Curriculum Vitae
Stéphane Dray

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Laboratoire de Biométrie et Biologie Evolutive
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Academic specialty: statistical ecology; numerical ecology; multivariate analysis; spatial statistics; applied statistics & statistical consulting

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Education

○ Habilitation (HDR), Biometry, Université Lyon 1, 2016.

○ Ph.D., Biometry, Université Lyon 1, 2003 (sup.: D. Chessel).

○ M. Sc., Biometry, Université Lyon 1, 1999 (sup.: D. Chessel).

○ B. Sc., Biometry, Université Lyon 1, 1997.

Academic Appointments

○ Senior Research Scientist (CNRS DR2), Laboratoire de Biométrie et Biologie Evolutive, Université Lyon 1 (2016 -).

- ○ Research Scientist (CNRS CR1), Laboratoire de Biométrie et Biologie Evolutive, Université Lyon 1 (2009 - 2016).

- ○ Research Scientist (CNRS CR2), Laboratoire de Biométrie et Biologie Evolutive, Université Lyon 1 (2005 - 2009).

- ○ Post-Doctoral Researcher, Pierre Legendre's Lab, Département des Sciences Biologiques, Université de Montréal (2003 - 2005).

- ○ Research and Teaching Assistant (Biometry), Université Lyon 1 (2002 - 2003).

- ○ Research Scholar, Laboratoire de Biométrie et Biologie Evolutive, Université Lyon 1 (1999 - 2002).

PUBLICATION

- ○ Co-author of the book *Multivariate Analysis of Ecological Data with ade4*

- ○ Co-author of 72 articles (7460 citations, h = 30)

More details at https://publons.com/researcher/1237260/stephane-dray/

[A.1] Bauman D., Drouet T., **Dray S.**, Vleminckx J. (2018). *Disentangling good from bad practices in the selection of spatial or phylogenetic eigenvectors.* Ecography, 41:1638–1649. ISSN 16000587. doi: 10.1111/ecog.03380.

[A.2] Bauman D., Drouet T., Fortin M.J., **Dray S.** (2018). *Optimizing the choice of a spatial weighting matrix in eigenvector-based methods.* Ecology, 99(10):2159–2166. ISSN 00129658. doi:10.1002/ecy.2469.

[A.3] Bel-Venner M.C., **Dray S.**, Allainé D., Menu F., Venner S. (2008). *Unexpected male choosiness for mates in a spider.* Proceedings of the Royal Society of London Series B - Biological Sciences, 275:77–82.

[A.4] Bonenfant C., Gaillard J.M., **Dray S.**, Loison A., Royer M., Chessel D. (2007). *Testing sexual segregation and aggregation: old ways are best.* Ecology, 88:3202–3208.

[A.5] Bougeard S., **Dray S.** (2018). *Supervised Multiblock Analysis in R with the ade4 Package.* Journal of Statistical Software, 86(1):1–17. doi:10.18637/jss.v086.i01.

[A.6] Braga J., ter Braak C.J.F., Thuiller W., **Dray S.** (2018). *Integrating spatial and phylogenetic information in the fourth-corner analysis to test trait-environment relationships.* Ecology, 99(12):2667–2674. ISSN 00129658. doi:10.1002/ecy.2530.

[A.7] Bréchignac F., Oughton D., Mays C., Barnthouse L., Beasley J.C., Bonisoli-Alquati A., Bradshaw C., Brown J., **Dray S.**, Geras'kin S., Glenn T., Higley K., Ishida K., Kapustka L., Kautsky U., Kuhne W., Lynch M., Mappes T., Mihok S., Møller A.P., Mothersill C., Mousseau T.A., Otaki J., Pryakhin E., Rhodes O.E., Salbu B., Strand P., Tsukada H. (2016). *Addressing ecological effects of radiation on populations and ecosystems to improve protection of the environment against radiation: Agreed statements from a Consensus Symposium.* Journal of Environmental Radioactivity, 158-159:21–29. ISSN 1879-1700. doi: 10.1016/j.jenvrad.2016.03.021.

[A.8] Brind'Amour A., Boisclair D., **Dray S.**, Legendre P. (2011). *Relationships between species feeding traits and environmental conditions in fish communities: a three-matrix approach.* Ecological Applications, 21(2):363–377.

