

SIGNS IN THE LANDSCAPE

INTERVIEW WITH PHENOLOGIST MARIE KEATLEY

by Charlotte Haywood

May 2021

CAN YOU INTRODUCE YOURSELF...

My name is Marie Keatley, I'm an Honorary Senior Research Fellow at the University of Melbourne. I am a phenologist, which means I study the different life stages of plants, such as their flowering and fruiting. I am interested in finding out how these stages influence one another, as well as how climate and other factors influence them. Historical, long-term records of plant and animal life stage from Australia fascinate me, including why they were collected and how they can be used to inform current management of Australia's biodiversity.

I have a strong interest in the development and application of statistical methods and was the co-editor of the book *Phenological Research: Methods for environmental and climate change analysis*, published by Springer. I am on the Scientific Advisory Panel of ClimateWatch, the current President of the International Society of Biometeorology, on the Editorial Board of the International Journal of Biometeorology and was an expert Reviewer for the 5th Intergovernmental Panel on Climate Change report.

WHAT IS CLIMATE WATCH AND HOW DID YOU BECOME INVOLVED?

ClimateWatch was the Southern Hemisphere's first online phenological network. It enables every Australian to be involved in collecting and recording data that will help fill Australia's (and the Southern Hemisphere) phenological knowledge – information decision-makers need to manage and respond to climate change.

The need for ClimateWatch, although long recognized by naturalists and researchers, was particularly highlighted in the 2007 Intergovernmental Panel on Climate Change (IPCC) report. In this report, a majority of the changes in



WHAT IS PHENOLOGY?

The term phenology has been around since 1849 – the term was coined by Charles Morren, who was, among other things, Director of the Botanic Gardens of Liège University (Belgium). However, as a practice phenology has very deep roots. Aboriginal calendars, for example, take a holistic view of changes in weather, phenology and astronomy.

Phenology is regarded as the study and recording of recurring life stages such as date of first flowering, first arrival or departure of migratory birds, the harvest of agricultural crops, the commencement of the hay fever season, etc. It also involves examining the relationships between each of these stages and the influence of seasonal and inter-annual environmental factors such as rainfall and temperature (climate).

SIGNS IN THE LANDSCAPE

phenology research (> 99 %; some 28,000 plus studies) were from the northern hemisphere, with less than 6 (from memory) Australian examples cited. The simple reason being that records didn't seem to exist. To address this knowledge gap across Australia, the ClimateWatch initiative was conceived. It was the collaborative brainchild of people (including myself) from Earthwatch Australia, the Bureau of Meteorology and the University of Melbourne.

Having ClimateWatch is important for other reasons. Australia contains a high proportion of species that are only found in this country, for instance of Australia's native species, approximately 45% of birds, 86% of plants and 94% of frogs are only found here. These endemic species have already adapted to a highly variable climate system. Hence, we need to be careful in applying Northern Hemisphere climate impact results to Australian species. I also think if you observe one of the ClimateWatch species over a period of time you see are likely to see for yourself the changes in your own area.

What is the importance of understanding phenology? And for the future? Phenology underpins the rhythm of life on earth. The timing of key life stages of plants and animals —such as flowering, fruiting, and migration—drives a wide range of processes at the community and population levels, at local and regional spatial scales, and at ecological and evolutionary time scales.

There is a quote from 1947 by Aldo Leopold & Sara Elizabeth Jones which I like as I think it illustrates that the breath of sciences phenology touches on:

Among contemporary phenologists are botanists, foresters, ornithologists, range managers and zoologists. Phenology, in short, is a horizontal science



which transects all ordinary biological professions. Whoever sees the land as a whole is likely to have an interest in it.

At an everyday level phenology plays a role in human and animal health, agriculture, forestry, conservation, tourism, etc. To give a couple of examples:

- Asthma and hay fever can all be influenced by pollen – part of the flowering cycle. Overseas, the pollen season has lengthened with species flowering earlier in Spring and lasting later into Summer. Plants are producing more pollen than they used to. According to the Australian Society of Clinical Immunology and Allergy 18% of Australians suffer from hay fever. Additionally, hay fever predisposes sufferers to more frequent sinus infections and makes asthma more difficult to control.
- Wine crops in southern Australia are ripening earlier. These changes are related to increasing air temperatures and decreasing moisture in the soil and management practices.

SIGNS IN THE LANDSCAPE

HOW CAN WE USE PHENOLOGY TO LOOK AT ECOSYSTEM MANAGEMENT?

As mentioned above, plants and animals don't exist in isolation, they are dependent on each other. Hence understanding the reproductive phenology of a food plant might assist in the management of a species – Swift parrots are a threatened species which breeds in Tasmania and overwinters in southern Australia where it depends on the flowering of a range of Eucalypts and lerps found on trees. In Victoria, this includes Greybox (*Eucalyptus microcarpa*) and Ironbark (*Eucalyptus tricarpa*) and in New South Wales Forest Red Gum (*E. tereticornis*), Mugga Ironbark (*E. sideroxylon*). Understanding if climate is changing the flowering timing of the Swift parrots food source can help inform conservation decisions of this endangered animal.

