



Australian Transect Network

Windows to our Environmental Future

ATN improves our understanding of factors that control the composition and function of species and ecosystems. This enables the monitoring of adaptations in the context of global climate change.

ATN was established in 2011 to connect the infrastructure established by bioclimatic gradient researchers in ways that facilitate the study of ecological structure and processes across major biophysical gradients.

Australian Transects: windows to our enviromental future

Transects span diverse ecosystems and bioclimatic gradients and their principal purpose is to measure selected ecosystem and species composition and how they are adapting to a changing environment. Transects will enable benchmarking and subsequent monitoring of trends in ecological condition in response to continental scale biophysical processes such as climate change.

ATN – the Australian Transect Network - comprises four member transects and three affiliate transects. We recognise that not all Australian transects are currently funded or part of the Network. Information on other transects can be found in the ATN's publications catalaogue Illuminating Transect Research. The transects presented in this document are:

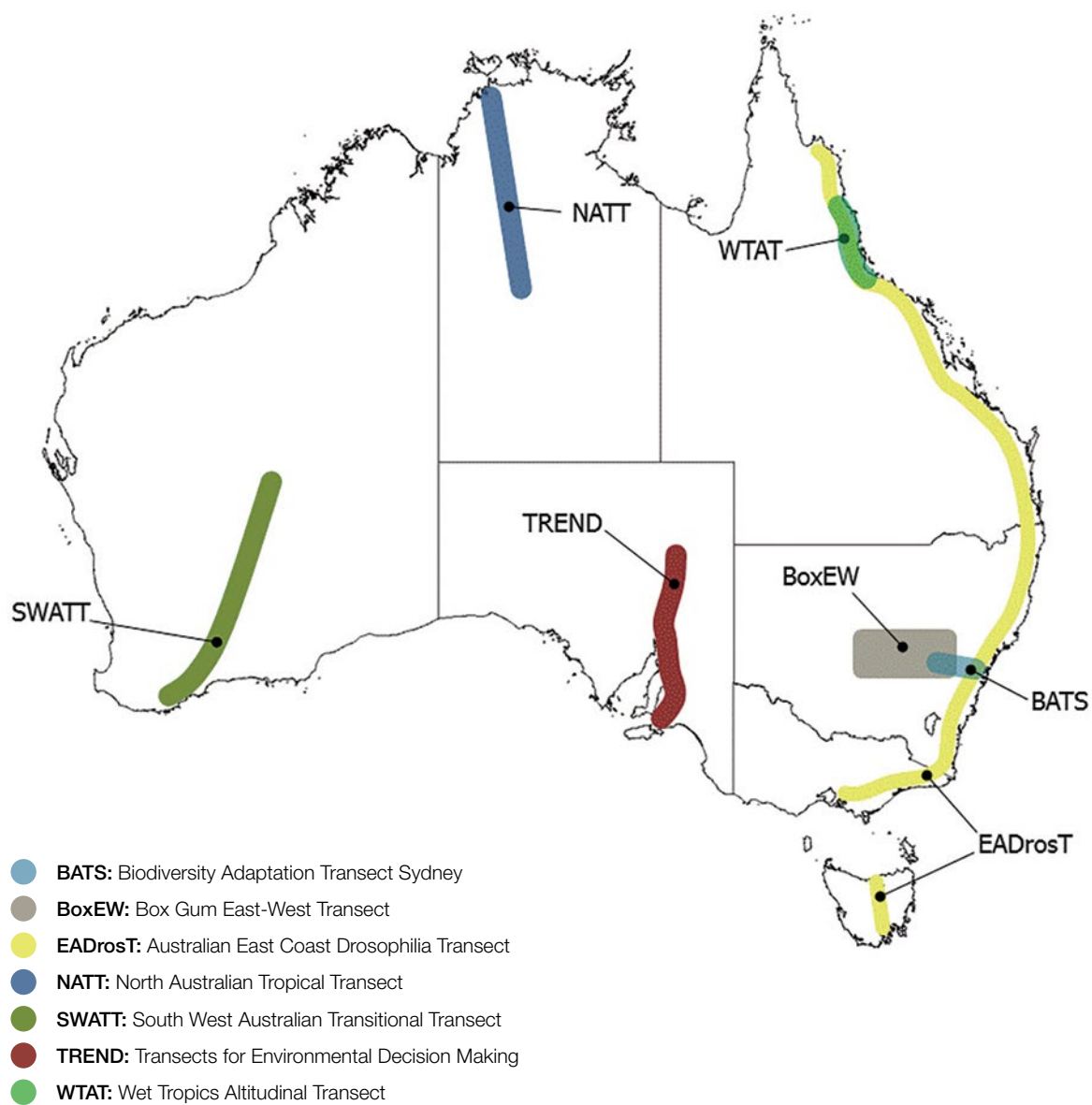
NATT[#]	North Australian Tropical Transect (NT)	Alan Andersen	CSIRO Tropical Environment Research Centre
SWATT[#]	South West Australian Transitional Transect (WA)	Stephen van Leeuwen/ Margaret Byrne	Department of Parks and Wildlife, Western Australia
TREND[#]	Transects for Environmental Decision Making (SA)	Andrew Lowe/ Greg Guerin	University of Adelaide
BATS[#]	Biodiversity Adaptation Transect Sydney (NSW)	Maurizio Rossetto	Royal Botanic Gardens Sydney
BOXEW[^]	Box Gum East-West Transect (NSW)	Suzanne Prober	CSIRO Land & Water Flagship
EADrosT[^]	Australian East Coast Drosophila Transect	Ary Hoffmann	University of Melbourne
WTAT[^]	Wet Tropics Altitudinal Transect (Queensland)	Stephen Williams	CSIRO- Ecosystem Sciences, James Cook University

