

CV Rainer M. Krug

PERSONAL DETAILS

Name Rainer M. Krug
Address Soorhaldenstr. 12
8308 Illnau
Switzerland
Telephone +41 52 534 65 13
Mobile +41 78 630 66 57
E-mail Rainer@krugs.de Rainer.Krug@uzh.ch
Date of birth 12 April 1968
Civil status married, one daughter

QUALIFICATIONS

Postgraduate

- 2008 PhD in Conservation Ecology**, Stellenbosch University, South Africa
Thesis Title: Modelling seed dispersal in restoration and biological invasion.
- 1997 MSc Conservation Biology**, University of Cape Town, South Africa
Thesis topic: The Genetic Diversity in a Founded Population of the African buffalo (*Syncerus caffer*): an example of an Artificial Bottleneck.
- 1995 Diplom (MSc equivalent) in Physics**, Philips-Universität Marburg, Germany
Thesis Title: Der Einfluss von Habitat Heterogenität auf die mittlere Überlebensdauer von Populationen (The influence of habitat heterogeneity on the mean survival time of populations)
Subjects for oral examination: Experimental Physics, Theoretical Physics, Ecological Modelling, Biology

Undergraduate

- 1992 Vor-Diplom (BSc equivalent) in physics**, Philips-Universität Marburg, Germany
Subjects for oral examination: Experimental Physics, Theoretical Physics, Mathematics, Chemistry.

POSITIONS HELD

- 03/2017 – present** Department of Evolutionary Biology and Environmental Studies, University Zürich
Researcher
- 08/2015 – 09/2015** Laboratoire Ecologie, Systematique et Evolution, Paris Sud
Postdoctoral Researcher

11/2014 – 12/2014	Laboratoire Ecologie, Systematique et Evolution, Paris Sud Postdoctoral Researcher
09/2013 – 11/2013	Laboratoire Ecologie, Systematique et Evolution, Paris Sud Postdoctoral Researcher
08/2011 – 12/2016	DST-NRF Centre of Excellence for Invasion Biology, Stellenbosch University Research Associate
06/2008 – 06/2008	DST-NRF Centre of Excellence for Invasion Biology, Stellenbosch University Postdoctoral Research Fellow, hosted by Prof. Dave Richardson.
06/2007 – 06/2008	Plant Conservation Unit, University of Cape Town Postdoctoral Research Fellow, hosted by Prof. Timm Hoffman.

AREAS OF INTEREST AND EXPERTISE

Keywords data and metadata management; open source tools; ecological modelling; statistical computing; combined modelling and experimental approaches; invasive species management; spatial pattern analysis; decision support

Details My current focus of research is in the field of data management, metadata management, workflows and data archival. Recent work included development of a framework for continuous data analysis and archival (ongoing but momentarily on hold); development of data management guidelines for our working group (ongoing), development of a domain specific metadata scheme to make entering and useful metadata as easy as possible for the researcher while at the same providing all the information needed for a useful re-use of the archived data; management of the large scale literature review of the IPBES Global Assessment Chapter 4, including data collection, quality control, analysis, graphing and archival (finalizing) as well as drafting of a Data Management Policy for IPBES.

My previous research interest and focus is on 1) spatial modeling and analysis of pattern and processes and their integration with field experiments and observations, ranging from population (local) to ecosystem (regional) scale, 2) the impact of change (climate change, human impacts, alien spread, ...) and conscious human actions (management) on these pattern and ultimately on the function of these ecosystems and ecosystem services, and 3) the use of models in decision support of the management of natural resources.

During my research career I have developed and used different types of models, ranging from individual based models, over hybrid models using individual based approaches together with grid based elements, to pure grid based models. The systems studied ranged from populations and communities on the local scale to community dynamics (e.g. grassland - shrubland dynamics, two biocontrol species one invasive species system, spread of three alien invasive species) on the local scale and spread simulations of individual species on the national scale under different climate change scenarios. Most of my research included different management scenarios in the form of alien plant management actions.

