

Extreme heat events in Vietnam must be studied more extensively to develop efficient adaptation policies.

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ABSTRACT

Climate change drives increased extreme heat events worldwide and Vietnam is no exception to this. Exposure to very high temperatures can have serious consequences on health and work capacity, which could negatively impact the prosperity of the country in future decades. We performed a literature review to identify the main knowledge gaps on this issue and provide some recommendations. Findings suggest that the subject remains understudied and that more research is needed to better anticipate potential heat-related damages at both country-scale and city-scale and to tailor efficient adaptation policies.

CONTEXT & MOTIVATION

Over the past few years, many high temperature records have been broken in different countries, with sometimes dramatic consequences for both human populations and ecosystems. In particular, exposure to extreme heat may lead to significant negative impacts on human health and mortality or work capacity, which are well documented in the scientific literature.

Current policies on greenhouse gas emissions at the global scale would increase the global average temperature by ~2°C above pre-industrial values by mid-century and potentially by more than 3°C in 2100. This drives growing concerns on future heat-related impacts, especially in tropical countries. Heat hazards are further amplified in urban areas, where the urban heat island effect can increase air temperature by several Celsius degrees compared to surrounding sub-urban or rural areas.

Vietnam will increasingly face extreme heat events in future decades, which could become problematic without proper adaptation strategies. It is important to identify the main knowledge gaps on this issue and where more research is needed to better inform adaptation policies. Therefore, we conducted a literature review to assess: 1) the level of knowledge on historical and future trends in extreme temperature in Vietnam; 2) heat-related impacts already documented; 3) potential future impacts of increasing heat events.

METHODS

We conducted a web search using Google Scholar in order to retrieve literature related to extreme heat in Vietnam. We collected the references based on keywords occurrence in the title, using heat/temperature-related keywords combined with Vietnam-related geographical keywords. The search was restricted to documents published in English between 2005 and September 2024. We selected 61 relevant documents for a detailed review.

RESULTS

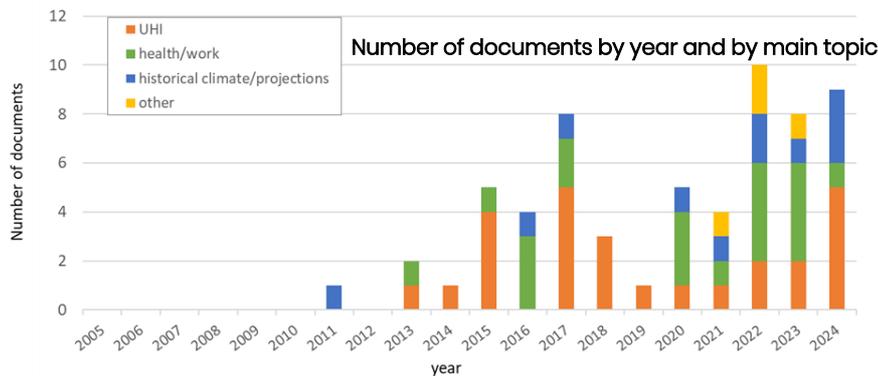
Overview. The upward trend in the number of publications (Figure) suggests increasing scientific interest in the issue of extreme heat in Vietnam. However, the annual number of publications remains small and the two main topics are the urban heat island (UHI) effect and current health impacts of high temperatures, while climatological studies remain rare. Hanoi stands out as the most studied location, while only few studies cover the whole Vietnam. Strikingly, only 11 documents include some climate change projections.

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Key words climate change, extreme heat, urban heat island effect, health

Geography Vietnam, Southeast Asia

Themes Climate Change



Historical trends and climate projections.

Despite the relatively limited number of documents, increasing trends in various extreme heat indices appear well recorded in Vietnam. However, only a handful of studies take into account not only air temperature but also air humidity, yet a very important variable to assess heat stress in humid environments. Most importantly, the literature on the future evolution of extreme temperature appears even more limited: only 4 studies provide projections in the context of climate change, which all indicate further increases in hot extremes.

UHI. The UHI effect is well documented in several cities, especially in Hanoi and Ho Chi Minh City. Some studies investigate the greening strategy of study investigates the combined effect of UHI and climate change on

temperatures in Vietnamese urban areas beyond 2030. This is an important knowledge gap for future planning strategies. Indeed, it seems that no greening strategies has a potential cooling effect large enough to counteract the compound effect of UHI and climate change on urban temperatures and protect the population from dangerous heat exposure. Hence, greening strategies will need to be accompanied by other actions. the Hanoi Master Plan at time horizon 2030 but only one also includes climate change projections. Moreover, it seems that currently no

Health. All publications investigating current high temperature impacts on health or work capacities of the Vietnamese population report negative impacts, with increased hospital admissions for various

causes and increased mortality during heat waves. However, the statistical relationship depends on the region or city considered, highlighting the need for further research to better inform local strategies adapted to the local demographic and socio-economic context.

Conclusions. Our review¹ should be completed with documents in Vietnamese. More elements might also be available in publications which did not enter the review because they did not match the selection criteria. Despite these limitations, it appears that the question of heat hazards in Vietnam has gained more attention over the past few years. The country increasingly faces extreme heat events, a trend which will continue as global warming level increases. Dangerous hot weather could even occur up to several months per year in some places. Yet, the issue remains understudied and related risks are probably underestimated. Future research priorities must be aligned with the pressing need to better anticipate potential heat-related damages and tailor relevant adaptation strategies.

¹ Woillez, M.-N. (2024). Vietnam in the face of extreme heat events : a literature review. AFD research papers, n°335.

RECOMMENDATIONS

- ▶ In order to improve climate change impacts assessments, **funding should be directed toward research programs addressing knowledge gaps on heat hazards**. In particular, priority should be given to programs that can provide:
 - **High-resolution climate projections**, to pinpoint regions most at risk of future extreme heat;
 - **Population vulnerability assessments** that identify at-risk communities by integrating demographic and socio-economic factors, as well as local hot extremes characteristics;
 - **Health impact studies**, that anticipate potential increased burden on the healthcare system due to future heat extremes;
 - Detailed assessments of **urban heat island (UHI) and global warming interactions**, in order to ensure that cooling strategies in urban planning are adequately calibrated to future temperature increases.
- ▶ **The findings of the aforementioned deliverables should be translated in targeted adaptation policies and action plans** to protect vulnerable populations—such as children, the elderly, and outdoor workers—across both urban and rural areas from extreme heat exposure.