Planning for Crisis or Risk? Lessons learned from Recent Severe Droughts in the U.S. Urban Metropolitan Areas

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ABSTRACT

The research examines whether the U.S. fast growing urban areas have taken planning actions to prepare to address the crisis of water scarcity or drought challenges. This paper aims to discover whether the extent of existing drought planning efforts serve for crisis responses or risk management. The local land use plans from the top 100 fastest growing counties in the U.S. were evaluated based on the plan evaluation coding protocols. Results show the weak local awareness and preparedness of water scarcity and drought issues across these rapid growing urban metropolitan areas in U.S. The majority of jurisdictions fail to take the long-term adaptive planning strategies into their land use plans. Local planners in these fast growing metropolitan areas generally consider their water resources seriously and therefore water is always a critical component in their comprehensive plans. However, water scarcity or drought is minimally addressed in these plans. The results indicate that local plans generally are weak in providing systematic assessments of local drought risks, seeking out for coordination to enhance coping capacity for such cross-boundary hazard, and adopting policies and strategies to address a drought risky future by mitigation and adaptation actions. The results indicate that local planning efforts in these fast growing areas are even not ready for water scarcity or drought crisis. There is a long way to build the local capacity towards long-term risk management for water shortage or drought challenges. In order to face with the future water scarcity or drought events in urban areas, it is a critical need to enhance the immediate crisis management ability and increase the long-term resilience for water resources management. By understanding their strengths and weaknesses, policy implications and recommendations are given to other countries.

Introduction

Drought is known as the most complex hazard and affects the most people across the globe [1]. Unlike other natural hazards (e.g. hurricanes, floods, tornadoes, earthquakes, tsunamis, etc.), drought and water scarcity is frequently gradual and cumulative in nature. The slow process of drought hazard makes it difficult to be timely recognized by decision makers in term of the impacts on the environment, economy and society [2,3]. Recent droughts in the U.S. have revealed

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the increasing vulnerability to this hazard. Severe droughts cause significant impacts on the urban areas in the U.S., such as the southeast drought in 2007, Texas drought in 2011-2012, Midwest drought in 2012, and California drought in 2013-2014. According to the National Climate Data Center, droughts were identified as one of the most expensive U.S. weather-related disasters \cite{4,5}. Severe drought episodes almost occurred every single year from 1996 to 2004, contributing to average annual losses of $6-8 billion \cite{6}. In 2002, the estimated losses were over $20 billion with a lack of national systematic analysis \cite{1}. More recently, the 2011 and 2012 droughts are regarded as the worst in the U.S. history. Although drought in 2011 was more severe, with nearly 12\% of the nation in exceptional drought conditions in late June, the 2012 drought became the costliest hazard of its kind due to the long-lasting impacts throughout that year \cite{7}. In 2011, drought in Texas resulted in over $7.62 billion of agricultural losses \cite{8}. The following year, the economic loss of drought was estimated to exceed $35 billion \cite{9}.

While population continuously increases in some metropolitan areas, especially in regions with limited water resources, a critical concern was raised to address the challenge of future water scarcity and drought hazards. Urbanization can unavoidably change land use and land cover and alter the ecosystems that may further reduce water storage and degrades water quality. Urbanization and development also increase water demands from multiple sectors, such as energy production, agriculture irrigation, industry use, municipal operation, ecosystem maintenance, or recreation activities. Compared to other hazards, droughts have not been prioritized on the planning agenda and therefore little attentions and resources are allocated to drought mitigation and preparedness \cite{10,11,12}. Since the damages and costs occur at the local levels \cite{13}, local capacity in preparing for drought and water scarcity has been our main concern. Water scarcity and extreme droughts in urban areas can cause significantly environmental, economic, and social impacts on urban management; however, very limited attention was paid to the urban drought planning.

The objective of this study is to examine whether the U.S. fast growing urban areas have taken planning actions to prepare to address the crisis of water shortage or drought challenges. More important, this paper aims to discover whether the extent of existing drought planning efforts serve for crisis responses or risk management. This paper developed a conceptual framework that can translate the key principles of the “drought-ready communities” to local land planning systems, including local land use comprehensive plans, local water resources plans, and local all-hazards plans.

