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# Climate risk assessment and management in agriculture: An overview

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**Abstract**

The three components of climate change risk are susceptibility, exposure, and hazard working together. The attributes of the climatic risk Components are impacted by long-term changes in the climate variables (temperature, wind, and precipitation). Future human mortality and economic losses are predicted to increase due to the severity of climate concerns. Given the low rate of mitigation and adaptation to date, it is quite possible that the adverse effects of climate change would surpass adaptive capacities in many climate-vulnerable countries. Even though the number of publications on climate change has increased significantly recently, there hasn't been much focus from the academic Community on a thorough survey of the literature on climate risk assessment. Accurate risk assessment and identification of its motivating factors are essential for efficient management of climatic risks. The concept of climate risk has been the focal point of the conversation between research and policy in recent years, but it has hardly ever been applied to produce local or national climate risk assessment results. An integrated approach to climate risk management, which takes into account both societal vulnerability and climate variability, is necessary to properly understand the risks associated with climate change and its localised reactions, including loss and damage. This method involves risk analysis, risk reduction, and risk transfer strategies. In order to make informed decisions, climate risk assessment offers a methodical way to identify the types and extent of various threats (estimation of the magnitude and frequency of natural hazards, the exposed assets & people, and the susceptibility of assets & people under certain natural hazards). Climate risk scenarios are plausible outcomes that have the potential to occur, not forecasts of the future.

**Keywords:** Climate change, risk, climate risk assessment, climate induced risk

## Introduction

A literature review evaluates research that have been discovered in the literature and are pertinent to the topic under consideration (Boote & Beile, 2005) [3]. The conclusions found in the published literature are usually regarded as confirmed facts or claims. A literature review is considered by the research community to be an essential stage in the creation of new knowledge. Research on climate change vulnerability has increased significantly since 2006, as per a study (Wang *et al*., 2014) [36] that examined 3,004 papers published in 658 scientific journals between 1991 and 2012 on the topic.

Despite the recent tremendous proliferation of publications on climate change, there have been a few attempts by academics to conduct literature reviews. Examining the literature on this topic is necessary since there hasn't been a comprehensive examination of the research that might help practitioners who deal with climate risk assessment at the local or sub-national level grasp it better conceptually.

It was reasonably believed that the web, which is now a massive repository of information, would have some documents on climate risk assessment. The keywords "climate risk assessment review," "climate risks literature review," "literature review on climate risks," "literature review on climate change induced risks," and "literature review on climate change induced risk assessment" did not, however, yield any results in a Google keyword analysis search until October 13, 2018. Instead of using any word within the term, the keyword analysis employed "quotes" to find documents that contained all of the key words. Google's keyword research revealed that the quantity of documents relating to climate risk assessment methodology and climate exposure assessment is extremely low and growing only slowly. Despite the fact that the climate change vulnerability assessment materials.

## Understanding climate risk concept

Risk is characterised as an adverse event that has not yet occurred but has the potential to affect individuals, residences, or communities in a particular area at a later

time. This theory holds that risk is an imagined, space- and time-varying threat. As per the UN, risk is defined as the potential for adverse consequences or estimated losses (such as fatalities, injuries, property damage, disruption of economic operations, or environmental harm) stemming from the interplay between vulnerable circumstances and natural or human-caused hazards (UNISDR 2009) [33].

Since 1980, the risk concept has gained traction and been applied as a systematic way to address natural risks (Brundl and Margreth 2015) [4]. The conceptualization of climate hazards has been greatly aided by research. It has been shown by research that local or subnational conceptualization of climate risk, exposure, and susceptibility issues is necessary (Hewitson *et al*., 2014, Cardona *et al*., 2012) [19, 6]. This is due to the different professions have different understandings of the concepts related to climate risk (Jurgilevich *et al*., 2017) [23]. Because human perception and cultural norms have a significant influence on the concept of risk, there may be ambiguities in risk vocabulary and concepts that lead to different interpretations.

