defines climate change as a change in the state of the climate over decades, or longer, due to external unnatural forces or natural systems (Bates et al., 2008). The UNFCCC classifies climate change as "a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is, in addition to natural climate variability, observed over comparable time periods" (IPCC, 2007, 30).

GREENHOUSE GASES

Greenhouse gases are the gases in the atmosphere that include water vapour, methane, carbon dioxide, nitrous oxide and ozone. These atmospheric gases (natural and produced by human intervention) absorb infrared radiation (Bates et al., 2008; Alcamo et al., 2009). The level of gases in the troposphere (inner layer of the atmosphere), according to Miller (1996), determines the level of sunlight entering the troposphere and the absorption of the heat in the troposphere, given off by the earth's surface (greenhouse effect), which consequently determines the temperature and climate on earth.

GREENHOUSE EFFECT

The greenhouse effect is the process whereby greenhouse gases trap heat in the troposphere. As explained above, the absorbed infrared radiation is produced by the earth's surface, and is absorbed by clouds and by the atmosphere itself (Bates et al., 2008). Due to the greenhouse effect, the earth's atmosphere and consequently its temperature remain warm enough for the survival of humans, animals and plant species (Spence, 2005).

GLOBAL WARMING

Global warming is the observed or projected steady increase in mean surface temperature globally. An increase in temperature is one of the side effects of a change in carbon dioxide levels – a product of human intervention (Bates et al., 2008). In the normal course of things, the earth absorbs heat rays from the sun and consequently gives off infrared radiation, some of which is trapped within the earth's atmosphere. The process of global warming occurs when, due to an increase in the level of carbon dioxide in the atmosphere, the atmosphere thickens. Subsequently, the atmosphere traps more infrared radiation, which causes the warming of the planet, and leads to increased temperatures (Houghton, 2004; Gore, 2006).

CARBON SINKS

Carbon sinks are natural terrestrial or aquatic systems that absorb atmospheric carbon dioxide. The two natural carbon sinks are the ocean and the land: they reduce by more than half the carbon dioxide produced by land use and fossil fuel emissions, by eliminating these from the atmosphere. Therefore, a huge part of the entire human-induced atmospheric carbon dioxide load does not merely stay in the atmosphere. Carbon sinks are very susceptible to land use and climate change (Alcamo et al., 2009).

In summary, planning is a profession that is based on uncertainty and uses past scenarios or possible alternatives to foresee likely changes in the future. In order to limit and minimise uncertainty in future plans, planning needs to use existing knowledge and experience drawn from a vast array of disciplines, in order to formulate alternatives or scenarios.

Climate change is a phenomenon that affects every country on earth. It can be categorised as an environmental problem, given that it can manifest or aggravate natural hazards. As natural hazards occur worldwide, the impact of climate change will, therefore, be experienced globally. Planning and climate change have, without a doubt, gradually become interconnected because both are based on uncertainty. Climate change influences the development and expansion of

cities, and therefore planning needs to understand and incorporate climate change-related aspects in all future urban planning.

This chapter forms the springboard for the remainder of the report, since it presents the link between planning and climate change, and shows the importance and need for conducting this and further research. The report utilises the planning aspects of uncertainty and possible scenarios, by outlining the possible future climate change impacts on water supply. Aspects of planning and climate change, as highlighted in this chapter, have been utilised, referred to and linked to in the rest of the report.