[A.9] Calenge C., **Dray S.**, Royer-Carenzi M. (2009). *The concept of animals trajectories from a data analysis perspective.* Ecological Informatics, 4:34–41.

[A.10] Chamaillé-Jammes S., Charbonnel A., **Dray S.**, Madzikanda H., Fritz H. (2016). *Spatial distribution of a large herbivore community at waterholes: An assessment of its stability over years in Hwange National Park, Zimbabwe.* PLoS ONE, 11(4):e0153639. ISSN 19326203. doi: 10.1371/journal.pone.0153639.

[A.11] Clappe S., **Dray S.**, Peres-Neto P.R. (2018). *Beyond neutrality: disentangling the effects of species sorting and spurious correlations in community analysis.* Ecology, 99(8):1737–1747. ISSN 00129658. doi: 10.1002/ecy.2376.

[A.12] Covain R., **Dray S.**, Fisch-Muller S., Montoya-Burgos J. (2008). *Assessing phylogenetic dependence of morphological traits using co-inertia prior to investigate character evolution in Loricariinae catfishes.* Molecular Phylogenetics and Evolution, 46(3):986–1002.

[A.13] Covain R., Fisch-Muller S., Montoya-Burgos J., Mol J., Le Bail P.Y., **Dray S.** (2012). *The Harttiini (Siluriformes, Loricariidae) from the Guianas: a multi-table approach to assess their diversity, evolution, and distribution.* Cybium, 36(1):115–161.

[A.14] Covain R., Fisch-Muller S., Oliveira C., Mol J.H., Montoya-Burgos J.I., **Dray S.** (2016). *Molecular phylogeny of the highly diversified catfish subfamily Loricariinae (Siluriformes, Loricariidae) reveals incongruences with morphological classification.* Molecular Phylogenetics and Evolution, 94:492–517. ISSN 10557903. doi:10.1016/j.ympev.2015.10.018.

[A.15] Crabot J., Clappe S., **Dray S.**, Datry T. (2019). *Testing the Mantel statistic with a spatially-constrained permutation procedure.* Methods in Ecology and Evolution, 10:532–540. ISSN 2041210X. doi: 10.1111/2041-210X.13141.

[A.16] Díaz S., Kattge J., Cornelissen J.H.C., Wright I.J., Lavorel S., **Dray S.**, Reu B., Kleyer M., Wirth C., Prentice I.C., Garnier E., Bönisch G., Westoby M., Poorter H., Reich P.B., Moles A.T., Dickie J., Gillison A.N., Zanne A.E., Chave J., Wright S.J., Sheremet'ev S.N., Jactel H., Baraloto C., Cerabolini B., Pierce S., Shipley B., Kirkup D., Casanoves F., Joswig J.S., Günther A., Falczuk V., Rüger N., Mahecha M.D., Gorné L.D. (2016). *The global spectrum of plant form and function.* Nature, 529:167–171. ISSN 0028-0836. doi:10.1038/nature16489.

[A.17] **Dray S.** (2008). *On the number of principal components: A test of dimensionality based on measurements of similarity between matrices.* Computational Statistics and Data Analysis, 52:2228–2237.

[A.18] **Dray S.** (2011). *A new perspective about Moran's coefficient: spatial autocorrelation as a linear regression problem.* Geographical Analysis, 43:127–141.

[A.19] **Dray S.**, Chessel D., Thioulouse J. (2003). *Co-inertia analysis and the linking of ecological data tables.* Ecology, 84:3078–3089.

[A.20] **Dray S.**, Chessel D., Thioulouse J. (2003). *Procrustean co-inertia analysis for the linking of multivariate data sets.* Ecoscience, 10(1):110–119.

[A.21] **Dray S.**, Choler P., Dolédec S., Peres-Neto P.R., Thuiller W., Pavoine S., ter Braak C.J. (2014). *Combining the fourth-corner and the RLQ methods for assessing trait responses to environmental variation.* Ecology, 95(1):14–21.

[A.22] **Dray S.**, Dufour A.B. (2007). *The ade4 package: implementing the duality diagram for ecologists.* Journal of Statistical Software, 22(4):1–20.