[#]Member of the ATN; [^]ATN affiliate.

Data from ATN TERN-funded transects are published on TERN's AEKOS data portal. Plant and soil samples are available for loan via a joint sample loan process managed

through TERN's University of Adelaide node. Please contact the transect leaders should you require additional information on individual transects.

ATN and its members strongly support researcher access to data, samples and field plots. Data are being published via the AEKOS data portal and increasingly, historic (pre-TERN) are published as well. Plant vouchers, plant genetic samples and soil samples are available for research use.





North Australian Tropical Transect



Transect Leader: Professor Alan Andersen

Contact: alan.andersen@csiro.au

Alan leads a team of researchers, students and support staff in Darwin, NT whose mission is to deliver environmental, social and economic benefits to people who influence, use and manage Australia's tropical savannas. The team has particular research interests in fire ecology and management, invertebrate biodiversity, Indigenous natural resource management, and rangeland ecology. Alan has strong skills in science leadership and project management. He is an international leader in the systematics, biogeography and community ecology of ants, and their use as bio-indicators in land management. He also has internationally recognised expertise in the ecology and management of fire, especially in tropical savannas.

NATT - the North Australian Tropical Transect - provides a biogeographic framework for studying the savanna landscapes that dominate the northern third of Australia. Savannas feature an open tree canopy and dense grass layer, and are the dominant biomes throughout the world's seasonal tropics. They experience very frequent fire and are often heavily grazed by domestic livestock. In contrast to those overseas, Australia's savannas are little-modified by human activity, and harbour their full complement of biological diversity. CSIRO established the NATT in the mid-1990s as part of a global network of sub continental-scale transects that traverse the world's major biomes, under the auspices of the United Nation's International Geosphere-Biosphere Program.

NATT uses the rainfall gradient that runs from the northern coast (up to 2,000 mm mean annual rainfall) south to the fringe of the arid zone (600 mm) to place representative sites for studying savanna dynamics in relation to variation in soils and disturbance, primarily fire and grazing. It also provides a space-for-time framework for identifying and monitoring ecosystem transitions in the context of climate change. Key collaborators include Charles Darwin University, the Max Planck Institute in Germany and the University of Massachusetts, USA.



Australian Transect Network NATT transect
location in northern Australia





Department of
Parks and Wildlife



South West Australian Transitional Transect



Transect Leader: Dr Stephen van Leeuwen

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Stephen is Assistant Director, Science in the Department of Parks & Wildlife Western Australia. His scientific research expertise is wide and includes biological survey, field survey methodology, arid zone and fire ecology, mulga woodland ecology, plant taxonomy, plant species distributions, rare flora reproductive ecology, and reserve system selection and design. His work has an emphasis on biodiversity conservation in partnership with Traditional Owners and other land managers to deliver enduring sustainable outcomes for nature conservation and Country.



Transect Leader: Dr Margaret Byrne

Contact: Margaret.Byrne@DPaW.wa.gov.au

Margaret is Director of the Science and Conservation Division in the Department of Parks and Wildlife Western Australia where she is active in the interface between science and policy in biodiversity conservation and management. She obtained a PhD from The University of Western Australia and was a Post Doctoral Fellow at CSIRO in Canberra. Her research has focused on plant genetic research to inform conservation strategies for rare and threatened plants as well as biodiversity conservation at landscape scales in relation to remnant viability, revegetation and adaptation to climate change. Margaret's current research interests are directed towards application of genomics in plant conservation and climate change adaptation strategies.



