PERMANOVA+ Online Workshop

PRIMER-e
Empowering Research

Multivariate Analysis for Ecology & Other Sciences

PRESENTER:	Dr Marti J. Anderson *(PRIMER-e and Massey University)*
DATES:	October 16th - 20th, 2023
TIME ZONE:	09:00 - 18:00, *USA Central Daylight Time (UTC -5 hrs)*

OVERVIEW

This **PERMANOVA+ Online Workshop** will take place over 5 days (Monday – Friday, 09:00 – 18:00). The workshop is designed to give a fundamental understanding of how to analyse and gain insights from multivariate data using the software **PERMANOVA+**, an add-on package for **PRIMER version 7**. Participants will learn through lectures, demonstrations, and practical experience with the software. The schedule will include a combination of live, online lectures and practical sessions and, throughout the workshop, there will be plenty of time for asking questions and free-flow discussions with the presenter.

For much of the final day of the workshop (Friday, October 20th) participants will be allocated into a number of small break-out groups. Within each group, participants are encouraged to ***analyse their own data in real time*** in an open, collaborative setting, with support from other participants in the group and also from the presenter, who will visit each group in turn. This provides a fantastic opportunity to see how tools learned during the week can be applied to your own data to gain valuable insights. They are also a great time for Q & A and further discussion on any topics of special interest arising during the week.

Participants are expected to use their own computer, equipped with secure and reliable internet access, a microphone, and a camera, enabling direct communication online *via* Google Meet for the duration of the workshop. All workshop materials, including recordings of online sessions, will be made available to participants for the duration of the workshop and for a period of four (4) weeks thereafter.

Software may be purchased (at a discounted price – see below) *or* a ***free*** fully functional (but time-limited) licence will be made available to registered participants ***for trial use during the workshop***. Note that PRIMER is a Windows-only product, so Macs need to run in Windows emulation.

Please note*: Participants are expected to have some basic knowledge of multivariate analysis, although this is not compulsory. We highly recommend attending a PRIMER 7 workshop before participating in a PERMANOVA+ workshop. An online PRIMER 7 workshop will be held* ***July 24th - 28th, 2023****, USA Pacific Daylight Time (UTC -7 hrs). Details can be found here: https://www.primer-e.com/workshops/.*

CONTENT

PERMANOVA+ is an add-on package to PRIMER 7. Its core routine, **PERMANOVA**, allows robust analysis of multivariate data in response to complex sampling/experimental designs on the basis of a resemblance measure of choice, with rigorous inferences obtained using permutation methods. The broader suite of methods in PERMANOVA+ enable formal models, tests and predictions to be achieved for multivariate ecological (and other) 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 and experimental design is desirable. However, the workshop will emphasise conceptual understanding, software implementation and interpretation of the methods for scientists and practitioners, so no prior specific background in statistics is assumed. Participants will explore the following core topics:

- estimation of components of variation in complex experimental designs, including interactions, covariates, contrasts, fixed or random factors, crossed or nested models, unbalanced designs, environmental impact designs, randomised blocks or repeated measures (**PERMANOVA**);
- tests for homogeneity of multivariate dispersions and analyses of beta diversity (**PERMDISP**);
- unconstrained ordination (**metric MDS**, **threshold-metric MDS**, **non-metric MDS** and **PCO**) of relationships among samples and of distances among centroids, enabling visualisation of fundamental multivariate patterns, salient group structures, covariates, and interactions;
- dissimilarity-based multivariate multiple regression and model selection (**DISTLM**), including constrained ordination using distance-based redundancy analysis (**dbRDA**), especially to relate biotic data to environmental (or other explanatory) variables;
- canonical analysis of principal coordinates (**CAP**), including leave-one-out allocation success for discriminant analysis, canonical correlation analyses and the predictive placement of new points into existing canonical model spaces.

WORKSHOP FEES

Workshop fees ***for residents of the USA*** are: USD **$880** for Professionals and USD **$580** for full-time Students. Registration fees cover access to all workshop materials and live sessions. The registration fee **does not include** the separate (discounted) cost of **time-unlimited** software.

For those who do not reside in the USA, we offer ***Global Equitability Pricing*** (GEP), which includes a percentage discount off our standard US prices (for online workshop registration and software) in direct accordance with the *Price Level Ratio published by the World Bank* for their country of residence. Thus, the workshop fee ***depends on your country of residence***. Please consult our table of GEP prices (p. 3 below *et seq.*) to find your price to register for this online workshop ($USD). If you would like a quotation from us prior to registering, please get in touch with us directly at: primer@primer-e.co.nz.

