Research Proposal: What can evolutionary modelling of coral reef diversity in the past tell us about how anthropogenic climate change will affect coral reef diversity today?

Coral reefs are some of the most diverse ecosystems in the world. They provide habitat and shelter for over 1 million species, protecting coastlines from storms and erosion and offering opportunities for tourism, employment and the discovery of new medicines. Globally, around half a million people are dependent on coral reefs for food, income and protection. However, anthropogenic activities contributing to global warming has meant that these abundant ecosystems are under threat. Since 2008, over 14% of the world's coral reefs have died as a direct result of climate-change. The Great Barrier Reef has lost over 50% of it's corals since 1995.

An essential step towards conserving coral reefs is developing a better understanding of the potential consequences of human-induced climate change. One way to approach this is to model trends observed from the geological record, in which the Earth experienced a change in climate conditions similar to those we are seeing today. This will allow us to predict the probable effects of current and future climate change on coral reefs. My research question is therefore:

What can evolutionary modelling of coral reef diversity in the past tell us about how anthropogenic climate change will affect coral reef diversity today?

I will test the hypothesis that coral reef diversity in the past was negatively impacted by climate conditions that are similar to those the Earth is experiencing today, using my results to quantify how we might expect reef diversity to suffer under human-induced climate change. The proposed research has been discussed with my academic mentor, Dr. Katie Davis, a specialist in evolutionary modelling and the impacts of climate change on biodiversity in the geological record. A plan of the project has been devised to maximise skill development and research outcomes, involving: software training, reef diversity and statistical analyses, interpretation of results and report writing.

The research question falls within the University's research theme of Environmental and Sustainability Resilience. While there is an established methodology, developed by my mentor, my research will be the first to apply it to coral reefs. I will use an evolutionary tree to model reef diversity and correlate this against measures of temperature, sea level and ocean pH. This will allow me to quantify how reef diversity is impacted by periods of global warming. The data required for this project are freely available to use.

Due to its computational nature, this project is low-risk and the research can be undertaken anywhere. My research project holds strong potential to provide valuable insight into the effects of climate-change on coral reef biodiversity loss and extinction. Research such as this is a vital part of the fight against the destructive repercussions of global warming. If we are to find solutions to these problems we need strong leadership, backed by meaningful research. The Laidlaw Scholarship would provide a fantastic springboard opportunity for my future career, allowing me to develop my research skills and grow as a leader. For the second summer, I would like to participate in a leadership expedition.