Australian Transect Network SWATT transect location in Western Australia



SWATT – the South West Australian Transitional Transect - is located in the south west of Western Australian extending for over 1,200km from Walpole on the south coast to just beyond the former pastoral lease of Lorna Glen and into the Little Sandy Desert. The SWATT incorporates the internationally recognised biodiversity hotspot that is the Southwest Botanical Province, a national biodiversity hotspot; the Central and Eastern Avon Wheatbelt; and the evolutionary significant species rich Southwest Interzone which includes the globally significant Great Western Woodlands.

The transect captures several biophysical gradients that drive species selection, influence community composition and determine assemblage distributional patterns across the landscape. Perhaps the most significant of these is the variation in climatic regimes which is best exemplified by the key

productivity driver rainfall. On the south coast at Walpole the median rainfall of 996mm/year is predominately consistent and predictable and is received across (<1mm) 128 days per year. These aspects of rainfall regime decay with progression north to the point where at Lorna Glen the medium rainfall is 260mm/year, it is episodic, it is highly unpredictable and there are only (<1mm) 29 rain days per year.

Some of the ecosystem science questions that SWATT will inform include how biodiversity is partitioned across the landscape (1) at a gene, species and community level in response to biophysical processes, (2) how species, population and regional scale genetic variability responds to biophysical gradients and (3) to what extent this confers an adaptive advantage to climate change.



THE UNIVERSITY
of ADELAIDE

Transects for Environmental Monitoring and Decision Making



Transect Leader: Professor Andrew Lowe

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Andy is Chair of Plant Conservation Biology and Director of the Centre for Conservation Science and Technology at the University of Adelaide. He is also Principal Advisor:- Biodiversity Research Partnerships for the South Australian Department of Environment, Water and Natural Resources. He leads a number of national and regional research programs, including the Terrestrial Ecosystem Research Network (TERN) for which he is Associate Science Director, and established the Transects for Environmental Monitoring and Decision-making (TREND) program. His research aims to develop and apply ecological and genomic analyses, to understand, monitor and better manage biodiversity, particularly adaptation in the face of the anthropogenic threats of habitat fragmentation, invasive species and climate change.



Transect Leader: Dr Greg Guerin

Contact: greg.guerin@adelaide.edu.au

Greg is a Postdoctoral Fellow at the University of Adelaide. His main research focus is on patterns of ecosystem composition and functional responses to changes in climate through space and time. Through this work we hope to better understand how mediterranean ecosystems in southern Australia respond to environmental change and apply new information on climate change impacts to practical interventions.



Australian Transect Network TREND Sites in South Australia



TREND - Transects for Environmental Monitoring and Decision Making - is a long-term research and monitoring program dedicated to understanding how species and ecosystems change over space and time. TREND provides a system of data collection across South Australia's native ecosystems, marine environments, primary production regions and regional communities. By assessing the impacts of various potential climatic and environmental shifts, TREND will provide an early warning system for changes in South Australia's diverse environments and a lasting legacy of long-term monitoring, informed policy and proactive response to environmental change.

Plots are established in a north-south transect running along the Mount Lofty Ranges and Flinders Ranges from Deep Creek on the coast to north of Arkaroola. TREND's infrastructure will help address questions such as how are changes in our climate driving shifts in the way communities of species are composed, and the timing of periodic biological processes like flowering, breeding and migration; and in a forecast warmer, drier future can we accurately model climate change effects by looking at current conditions in these areas?

Biodiversity Adaptation Transect Sydney



Transect Leader: Dr Maurizio Rosetto

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Maurizio is a Senior Principal Research Scientist and manages the Evolutionary Ecology team at the Herbarium of NSW (Royal Botanic Garden Sydney (RBGS)). His principal research interest is in the evolutionary, ecological and conservation genetics of native plants. One of his lab's main objectives is to understand why species are distributed and assembled the way they are. This involves three main research steps: 1) describe the distribution of diversity; 2) place diversity patterns within a temporal context; 3) explore adaptive responses to local selective filters. To achieve this, his research combines molecular genomics, functional ecology and environmental modelling. Most of his team's research focuses on two main study systems: Australian rainforest habitats and Sydney's sandstone flora with which he works on diverse projects ranging from tracking adaptive changes across an altitudinal gradient, to exploring the impact of habitat change on hanging swamp floras.