DISCOUNTED SOFTWARE PRICES FOR WORKSHOP PARTICIPANTS

Workshop participants may purchase time-unlimited PRIMER software at ***10% off*** our standard prices in $USD. Participants who do not reside in the USA may ***also*** be eligible for our ***Global Equitability Pricing*** (GEP). The workshop discount will be applied ***on top of*** the adjusted GEP price appropriate for each individual customer. For example, workshop-discounted prices for a ***single end-user licence*** of **PRIMER 7 with PERMANOVA+** across different sectors are shown below for residents of various countries:

Country of Residence	GEP discount (%)	Commercial licence ($USD)	Public licence ($USD)	Academic licence ($USD)	Student licence ($USD)
USA	0.00%	$1,620.00	$1,215.00	$810.00	$405.00
Canada	5.88%	$1,524.74	$1,143.56	$762.37	$381.19
Belize	39.15%	$985.77	$739.33	$492.89	$246.45
Costa Rica	47.04%	$857.95	$643.46	$428.98	$214.49
Mexico	48.44%	$835.27	$626.45	$417.64	$208.82
Colombia	67.32%	$529.42	$397.06	$264.71	$132.35

All prices are given in US dollars. Note that ***your price*** may well differ from those listed above. **All** discounts for which you are eligible (including, for example, discounts for upgrades from PRIMER 6) will be applied on invoice. If you would like a quotation from us for workshop registration + software prior to registering, please get in touch with us directly at: primer@primer-e.co.nz.

REGISTRATION

To register, please fill out the registration form available on the PRIMER-e website (www.primer-e.com/workshops/) and return it directly to primer@primer-e.co.nz to secure your place. The deadline for registration and payment is **October 8th, 2023**. Late registrants will only be accepted if space permits. Please get in touch with us directly if you have any questions (primer@primer-e.co.nz), 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

Dr Marti J. Anderson is the Director of PRIMER-e (Quest Research Limited), a Fellow of the Royal Society of New Zealand and an Honorary Research Associate at 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 workshops, shedding new light on multivariate data.

GLOBAL EQUITABILITY PRICING (GEP)

Table of Global Equitability Pricing (GEP) discounts off standard (US) prices for individual countries, based on the *Price Level Ratio published by the World Bank*. Prices shown are for professional or student registration for a single individual to attend our online workshop after applying the GEP percentage

discount shown. **All prices are in US dollars ($ USD)**. Prices do not include costs for bank fees or currency conversions. Note that the USA and all countries with a Price Level Ratio ≥ 1.0 relative to the USA are given a discount of 0.00%.

If your country of residence is not listed here, or if you have any other questions, please contact us directly at primer@primer-e.co.nz.

Country Name	% Discount	Professional (USD)	Student (USD)
Afghanistan	75.14%	$218.77	$144.19
Albania	63.33%	$322.70	$212.69
Algeria	67.65%	$284.68	$187.63
Angola	57.00%	$378.40	$249.40
Antigua and Barbuda	26.02%	$651.02	$429.08
Argentina	48.36%	$454.43	$299.51
Armenia	62.97%	$325.86	$214.77
Aruba	31.58%	$602.10	$396.84
Australia	0.00%	$880.00	$580.00
Austria	23.26%	$675.31	$445.09
Azerbaijan	56.45%	$383.24	$252.59
Bahamas, The	22.09%	$685.61	$451.88
Bahrain	50.75%	$433.40	$285.65
Bangladesh	63.65%	$319.88	$210.83
Barbados	0.00%	$880.00	$580.00
Belarus	65.01%	$307.91	$202.94
Belgium	23.75%	$671.00	$442.25
Belize	39.15%	$535.48	$352.93
Benin	67.87%	$282.74	$186.35
Bermuda	0.00%	$880.00	$580.00
Bhutan	72.86%	$238.83	$157.41
Bolivia	63.62%	$320.14	$211.00
Bosnia and Herzegovina	62.77%	$327.62	$215.93
Botswana	57.77%	$371.62	$244.93
Brazil	49.96%	$440.35	$290.23
Brunei Darussalam	46.37%	$471.94	$311.05
Bulgaria	58.99%	$360.89	$237.86
Burkina Faso	67.28%	$287.94	$189.78
Burundi	71.48%	$250.98	$165.42
Cabo Verde	57.03%	$378.14	$249.23
Cambodia	66.60%	$293.92	$193.72
Cameroon	63.96%	$317.15	$209.03
Canada	5.88%	$828.26	$545.90
Central African Republic	55.85%	$388.52	$256.07
Chad	57.03%	$378.14	$249.23
Chile	49.17%	$447.30	$294.81

