Cross-References

► Translating Health Status Questionnaires/ Outcome Measures

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Manic Depression

► Bipolar Disorder (BD)

Manic Depressive Disorder

► Bipolar Disorder (BD)

Manic Depressive Illness

► Bipolar Disorder (BD)

Manifestations of Drought

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Synonyms

Prolonged "drying," Climate change "event"

Definition

Drought is a natural, recurrent feature of climate change. Some authors suggest, however, that its effects have been exacerbated due to climate change, thus the terms are often linked. Drought occurs in virtually all climatic zones, yet its characteristics vary considerably among regions with some experiencing extreme, prolonged, drying conditions such as ► Australia and others recording drought if there has been an absence of precipitation for more than 6 days as was the case in Bali, Indonesia, in 1964 (Ponso, 2004). As such, it is important to recognize that the experience of drought can differ significantly between geographic regions and even within the same country. Despite drought occurring naturally for thousands of years, there is still, however, no single, universal definition of drought that exists today.

Description

Manifestations of Drought: An Overview

Hisdel and Tallaksen (2000:1) suggest that "drought studies have [long] been suffering from the lack of consistent methods for drought analysis." As drought characteristics vary significantly between regions, it has become common for drought to be defined in terms of its operational characteristics which allows for the severity and length of drought to be measured and the probability of reoccurrence to be modeled. From 1965 onward, these operational definitions began to emerge, with Wayne C. Palmer of the US Weather Bureau, declaring that "drought can be considered as a strictly meteorological phenomenon" and "evaluated as a meteorological anomaly"; this approach avoids "many of the complicated biological factors and arbitrary definitions" (Palmer, 1965:1). Forty-seven years on and with greater understanding of the intricacies of drought, however, an extended classification of drought has been developed to distinguish between four different operational characteristics of drought: meteorological, agricultural, hydrological, and socioeconomic, the characteristics of which are discussed below.

Meteorological Drought

The most commonly known definition of drought is meteorological, usually explained by the degree of dryness, or long-term departure from precipitation, in comparison to a normal or average amount of moisture measured over a period of time in a given region. However, according to Remer (2010), there is no consensus regarding the threshold of the deficit or the minimum duration of the lack of precipitation that makes a dry spell an official drought. Thus, Ponso (2004) argues that definitions of meteorological drought must be region-specific as the atmospheric conditions that result in deficiencies of precipitation are highly region-specific.

The diversity of available meteorological definitions quite clearly illustrates why it is not possible to apply a single, undifferentiated definition of drought developed in one region of the world to another. For example, the following conditions have been defined as drought at various points in recent history:

- In the United States (1942), when less than 2.5 mm of rain fell in 48 hours
- In Great Britain (1936), when there was 15 consecutive days with daily precipitation measuring less than 0.25 mm
- In Libya (1964), when annual rainfall was less than 180 mm
- In Bali (1964), when there was a period of 6 days without rain (Ponso, 2004)

Such variability reconfirms the need for locally specific data sets to be used to assess levels of meteorological drought, as robust drought adaptation strategies cannot be developed without accounting for place-specific characteristics.

For McKee, Doesken and Kleist (1993:1), there are more practical issues and impacts that arise from these meteorological characteristics that provide a fundamental basis for defining and analyzing drought, namely: (1) time scale, (2) probability, (3) precipitation deficit, (4) application of the definition to precipitation, and (5) the relationship of the definition to the impacts of drought. This approach to drought combines its meteorological characteristics with its affects to form a more holistic and impact-oriented definition. The agricultural, hydrological, and socioeconomic classifications described below are a product of these more comprehensive perspectives on drought.

Agricultural Drought

Agricultural drought occurs over a period of time – usually months or even years. It is when the moisture supply of a region consistently falls below what is considered a climatically appropriate moisture level for the production of crops (traditionally grown in a region) or the overall yield is adversely affected (Quiring and Papakryiakou, 2003). Plant water demand obviously depends on prevailing weather conditions, biological characteristics of specific plants, stages of growth, and the physical and biological properties of particular soil types. A good definition of agricultural drought should also account for the susceptibility of crops during different stages of crop development. Deficient topsoil moisture at planting may hinder germination, thus leading to low plant populations per hectare and a reduction of yield (Ponso, 2004).

Understanding the complex relationship between drought effects and plant behavior is particularly vital for farm businesses, farm families, rural communities, and the landscape itself as responding appropriately to the consequences of an uncertain water supply is paramount if all facets of life on farms are to remain viable and resilient.