Nearly all the simulation and analysis tools I use (and used) are Open Source software (R, GRASS GIS, QGIS). This provides the flexibility to develop the simulation models and analysis protocols without additional costs, distribute

them freely and to enable others (scientists as well as implementing agencies like nature conservation agencies) to use and evaluate the code without limitations and without having to purchase specific software, i.e. reproducible research. Reproducible research includes for me to use scripts in analysis and generation of graphs and to make these as well as the simulation models available (as far as funder conditions allow this).

RESEARCH PROJECTS

- Development of a data management strategy for our research group and of tools to facilitate the provision and improve the quality of metadata. Also developing of data workflows to make the workflow from data generation to archival as smooth and reproducible as possible.
- Predictions in Chaotic systems
- Management of the Literature Analysis (**IPPBES Global Assessment Chapter 4**) and the generated data for archiving.
- Analyze measured vertical wind profiles to improve the performance of a forest growth model (CASTANEA) in regards to energy balance
- modelling temporal and spatial dynamics of a range of different alien species, alien control agents and management strategies
- Optimising alien invasive plant management through modelling of temporal and spatial modelling
- Modelling the role of seed dispersal in restoration and biological invasion

ADDITIONAL SKILLS

Computer	Operating System Expert Linux user; advanced Mac and Windows user
	Programming Languages Extensive experience in programming in R, Delphi / Pascal; user of L ^A T _E X; basic usage of C
	Programs Extensive experience in R, GRASS; Daily Emacs user; MS Office programs / Libre Office; basic experience of QGIS and Arc-GIS
Language	German native language
	English reading, writing and speaking fluent
	French reading, writing and speaking fair

GRANTS

2009 – 2010	NRF Freestanding Postdoctoral Fellowship
1999 – 2000	Deutscher Akademischer Austauschdienst (DAAD: German Academic Exchange Service) grant to conduct fieldwork for PhD at Gobabeb, Namibia.
1996 – 1997	Deutscher Akademischer Austauschdienst (DAAD: German Academic Exchange Service) grant to attend MSc in Conservation Biology course at UCT.

PUBLICATIONS

Peer-reviewed Journals

Krug, R. M., Richardson, D. M., apr 2014. Modelling the effect of two biocontrol agents on the invasive alien tree *Acacia cyclops* — Flowering, seed production and agent survival.