According to (Balica 2012) [2] and (Esnard *et al*. 2011) [11], climate risk is the likelihood that an extreme environmental hazard would have negative effects on vulnerable groups that are exposed to it, such as the loss of life, property, or other economic assets. Since 1992, definitions and concepts related to the different aspects of climate change have been included in the assessment reports of the Intergovernmental Panel on Climate Change. IPCC. By assessing vulnerability, the IPCC's third and fourth assessment reports provided a conceptual framework for prior research on the consequences of climate change. The vulnerability framework, however, did not include hazard as a separate factor in the IPCC third or fourth assessment reports; rather, exposure was assumed to be a manifestation of the hazard. The idea of climate risk was first proposed in the IPCC Fifth Assessment Report. Despite the fact that in recent years, the notion of climate risk has taken centre stage in the discussion of science and policy (IPCC 2014) [22], In order to offer results of climate risk assessments at the local or national level, this notion has only sometimes been used (Muccione *et al*., 2016) [29]. Furthermore, there is confusion regarding how the notion of climate risk will be applied to guide the assessment of the implications of climate change for planning related to climate risk reduction at various scales, such as the village, sub-national, and national levels. Identification and comprehension of the susceptibility of elements at risk from climate change require an understanding of the relationship between vulnerability, adaptive capacity (a system's or person's ability to adapt to changes), and resilience (a system's or person's ability to resist negative outcomes from a risk or hazard) (Fuchs *et al*., 2012; Cutter *et al*. 2008) [13, 9].

**The reality of climate induced risk**

Numerous studies have found that the environment, human health, communities, cultures, and livelihoods are all at risk due to climate change (Fatori & Seekamp, 2017; Kumssa & Jones, 2011; Watts *et al*., 2015) [12, 26, 37]. Without extensive air conditioning, many parts of the world may become uninhabitable due to climate change. Cultural heritage is increasingly seen as being under risk from climate change (Fatori & Seekamp, 2017) [12]. Floods and droughts are predicted to cause an additional 100 million people to become impoverished if adaptation is not increased (Hallegatte *et al*., 2015) [17]. Over the past 50 years, there have been more deaths and economic losses as a result of natural disasters (Dewan, 2013). [10] 70% of the total damages caused by natural catastrophes worldwide were incurred by disaster victims in developing nations (Guha-Sapir *et al*., 2015) [16]. According the number of reported catastrophic occurrences grew dramatically from 294 in 1950-1959 to 4210 in 2003-2013. According to this data, recorded catastrophic occurrences occurred about 29 times annually between 1950 and 1959, but 383 times annually between 2003 and 2013. Reports of catastrophic incidents have increased globally over the past 54 years (1959-2013) at a pace of roughly 73 instances per year.

The rise in the global mean surface temperature (Morice *et al*., 2012) [28], the sea-surface temperature, the ocean heat content (Hobbs & Willis 2013) [20], the melting of sea ice (Wadhams *et al*., 2011) [34], the glaciers and the retreat of Antarctic and Greenland ice sheets (Clark *et al*., 2015) [8] are a few of the effects of global warming that are already apparent. Climate model projections indicate that between 1986 and 2100, the average global surface temperature will increase by 0.3 to 4.8 degrees Celsius (IPCC 2013) [21]. (Knutson *et al*., 2017) [25] Claim that since 1951, human-caused climate change has accounted for more than half of the increase in the global average temperature.

Because global warming will increase the frequency and intensity of extreme rainfall or precipitation occurrences, it is anticipated that climate change will increase the frequency of flooding associated with extreme rainfall in the future (Alfieri *et al*. 2015; Rojas *et al*. 2013; Hirabayashi *et al*. 2013; Bruwier *et al*. 2015; IPCC, 2013) [1, 31, 18, 5, 21]. By the end of this century, river flood damages could increase by a factor of 20 (Winsemius *et al*., 2015) [38]. In all major ocean basins where tropical cyclones are found, the intensity of tropical storms has increased noticeably faster since the 1970s (Trenberth *et al*., 2007) [32]. The strongest tropical cyclones are predicted to intensify due to climate change (Knutson *et al*., 2010, Grossmann & Morgan 2011, Walsh *et al*. 2016) [24, 15, 35].

Increased water evaporation, cloud formation, and the possibility of localised lightning storms are all effects of global warming.

**Conclusion**

Reducing future human casualties requires careful consideration of climate risk assessment. To comprehend the risks and responses related to climate change at the community level, including loss and damage, an integrated approach to climate risk management (risk analysis, risk reduction, and risk transfer techniques) that takes into account both climate variability and social vulnerability is required. There is no need to put off risk assessment until science is able to predict climate change with more accuracy. Restoring the damaged system through increased risk tolerance is the main goal of the concept of climate resilience. On the other hand, the concept of adaptive capacity ought to focus on ways to enhance the ability of individuals and organisations to adapt within the system so as to cope or adjust to the disturbed system. Research may

be very important in raising public and political understanding of climate challenges and encouraging action on their part. To combat the threats posed by climate change, democratic practice—that is, transparent, inclusive, and participatory decision-making—is just as important as collective action. Further research is required to ascertain the level of uncertainty since estimations of potential hazards resulting from a changing climate may generate uncertainty. Bottom-up risk assessment ought to receive more attention than traditional top-down meteorological methods.

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