Hydrological Drought

Hydrological drought refers to a persistently low volume of water in streams, channels, and reservoirs, lasting months or years. It is usually associated with agricultural drought where combined with high evaporation rates, ground water discharge and streamflow are reduced. Hydrological drought is a natural phenomenon, but it can also be exacerbated by non-climatic changes in anthropocentric activities such as the extensive use of irrigation, change in land use, reengineering of the land, and diversion of surface waters. Stahl and Hisdal (2004:33) suggest that "hydroclimatic variables of precipitation or streamflow provide the basis for characterization of drought in quantitative terms," though "to

obtain information at the regional scale, the spatial pattern of at site characteristics [must] be analysed." While knowledge of such spatial patterns and continuous ▶ monitoring may help with better planning for drought and improve early-warning systems, it should also be noted that an appreciation of the socioeconomic characteristics and their connection with interrelated issues such as vulnerability, uncertainty, and risk are also key to identifying drought ▶ adaptation needs.

Socioeconomic Drought

Socioeconomic definitions of drought can be associated with the supply, demand, and availability of certain commodities and their relationship with meteorological, hydrological, and agricultural drought. Yevjevich, da-Cunha and Vlachos (1983), however, define drought as a social phenomena that can be perceived only as a human-related disaster which by definition has an impact on society. This latter definition would suggest that although the effect of drought on businesses and productivity is extremely important, perhaps equally important is its impact on ▶ social well-being and amenity. Severity and impacts, however, are best understood and defined by "multiple indicators" as Wilhite (2006:17) suggests.

In expanding our understanding of drought, its multiple indicators and the socioeconomic conditions associated with it are essential if we are to direct adaptation strategies toward key vulnerabilities and make relevant planning and policy decisions. Importantly, this can mean recognizing the fact that, due to the uncertainty which surrounds drought frequency and the mechanisms that cause drought, many nations have employed flawed strategies in an attempt to mitigate the impacts associated with drought conditions. This has certainly been the case in Australia, and studies by Wilhite (2002), the World Meteorological Organization (2006), and others suggest that it is the same elsewhere around the globe. As such, understanding regional specificity remains key to addressing not only the effects of drought but also in building communities that are resilient in the face of ongoing climate extremes. To accurately capture the dynamic and locally specific nature of vulnerability to drought, an in-depth and integrated consideration of local environments, individuals, communities, institutions, and governance frameworks is required.

Drought in Australia

Australia has a history of drought and a climate driven by extremes. It is renowned for being the driest inhabited continent, yet it is also characterized as having one of the world's most variable rainfall patterns (Smith, 2003). For a long period of time, the Australian landscape has been shaped by successive droughts of varying lengths and magnitudes that have simultaneously affected patterns of settlement, migration, agriculture, and production. Thus, it is important to recognize that drought is not an occasional one-off event but rather a normal part of variability in the ocean-atmospheric system that drives Australia and the world's climates.

McKernan (2005:5) notes that between 1895 and 2000, Australia experienced "24 years of 'devastating drought'; 22 years of 'major droughts'; 23 years of 'severe droughts' and for nearly half of the years since records began, across the country there has been some sort of 'significant' drought" registered. Vernon-Kidd and Kiem (2009) in fact suggest that a prolonged drought affected southeastern Australia from the mid-1990s to 2009. The drivers of this were associated with several El Niño events coinciding with a positive southern annular mode (SAM) or Antarctic oscillation which represents an exchange of mass (sea-level pressure seesaw) between the midlatitudes ($\sim$45°S) and the polar region ($>$60°S) (Vernon-Kidd and Kiem, 2009). When the SAM is in a positive phase, these frontal weather systems are located further south than usual resulting in below average rainfall in the southern parts of Australia (e.g., southwest Western Australia, Victoria, and South Australia). As this occurred in these parts of Australia for the past 15 years or more, concepts such as vulnerability, mitigation, and adaptation became prominent in debates centered around drought and drought responses.

Vulnerability and Drought

Understanding and quantifying vulnerability to climate change events such as drought provides the foundation for developing effective mitigation and adaptation strategies. Vulnerability can be defined as "the susceptibility of a system to disturbances determined by exposure to perturbations, sensitivity to perturbations and the capacity to adapt" (Nelson, Kokic, Crimp, Meinke, & Howden, 2010). Therefore, vulnerability is not an absolute measure of harm itself (Adger 2006), but instead, is constituted by micro and macro factors whose expression is shaped by locally idiosyncratic social, economic, cultural, and political contexts.

By taking a holistic view of vulnerability as socially differentiated, dynamic, and contextual, determinants of drought vulnerability include a range of socioeconomic, political, and cultural aspects such as household assets, productive labor, social capital, farming practices, local governance structures, and the ability of the state to provide effective support (Wilhite and Buchanan-Smith, 2005). While the field of vulnerability research has traditionally been dominated by hazard/impact modeling and risk management assessments (e.g., Kiem and Franks, 2004; Adger, 2006), there is growing sentiment that these approaches need to be expanded to account for diverse determinants which are known to significantly influence vulnerability. Indeed, recent research has noted that vulnerability may have as much to do with perceived vulnerability as it does with resource scarcity and that social conditions of vulnerability can often occur more rapidly than environmental changes (e.g., Dow, O'Connor, Yarnal, Carbone, & Jocoy, 2007; Few, 2007; Marshall, 2010).

