

Bringing Evolution into Conservation

BY ARY HOFFMANN

To protect biodiversity in a rapidly changing environment we need to encourage selection and evolution in our native plants and animals.

The recent heat waves across coastal Australia killed many plants and animals. A year ago, when walking around my neighbourhood in outer Melbourne after the temperature soared to more than 40°C for the third consecutive day, I encountered numerous dead birds, possums, lizards and small plants.

This scene was repeated around the coastal towns and cities of Victoria and beyond, with hundreds of thousands of individuals of various life forms dying under the hot and dry conditions. However, it is doubtful that these would have had much impact on life in many inland areas where long, hot and dry periods have been the norm for thousands of years.

Although many of the same species of plants and animals are found inland as on the coast, inland populations are able to withstand extreme conditions much better than their coastal counterparts for two main reasons.

The first involves something that biologists call plasticity. When individuals are exposed to extreme conditions, a set of protective mechanisms are triggered. For instance, most animals and plants turn on genes that produce a specific class of proteins when hot conditions arrive. These proteins then prevent molecules in cells degrading.

The second reason is that different types of genes occur in populations of the same species, which allow popula-

tions to adapt for local conditions. Different genes come to predominate in different environments because of natural selection. Over generations, some genes are favoured at the expense of others because they allow organisms to survive and reproduce there. When some individuals survive hot conditions whereas others perish, we are witnessing natural selection and evolution in action.

Recent research at the University of Melbourne and elsewhere indicates that the effects of natural selection can become apparent extremely rapidly – a few years is ample time. Some populations have now evolved and adapted to global climate change occurring over the past few decades. There are plants that have evolved to flower earlier to avoid dry conditions in summer, and insects that have evolved to come out of inactive winter diapause earlier and take advantage of warmer winters. Even birds have evolved to migrate to new areas where food resources have appeared.

An important challenge facing Australia is the maintenance of our natural diversity in the face of climate change and other pressures. We can help meet this challenge by promoting selection and evolution – increasing the ability of our plant and animal populations to evolve and deal with changing conditions.

When we re-establish natives in our gardens, along roadsides and in our parks, we should use plants with genes that are



Prof Hoffmann in the Victorian high country where his group runs experiments on local adaptation in plants, and is one of the environments most threatened by climate change.

Photo: Phillipa Griffin

going to cope well with conditions in the future. By using mixtures of seeds from local areas and other locations that reflect the future environment we create a diversity of genes upon which natural selection can act. The individuals that survive and reproduce will help found new populations that are well-adapted to new conditions as these develop.

This approach requires changes in the way we produce nursery stock, revegetate degraded areas, value tracts of remnant vegetation and even manage our endangered species. The most valuable tracts will contain mixtures of genes and be capable of evolving to deal with future conditions.

Our nursery stocks need to be bred for diversity, not for uniformity, as is commonly undertaken. Vegetation schemes have to aim to create treed landscapes under conditions expected in 2030 and 2050, not within a short 10-year timeframe. Genetic diversity in endangered species needs to be maintained because small and isolated populations of threatened species will not easily evolve and adapt.

Climate change is with us for many decades and adaptation is needed. Promoting evolution represents a very powerful way of building resilience and maintaining our biodiversity.

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