WESTERN SYDNEY
UNIVERSITY

Hawkesbury Institute
for the Environment

RESEARCH CAPABILITY

Drought Resilience

Helping Australian ecosystems
overcome extreme conditions

Acknowledgement

Western Sydney University acknowledges the peoples of the Darug, Tharawal, Eora and Wiradjuri nations. We acknowledge that the teaching, learning and research undertaken across our campuses continues the teaching, learning and research that has occurred on these lands for tens of thousands of years.

Researchers

To contact HIE Ecosystem Function and Integration Theme scientists, please go to:
www.westernsydney.edu.au/hie/research/ecosystem_function_and_integration

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Future climate

Scientists predict that extreme weather could become the new normal for pastoral systems within the next 30 years.

A less predictable climate with intense heatwaves, longer droughts and more frequent flooding will expose natural and managed ecosystems to unprecedented combinations of heat and water stress.

A future with more extreme weather and changes in seasonal rainfall patterns could disrupt the supply of reliable and consistent high-quality forage for cattle and sheep.

To manage the impact on Australia's dairy and livestock producers, it is imperative to understand how future drought events will impact natural and agricultural ecosystems, their productivity and resilience.

Drought resilience research

Research at the Hawkesbury Institute for the Environment focusing on drought resilience aims to understand the impacts of future extreme weather and climate conditions on natural and productive ecosystems to inform and develop new adaptation strategies for the future.

Research topics

Rainfall regimes

Responses of plants, invertebrates, microbial communities and soil nutrient cycling to altered rainfall regimes and drought.

Pasture systems

The impacts of predicted climate scenarios (drought and heat stress) on productivity, quality and resilience of pasture systems.

Herbivores & silicon

The role of root herbivores and silicon in grassland resistance to predicted changes in rainfall patterns.

Atmospheric CO_2

Impact of elevated atmospheric CO_2 and drought on the physiology and development of eucalypt leaf feeders and their microbial associations.

Tree mortality

Drought-induced tree mortality:

- Resilience of Australian forests and woodlands to drought
- Xylem and phloem transport limitations in drought-induced mortality of trees
- Vulnerability to plant embolism and recovery.

RESEARCH DIRECTIONS

Flexibility of forest trees in a rapidly warming world

With a projected average Australian climate warming of 3°C by 2070, forest trees cannot migrate fast enough to avoid the unprecedented increases in temperature.

Our researchers are using enclosed chambers to investigate how thermal acclimation influences leaf and tree carbon exchange, and whether this depends upon a tree's home climate. Ultimately, we will be better placed to predict the future of our forests and consequences for carbon cycling in a warmer world.

RESEARCH DIRECTIONS

Improving pastures in the face of climate extremes

To achieve sustainable pasture production and climate mitigation by 2030 requires new knowledge of plant responses to climate extremes and associated implications for greenhouse gas budgets.

Our researchers are investigating perennial legumes and herbs that show promise for increasing the climate-resilience and soil carbon storage of pasture systems, and potentially offering a route for lowering livestock methane emissions. Such information is essential to identify the mechanisms that underpin climate resilience that can then inform management decisions needed to achieve economic viability and carbon neutrality in a changing climate.

RESEARCH DIRECTIONS

The survival of forests under drought

Droughts are predicted to become more extreme with potentially devastating impacts on Australian forest ecosystems.

Our researchers are addressing key knowledge gaps in our understanding of how plants tolerate extreme drought stress and using this new knowledge to improve vegetation models suitable for assessing ecosystem vulnerability. We are providing a deeper understanding of drought tolerance in trees, improved forecasting of risks to native vegetation, and enhanced management of native forest resources.

RESEARCH DIRECTIONS

Root herbivores & their effect on grassland climate resilience

Grasslands support a wealth of biodiversity and provide many valuable ecosystem services to society. Temperate grasslands are, however, one of the most threatened ecosystems in Australia.

Responses to warmer temperatures and rainfall extremes including drought will depend critically on the nature and strength of competition between plant species and interactions with feeders such as insect herbivores. Our researchers use experimental facilities to investigate the impact of altered climates on the plant community composition and the role of root herbivores in amplifying the effects of climate change.

The combined weight of root-eating insects exceeds that of sheep on some pastures. Root-munching herbivores can reduce plant productivity by up to 25%.

Research shows that plants take strength from silicon to brace themselves against attacks.

RESEARCH DIRECTIONS

Drought impacts on grassland ecosystems

Our researchers use long term, field manipulation experiments to simulate variable rainfall conditions and modify nutrient inputs to investigate the impacts of these key global changes on temperate grasslands.

By studying the complex species dynamics, diversity and functioning of grassland ecosystems under shifting rainfall patterns and altered nutrient inputs, we can increase our understanding of the mechanisms driving change in managed and natural grasslands.

In addition to extending our fundamental knowledge of grassland ecology, this research helps inform the way that industries such as turf producers, agricultural enterprises and golf courses manage their grassland resources in an increasingly variable climate.

Climate change will intensify the severity of drought and heatwave events, with declines in rainfall and hotter conditions impacting all Australian ecosystems.

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We invite researchers and investors to explore future opportunities to work with the **Hawkesbury Institute for the Environment.**

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