# A Response: Functional Feeding Groups as a Taxonomic Surrogate for a Grassland Arthropod Assemblage

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# A response: Functional feeding groups as a taxonomic surrogate for a grassland arthropod assemblage

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M. Mlambo (2011) raises very valid points in his commentary on our paper (Buschke & Seaman 2011). Although much can be said about the merits (or lack thereof) of our study, we limit our rebuttal to the four points specifically raised by Mlambo.

The first point, that assigning functional feeding groups (FFG) is simpler than assigning family level, is rightfully contested by Mlambo and our paper did not provide quantitative evidence of this. Certain FFG cannot be assigned without traditional taxonomic efforts but many others can. For example, although large families such as Scarabaeidae and Muscidae cannot easily be assigned to FFG without further identification, many orders, such as adult Odonata, Neuroptera and Orthoptera, and superfamilies, such as parasitoid Ichneumonoidea and the piercing/sucking Pentatomoidea, share broad feeding styles. Based on our experience, we believe that *on average* it is simpler to assign FFG than other taxonomic levels. Mlambo's assertion that Kaiser *et al.* (2009) provide empirical evidence against the use of FFG is unfounded: their study also lacked quantitative evidence of taxonomic difficulties and their judgements were as subjective as ours.

Arguably, FFG might not be associated with easier taxonomy but we can say that they dramatically simplify the handling of data and/or sampled material because the number of specimen "types" is reduced dramatically. In addition, FFG could potentially simplify comparisons across space because, although taxonomic diversity can vary across spatial gradients (making community comparisons difficult), it is possible that FFG diversity is more uniform across space. By implication, differences across space could more easily be attributed to the specific pressure being investigated as natural variations are reduced. This is speculation, but we hope that our paper has laid the theoretical framework on which such hypotheses can be tested. In addition, fewer samples are required to obtain a more accurate representation of the assemblage when using FFG, so fewer resources will be spent on data gathering.

It is with trepidation that we address Mlambo's second point, that assigning taxa to FFG is subjective. Functional traits vary continuously across assemblages, yet functional groups are discrete clusters (Petchey *et al.* 2009). FFG are, therefore, inseparable from (a) the subjective selection of which traits to use, and (b) the width of the discrete functional clusters (and, in consequence, the number of functional groups). Despite this, many studies still divide grassland arthropods into functional groups (e.g. Koricheva *et al*. 2000; Haddad *et al*. 2001; Cagnolo *et al*. 2002; Boyer *et al.* 2003). If anything, our proposed method reduces the effect of discretising continuous functional traits because we discern between the orders of the functional groups, thereby adding resolution to the assemblage. How we divided taxa into FFG is shown in Table 1 of our paper, although we did not provide specific details on the assignment for each of the 108 families. We do not advocate that the FFG used in our paper are the only possible ones: they were simply the FFG that best suited our data. If it is felt that a specimen does not fit into any of these groups, a new group can be created. Similarly, it is theoretically justifiable to split or merge groups, although this is less desirable because it would severely limit the viability of cross-study meta-analyses.

Mlambo's third point, that there is virtually no theoretical framework underpinning the concept of FFG in grasslands, is difficult to justify. There is no theoretical framework supporting the use of FFG: this was exactly what we hoped to initiate with the publication of our paper. It will never be known if and how grassland FFG respond to perturbations unless someone makes the effort to gather data and test the hypotheses. In our paper (p. 228) we gave the caveats of using FFG and we warned against the untested assumptions of homogenously applying our finding across faunal groups, sampling methodologies, habitat types, environmental gradients and spatio-temporal scales without further investigation.

Mlambo's last point, that focussing on a few, well-understood taxa could be more advantageous than focusing on the assemblage as a whole, is valid and is supported by the literature cited by him (Kaiser *et al.* 2009; Uys *et al.* 2010; McGeoch *et al*. 2011). Although biodiversity surrogacy has obvious merits, it too should be scrutinised closely. For example, Lovell *et al.* (2007) failed to find congruence between invertebrate taxa in a South African savanna habitat and recommended a multi-taxon approach. Similarly, Kati *et al.* (2004), although supportive of the usage of biodiversity surrogates, found that no single taxon (or higher level grouping of taxa) was an accurate representation of all other groups of taxa. The usefulness of a biodiversity surrogate is known to be sensitive to (a) the selection of the surrogate, (b) the study area in question, (c) the method of assessing suitability of the indicator and (d) the relational variable being assessed (Grantham *et al.* 2010). It has even been shown that carefully selected biodiversity indicators often perform no better than randomly selected ones (Andelman & Fagan 2000).

Surveying an assemblage as a whole provides a better understanding of the differential responses of multiple taxa and reduces the effect of sampling errors and potential anomalous responses of individual taxa. This does not mean that the methods proposed in our paper are superior to those of biodiversity surrogacy; we are offering an alternative strategy that should be applied and tested so that it can be utilised, modified or discarded.