[A.23] **Dray S.**, Dufour A.B., Chessel D. (2007). *The ade4 package - II: Two-table and K-table methods.* R News, 7(2):47–52.

[A.24] **Dray S.**, Jombart T. (2011). *Revisiting Guerry's data: introducing spatial constraints in multivariate analysis.* The Annals of Applied Statistics, 5(4):2278–2299.

[A.25] **Dray S.**, Josse J. (2015). *Principal component analysis with missing values: a comparative survey of methods.* Plant Ecology, 216:657–667. doi:10.1007/s11258-014-0406-z.

[A.26] **Dray S.**, Legendre P. (2008). *Testing the species traits-environment relationships: the fourth-corner problem revisited.* Ecology, 89:3400–3412.

[A.27] **Dray S.**, Legendre P., Peres-Neto P.R. (2006). *Spatial modeling: a comprehensive framework for principal coordinate analysis of neighbor matrices (PCNM)*. Ecological Modelling, 196:483–493.

[A.28] **Dray S.**, Pavoine S., Aguirre de Carcer D. (2015). *Considering external information to improve the phylogenetic comparison of microbial communities: a new approach based on constrained Double Principal Coordinates Analysis (cDPCoA)*. Molecular Ecology Resources, 15:242–249. doi:10.1111/1755-0998.12300.

[A.29] **Dray S.**, Pélissier R., Couteron P., Fortin M.J., Legendre P., Peres-Neto P.R., Bellier E., Bivand R., Blanchet F.G., De Caceres M., Dufour A.B., Heegaard E., Jombart T., Munoz F., Oksanen J., Thioulouse J., Wagner H.H. (2012). *Community ecology in the age of multivariate multiscale spatial analysisDray, S., Pélissier, R., Couteron, P., Fortin, M. J., Legendre, P., Peres-Neto, P. R., Bellier, E., et al. (2012). Community ecology in the age of multivariate multiscale spatial anal*. Ecological Monographs, 82(3):257–275.

[A.30] **Dray S.**, Pettorelli N., Chessel D. (2002). *Matching data sets from two different spatial samples*. Journal of Vegetation Science, 13:867–874.

[A.31] **Dray S.**, Pettorelli N., Chessel D. (2003). *Multivariate analysis of incomplete mapped data*. Transactions in GIS, 7:411–422.

[A.32] **Dray S.**, Royer-Carenzi M., Calenge C. (2010). *The exploratory analysis of autocorrelation in animal-movement studies*. Ecological Research, 25:673–681.

[A.33] **Dray S.**, Saïd S., Débias F. (2008). *Spatial ordination of vegetation data using a generalization of Wartenberg's multivariate spatial correlation*. Journal of Vegetation Science, 19:45–56.

[A.34] Ferry N., **Dray S.**, Fritz H., Valeix M. (2016). *Interspecific interference competition at the resource patch scale: do large herbivores spatially avoid elephants while accessing water?* Journal of Animal Ecology, 85:1574–1585. ISSN 00218790. doi:10.1111/1365-2656.12582.

[A.35] Gimaret-Carpentier C., **Dray S.**, Pascal J.P. (2003). *Broad-scale biodiversity pattern of the endemic tree flora of the Western Ghats (India) using canonical correlation analysis of herbarium records*. Ecography, 26:429–444.

[A.36] Gimenez O., Buckland S.T., Morgan B.J.T., Bez N., Bertrand S., Choquet R., **Dray S.**, Etienne M.P., Fewster R., Gosselin F., Mérigot B., Monestiez P., Morales J.M., Mortier F., Munoz F., Ovaskainen O., Pavoine S., Pradel R., Schurr F.M., Thomas L., Thuiller W., Trenkel V., de Valpine P., Rexstad E. (2014). *Statistical ecology comes of age*. Biology Letters, 10(12):3–6. ISSN 1744-957X. doi:10.1098/rsbl.2014.0698.

[A.37] Hurley M.A., Hebblewhite M., Gaillard J.M., **Dray S.**, Taylor K.A., Smith W.K., Zager P., Bonenfant C. (2014). *Functional analysis of Normalized Difference Vegetation Index curves reveals overwinter mule deer survival is driven by both spring and autumn phenology.* Philosophical Transactions of the Royal Society of London Series B, Biological Sciences, 369:20130196.