BATS–Biodiversity Adaptation Transect Sydney is investigating how floristic diversity changes across an environmental gradient in the Sydney region. The study area is between the coast and the Capertee valley, west of the Great Dividing Range. In this project we are using a landscape-level approach to investigate taxonomic, functional, genetic and genomic turn-over along a natural environmental gradient. The project can roughly be divided into three parts all aiming at improving our knowledge of how and why diversity changes across natural gradients.

The first part of the project is a plot-based study along an environmental transect traversing the sandstone soils of the Sydney region, and exploring species turnover across altitudinal and rainfall gradients. The second part of the project aims at contrasting plastic versus adaptive variation in two species co-occurring along this same environmental gradient. And the third part aims to place genetic turnover across the transect into the broader context of genetic variation across the entire distributional range of these same species, to answer questions such as whether altitudinal variation is similar to latitudinal variation?

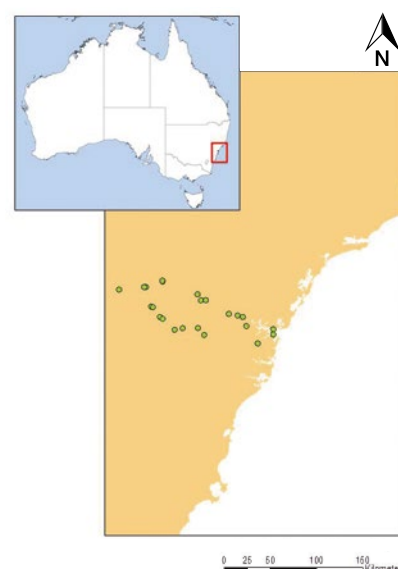
Projects currently running on the BATS transect:

Genetic, floristic and functional turnover along an altitudinal gradient – RBGS.

Floristic and functional datasets representative of all BATS plots are being analysed to explore correlative patterns. Three selected species have also been sampled extensively for genetic studies using genome reduction techniques, with the aim of comparing likely replicative patterns between altitudinal and latitudinal gradients. Transcriptome analyses for two Proteaceae species are being completed with the aim of interpreting the findings within an adaptive context. These findings will be combined with the *Telopea* data to identify loci that can potentially be broadly used to obtain local adaptive measures.



Australian Transect Network BATS Sites in New South Wales



Hybridisation patterns in *Lomatia* from coast to mountaintops – RBGS, University of Sydney.

cpDNA genome studies are being completed to compare previous nDNA-based studies. These aim to confirm that differentiation patterns are as much depending on geographic (altitudinal) location then on taxonomy.

Landscape genetics in hanging-swamp flora distributed along an altitudinal gradient – RBGS.

Do either altitude, functional characteristics or habitat preference influence the distribution of genetic diversity in swamp species distributed along an altitudinal gradient? A NGS-based study of 13 plant species aims to ascertain the most important factors impacting on the distribution of species and genes in swamp flora.

***Eucalyptus* speciation in the Blue Mountains – RBGS, University of NSW.**

Blue Mountain *Eucalypts* appear to be morphologically and taxonomically differentiated according to their distribution along the altitudinal gradient. We are using morphological and genetic studies to explore landscape-level associative patterns among lineages, and the impact of hybridisation in green ashes.

Australian East Coast *Drosophila* Transect



Transect Leader: Professor Ary Hoffmann

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Ary is an ARC Australian Laureate Fellow. His group undertakes research on adaptation of organisms (particularly invertebrates) to environmental stresses including climate change, using field sites along eastern Australia as well as in the Victorian high country. He has a strong interest in using genetics, genomics and invertebrate biodiversity for monitoring environmental health and developing resilience indicators. Ary is also a fellow of the Australian Academy of Science, past President of the Australian Entomology Society and the Genetics Society of Australasia, and has published more than 460 scientific papers.

EADrosT - Australia East Coast *Drosophila* Transect – is a coastal transect running from Hobart to Cooktown. Its aim is to monitor the dynamics of evolutionary adaptation to climate change in *Drosophila* flies along a temperate-to-tropical gradient, track species composition changes under climate change and understand driving forces, determine the genes and genetic processes underlying adaptive evolution, and track the speed of response to contemporary environmental change.

Major research questions are: 1) How quickly can adaptive changes to different conditions evolve? 2) What is the role of average versus extreme conditions in dictating species ranges and range shifts? 3) What is the nature of genetic processes underlying climate change adaptation?

Surveys along the gradient retrieve all *Drosophila* trapped species and genetic and genomic analyses are conducted

The frequency of surveys generally ranges from every 2 to 4 years. The original screening of species along the clines and genetic polymorphisms took place in the 1970s and 1980s. More intense sampling has occurred since 2000.