Mitigation and Drought

The concept of mitigation (i.e., minimizing the causes of human-induced climate change) is also fundamental in dealing with climate-related impacts such as drought. It has been argued that successful mitigation strategies can result in global, equitable, and cumulative benefits over time: aspects which have aided the ascendancy of climate change issues such as drought and its management into the global political sphere (Hayes & Roddick, 2008). The traditional emphasis of mitigation strategies on global greenhouse gas emissions reduction, for example, means that in Australia, the agricultural sector, which bears much of the burden of drought impacts, is largely excluded or suspended from inclusion in broad-brush national or global emissions mitigation strategies (Gunasekera, Kim, Tulloh, & Ford, 2007). Despite this separation at the national policy level, the agricultural and farming sectors have adopted key mitigation practices in farming approaches. Consequently, recent research in Australia and the USA has begun to investigate strategies known as "win-win" or "no regrets" approaches that reduce emissions and provide cost savings to farmers (Hills and Bennett 2010). These include practices such as minimum tillage, more efficient use of fertilizer, and improved grazing regimes. Many Australian farmers in drought-affected regions have been quick to adopt these strategies in response to the ever-increasing pressures of prolonged drought, with such strategies now viewed as a significant part of best practice farming for the future.

Adaptation and Drought

Adaptation represents the world's predominant approach to dealing with climate change and associated issues such as drought. Adaptation consists of strategies to reduce the impacts of climate change on human and natural systems, with adaptive capacity referring to the necessary preconditions for adapting (Marshall, 2010). Interest in adaptation as part of climate change more generally has grown significantly since the Third Assessment Report of the IPCC stated that "adaptation to climate change is both vital and complex" (Smit and Pilifosova, 2001). Adaptation is a particularly effective and favored strategy as it involves existing and feasible practices that are industry and place focused, and often participatory in approach. The latter is of great significance because (successful) participatory approaches help build social capital. Not only is social capital associated with an enormous array of social, economic, educational, political, and

health benefits (see, e.g., Robert Putnam's American study, *Bowling Alone* (Putnam, 2000)), it may be *the* key ► mediator of the relationship between adverse climate change and its (negative) impacts, especially on vulnerable people and places (Berry, Bowen, & Kjellstrom, 2010).

Conclusions

Concepts such as vulnerability, mitigation, and adaptation have become prominent in current debates around drought, particularly when associated with projected climate change. All three concepts are intertwined and fundamental to understanding drought-related impacts and effective responses to climate-driven events such as drought. Given the ongoing concerns about climate change, projected increases in the frequency, intensity, and duration of droughts and the resulting impacts on many sectors, particularly those of food, water, and energy, the World Meteorological Organization (WMO) has recommended the organization of a "High-Level Meeting on National Drought Policy (HMNDP)" to take place in Geneva in May 2013.

The WMO believes that there is cause for concern regarding what it sees as a general lack of drought preparedness and appropriate drought management policies in virtually all nations of the world. As such, it believes that "the time is ripe for nations to move forward with the development of a pro-active, risk-based national drought policy" (WMO, 2012). This will be an essential first step if governments are to begin to truly acknowledge and address the effects of climate-related events such as drought.

Cross-References

- ► Adaptation
- ► Australia, Quality of Life
- ► Indicators, Quality of Life
- ► Mediator
- ► Monitoring
- ► Resilience
- ► Social Well-being

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Manitoba Centre for Health Policy (MCHP)

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Brief History

The Manitoba Centre for Health Policy is a research unit in the Department of Community Health Sciences in the University of Manitoba's Faculty of Medicine. The mission of MCHP is to provide accurate and timely information to ▶ healthcare decision-makers, analysts, and providers, so they can offer services which are effective and efficient in maintaining and improving the health of Manitobans. MCHP researchers rely upon the unique Population Health Research Data Repository (Repository) to describe and explain patterns of care and profiles of illness and explore other factors that influence health, including income, ▶ education, employment, and social status. This Repository is unique in terms of its comprehensiveness, degree of integration, and orientation around an anonymized population registry.

MCHP's history dates back to 1973 when Dr. Noralou Roos contacted Dr. Paul Henteleff at the Manitoba Health Services Commission to discuss access to the province's administrative health records. The encounter resulted in collaborations on what would become MCHP's first research studies. MCHP was officially formed in 1991, but its development started in the fall of 1989 with the vision for the research center. On August 3, 1990, the Minister of Health at the time, Donald Orchard, announced the creation of a health research center. The official opening took place on April 4, 1991 with Dr. Noralou Roos serving as director of the research center and Dr. Les Roos as the director of the repository. From 1996 to 2005, Dr. Charlyn Black served as codirector of the center. In 2005 Dr. Patricia