[A.38] Jombart T., Balloux F., **Dray S.** (2010). *adephylo: new tools for investigating the phylogenetic signal in biological traits.* Bioinformatics, 26:1907–1909.

[A.39] Jombart T., **Dray S.**, Dufour A.B. (2009). *Finding essential scales of spatial variation in ecological data: a multivariate approach.* Ecography, 32:161–168.

[A.40] Kleyer M., **Dray S.**, Bello F., Lepš J., Pakeman R.J., Strauss B., Thuiller W., Lavorel S. (2012). *Assessing species and community functional responses to environmental gradients: which multivariate methods?* Journal of Vegetation Science, 23:805–821. ISSN 11009233. doi: 10.1111/j.1654-1103.2012.01402.x.

[A.41] Martin J., van Moorter B., Revilla E., Blanchard P., **Dray S.**, Quenette P.Y., Allainé D., Swenson J.E. (2013). *Reciprocal modulation of internal and external factors determines individual movements.* Journal of Animal Ecology, 82:290–300. ISSN 1365-2656. doi:10.1111/j.1365-2656. 2012.02038.x.

[A.42] Mason N.W., de Bello F., Mouillot D., Pavoine S., **Dray S.** (2013). *A guide for using functional diversity indices to reveal changes in assembly processes along ecological gradients.* Journal of Vegetation Science, 24:794–806. ISSN 11009233. doi:10.1111/jvs.12013.

[A.43] Mason N.W.H., Wiser S.K., Richardson S.J., Thorsen M.J., Holdaway R.J., **Dray S.**, Thomson F.J., Carswell F.E. (2013). *Functional traits reveal processes driving natural afforestation at large spatial scales.* PLoS ONE, 8(9):e75219. ISSN 1932-6203. doi:10.1371/journal.pone.0075219.

[A.44] Michel J.F., **Dray S.**, de La Rocque S., Desquesnes M., Solano P., De Wispelaere G., Cuisance D. (2002). *Modelling bovine trypanosomosis spatial distribution by GIS in an agro-pastoral zone of Burkina Faso.* Preventive Veterinary Medicine, 56:5–18.

[A.45] Miele V., Picard F., **Dray S.** (2014). *Spatially constrained clustering of ecological networks.* Methods in Ecology and Evolution, 5(8):771–779. ISSN 2041210X. doi:10.1111/2041-210X.12208.

[A.46] Münkemüller T., Lavergne S., Bzeznik B., **Dray S.**, Jombart T., Schiffers K., Thuiller W. (2012). *How to measure and test phylogenetic signal.* Methods in Ecology and Evolution, 3:743–756.

[A.47] Ohlmann M., Miele V., **Dray S.**, Chalmandrier L., O'Connor L., Thuiller W. (2019). *Diversity indices for ecological networks: a unifying framework using Hill numbers.* Ecology Letters, 22:737–747. doi: 10.1111/ele.13221.

[A.48] Pélissier R., Couteron P., **Dray S.** (2008). *Analyzing or explaining beta diversity? Comment.* Ecology, 89:3227–3332.

[A.49] Pélissier R., Couteron P., **Dray S.**, Sabatier D. (2003). *Consistency between ordination techniques and diversity measurements: two alternative strategies for species occurrence data.* Ecology, 84:242–251.

[A.50] Pélissier R., **Dray S.**, Sabatier D. (2002). *Within-plot relationships between tree species occurrences and hydrological soil constraints: an example in French Guiana investigated through canonical correlation analysis.* Plant Ecology, 162(2):143–156.

[A.51] Peres-Neto P.R., **Dray S.**, ter Braak C.J. (2017). *Linking trait variation to the environment: Critical issues with community-weighted mean correlation resolved by the fourth-corner approach.* Ecography, 40:806–816. ISSN 16000587. doi:10.1111/ecog.02302.

[A.52] Peres-Neto P.R., Legendre P., **Dray S.**, Borcard D. (2006). *Variation partitioning of species data matrices: estimation and comparison of fractions.* Ecology, 87:2614–2625.

