2013 New Zealand Epiphyte Workshop
21-23 February 2013
Brian Bellringer Pavilion, New Plymouth
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Cover image: *Earina mucronata* at Maungatapiti Ecological Island by Catherine Bryan
Proceedings produced by Catherine Bryan, published by the Environmental Research Institute, University of Waikato, February 2013.
Welcome to the first epiphyte workshop to be hosted in New Zealand. As our understanding of epiphytes in New Zealand and around the world grows slowly, the number of questions to be answered grows much faster. This event has been coordinated to share what we currently know, to answer some questions with the help of national and international experts, and to plan a collaborative approach to address some of the larger unknowns.

The 2013 workshop will focus not only on epiphytes but also vines, lianas and parasites as these life-forms share a similar habitat and are generally understudied. This group of plants will be addressed from different perspectives including biological, ecological, restoration and conservation science.

At this workshop we are very pleased to be hosting Professor Gerhard Zotz, an internationally recognised epiphyte expert. With his guidance we aim to establish a NZ branch of Epinet: a new epiphyte research network.

We kindly thank our four sponsors and the organising team for making this workshop possible. We trust that you will enjoy the diverse mix of presentations within the beautiful setting of Pukekura Park and New Plymouth City.

No reira, tēnā koutou, tēnā koutou, tēnā tātou katoa.

Catherine Bryan

on behalf of the organising committee.
From our lead sponsor

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- Workshops and Resources
  - Customised for your area and interests

- Epiphyte expertise

  Selected publications:


New Plymouth Field Trip

Friday 22nd February
Meeting place: Brian Bellringer Pavilion, Pukekura Park
Depart: 2.00pm
Return: around 5.00pm

Details:
We will travel by van to a semi-coastal urban forest in New Plymouth City. This field trip will provide an introduction to lowland and coastal epiphytes, vines, lianes and parasites and demonstrate the abundance and diversity of Taranaki populations. A demonstration of tree climbing techniques for research will be provided.

What to expect and bring:
The tracks will be predominantly easy-access and flat. We will be moving from sunny open areas to mature forest than can be damp and cold. Be prepared for all conditions. Bring sturdy footwear, your own water, hat, camera and necessary medication (e.g. for bee sting allergies). Afternoon tea, sunscreen and insect repellent will be provided.
Egmont National Park Field Trip

Saturday 23rd February
Meeting place: Bus Stop at 11 Queen Street, New Plymouth
Depart: 8.30am sharp
Return: around 4pm

Details:
Meet at the bus stop at 11 Queen Street. Free parking is available along nearby streets (see below), please ensure you choose a spot without a time limit. We will travel by van up the northern side of Mount Taranaki and then work our way back towards the coast, visiting forests at different altitudes along the way.

What to expect and bring:
We will experience different conditions throughout the day as we move through altitudinal zones, this may include sunny open tracks and damp mature forest. The weather can also change very quickly on the mountain. Be prepared for all conditions. Bring sturdy footwear, your own water, hat, camera and necessary medication (e.g. for bee sting allergies). Lunch, snacks, sunscreen and insect repellent will be provided.

A map of New Plymouth City is provided on page 18
Workshop Programme

Thursday 21.02.13

9.00 am  Welcome & Introduction

Keynote address
9.30 am  Gerhard Zotz  University of Oldenburg

10.40 am  Morning tea

Symposium 1
11.20 am  Catherine Bryan  The University of Waikato
11.40 am  Sarah Wyse   The University of Auckland
12.00 pm  Bruce Clarkson  The University of Waikato
12.20 pm  K.C. Burns   Victoria University of Wellington
12.40 pm  Mike Clearwater  The University of Waikato

1.00 pm  Lunch

Symposium 2
2.00 pm  Kathrin Affeld  Landcare Research, Manaaki Whenua
2.20 pm  Hannah Buckley  Lincoln University
2.40 pm  David Orlovich  University of Otago
3.00 pm  Donna Worthy  Department of Conservation

3.20 pm  Afternoon tea

Symposium 3
4.00 pm  John Sawyer  Auckland Council
4.20 pm  Bruce Burns  The University of Auckland
4.40 pm  Catherine Bryan  The University of Waikato
5.00 pm  Notices for tomorrow
5.15 pm  Finish

