Environmental Levy Grants 2023 application

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Section 1 - Applicant details

1. Full name	Vanessa McPherson and Michael Gillings
2. Postal address	School of Natural Sciences, Macquarie University, NSW 2109
3. Day time phone contact	
4. Email address	
5. Do you represent a community group or not for profit organisation?	No
5a. Name of group / organisation	
5b. Contact details (if not as above)	
5c. What are the aims of your organisation?	
5d. How is your organisation funded (grants, fees, donations etc.)?	
5e. Are you registered for GST?	
5f. ABN (if you have one otherwise enter NA)?	
6. Grant category you are applying for?	Environmental Conservation Grant

Environmental Conservation Grant

7. Name of project?	Fungal Biodiversity and Management of Native Bushland
8. Project details?	Plant communities rely on symbiotic relationships with fungi for resilience and health. However, regeneration and management of native bushland currently does not take fungal diversity into account. Here, we will assess fungal diversity along transects spanning weedy, regenerated and pristine areas. Initial above-ground surveys suggest that regenerated areas lack fungal diversity and are more similar to weed infested areas. A lack of fungal diversity would have serious implications for the long-term success of revegetation and management programs. By identifying fungi characteristic of healthy, pristine vegetation, we will set the stage for future re-inoculation studies that will promote resilience of

our native bushland.

9. Proposed works must be outlined in detail below.

We will characterise fungal diversity in soil using next generation DNA sequencing, comparing the fungi present in soil samples taken from weedy, regenerated and pristine areas. The project will involve four stages: (i) Sample collection and site characterisation; (ii) Extraction of DNA from soil samples, PCR amplification of fungal DNA barcodes and Nanopore DNA sequencing; and (iii) Bioinformatic analysis to identify the fungal taxa associated with each location, and (iv) Statistical analysis to identify similarities and differences in fungal taxa between weedy, regenerated and pristine areas of vegetation.

These analyses will identify locations that contain high fungal diversity and determine if these are restricted to relatively intact or pristine bushland areas. If this is the case, then regenerated bushland might not contain the fungal diversity necessary for ongoing survival and resilience of the plants it contains. This would open the possibility for testing transplantation of fungal diversity to regenerated areas, although this activity would fall outside the current project.

Full technical details of the methods we propose are set out in the attached methods document. We propose conducting our project along three creek lines that each represent a range of vegetation states, and that have been subject to some bush regeneration in the past. These are: Blackbutt Creek, Gordon, Stoney Creek, Gordon, and Cowan Creek, North Turramurra.

A brief overview of our methods follows:

Sampling will be conducted along creek lines using a spatially explicit sampling scheme. Each sampling location will be characterised for plant and above ground fungal diversity. Sampling locations will be at consecutive 100 meter intervals down creek lines. At each location, sieved soil samples will be collected, and retained for DNA extraction and physicochemical analysis (if required).

DNA will be extracted from soil samples using bead beating, and the fungal ITS barcode amplified using PCR. PCR products will then be sequenced using the latest Nanopore DNA sequencing unit, and the sequence data processed using pipelines that are routine in our laboratory.

Sequence data will then be used to interrogate the RDP database and generate lists of the fungal taxa present at each sampling location. Taxa will be assigned to functional groups: saprophytes, parasites, or beneficial (mycorrhizal) fungi.

Fungal community profiles will be subject to Principal Component Analysis to determine associations of fungal taxa and communities with environmental parameters, including those parameters of immediate interest, these being the history of vegetation management at each sampling location.

These analyses will allow us to answer the primary questions posed in this project, which are 'Does fungal diversity return to regenerated bushland in parallel with plant diversity?', and 'What fungal taxa are associated with high value bushland?'.

10. Outcomes should relate back to at least one of the grant criteria. Outcomes must be measurable and achievable. Projects that align with more than one or more of the criteria may be looked at more favourably.

This grant application addresses multiple criteria set out in the Environmental Conservation Grant document, including the following:

Improve the natural environment and conserve native flora and fauna:

This project will enhance our understanding of the interactions between native fungi and flora. This will improve the potential for long-term rehabilitation of bushland areas by ensuring these areas have preserved below ground diversity as well as the diversity of flora. In the long term,

the project could open up the potential for fungal inoculation studies, the aim being to rehabilitate fungal diversity, and improve the condition of bushland.