[A.53] Peres-Neto P.R., Leibold M., **Dray S.** (2012). *Assessing the effects of spatial contingency and environmental filtering on metacommunity phylogenetics.* Ecology, 93(8):S14–S30.

[A.54] Pettorelli N., **Dray S.**, Gaillard J.M., Chessel D., Duncan P., Illius A., Guillon N., Klein F., Van Laere G. (2003). *Spatial variation in springtime food resources influences the winter body mass of roe deer fawn.* Oecologia, 137:363–369.

[A.55] Pettorelli N., **Dray S.**, Maillard D. (2005). *Coupling principal component analysis and GIS to map deer habitats.* Wildlife Biology, 11:363–370.

[A.56] Reino L., Beja P., Araújo M.B., **Dray S.**, Segurado P. (2013). *Does local habitat fragmentation affect large-scale distributions? The case of a specialist grassland bird.* Diversity and Distributions, 19:423–432. ISSN 13669516. doi:10.1111/ddi.12019.

[A.57] Siberchicot A., **Dray S.** (2013). *Conference Report: Deuxièmes Rencontres R.* The R Journal, 5:164–165.

[A.58] Siberchicot A., Julien-Laferrière A., Dufour A.B., Thioulouse J., **Dray S.** (2017). *adegraphics: an S4 lattice-based package for the representation of multivariate data.* The R Journal, 9(2):198–2012.

[A.59] Tall L., Cattaneo A., Cloutier L., **Dray S.**, Legendre P. (2006). *Resource partitioning in a grazer guild feeding on a multilayer diatom mat*. Journal of the North American Benthological Society, 25:800–810.

[A.60] ter Braak C., Cormont A., **Dray S.** (2012). *Improved testing of species traits-environment relationships in the fourth corner problem*. Ecology, 93:1525–1526.

[A.61] ter Braak C., **Dray S.**, Peres-Neto P. (2017). *A critical issue in model-based inference for studying trait-based community assembly and a solution*. PeerJ, 5:e2885. ISSN 2167-8359. doi:10.7717/peerj.2885.

[A.62] ter Braak C.J., Peres-Neto P.R., **Dray S.** (2018). *Simple parametric tests for trait–environment association*. Journal of Vegetation Science, 29:801–811. ISSN 16541103. doi:10.1111/jvs.12666.

[A.63] ter Braak C.J., Šmilauer P., **Dray S.** (2018). *Algorithms and biplots for double constrained correspondence analysis*. Environmental and Ecological Statistics, 25:171–197. ISSN 15733009. doi:10.1007/s10651-017-0395-x.

[A.64] Thioulouse J., **Dray S.** (2007). *Interactive multivariate data analysis in R with the ade4 and ade4TkGUI packages*. Journal of Statistical Software, 22(5):1–14.

[A.65] Tolon V., **Dray S.**, Loison A., Zeileis A., Fischer C., Baubet E. (2009). *Responding to spatial and temporal variations in predation risk: space use of a game species in a changing landscape of fear*. Canadian Journal of Zoology, 87:1129–1137.

[A.66] Tolon V., Martin J., **Dray S.**, Loison A., Fischer C., Baubet E. (2012). *Predator-prey spatial game as a tool to understand the effects of protected areas on harvester-wildlife interactions*. Ecological Applications, 22(2):648–657.

[A.67] Trivellone V., Bougeard S., Giavi S., Krebs P., Balseiro D., **Dray S.**, Moretti M. (2017). *Factors shaping community assemblages and species occurrence of different trophic levels*. Ecology and Evolution, 7:4745–4754. ISSN 20457758. doi:10.1002/ece3.3061.

[A.68] Venner S., Bernstein C., **Dray S.**, Bel-Venner M.C. (2010). *Make love not war: when should less competitive males choose low-quality but defendable females?* The American Naturalist, 175:650–661.

[A.69] Wagner H.H., **Dray S.** (2015). *Generating spatially constrained null models for irregularly spaced data using Moran spectral randomization methods*. Methods in Ecology and Evolution, 6(10):1169–1178. ISSN 2041210X. doi:10.1111/2041-210X.12407.

[A.70] Wesuls D., Oldeland J., **Dray S.** (2012). *Disentangling plant trait responses to livestock grazing from spatio-temporal variation: the partial RLQ approach.* Journal of Vegetation Science, 23:98–113. ISSN 11009233. doi:10.1111/j.1654-1103.2011.01342.x.