- Ecological Modelling 278, 100–113.
 URL <http://dx.doi.org/10.1016/j.ecolmodel.2014.01.028><http://linkinghub.elsevier.com/retrieve/pii/S0304380014000714><http://www.sciencedirect.com/science/article/pii/S0304380014000714>
- Krug, R. M., Roura-Pascual, N., Richardson, D. M., jul 2010. Clearing of invasive alien plants under different budget scenarios: using a simulation model to test efficiency. *Biological Invasions* 12 (12), 4099–4112.
 URL <http://www.springerlink.com/index/E342L4008P462563.pdf><http://www.springerlink.com/content/e342l4008p462563>
- Le Maitre, D. C., Krug, R. M., Hoffmann, J. H., Gordon, A. J., Mgidi, T. N., 2008. *Hakea sericea*: Development of a model of the impacts of biological control on population dynamics and rates of spread of an invasive species. *Ecological Modelling* 212 (3–4), 342–358.
 URL <http://www.sciencedirect.com/science/article/pii/S0304380007006059>
- Marques, A., Pereira, H. M., Krug, C., Leadley, P. W., Visconti, P., Januchowski-Hartley, S. R., Krug, R. M., Alkemade, R., Bellard, C., Cheung, W. W. L., Christensen, V., Cooper, H. D., Hirsch, T., Hoft, R., van Kolck, J., Newbold, T., Noonan-Mooney, K., Regan, E. C., Rondinini, C., Sumaila, U. R., Teh, L. S., Walpole, M., oct 2014. A framework to identify enabling and urgent actions for the 2020 Aichi Targets. *Basic and Applied Ecology* 15 (8), 633–638.
 URL <http://www.sciencedirect.com/science/article/pii/S1439179114001261><http://linkinghub.elsevier.com/retrieve/pii/S1439179114001261><http://dx.doi.org/10.1016/j.baae.2014.09.004>
- Privett, S. D. J., Krug, R. M., Forbes, G., Gaertner, M., sep 2014. Wild flower harvesting on the Agulhas Plain, South Africa: Impact of harvesting intensity under a simulated commercial harvesting regime for two re-seeding and two re-sprouting fynbos species. *South African Journal of Botany* 94, 270–275.
 URL <http://linkinghub.elsevier.com/retrieve/pii/S025462991400129X><http://www.sciencedirect.com/science/article/pii/S025462991400129X>
- Richardson, D., Iponga, D., Roura-Pascual, N., Krug, R., Milton, S., Hughes, G., Thuiller, W., 2010. Accommodating scenarios of climate change and management in modelling the distribution of the invasive tree *Schinus molle* in South Africa. *Ecography* 33 (July), 1049–1061.
 URL <http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0587.2010.06350.x/full>
- Roura-Pascual, N., Bas, J. M., Thuiller, W., Hui, C., KRUG, R. M., Brotons, L., 2009a. From introduction to equilibrium: reconstructing the invasive pathways of the Argentine ant in a Mediterranean region. *Global Change Biology* 15 (9), 2101–2115.
 URL <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2486.2009.01907.x/full>
- Roura-Pascual, N., Krug, R. M., Richardson, D. M., Hui, C., apr 2010. Spatially-explicit sensitivity analysis for conservation management: exploring the influence of decisions in invasive alien plant management. *Diversity and Distributions* 16 (3), 426–438.
 URL <http://www.sciencemag.org/content/312/5781/1715><http://onlinelibrary.wiley.com/doi/10.1111/j.1472-4642.2010.00659.x/full><http://doi.wiley.com/10.1111/j.1472-4642.2010.00659.x>
- Roura-Pascual, N., Richardson, D. M., Chapman, R. A., Hichert, T., Krug, R. M., 2011. Managing biological invasions: charting courses to desirable futures in the Cape Floristic Region. *Regional Environmental Change* 11 (2), 311–320.
- Roura-Pascual, N., Richardson, D. M., Krug, R. M., Brown, A., Chapman, R. A., Forsyth, G. G., Le Maitre, D. C., Robertson, M. P., Stafford, L., van Wilgen, B. W., Wannen-

burgh, A., Wessels, N., 2009b. Ecology and management of alien plant invasions in South African fynbos: accommodating key complexities in objective decision making. *Biological Conservation* 142, 1595–1604.

Singer, A., Johst, K., Banitz, T., Fowler, M. S., Groeneveld, J., Gutiérrez, A. G., Hartig, F., Krug, R. M., Liess, M., Matlack, G., Meyer, K. M., Pe'er, G., Radchuk, V., Voinopol-Sassu, A.-J., Travis, J. M., dec 2015. Community dynamics under environmental change: How can next generation mechanistic models improve projections of species distributions? *Ecological Modelling* in press.

URL <http://dx.doi.org/10.1016/j.ecolmodel.2015.11.007><http://linkinghub.elsevier.com/retrieve/pii/S0304380015005281>

Book Chapters

Hui, C., Krug, R. M., Richardson, D. M., 2011. Fifty Years of Invasion Ecology: The Legacy of Charles Elton. *Wiley-Blackwell, Oxford, Ch. Models spr*, pp. 329–343.

Krug, C. B., Krug, R. M., 2007. Old fields: Dynamics and restoration of abandoned farmland. *Island Press / Society for Ecological Restoration, Washington, Ch. Restoratio*.