Country Name	% Discount	Professional (USD)	Student (USD)
China	40.77%	$521.22	$343.53
Colombia	67.32%	$287.58	$189.54
Comoros	61.25%	$341.00	$224.75
Congo, Dem. Rep.	56.15%	$385.88	$254.33
Congo, Rep.	35.42%	$568.30	$374.56
Costa Rica	47.04%	$466.05	$307.17
Cote d'Ivoire	61.97%	$334.66	$220.57
Croatia	54.40%	$401.28	$264.48
Curacao	22.74%	$679.89	$448.11
Cyprus	37.35%	$551.32	$363.37
Czech Republic	44.66%	$486.99	$320.97
Denmark	9.49%	$796.49	$524.96
Djibouti	46.78%	$468.34	$308.68
Dominica	38.01%	$545.51	$359.54
Dominican Republic	55.68%	$390.02	$257.06
Ecuador	50.15%	$438.68	$289.13
Egypt, Arab Rep.	71.54%	$250.45	$165.07
El Salvador	53.79%	$406.65	$268.02
Equatorial Guinea	59.45%	$356.84	$235.19
Eritrea	63.72%	$319.26	$210.42
Estonia	39.33%	$533.90	$351.89
Eswatini	62.54%	$329.65	$217.27
Ethiopia	63.45%	$321.64	$211.99
Fiji	62.36%	$331.23	$218.31
Finland	14.38%	$753.46	$496.60
France	26.18%	$649.62	$428.16
Gabon	46.45%	$471.24	$310.59
Gambia, The	66.53%	$294.54	$194.13
Georgia	67.05%	$289.96	$191.11
Germany	23.31%	$674.87	$444.80
Ghana	66.52%	$294.62	$194.18
Greece	43.72%	$495.26	$326.42
Grenada	41.04%	$518.85	$341.97
Guatemala	49.41%	$445.19	$293.42
Guinea	51.94%	$422.93	$278.75
Guinea-Bissau	64.58%	$311.70	$205.44
Guyana	53.28%	$411.14	$270.98
Haiti	47.10%	$465.52	$306.82
Honduras	54.90%	$396.88	$261.58
Hong Kong SAR, China	29.06%	$624.27	$411.45
Hungary	55.94%	$387.73	$255.55
Iceland	0.00%	$880.00	$580.00

Country Name	% Discount	Professional (USD)	Student (USD)
India	71.49%	$250.89	$165.36
Indonesia	67.32%	$287.58	$189.54
Iraq	45.34%	$481.01	$317.03
Ireland	18.02%	$721.42	$475.48
Israel	0.00%	$880.00	$580.00
Italy	34.14%	$579.57	$381.99
Jamaica	48.85%	$450.12	$296.67
Japan	25.80%	$652.96	$430.36
Jordan	61.79%	$336.25	$221.62
Kazakhstan	63.51%	$321.11	$211.64
Kenya	63.58%	$320.50	$211.24
Kiribati	28.03%	$633.34	$417.43
Korea, Rep.	35.58%	$566.90	$373.64
Kosovo	63.65%	$319.88	$210.83
Kuwait	25.53%	$655.34	$431.93
Kyrgyz Republic	73.80%	$230.56	$151.96
Lao PDR	77.75%	$195.80	$129.05
Latvia	45.31%	$481.27	$317.20
Lebanon	71.14%	$253.97	$167.39
Lesotho	58.90%	$361.68	$238.38
Liberia	56.26%	$384.91	$253.69
Libya	71.27%	$252.82	$166.63
Lithuania	48.70%	$451.44	$297.54
Luxembourg	11.10%	$782.32	$515.62
Macao SAR, China	42.87%	$502.74	$331.35
Madagascar	71.53%	$250.54	$165.13
Malawi	62.75%	$327.80	$216.05
Malaysia	64.19%	$315.13	$207.70
Maldives	52.29%	$419.85	$276.72
Mali	66.90%	$291.28	$191.98
Malta	39.31%	$534.07	$352.00
Marshall Islands	6.92%	$819.10	$539.86
Mauritania	65.90%	$300.08	$197.78
Mauritius	62.03%	$334.14	$220.23
Mexico	48.44%	$453.73	$299.05
Micronesia, Fed. Sts.	2.96%	$853.95	$562.83
Moldova	63.50%	$321.20	$211.70
Monaco	0.00%	$880.00	$580.00
Mongolia	65.24%	$305.89	$201.61
Montenegro	63.34%	$322.61	$212.63
Morocco	62.94%	$326.13	$214.95
Mozambique	63.11%	$324.63	$213.96