SOFTWARE

Co-author of several R packages. More details at `https://github.com/sdray`

- ade4

- adegraphics

- adespatial

- adephylo

- adeTkGUI

FUNDED PROJECTS

- ANR EcoNet: Advanced statistical modelling of ecological networks. Co-ordinator: C. Matias (2019 - 2022).

- ANR ODYSSEE: Opening new avenues to model the DYnamics of Species aSsemblages by integrating Ecology and Evolution: a case study from the mountain ecosystems of the Alps and the Carpathians. Coordinator: P. Choler (2014 - 2017).

- ANR DECOVIR: Diversity and Environmental Control of Prasinoviruses. Coordinator: Y. Desdevises (2012 - 2015).

- ANR DIVERSITALP: Forecasting the impacts of global changes on French Alpine Flora: distribution of specific, functional and phylogenetic diversities, simulations and conservation strategies. Coordinator: W. Thuiller (2008 - 2011).

- ANR MOBILITE: Spatial heterogeneity and wildlife mobility: applications to threatened areas and species conservation in Africa and Europe. Coordinator: M.-N. de Visscher (2005 - 2009).

- BQR UCB: Spatial heterogeneity and wildlife mobility: A case study of the wild boar in the Geneva Basin (2006).

Reviewing and editorial activities

○ Associate editor for *Methods in Ecology and Evolution* (2013-2016)

○ Reviewer for more than 80 aricles submitted in ecological or statistical journals. Details at `https://publons.com/researcher/1237260/stephane-dray/peer-review/`

Scientific and administrative responsabilities

Here are my main and current responsibilities:

○ Head of the GDR EcoStat (2018 -)

○ Head of the team Quantitative and Evolutionary Community Ecology (2013 -)

○ Member of the scientific council of the CESAB (2019 -)

○ Member of the scientific council of the PRABI (2007 -)

○ Member of the LBBE lab council of the PRABI (2007 -)

Teaching activities

Main courses taught

○ The ade4 package for R: simple methods, Université de Lausanne, 2 days (2014, 2017)

○ The ade4 package for R: advanced methods, Université de Lausanne, 3 days (2015, 2018)

○ Multivariate analysis, Licence MMA, PolyTech Lyon, 24h, (2013 - 2018)

○ Introduction to multivariate analysis of ecological data, Master BEE, Université de Montpellier, 3h (2006 -)

○ Statistical description of biological structures, Master EEB, UCB Lyon, 15h (2006 - 2016)

○ Statistical description of biological structures, Master E2B2, UCB Lyon, 6h (2006 - 2016)

○ Introduction to the ade4 R package, UCB Lyon / PRABI, 5 days (2008, 2009, 2010, 2013, 2014)

○ Introduction to the R software, UCB Lyon, 25h (2003)

○ Mathematics for biologists, UCB Lyon, 77h (2003)

- Statistics for ecologists, Ho Chi Minh City University, Vietnam, 5 days (2003)

- Introduction to statistics, UFRSTAPS Lyon, 44h (2001-2002)

Graduate student supervision

Postdoc
- B. Alric, 2015

Ph. D. supervised
- S. Clappe (co-sup. with P.R. Peres-Neto), 2015-2018
- J. Braga (co-sup. with W. Thuiller), 2015 - 2018
- N. Ferry (co-sup. with M. Valeix and H. Fritz), 2014 - 2017
- R. Covain (co-sup. with S. Fisch-Muller), 2007 - 2011
- V. Tolon (co-sup. with A. Loison), 2006 - 2010

Master supervised
- L. Nicvert (co-sup. with H. Fritz), 2020
- F. Grill (co-sup. with K. Princé), 2019
- E. Say-Sallaz (co-sup. with M. Valeix), 2017
- N. Paffoni (co-sup. with B. Sinaimeri), 2017
- A. Comte (co-sup. with D. de Vienne), 2017
- S. Clappe (co-sup. with P.R. Peres-Neto), 2015
- J. Braga (co-sup. with W. Thuiller), 2015
- N. Ferry (co-sup. with M. Valeix), 2014
- B. Galliot, 2012