AND CLIMATE CHANGE?

In the current and future world where climate is changing, understanding the impacts of these changes on the natural world is critical for land management, agriculture, health and so much more. As changes in stage are significantly influenced by temperature and rainfall or a combination of the two, phenology plays a really important role here – it is an indicator of a changing climate and some of the impacts that a changing climate is having. One reason that the 2007 IPCC report was dominated by Northern Hemisphere examples is that they have a very long history of written phenological records, and they can use this information to compare the current with what was happening previously.



HOW CAN YOU BE INVOLVED?

I record observations for pleasure – both on the ClimateWatch App – I have Blackwoods and a few other species in my garden. I also tried and record some street trees such as London Plane trees (there are some exotic species listed in ClimateWatch so changes in Australia can be compared to overseas). I also record phenological events in my own garden – I look forward to the arrival of tree martins, the shedding of bark on the Manna gums and the flowering of my recently planted apple trees and picking the apples. Overtime I hope to predict when the apples will be ready for harvesting.

Recording is one area where individuals can contribute to our understanding of climate change. And the beauty of this is that observing and recording the life cycles of plants and animals is a simple and pleasurable past time – okay I think this. ClimateWatch was launched to enable people to do just this – and continues to look for citizen scientists/ volunteers.

SIGNS IN THE LANDSCAPE

CAN YOU TELL US ABOUT ANY UNIQUE FINDINGS OR SPECIES THAT YOU HAVE COME ACROSS THAT HAVE SIGNIFICANT POINTERS OF THE CURRENT CHANGING CLIMATE?

Our knowledge about changes in our environment is increasing. Australia is seeing changes such as the advances and delays in flowering, changes in distribution in species etc but they are unique to Australia – particularly given the percentage of plants and animals that are unique to this country. A couple of examples:

- Box-Ironbark Eucalypts in Victoria are primarily winter flowering and occur mainly north of the Great Divide. This winter flowering attracts many birds that have nectar as a main part of their diet. The examination of one rare example of old phenological records and more recent studies showed that some species were flowering much less often in 2000s than the 1940 through to the 1970s. This resulted in a decline in the bird populations.
- The population of the Bogong Moths has seen a significant decline in the last few years. These moths breed in New South Wales, Queensland and Victoria. They then migrate to the Alps in Spring where they are a very important food source for wildlife including the threatened mountain pygmy possum.

HOW DOES THE MOON OR THE NIGHT APPEAR IN PHENOLOGY?

The cycles of the moon provide cues that can be recognized by animals (e.g. frogs, fish, coral) including changes in light intensity, geomagnetism and gravity. This influences among other things the timing of their breeding.

ARE YOU ABLE TO TALK ABOUT FIRE IN THE AUSTRALIAN LANDSCAPE THROUGH THE LENS OF PHENOLOGY?

Many plants and animals are adapted to a particular fire regime and/or the

the habitat that results from that fire regime.

Some adaptations are about the species surviving and not the individual. All plants need to reach maturity before they can produce seed - this can range from one year to at least 20 years. A changing climate is changing the way fire behaves and how often it occurs. If fires occur too frequently for a species they can become extinct at that location. There are some Eucalypt species – such as Alpine Ash - that need to be about 20 years old before they produce seed. The other phenological information we have about this species is that there are good and poor flowering and seeding years. A fire usually kills an individual Alpine Ash tree but seeds are released onto a fertile ash bed created by the fire. The large fires in Victoria (e.g. 2003, 2006/07, 2009, 2013, 2020) means that some areas have been burnt before the trees were old enough to produce seed. So, to prevent the species being lost in large parts of the landscape aerial reseedling has occurred.

FURTHER WEB LINKS, PLANTS, PEOPLE, PLACES OR ARTICLES/TEXT THAT YOU WOULD LIKE TO SHARE.

- + ClimateWatch <https://www.climatewatch.org.au/>
- + Indigenous Weather Knowledge <http://www.bom.gov.au/iwk/>
- + Intergovernmental Panel on Climate Change <https://www.ipcc.ch/>
- + <https://theconversation.com/early-birds-how-climate-change-is-shifting-time-for-animals-and-plants-34766>
- + <https://theconversation.com/pass-the-shiraz-please-how-australias-wine-industry-can-adapt-to-climate-change-140024>
- + Reseeding Giants <https://www.youtube.com/watch?v=BEfCE22q8aU>
- + USA National Phenology Network <https://www.usanpn.org/usa-national-phenology-network>
- + The Pan European Phenology Network <http://www.pep725.eu/>
- + <https://theconversation.com/climate-change-is-happening-in-your-garden-heres-how-to-spot-it-65730>
- + <https://www.abc.net.au/news/science/2019-02-27/bogong-moth-decline-in-australian-alps/10850036>