Australian Transect Network EADrosT Sites
along the Australian east coast





Grassy Box Eucalypt Woodland Transect (NSW)



Transect Leader: Dr Suzanne Prober

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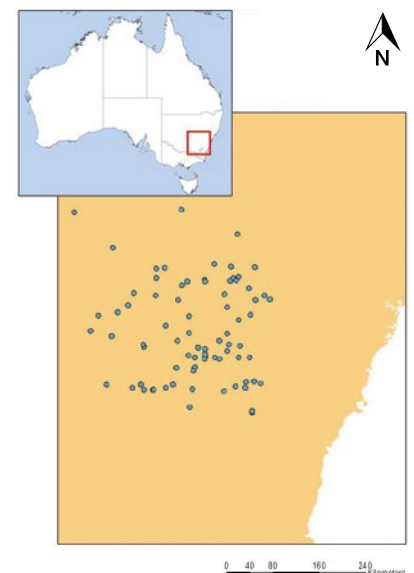
Suzanne's research interests are centred on understanding, managing and restoring the natural diversity, ecosystem function, and resilience of plant communities, particularly temperate eucalypt woodlands. This includes a focus on facilitating adaptation of species and ecosystems to climate change.

BoxEW – Grassy Box Eucalypt Woodland – transect captures a rainfall gradient of 400 mm in an east-west direction across box-gum woodlands of central NSW, incorporating major shifts at the family level in woodland plant composition. Along

each part of the gradient, woodlands modified by intermittent livestock grazing are contrasted with rare sites with a history of minimal livestock grazing, to highlight potential interactions between landuse and climate.



Australian Transect Network BoxEW Sites in New South Wales





Wet Tropics Altitudinal Transect



Transect Leader: Professor Stephen Williams

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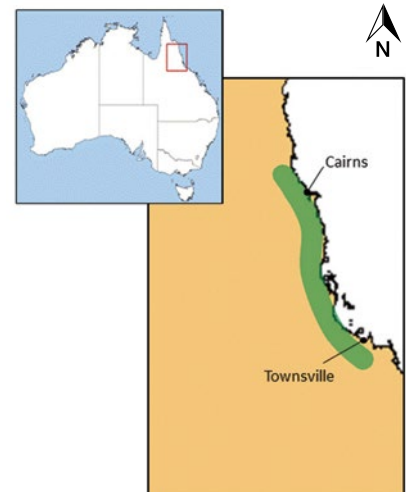
Stephen is the program leader for the Global Change Program within the Centre for Tropical Biodiversity & Climate Change research (CTBCC) which he founded in 2006. He was the convenor/director of the NCCARF National Adaptation Research Network - Terrestrial Biodiversity (2009-2013) and the Ecosystems Network under the new NCCARF II. He is Chair of the IUCN Climate Change & Biodiversity Specialist Group and Wet Tropics Management Authority Science Advisory Committee. Stephen's research is focused on understanding biodiversity, assessing the vulnerability of biodiversity to global climate change and using this knowledge to maximise the positive benefits of conservation management and adaptation.

WTAT – Wet Tropics Altitudinal Transect - Research based on altitudinal studies in the Queensland wet tropics was one of the first to identify global climate change as a severe threatening process in the tropics and that we may be facing many species extinctions in mountain systems around the world. This work resulted in the Australian Wet Tropics being internationally recognized by the IPCC as one of the world's most vulnerable

ecosystems. Papers in PLoS Biology, Nature, American Naturalist, Global Change Biology, Diversity & Distributions and Proceedings of the Royal Society of London have made significant contributions to the high profile of climate change biology in the literature. It has produced significant outcomes in research, policy and management at all levels from regional to international.



Australian Transect Network WTAT transect location in North Queensland



Acknowledgements:

Many thanks to the transect leaders for providing text and for proof-reading.
Thanks to Ashleigh Burke for preparing maps.

We acknowledge the assistance of TERN's EcolInformatics Facility in preparing and publishing ATN data via the AEKOS data portal.



Photo credits

Front Page: Rachel Meissner; NATT – Alan Andersen; SWATT – Rachel Meisner; TREND – Emrys Leitch; BATS – Maurizio Rossetto; EADrosT – Denis Crawford; BoxEW – Suzanne Prober - WTAT Stephen Williams

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tern.org.au/Australian-Transect-Network-pg22748.html



The Terrestrial Ecosystem Research Network (TERN) is hosted at the University of Queensland and supported by the National Collaborative Research Infrastructure Strategy (NCRIS), an Australian Government Initiative. The Australian Transect Network is one of three TERN Facilities hosted by the University of Adelaide.

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