Friday 22.02.13

8.30 am  Introduction to Epinet
9.00 am  Epinet workshop
10.30 am  Morning tea
11.00 am  Epipnet workshop
12.30 pm  Lunch
2.00 pm  New Plymouth field trip - depart from Bellringer Pavilion
~5.00 pm  Return to Bellringer Pavilion
6.30 pm  Workshop Dinner - meet at Pankawalla, 85 Devon Street West

Saturday 23.02.13

8.30 am  Egmont National Park field trip - depart from 11 Queen Street
~4.00 pm  Return to 11 Queen Street
Keynote Abstract

**Epiphytes - a critical review of concepts, facts and assumptions**

Gerhard Zotz
University of Oldenburg, Germany

Epiphytes make up a considerable portion of global plant diversity, but progress in understanding their ecology has been much slower than in ground-rooted flora. I argue that this is partly due to conceptual problems and unproven assumptions which make comparisons across studies difficult and hinder generalizations. Another major issue concerns the taxonomic and geographical biases in our data. With these limitations in mind I am going to review our current knowledge of epiphyte biology with the intention to provide common ground for fruitful discussions on possible joint projects focusing on epiphytes in the temperate zones.

Symposium Abstracts

**Can spatial variation in epiphyte diversity and community structure be predicted from sampling vascular epiphytes alone?**

Kathrin Affeld
Landcare Research - Manaaki Whenua, Lincoln

Non-vascular epiphytes have been largely ignored in studies examining the biotic and abiotic determinants of spatial variation in epiphyte diversity. Our aim was to test whether the spatial patterning of species richness, biomass and community composition is consistent between the vascular and non-vascular components. We collected single samples (30 - 25 cm) from 96 epiphyte assemblages located on the inner branches of 40 northern rata (*Metrosideros robusta*) trees. For each sample branch characteristics were recorded and the biomass for each individual epiphyte species was determined. Vascular and non-vascular epiphytes showed strikingly different spatial patterns in species richness, biomass and composition, which could not be explained by the branch structural characteristics we measured.

Non-vascular plants contributed substantially to the high species richness and biomass recorded in this study. High variability in community composition among epiphyte mats, and very low correlation with any of the environmental factors measured, possibly indicate high levels of stochasticity in seed or spore colonization, establishment success or community assembly among branches in these canopy communities. There was no correlation in the spatial patterning or determinants of species richness between non-vascular and vascular plants. This study highlights the crucial importance of sampling non-vascular plants when undertaking epiphyte community studies.
Network properties of arboreal plants: Are epiphytes, mistletoes and lianas structured similarly?

Ray Blick and K.C. Burns*
Victoria University of Wellington. *Presenting author

We used a network approach to evaluate three different arboreal plant metacommunities. Interactions between mistletoes, lianas and epiphytes and their host trees were quantified in two New Zealand forests and individual-based null models were used to test for non-random patterns in network degree, nestedness and negative co-occurrences. Arboreal plants were simulated to occur on individual host trees randomly to derive ‘null’ interaction matrices, which were then compared to the observed matrix. Results showed that mistletoes, lianas and epiphytes had different network properties. Mistletoe and liana degree distributions exhibited fewer links than expected under the null model, indicating strong host preferences. Conversely, degree distributions for epiphytes were consistent with randomised expectations. Mistletoes and lianas were less nested than null model expectations and showed evidence for negative co-occurrence patterns, meaning they had mutually exclusive host preferences. Conversely, epiphytes were more nested than expected by chance and showed positive co-occurrence patterns. Overall results indicate that different types of arboreal plants have different network properties. We hypothesize that these differences result from differences in coevolutionary dynamics between arboreal plants and their hosts, which range from parasitic (mistletoes) to commensal (epiphytes).

