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# [TBD: NAME OF TOOL]

TBD: A tool to study microclimates in an orchard

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By

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# Executive Summary

## Dedication and Acknowledgments

## Author's Declaration

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# 1 Introduction

In this report I give details of an online tool called [TBD: NAME OF TOOL], an interactive website that collects real time data from [NAME OF FARM]- a farm in [FARM LOCATION]. The tool aims to give farmers accessible, specific climate data to help reveal the existence of microclimates over a small area and inform their decision making.

Three sensor clusters were distributed at three points in the farm. Each cluster was powered by an ESP32 microcontroller and then a variety of sensors were added to these. Data is then sent in real time back to a backend server which processes the information and allowed for real time data to be presented to farm workers via a website.

## 2 Background

### 2.1 Microclimates in agriculture

A microclimate is generally understood as a set of distinct climatic conditions within a small, localised area [1]. The maximum size of a microclimate is debated, but the World Meteorological Organisation (WMO) regards it as occupying an area of anywhere from less than one metre across to several hundred metres [2]. In practice, microclimates can occur in spaces such as gardens, valleys, caves, or fields. Even human-made structures can generate their own microclimates; for example, tall buildings can create *street valleys* that reduce wind flow and lead to the formation of localised pockets of warmer air, which can also trap higher concentrations of pollution from vehicle emissions [3]. Vegetation plays a critical role in influencing microclimates. The addition of trees to an urban environment can reduce air temperature by as much as 2.8 °C [4].

This localised climatic variation, characteristic of microclimates, is therefore significant in agriculture. The climate that crops are exposed has an enormous impact on overall agricultural yields. Indeed, farmers have modified the microclimate of crop fields for millennia, a clear example of this being the use of fencing to reduce soil erosion and damage to edible plants [5]. Therefore, the relationship between microclimates and agriculture has been the subject of extensive research - particularly as climate change introduces new threats to food security.

### 2.2 Microclimates in apple orchards

### 2.3 Smart farming

### 2.4 Long range systems and LoRaWAN

Long range systems are a way of transmitting data over much longer distances than Wi-Fi allows. LoRa has a range 4000 times greater than Wi-Fi (<https://youtu.be/BOc3N3Yl38o?t=817>).

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