



PRIMER and PERMANOVA

Course in Multivariate Analysis for Ecology & Other Sciences

PRESENTER:	Marti J. Anderson (Distinguished Professor Emerita, FRSNZ)	
DATES:	Week 1: PRIMER Week 2: PERMANOVA	9 - 13 February 2026 16 - 20 February 2026
HOSTED BY:	ARC Training Centre for Biofilm Research & Innovation, Flinders University, South Australia.	

OVERVIEW

PRIMER-e is pleased to announce a **hybrid offering** (i.e., offered *in person* and *online*) of backto-back courses in *Multivariate Analysis for Ecology & Other Sciences* to be held over two weeks at Flinders University in Adelaide, South Australia.

Week 1 will cover the core non-parametric methods implemented in PRIMER software. *Week 2* will cover the semi-parametric methods encapsulated in PERMANOVA+ and other advanced topics. Sessions will run 5 days per week, Monday to Friday, from **8:30 am to 5:30 pm** each day. Participants may register for **week 1 only, week 2 only**, or **both weeks**. Online participants will join the course live in the Australian Central Daylight Time (ACDT) time zone (UTC +10.30 hours). Each day will include a mixture of lectures and computer lab sessions to implement the new methods and techniques learned on example datasets. Participants will have the opportunity to discuss and analyse their own data in consultation with the presenter. Those who register to attend in person **are expected to bring their own laptop to the venue**. Software may be purchased at a discounted price (see below), or a **free** fully functional (but time-limited) licence of the software will be made available to registered participants for trial use during the course. Note that PRIMER is a Windows-only product, so Macs need to run in Windows emulation. This course will cater both to those who are new to PRIMER and to those who are familiar with PRIMER methods but would like a refresher regarding the latest techniques and approaches.

VENUE

This course is being hosted by the ARC Training Centre for Biofilm Research & Innovation, Flinders University. All sessions will be held in **Lecture Theatre 2** on the ground floor of the **Flinders University Campus** building at Tonsley, 4 MAB Eastern Promenade, <u>Tonsley Innovation</u> <u>District</u>, 1284 Clovelly Park, South Australia. For a detailed map of the venue and location of the Lecture Theatre, please click <u>here</u>, (note that the meeting room on Level 5 is only booked for morning and afternoon tea breaks). If you have any other questions regarding on-the-ground logistics at the venue, please contact: Michael Gilbert (<u>michael.gilbert@flinders.edu.au</u>) or telephone: +61-(0)414-710-540. For information regarding registration or any other courserelated matters, contact PRIMER-e directly on +64-(0)9-869-2230 or email us at: <u>primer@primer-e.com</u>.

WEEK 1 – PRIMER

Week 1 will provide an extensive overview of statistical methods in non-parametric analysis of multivariate data implemented in **PRIMER** software. Non-parametric statistics and permutation tests make the methods intuitively simple to understand, so *no prior background in statistics is required*.

The topics covered in this course shall include:

- Properties of multivariate data (summary stats, shade plots, histograms, draftsman plots, etc.);
- Pre-treatment of data (transformations, normalisations, standardisations, cumulate, aggregate, dispersion/variable weighting);
- Resemblance measures: distance, similarity/dissimilarity (Euclidean, Bray-Curtis, Jaccard, etc.);
- Cluster analysis (hierarchical agglomerative, divisive and k-R cluster methods using **CLUSTER**), including tests for significant structure within clusters (**SIMPROF**) to permit non-arbitrary classifications of samples/species;
- Ordination via Euclidean projection using principal component analysis (PCA);
- Ordination to preserve sample relationships *via* non-metric, metric or threshold-metric multidimensional scaling (**nMDS**, **mMDS**, **tmMDS**);
- Non-parametric permutation tests for differences among *a priori* groups of samples (analysis of similarities; **ANOSIM**) for one-, two- and three-way multi-factor designs and for ordered factors;
- Visualise differences among groups and variation of group averages using **bootstrap averages**;
- Relate biotic to abiotic data, including tests of association between resemblance matrices (**RELATE**), and find optimal subsets of environmental (or other) variables that generate a 'best' match to patterns among samples based on species variables (**BEST**);
- Measures of biodiversity, including richness, even-ness/dominance, abundance-biomass curves, and taxonomic and/or functional diversity and distinctness (**DIVERSE**);
- Identify important subsets of species and their roles in generating overall multivariate patterns (BIOENV, coherence curves) or group/cluster differences (SIMPER);
- Identify roles of environmental (or other) variables in generating biotic patterns or distinctive splits using non-parametric classification and regression trees (**LINKTREE**);
- Graphical tools for effective presentation of results, including **matrix displays** and a variety of plot types (bar, box, dot, violin, means, line, histogram, scatter, surface, shade), **animations** of ordinations captured to video files, bubble plots and multi-variable **segmented bubble plots**.

WEEK 2 - PERMANOVA+

PERMANOVA+ allows robust analysis of multivariate data in response to complex sampling / experimental designs on the basis of a chosen resemblance measure, with rigorous inferences *via* permutation methods. The broader suite of methods in PERMANOVA+ enable formal models, tests and predictions to be achieved for multivariate systems that are over-parameterised (i.e., have too many variables) and/or that demonstrate substantial non-normality. Familiarity with the core methods in PRIMER and/or some prior knowledge of basic multivariate methods is desirable. However, Week 2 (like Week 1) will emphasise conceptual understanding, software implementation of the methods and interpretation of results for scientists and practitioners, so *no prior background in statistics is assumed*.