An introduction to New Zealand’s vascular epiphytes, vines and parasites

Catherine L. Bryan
University of Waikato, Hamilton

This brief introduction will illustrate the diversity and abundance of vascular epiphytes, vines and parasitic plants in New Zealand. The key characteristics of these plants will be discussed in groups based on growth form. This will provide a platform for the following presentations to inspire new research questions and direction. The presented information is sourced from a field guide that is being developed by the Environmental Research Institute at the University of Waikato.
Epiphytes play important ecological roles in both tropical and temperate forest, but some are slow to recolonise degraded forest patches, despite ecological restoration efforts. Temperate rainforest patches in New Zealand follow this pattern, especially small patches that remain within urban landscapes. A survey of the epiphyte populations on 750 trees across the Waikato region showed that 45% of the region’s 29 epiphyte species were absent from forests within Hamilton City. Those epiphytes present were most abundant on larger diameter host trees especially those with non-peeling bark and broad spreading crown architecture. Increased abundance was also recorded when soil-building nest epiphyte species were present on a host tree. Local restoration practitioners wish to include these plants in restoration projects but lack best practise methods. To develop guidelines for epiphyte restoration, a reintroduction trial has been established in Hamilton City that is designed to identify the most important factors for successful epiphyte establishment. *Griselinia lucida* and *Pittosporum cornifolium*, both late-successional species, have been used as indicator species because the establishment of these species will indicate that epiphyte species with less specific habitat requirements should also survive. The trial involves a range of treatments including different host tree species, attachment techniques, attachment heights, plant aspects, and plant positions.

Epiphytic lichens are an excellent study system for investigating the processes that structure biological communities. First, I describe a study of the relative roles of habitat, interactions, and chance events in structuring epiphytic lichen communities on over 300 mountain beech trees (*Nothofagus solandri var. cliffortioides*) in the foothills of the Southern Alps. Second, I describe how we are using molecular methods to better understand the ecology of the lichen symbiosis in these epiphytic communities and for New Zealand species in the cryptic lichen genus *Usnea* (old man's beard lichens).
Developing restoration techniques for northern rata - a once-common hemiepiphyte

Bruce R. Burns
University of Auckland

Northern rata used to be an emergent feature of many forests from which it is today rare; its decline driven by its high palatability to brushtail possums. I review evidence of the former abundance of northern rata within North Island forests and compare these to its current extent showing its dramatic decline in many areas. Northern rata in natural forests occurs most commonly on large host trees (> 50 cm diameter) and preferentially establishes on several specific species. I am currently carrying out an adaptive management experiment to determine methods to restore hemi-epiphytic northern rata populations to forests with no brushtail possums. At Zealandia - Karori Sanctuary near Wellington, in the absence of brushtail possums, the establishment success of 200 northern rata seedlings is being assessed against 3 factors: host tree, rooting volume, location on a stem and stem aspect. Significant mortality occurred over the first year due to seedlings drying out, but seedlings appear resilient after this. Survival and growth were greatest on trees with smooth bark, in seedlings planted with larger rooting volumes, and on southern (shaded) sides of trees. Water availability appears to be a key factor limiting growth and survival.

Comparative autecology of Pittosporum shrub epiphytes

Bruce D. Clarkson, Fiona M. Clarkson, Kirsty J. Myron, Catherine L. Bryan
University of Waikato, Hamilton

Recent research at the University of Waikato has investigated the autecology of New Zealand’s two endemic specialised shrub epiphytes: *Pittosporum cornifolium* (tāwhiri karo) and *P. kirkii* (Kirk’s kōtāhē). This presentation will compare some key characteristics of these two species including environmental limits, population structures, reproductive biology and lifestyle. The implications of these findings will be related to conservation management requirements as both species have become increasingly threatened by pest browsing and habitat disturbance.
Water relations of New Zealand vascular epiphytes

Michael J. Clearwater*, Catherine L. Bryan, Kirsty J. Myron, Katie Davison
University of Waikato, Hamilton. *Presenting author

Water availability is often cited as the most important constraint to epiphyte growth and functioning, and is thought to be a major determinant of the extent of temperate epiphyte floras. Very little is known about the physiological ecology or drought responses of NZ vascular epiphytes. In this presentation we will review the types of adaptations to low or intermittent water supply that are typically displayed by epiphytes elsewhere, and consider whether NZ epiphytes display the same suite of characters. Recent experiments have examined the drought responses of three New Zealand shrub epiphytes, *Griselinia lucida*, *Pittosporum kirkii*, and *Pittosporum cornifolium*. The results show that they do possess many drought tolerance characters considered typical of epiphytes elsewhere, but that their predicted drought tolerance varies and may be an important determinant of their distribution within NZ. We consider whether CAM photosynthetic physiology might be important in NZ epiphytes, as it is in tropical epiphytes, and report on the first detection of CAM-like physiology in a NZ species of epiphytic orchid, *Drymoanthus adversus*.