Maertens, B., Henle, K., Kuhn, W., Krug, R. M., Johst, K., Grosse, W.-R., Wissel, C., 1996. Species Survival in Fragmented Landscapes. In: Settele, J., Margules, C., Poschlod, P., Henle, K. (Eds.), *Species Survival in Fragmented Landscapes*. Vol. 35 of *The GeoJournal Library*. Springer Netherlands, Dordrecht, pp. 241–247.

URL <http://link.springer.com/10.1007/978-94-009-0343-2>

Marques, A., Krug, C., Regan, E., Bowles-Newark, N., Burgess, N., Visconti, P., Walpole, M., Tittensor, D., Pereira, H., Leadley, P., Krug, R. M., 2014. Integrated Analysis of the 2020 Strategic Goals: Time Lags, Indicators and Interactions. In: Leadley, P., Krug, C., Alkemade, R., Pereira, H., U.R., S., Walpole, M., Marques, A., Newbold, T., Teh, L., van Kolck, J., Bellard, C., Januchowski-Hartley, S., Mumby, P. (Eds.), *Progress towards the Aichi Biodiversity Targets: An Assessment of Biodiversity Trends, Policy Scenarios and Key Actions*. Secretariat of the Convention on Biological Diversity, Montreal, Canada., Ch. 21, pp. 441–467.

Conference proceedings

Krug, C. B., Krug, R. M., Midoko Iponga, D., Walton, B. A., Milton, S. J., Newton, I. P., Farley, N., Shiponeni, N. N., 2004a. Restoration of West Coast Renosterveld: facilitating the return of a highly threatened vegetation type. In: Arianoutsou, M., Papanastasis, V. P. (Eds.), *Ecology, Conservation and Management of Mediterranean Ecosystems. Proceedings of the 10th International Conference on Mediterranean Ecosystems, April 25 – May 1, 2204, Rhodes, Greece*. Millpress, Rotterdam, pp. 1–12.

Krug, R. M., Johst, K., Wissel, C., Maertens, B., 1996. Wirkung der räumlichen Heterogenität innerhalb eines Habitats auf die mittlere Überlebensdauer einer Zauneidechsen-Population. *Verhandlungen der Gesellschaft fuer Oekologie* 26, 447–454.

Krug, R. M., Krug, C. B., Midoko Iponga, D., Walton, B. A., Milton, S. J., Newton, I. P., Farley, N., Shiponeni, N. N., 2004b. Reconstructing West Coast Renosterveld: past and present ecological processes in a Mediterranean shrubland of South Africa. In: *Ecology, Conservation and Management of Mediterranean Ecosystems. Proceedings of the 10th International Conference on Mediterranean Ecosystems, April 25 – May 1, 2204, Rhodes, Greece*. No. 1999. pp. 1–12.

Krug, R. M., Roura-Pascual, N., Richardson, D. M., 2009. Prioritising areas for the management of invasive alien plants in the CFR: different strategies, different priorities? *South African Journal of Botany* 75 (2), 408–409.

Roura-Pascual, N., Krug, R. M., Richardson, D. M., 2009. Identifying priority areas for the

management of invasive alien plants in the Cape Floristic Region. In: South African Journal of Botany. Vol. 75. p. 439.