Country Name	% Discount	Professional (USD)	Student (USD)
Myanmar	77.50%	$198.00	$130.50
Namibia	56.17%	$385.70	$254.21
Nauru	9.18%	$799.22	$526.76
Nepal	71.71%	$248.95	$164.08
Netherlands	19.54%	$708.05	$466.67
New Zealand	7.15%	$817.08	$538.53
Nicaragua	67.19%	$288.73	$190.30
Niger	64.59%	$311.61	$205.38
Nigeria	62.73%	$327.98	$216.17
North Macedonia	67.31%	$287.67	$189.60
Norway	7.62%	$812.94	$535.80
Oman	39.95%	$528.44	$348.29
Pakistan	75.20%	$218.24	$143.84
Palau	20.56%	$699.07	$460.75
Panama	55.81%	$388.87	$256.30
Papua New Guinea	32.08%	$597.70	$393.94
Paraguay	61.49%	$338.89	$223.36
Peru	52.64%	$416.77	$274.69
Philippines	65.47%	$303.86	$200.27
Poland	57.66%	$372.59	$245.57
Portugal	41.44%	$515.33	$339.65
Puerto Rico	13.06%	$765.07	$504.25
Qatar	23.20%	$675.84	$445.44
Romania	62.06%	$333.87	$220.05
Rwanda	65.39%	$304.57	$200.74
Samoa	38.04%	$545.25	$359.37
San Marino	19.12%	$711.74	$469.10
Sao Tome and Principe	49.26%	$446.51	$294.29
Saudi Arabia	48.47%	$453.46	$298.87
Senegal	62.02%	$334.22	$220.28
Serbia	60.71%	$345.75	$227.88
Seychelles	54.94%	$396.53	$261.35
Sierra Leone	76.11%	$210.23	$138.56
Singapore	35.09%	$571.21	$376.48
Sint Maarten (Dutch part)	13.37%	$762.34	$502.45
Slovak Republic	43.25%	$499.40	$329.15
Slovenia	41.12%	$518.14	$341.50
Solomon Islands	16.99%	$730.49	$481.46
Somalia	66.15%	$297.88	$196.33
South Africa	57.39%	$374.97	$247.14
South Sudan	9.32%	$797.98	$525.94
Spain	35.95%	$563.64	$371.49

Country Name	% Discount	Professional (USD)	Student (USD)
Sri Lanka	76.71%	$204.95	$135.08
St. Kitts and Nevis	40.75%	$521.40	$343.65
St. Lucia	35.34%	$569.01	$375.03
St. Vincent and the Grenadines	46.97%	$466.66	$307.57
Sudan	73.86%	$230.03	$151.61
Suriname	66.75%	$292.60	$192.85
Sweden	13.48%	$761.38	$501.82
Switzerland	0.00%	$880.00	$580.00
Tajikistan	78.42%	$189.90	$125.16
Tanzania	61.50%	$338.80	$223.30
Thailand	66.58%	$294.10	$193.84
Timor-Leste	51.15%	$429.88	$283.33
Togo	64.79%	$309.85	$204.22
Tonga	34.71%	$574.55	$378.68
Trinidad and Tobago	34.40%	$577.28	$380.48
Tunisia	69.76%	$266.11	$175.39
Turkey	71.52%	$250.62	$165.18
Turkmenistan	51.57%	$426.18	$280.89
Turks and Caicos Islands	0.00%	$880.00	$580.00
Tuvalu	1.59%	$866.01	$570.78
Uganda	64.21%	$314.95	$207.58
Ukraine	64.22%	$314.86	$207.52
United Arab Emirates	38.72%	$539.26	$355.42
United Kingdom	16.03%	$738.94	$487.03
United States	0.00%	$880.00	$580.00
Uruguay	27.90%	$634.48	$418.18
Uzbekistan	76.34%	$208.21	$137.23
Vanuatu	8.49%	$805.29	$530.76
Vietnam	69.06%	$272.27	$179.45
West Bank and Gaza	43.92%	$493.50	$325.26
Yemen, Rep.	56.43%	$383.42	$252.71
Zambia	61.79%	$336.25	$221.62
Zimbabwe	49.93%	$440.62	$290.41