Ectomycorrhizal fungi on adventitious canopy roots of old-growth silver beech (*Nothofagus menziesii*)

David A. Orlovich1*, Suliana E. Teasdale1, Steven L. Stephenson2
1University of Otago, Dunedin. 2University of Arkansas, USA. *Presenting author

The canopy soil associated with the mats of vascular and nonvascular epiphytes found on the branches of *Nothofagus menziesii* in the temperate rainforests along the south-western coast of the South Island of New Zealand were examined for evidence of ectomycorrhizal fungi. DNA sequencing and cluster analysis were used to identify the taxa of fungi present in 74 root tips collected from the canopy soil of three old growth trees. Sequences from nine genera of putative ectomycorrhizal fungi were found on an extensive network of adventitious canopy roots, including one fungal species that may be a canopy specialist. Canopy ectomycorrhizas provide an unexpected means for increased host nutrition that may have functional significance in some forest ecosystems. Presumably, canopy ectomycorrhizas on host adventitious roots circumvent the tree-ground-soil nutrient cycle by accessing a wider range of nutrients directly in the canopy than would be possible for non-mycorrhizal or arbuscular mycorrhizal canopy roots. In this system, both host and epiphytes would seem to be in competition for the same pool of nutrients in canopy soil. Preliminary evidence using terminal fragment length polymorphism (TRFLP) analysis indicates that the canopy ectomycorrhizal fungal community is more uniform and less diverse than terrestrial communities.
**Epiphyte biogeography and its importance to species conservation**

John Sawyer  
Auckland Council

Understanding the distribution of epiphytes in NZ is important to their conservation management. It helps us:
- Improve understanding of factors influencing epiphyte autecology and their survival;
- Identify priority sites for conserving the greatest number of epiphytic species; and
- Select sites where epiphyte restoration could be undertaken

The NZ Plant Conservation Network holds data about all New Zealand epiphytic plants (100+ taxa), including taxon information and distribution data. This is held on the Network's website (www.nzpcn.org.nz) and includes data for all NZ threatened epiphyte taxa (status based on de Lange et al 2009). They include:

-Xeronema callistemon f. callistemon (Naturally Uncommon) - Ackama nubicola (Nationally Critical)  
-Adelopetalum tuberculatum (Naturally Uncommon) - Metrosideros bartlettii (Nationally Critical)  
-Asplenium shuttleworthianum (Naturally Uncommon) - Nephrolepis brownii (Naturally Uncommon)  
-Davallia tasmanii subsp. cristata (Nationally Critical) - Pterostylis silvicultrix (Naturally Uncommon)  
-Davallia tasmanii subsp. tasmanii (Naturally Uncommon) - Tmesipteris horomaka (Nationally Critical)  
-Dracophyllum arboreum (Naturally Uncommon) -Pittosporum kirkii (Declining)  
-Drymoanthus flavus (Naturally Uncommon) - Brachyglottis kirkii var. kirkii (Declining)  
-Xeronema callistemon f. bracteosa (Naturally Uncommon) - Hebe barkeri (Nationally Critical)

Contributing site observations to the Network's on-line biogeographic data set will improve our ability to manage the species in the wild, improve our understanding of the changing phenology of these taxa; and provide those involved with ecological restoration of these threatened species with useful data for seed collection and seed banking.