Conference presentations Only first author, except invited keynote presentations

- Krug, R. M., 1997. Population size, sample size and Microsatellites. Meeting of the Zoological Society of Southern Africa, Cape Town, South Africa.
- Krug, R. M., 2007. Two Approaches — same Answer? UCT Conference on Biomathematics in Africa, Cape Town, South Africa.
- Krug, R. M., 2011. Spatial modelling with the R-GRASS Interface. The R User Conference, University of Warwick, Coventry, UK.
- Krug, R. M., 2013. Bringing Science to Management: using Simulation- and Scenario-Based Approaches to Guide Decision Making in Invasive Species Management — one tool which can do both. INTECOL - Into the Next 100 Years, London, UK.
- Krug, R. M., Farley, N., Midoko-Iponga, D., Newton, I. P., Shiponeni, N., Walton, B. A., Milton, S. J., 2004. Reconstructing Ecological Processes in West Coast Renosterveld: The Grazers, the Fires and the Humans. Fynbos Forum, Langebaan, South Africa.
- Krug, R. M., Le Maitre, D. C., 2006. An alien invasive species, an agent and experts: A case study of hakea spread and two seed feeding biocontrol agents. UCT Conference on Biomathematics in Africa, Cape Town, South Africa.
- Krug, R. M., Milton, S. J., 2002. Pattern in Vegetation Dynamics: Identification and Application in Modelling Restoration of Old Fields in West Coast Renosterveld. Fynbos Forum 14th 1–16th, Rawsonville, South Africa.
- Krug, R. M., Richardson, D. M., 2011. Biocontrol Agents, Aliens and Eneergy. Fynbos Forum: Fynbos and Human Heritage, Still Bay, South Africa.
- Krug, R. M., Richardson, D. M., Le Maitre, D. C., 2012. The Impact of two biological control agents at the landscape scale: implications for management. Fynbos Forum, Port St. Francis, South Africa.
- Krug, R. M., Roura-Pascual, N., Richardson, D. M., 2009a. Prioritising areas for the management of invasive alien plants in the CFR: different strategies, different priorities? 25th Annual Conference of the South African Association of Botanists, Stellenbosch, South Africa.
- Krug, R. M., Roura-Pascual, N., Richardson, D. M., 2009b. Towards More Efficient Management of Invasive Alien Plants in the Cape Floristic Region: Optimising the Priorities. 10th International Conference on the Ecology and Management of Alien Plant Invasions (EMAPi 10), Stellenbosch, South Afrtica.
- Krug, R. M., Roura-Pascual, N., Richardson, D. M., 2009c. Towards more efficient management of invasive alien plants: Spatial prioritisationse. Diversitas Open Science Conference 2 - Biodiversity and Society, Understanding Connections, Adapting to Change, Cape Town, South Africa.
- Krug, R. M., Roura-Pascual, N., Richardson, D. M., 2009d. Towards more Efcient Management of Invasive Alien Plants (AIPs): Spatial Prioritisation. Fynbos Forum, Bredarsdorp, South Africa.
- Krug, R. M., Roura-Pascual, N., Richardson, D. M., 2016. From Scenarios over Models to Management — Alien Spread Management. International Conference on Scenarios and Models of Biodiversity and Ecosystem Services in Support of Decision Making, Montpellier, France.
- Krug, R. M., Rushworth, I., 2012. Optimising the Use of and Motivating for Funding - one tool which can do both. Ezemvelo KZN Wildlife Symposium on Contemporary Conservation Practice, Howick, South Africa.

Krug, R. M., Wiegand, T., Milton, S. J., 2003. Optimal Patch Size for Restoration of Renosterveld? A Seeds View. Fynbos Forum, Hartebos, South Africa.

Rushworth, I., Krug, R. M., 2016. Integrating Scenarios and Models into Ecosystem Management: an example from the Maloti-Drakensberg Park World Heritage Site, South Africa. International Conference on Scenarios and Models of Biodiversity and Ecosystem Services in Support of Decision Making, Montpellier, France.

Software Packages

Krug, R. M., Eddelbuettel, D., 2009. earthmovdist: Wrapper to the Emd-L1 library by Haibin Ling and Kazunori Okada.

URL <http://earthmovdist.r-forge.r-project.org/>

Guest lectures

Krug, C. B., Krug, R. M., 2004. West Coast Renosterveld: Ökologische Prozesse und Restaurierung (West Coast Renosterveld: Ecological Processes and Restoration).

Krug, R. M., 2004. Ecological Modelling — A Taxonomy.

Krug, R. M., 2013. Bringing Science to Management: using Simulation- and Scenario-Based Approaches to Guide Decision Making in Invasive Species Management — one tool which can do both. Helmholtz Zentrum für Umweltforschung, UFZ Halle.