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A Review on the Utilization of Herbarium Data in Phenological Research Addressing Climate Change Implications

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Abstract

In recent years, the profound impact of climate change on biodiversity has become increasingly evident, with significant consequences for critical life events in the natural world. It underscores the significant influence of climate variations on seasonal life events within the biotic environment of flora, such as blooming response, leaf growth, leaf senescence and fruit ripening. These phenological shifts, particularly in temperate and tropical ecosystems, serve as vital indicators of climatic changes. This review study delves into the intricate relationship of herbarium data for bridging the gap in plant phenological observation for the investigations on climatic change. This comprehensive literature review of 30 key research papers published in the past two decades, which focus on the utility of herbarium specimens as tools to document phenological changes, was critically analysed in this research study. Long-term observation of phenological data by various phenological observation networks has paved the way for advanced environmental analysis in climatic change studies. However, despite the importance of phenological data from field observation, its collection and long-term observation records, present challenges, emphasizing the need for spatiotemporal depth of phenological data. A noticeable gap in field data collection has hindered various studies reliant on plant phenological data. In response to these challenges, herbaria serve as invaluable repositories of plant specimens, boasting rich historical records spanning over a century, providing a deep spatiotemporal and taxonomic insight. Research findings indicate the fidelity of herbarium records to fill the gap in field observations, with no significant differences between the field observations and herbarium data, highlighting the reliability of herbarium data in capturing phenological information. Overcoming the challenges associated with extensive herbarium datasets, digitalization and the implementation of crowdsourcing platforms have emerged as effective strategies, granting researchers easy online access to these data. Moreover, it is evident that in Sri Lanka, there exists a research gap in utilizing herbarium data for phenological studies in climate change observation and the implementation of online accessibility for herbarium data, highlighting the need to address this gap in future research endeavours.

***Keywords*:** Climate change, Herbarium data, Biodiversity, Phenological data