The project will identify hotspots of fungal diversity for priority conservation and protection. We will also assemble a catalogue of fungal species present in the Ku-ring-gai area, benefitting our knowledge of the local environment.

Increase community understanding of the value of the natural environment:

We will use this project as a platform for public engagement. We aim to build bridges between researchers, practitioners and the general public, promoting understanding of the natural environment. We have a considerable history of public presentations and lectures, including a growing number of talks to the general public and bushcare managers over the last year. We hope to engage research students and diverse volunteers in the project, spanning all ages, interests and abilities.

Our public engagement strategy includes free lectures, fungal forays and collaborations. A selection of our recent talks and activities is given below.

Talks and Seminars
McPherson, V. and Gillings, M.R (2023) Fungal Diversity: Ecology, Diversity and Distribution, Willoughby City Council, Chatswood Library, 2nd May 2023.
McPherson, V. and Gillings, M.R (2023) Fungal Biodiversity Berowra Fauna Fair, Friends of Berowra Valley and Hornsby Shire Council, Berowra Community Centre, 12th March 2023.
McPherson, V. and Gillings, M.R. (2022) Fungal Diversity of the Lane Cove Valley, 2022 Linnean Society of NSW Natural History Field Symposium, Hornsby NSW, 16th-18th November 2022.
Gillings, M.R. and McPherson, V. (2022) Club and Coral Fungi: Diversity, Distribution and DNA. 2022 Linnean Society of NSW Natural History Field Symposium, Hornsby NSW, 16th-18th November 2022.
Gillings, M.R. and McPherson, V. (2022) Diversity and Discovery of Club and Coral Fungi in the Lane Cove Valley, Ku-ring-gai Bushcare Association, St Ives, 6th November 2022.
McPherson, V. and Gillings, M.R. (2022) Diversity and Discovery of Club and Coral Fungi in the Lane Cove Valley, STEP Association Seminar series, South Turramurra, 28th June 2022.

Public Outreach
Guided Fungal Foray, Benowie Walking Track / Callicoma Trail, Hornsby Council, with J. Stannard and M. Gillings, 16th June 2023 (upcoming)
Guided Fungal Foray, Sheldon Forest, Ku-ring-gai Council, with L. Williams and M. Gillings, 27th May 2023 (upcoming)
Guided Fungal Foray, Sheldon Forest, Ku-ring-gai Council, with K. Griffin and M. Gillings, 27th August 2022
Guided Fungal Foray, Sheldon Forest, Ku-ring-gai Council, with A. Austin and M. Gillings, 25th June 2022

Popular Press
McPherson, V. & Gillings, M.R. (2022) Diversity and Discovery of Club and Coral Fungi in the Lane Cove Valley. STEP Matters, June 2022. https://mcusercontent.com/8c1039a8091e19e0ac06397a7/files/6839dc6a-afa6-099e-a855-f83482e66f30/STEP_Matters_217.pdf
McPherson, V. & Gillings, M.R. (2022) Bushland Treasures on the doorstep. MQ Life, The Lighthouse, April 2022 https://lighthouse.mq.edu.au/life/campus-showcase/Bushland-treasures-on-the-doorstep

Journal Articles
McPherson, V.J., Gillings, M.M. and Gillings, M.R., 2023, May. Diversity and Abundance of Club and Coral Fungi in the Upper Lane Cove Valley. Proceedings of the Linnean Society of New South Wales 145:25-34.