Finally, we must stress that our data did not allow us to test the validity of FFG as ecological indicators (p. 218), and we hope that our paper will aid and encourage others to address this question. The use of invertebrates in the environmental assessment of aquatic ecosystems is grounded on decades of research. The South African Scoring System (Dickens & Graham 2002), for example, is in its fifth version since the publication of Chutter's (1972) precursory prototype and it still has its limitations (application in non-perennial systems being the most obvious). Our paper is, hopefully, the first in a long line of investigations that will give rise to a useable and effective biomonitoring methodology for South African grasslands. We are grateful that our ideas were published in *African Invertebrates* and that they raised a debate on the use of surrogates. We will be satisfied if we initiate a more advanced future study that will support or contradict our findings, and further our understanding of this complex concept.

## REFERENCES


ANDELMAN, S.J. & FAGAN, W.F. 2000. Umbrellas and flagships: efficient conservation surrogates or expensive mistakes? *Proceedings of the National Academy of Science of the USA* **97**: 5954–5959.

BOYER, A.G., SWEARINGTON, R.E., BLAHA, M.A., FORTSEN, C.T., GREMILLION, S.K., OSBORN, K.A. & MORAN, M.D. 2003. Seasonal variation in top-down and bottom-up processes in a grassland arthropod community. *Oecologia* **136**: 309–316.

BUSCHKE, F.T. & SEAMAN, M.T. 2011. Functional feeding groups as a taxonomic surrogate for a grassland arthropod assemblage. *African Invertebrates* **52** (1): 217–228.

CHUTTER, F.M. 1972. An empirical biotic index of the quality of water in South African streams and rivers. *Water Research* **6**: 19–30.

COGNOLO, L., MOLINA, S.I. & VALLADARES, G.R. 2002. Diversity and guild structure of insect assemblages under grazing and exclusion regimes in a montane grassland from Central Argentina. *Biodiversity and Conservation* **11**: 407–420.

DICKENS, C.W.S. & GRAHAM, P.M. 2002. The South African Scoring System (SASS). Version 5 rapid bioassessment method for rivers. *African Journal of Aquatic Science* **27**: 1–10.

GRANTHAM, H.S., PRESSEY, R.L., WELLS, J.A. & BEATIE, A.J. 2010. Effectiveness of biodiversity surrogates for conservation planning: different measures of effectiveness generate a kaleidoscope of variation. *PLoS ONE* **5** (7): e11430. (doi:10.a371/journal.pone.0011430)

HADDAD, N.M., TILMAN, D., HAARSTAD, J., RITCHIE, M. & KNOPS, J.M.H. 2001. Contrasting effects of plant richness and composition on insect communities: a field experiment. *The American Naturalist* **158**: 17–35.

KAISER, W., AVENANT, N.L. & HADDAD, C.R. 2009. Assessing the ecological integrity of a grassland ecosystem: the applicability and rapidity of the SAGraSS method. *African Journal of Ecology* **47** (3): 308–317.

KATI, V., DEVILLIERS, P., DUFRÊNE, M., LEGAKIS, A., VOKOU, D. & LEBRUN, P. 2003. Testing the value of six taxonomic groups as biodiversity indicators at a local scale. *Conservation Biology* **18**: 667–675.

KORICHEVA, J., MULDER, C.P.H., SCHMID, B., JOSHI, J. & HUSS-DANELL, K. 2000. Numerical responses of different trophic groups of invertebrates to manipulations of plant diversity in grasslands. *Oecologia* **125**: 271–282.

LOVELL, S., HAMER, M., SLOTOW, R. & HERBERT, D. 2007. Assessment of congruency across invertebrate taxa and taxonomic level to identify potential surrogates. *Biological Conservation* **139**: 113–125.

MCGEOCH, M.A., SITHOLE, H., SAMWAYS, M.J., SIMAIKA, J.P., PRYKE, J.S., PICKER, M., UYS, C., ARMSTRONG, A.J., DIPPENAAR-SCHOEMAN, A.S., ENGELBRECHT, I.A., BRASCHLER, B. & HAMER, M. 2011. Conservation and monitoring of invertebrates in terrestrial protected areas. *Koedoe* **53** (2): Art. #1000, 13 pp. (doi 10.4102/koedoe.v53i2.1000)

MLAMBO, M. 2011. A comment: Functional feeding groups as a taxonomic surrogate for a grassland arthropod assemblage. *African Invertebrates* **52** (2): 587–589.

PETCHEY, O.L., O'GORMAN, E.J. & FLYNN, D.F.B. 2009. A functional guide to functional diversity measures. *In*: Naeem, S., Bunker, D.E., Hector, A., Loreau, M. & Perrings, C., eds, *Biodiversity, Ecosystem Functioning, & Human Wellbeing*. Oxford: Oxford University Press, pp. 49–59.

UYS, C., HAMER, M. & SLOTOW, R. 2010. Step process for selecting and testing surrogates and indicators of Afrotemperate Forest invertebrate diversity. *PLoS ONE* **5** (2): e9100. (doi:10.1371/journal.pone.0009100)