Methods

This paper analyzed 100 fastest growing counties in the U.S., by systematically evaluating these local land use plans against an evaluation protocol of what makes a drought-ready community. The top 100 fastest growing counties were defined by the U.S. Census in September 2010 according to the housing unit changes from April 1, 2000 to July 1, 2009. The sampling strategy depends on the data availability of their local comprehensive land use plans from each county’s official planning website.

In this study, a protocol with measurable indicators was developed to measure the strengths and weaknesses of these local comprehensive plans in drought mitigation and adaptation. The measurable indicators are listed below: Local perception of drought and water shortage;
Historical records of drought; Population growth and impacts; Recognition of state drought plans; Existing water-related regulations/codes/plans; Water conservation/efficiency goals; Public awareness and education campaign; Water supply sources inventory; Identify water uses; Identify water supply status; Identify how previous drought affect local community; Identify drought prone areas and vulnerable sectors; Identify local climate; Identify local drought triggers and indicators; Current water usage and future demand projection; Coordination within jurisdiction; Coordination beyond jurisdiction; Land use restrictions from watersheds; Land acquisition to preserve integration of watersheds; Green infrastructures; Mix-used and compact development; Water-saving building codes; Water-efficient irrigation; Drought-resilient landscaping; Restrictions in some urban water uses; Improve water system efficiency; Wastewater recycle and reuse; Water Pricing; Establish water conservation incentives; Establish drought leadership team; Prioritize water related programs; Identify feasibility of actions; and Continuously monitor, assess, and update.

Results
The results demonstrate the overall assessment of how well local jurisdictions addressed drought mitigation and adaptation in their comprehensive plans. The mean score of these plans is only 31% of the maximum possible score. Only 7% counties (Osceola, FL; Brunswick, NC; Indian River, FL; Kendall, IL) received more than half of the total points, indicating an overall weak drought preparedness through local land use planning. Moreover, plan quality in drought preparedness varies widely from the lowest 10% to the highest 67%, revealing the huge capacity gap among these regions. There are large geographic variations among the quality of these plans. Of the three plan components, analysis received the lowest average score. It indicates that jurisdictions failed to provide systematic analysis of the drought hazard at the local level. Lack of information about how local communities were affected by drought renders them vulnerable to such hazard. The awareness and action components also received low average scores, 35% and 37%, respectively, demonstrating that these jurisdictions tended to ignore drought and were less willing to take action to mitigate drought impacts in their local plans. These results show that local jurisdictions have not realized the extreme impact and loss that drought could cause their communities and therefore fail to make a thorough analysis of such a hazard as well as take action to enhance local drought preparedness through land use planning.

Acknowledgement
This paper has been funded wholly or partially by the United States Environmental Protection Agency (EPA) under an assistance agreement (Urban Water Grant). The contents do not necessarily reflect the views and policies of the EPA, no does mention of trade names or commercial products constitute endorsement or recommendation for use.

Conclusions
This research concludes that there is weak local awareness and preparedness of water shortage and drought issues across the urban metropolitan areas in U.S. The majority of jurisdictions fail to integrate drought mitigations and adaptations into their land use plans. Local planners in these fast growing metropolitan areas generally consider their water resources seriously and therefore water is always a critical component in their comprehensive plans. However, drought is minimally addressed in these plans. The findings indicate that local plans generally are weak in providing systematic assessments of local drought risks, seeking out for coordination to enhance
coping capacity for such cross-boundary hazard, and adopting policies and strategies to address a
drought risky future by mitigation and adaptation actions. Local planning efforts in these fast
growing areas are even not ready for water shortage crisis or drought crisis. There is a long way
to build the local capacity towards long-term risk management for water shortage or drought
challenges. In order to face with the future water shortage or drought events in urban areas, it is a
critical need to enhance the immediate crisis management ability and increase the long-term
resilience for water resources management. By understanding their strengths and weaknesses,
policy implications and recommendations are given to other countries.

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