	Reports Gillings, M.R. and McPherson, V. (2023) DNA sequencing of selected club and coral fungi from the DAR Herbarium. Report prepared for the NSW Department of Primary Industries Agricultural Scientific Collections Trust, Biosecurity Collections. Conference Abstracts McPherson, V. and Gillings, M.R. (2022) Fungal Diversity of the Lane Cove Valley. 2022 Linnean Society of NSW Natural History Field Symposium, Hornsby NSW, 16-18 November 2022. Gillings, M.R. and McPherson, V. (2022) Club and Coral Fungi: Diversity, Distribution and DNA. 2022 Linnean Society of NSW Natural History Field Symposium, Hornsby NSW, 16-18 November 2022.
11. What will a successful project look like and how will it be measured?	This project will result in the first detailed survey of soil fungal diversity in the Ku-ring-gai area and will provide a valuable baseline to help ensure the resilience of native vegetation into the future. We will generate a catalogue of the fungal taxa present in native bushland, adding to our knowledge of biodiversity, and identifying diversity hotspots worthy of conservation. Our field observations, and reports in the scientific literature, suggest that bush regeneration and remediation of damaged local ecosystems is not accompanied by recovery of soil microbial populations, and in particular, the soil fungi that are essential for long-term stability of native bushland. This project will test this hypothesis and identify those fungi and functional groups that are missing in regenerated bushland. Identification of missing taxa and missing functions will set the scene for future, targeted re-introduction of key fungal species likely to be important for long-term plant and ecosystem health. We anticipate that the project will result in scientific publications, but perhaps more importantly, it will be used as a vehicle for increasing community understanding and appreciation of the value of natural environments. We have a track record of bringing science to the general public and to various interest groups via public talks and activities. For instance, we have given six public lectures on fungal diversity over the past year to various Bushcare and Environmental groups, and to the general public. We have also run a number Fungal Forays for Ku-ring-gai and Hornsby Councils, where we show participants the diversity of fungi that are present in local bushland.
12. Name the relevant Land Manager eg. is your project located on land managed by Council, NPWS, School, private / other?	Survey areas are managed by Ku-ring-gai Council
13. Has the land manager been advised and given written approval for this project?	Yes
14. Provide detail on the location of the project. GPS co-ordinates will be beneficial	Blackbutt Creek Gordon from Minamurra Avenue (-33.757166, 151.140286) to Lady Game Drive (-33.770598, 151.141316); Stoney Creek Gordon from above Rosedale Road (-33.749855, 151.155805) to the junction with Rocky Creek (-33.754316, 151.167221); Cowan Creek North Turramurra from Bedford Avenue (-33.719292, 151.150446) to below Tokanue Place (-33.707944, 151.155011).
15. Name/s of contractors. Please note contractors need to supply a breakdown of costs on their quote.	$0
16. Goods eg. materials etc.	$5,000.00
17. Services eg. publicity etc.	$0

18. Other (please specify)	$0
19. How much funding are you applying for from the Environmental Levy Grants?	$5,000.00 - see attached budget and justification
20. Cash from any other sources eg. school funds, social club, private contribution	STEP Research Grant for the Conservation of Bushland - $5,000.00 to Vanessa McPherson
21. Does the project involve volunteers?	Yes
How many volunteers and number of hours? eg. three volunteers at three hours	Could involve PACE students from Macquarie, but not certain yet.
22. Upload any relevant photos, maps, quotes or documentation to support your project	McPherson and Gillings Budget.pdf 2023 159472 KRG Research approval - ID 2303 Fungal Biodiversity and Management of Native Bushland.pdf McPherson and Gillings Methods.pdf
Subscribe to the monthly Sustainability enews and stay up to date with environmental news and events in the area	Yes

Net Zero Communities Grant

7. Name of project?	
8. Brief description of your project	
9. Proposed works must be outlined in detail below.	
10. Outcomes should relate back to at least one of the grant criteria. Outcomes must be measurable and achievable. Projects that align with more than one or more of the criteria may be looked at more favourably.	
11. What will success of the project look like and how will it be measured?	
12. Name/s of contractors if required. Please note contractors need to supply a breakdown of costs on their quote.	
13. Good eg. materials etc.	
14. Services eg. publicity etc.	
15. Other (please specify)	
16. How much funding are you applying for from the Environmental Levy Grants?	
17. Cash from any other sources eg. school funds, social club, private contribution	
18. Does the project involve volunteers?	

How many volunteers and number of hours? eg. three volunteers at three hours

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19. Upload any relevant photos, maps, quotes or documentation to support your project

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