*Note an updated threatened vascular plant species list is expected to be published by the Department of Conservation in 2013.*
**Alepis flavida distribution in the Kepler Mountains**

Donna Worthy  
Department of Conservation, Taranaki

The Kepler Mountains in Fiordland National Park were chosen as a priority site for the conservation of yellow-flowered mistletoe, *Alepis flavida*. Yellow mistletoe is currently assessed as ‘At Risk: Declining’ in the New Zealand threat classification system (de Lange et al, 2009).

Initially, a mistletoe distribution survey of the Kepler beech forest was undertaken. Areas searched and plants found were recorded using GPS. This survey found a significant population of over 3000 *Alepis flavida* plants over approximately 4000ha, mainly concentrated around the Dock Bay and Coal Creek areas. Field work was carried out by Lynley King as part of a teaching fellowship sponsored by the Royal Society. To monitor the status of the population, nine recruitment plots were then established in a 400ha area between Dock Bay and Brod Bay, where a community project plans to carry out rat and possum control. In the recruitment plots all potential host trees, total number of mistletoe plants, size, condition and any evidence of browse was recorded. These plots will be re-measured over time and compared to indexes of possum abundance to determine if the level of possum control is sufficient to protect the mistletoe.

**Effects of host bark traits on trunk epiphyte communities**

Sarah V. Wyse, Bruce R. Burns  
The University of Auckland

Host bark traits are known to affect the characteristics of epiphyte communities in forests worldwide; however, few investigations of such relationships have been undertaken in New Zealand forests. By examining the trunk epiphyte communities on four co-occurring forest tree species (*Agathis australis*, *Dacrydium cupressinum*, *Knightia excelsa* and *Vitex lucens*) representing a range of bark characteristics, we sought evidence that bark traits may shape these communities. Sampling was conducted on tree trunks in the Waitakere and Hunua ranges in the Auckland Region. As expected, the rough but lightly shedding bark of *Vitex lucens* was found to support many epiphytes, whereas the coarsely flaking bark surface of *Dacrydium cupressinum* supported few epiphytes. Conversely, despite bark with a smooth texture that sheds in large flakes, and contrary to the suggestions of previous authors, *Agathis australis* trunks were found to support the greatest numbers of epiphytes and this species was one of the most frequent epiphyte hosts. The individual epiphytes found on *Agathis australis*, however, were significantly smaller and more appressed to the trunk than those on the other trees, and species composition differed from the other host species.
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Maps

New Plymouth City

⭐ Workshop Venue: Brian Bellringer Pavilion

- 11 Queen Street: meeting place for Egmont National Park field trip
Pukekura Park

Legend:
- Trees - specimen and bush
- Grass - lawns and gardens
- Paths - pedestrians only
- Roads - limited vehicle access

Park Entrance / Exit
Toilet

Layout of Pukekura Park and
Brooklands showing main features

1 Victoria St Entrance
2 Water Wheel
3 Children’s Play Area
4 Japanese Hillside
5 Fountain Lake
6 Bellringer Pavilion
7 Main Gates
8 Sports Ground
9 King Fern Gully
10 Rogan St Entrance
11 Rogan St Playground
12 Ferry
13 Tea House
14 Band Rotunda
15 Main Lake
16 Waterfall
17 Hatchery Lawn
18 Victoria Rd Entrance
19 Shortland St Entrance
20 Pool’s Bridge
21 Eastern Hillside
22 Stainton Dell
23 Racecourse Walk Entrance
24 Boat Shed Bridge
25 Upper Lake
26 Goodwin Dell
27 Kauri Grove
28 Kemming Garden
29 The Gables
30 Rhododendron Dell
31 Lily Lake
32 Bowl Lake Bridge
33 Sound Shell
34 Bowl Lake
35 Bowl of Brooklands
36 Brooklands Entrance
37 Brooklands Zoo
38 Brooklands
39 Brooklands Chimney
40 Pinetum
41 Scanlan Lookout
42 Racecourse Track Entrance
43 Lower Maranui Gully
44 Ambush Gully
45 2,000 Year Old Pohutu Tree
46 Historic Giant Ginkgo Tree
47 Kaimata St Entrance
48 List St Entrance
49 Upper Maranui Gully
50 Somerset St Entrance
51 Upjohn St Entrance
52 Chinese Collection
53 Coronation Ave Entrance