The topics covered in Week 2 include:

- Partition variation for high-dimensional data on the basis of a chosen resemblance measure a geometric approach (**PERMANOVA**);
- Test the equality of centroids among groups and construct specific contrasts (**PERMANOVA**);
- Measure multivariate variation (spread) in the space of a resemblance measure, test for homogeneity of multivariate dispersions and compare **beta diversity** among groups (**PERMDISP**);

- Construct (pseudo) F-ratios and permutation methods for correct tests of individual terms in multi-factorial designs, based on **expectations of mean squares** (EMS).
- Quantify **components of variation** for individual terms in a PERMANOVA model; simplify models by **pooling** or removing terms;
- Advanced experimental design topics, including:
 - o randomised blocks, repeated measures and split-plot designs;
 - inclusion of covariates;
 - o unbalanced designs; Type I, Type II and Type III sums of squares.
 - environmental impact assessment; BACI (before-after/control-impact) and beyond-BACI (asymmetrical) designs.
- Fit multivariate response data (e.g., species) to continuous predictor variables (e.g., environmental), including model selection *via* information criteria (**DISTLM**);
- Visualise and quantify explained (fitted) variation using dissimilarity-based redundancy analysis (dbRDA);
- Dissimilarity-based discriminant analysis *via* canonical analysis of principal coordinates (**CAP**), including leave-one-out allocation success and the predictive placement of new points into existing canonical models;
- Discriminate positions along an environmental (or other) continuous variable axis; rotate two sets of variables to explore inter-relationships in a (dissimilarity-based) canonical correlation analyses (CAP).

COURSE FEES

The course fees for **each week** of training are shown in the table below. These fees **include** all course materials, coffee/tea and snacks during breaks, free Wi-Fi, and a temporary fully functional software licence key (time-limited) for participants to use for the duration of the course. **Not included in the registration** are accommodation, meals or the separate (discounted) cost of purchasing time-unlimited software.

Registration fees (\$AUD) for EACH WEEK	IN PERSON	ONLINE ONLY
EARLY BIRD	AUD \$1,500	AUD \$1,240
On or before 30 September 2025	(\$1,050 for full-time students)	(\$800 for full-time students)
AFTER	AUD \$1,650	AUD \$1,240
30 September 2025	(\$1,150 for full-time students)	(\$800 for full-time students)

All prices are in Australian Dollars (\$AUD). Residents of New Zealand will be charged New Zealand goods and services tax (GST). Participants registering to attend this course **online only** may be eligible for a <u>Global Equitability Pricing</u> (GEP) discount on their registration fees, in accordance with their country of residence. Please note that **the GEP does not apply to in-person registrations**.

DISCOUNTED SOFTWARE PRICES FOR COURSE PARTICIPANTS

We are pleased to offer course participants a **special discounted price** of **10% off** our standard prices to purchase time-unlimited PRIMER software in \$AUD. Course participants not residing in the USA may also be eligible for a <u>GEP</u> discount on all our software products, in accordance with

their country of residence. Any GEP discount will be applied **on top of** the special discounted price for course participants.

The prices in the table below show the **special discounted price** for an **Individual Licence of PRIMER 7 with PERMANOVA+** for Australian residents. **All** discounts for which you are eligible (including, for example, discounts for upgrades, etc.) will be applied on invoice.

Sector	Special Discounted Price (\$AUD)
Commercial Licence	AUD \$2,500.00
Public Licence	AUD \$1,900.00
Academic Licence	AUD \$1,250.00
Student Licence	AUD \$630.00

If you would like to receive a quotation from us for course registration (+ software) prior to registering, please get in touch with us directly at: primer@primer-e.com.

REGISTRATION

To register, please fill out the registration form available on the <u>PRIMER-e website</u> and return it directly to <u>primer@primer-e.com</u> to secure your place. The deadline for registration and payment is **Friday 30th January 2026**. Late registrants will only be accepted if space permits. Unfortunately, we cannot permit attendance at the course unless payment for registration has been **received in full** by PRIMER-e prior to the commencement of the course. Please get in touch with us directly if you have any questions <u>primer@primer-e.com</u>, and especially if you would like:

- to *obtain a quote* for your registration (with or without software), including all discounts for which you are eligible;
- to register *more than one individual* from your organisation and pay on a single invoice (please include separate registration forms for each individual participant); or
- to purchase *more than one software licence* at discounted prices on a single invoice.

ABOUT THE PRESENTER (https://www.primer-e.com/about/)

Marti J. Anderson is the Director of PRIMER-e (Quest Research Limited), a Fellow of the Royal Society of New Zealand (*FRSNZ*) and Distinguished Professor *Emerita* in the New Zealand Institute for Advanced Study (NZIAS) at Massey University in Auckland. Her core research is in community ecology, biodiversity, multivariate analysis, experimental design and resampling methods, with a special focus on developing novel statistical methods for ecology. She has developed all of the statistical methods in PERMANOVA+ and especially enjoys engaging in the dynamic interactions with students, academics and professionals that have become a trademark of the PRIMER/PERMANOVA+ international courses, shedding new light on multivariate data.