What Does Reproducible Research Mean for Plant Pathology?

A. H. Sparks, E. M. Del Ponte, N. J. Grünwald, and Z. Foster

2016-12-05

1. Adam H. Sparks: Centre for Crop Health, University of Southern Queensland, Toowoomba, Qld 4350, Australia
2. Emerson M. Del Ponte: Universidade Federal de Viçosa, Viçosa, MG, Brasil
3. Niklaus J. Grünwald: Horticultural Crops Research Laboratory, USDA Agricultural Research Service, Corvallis, OR 97330, USA
4. Zachary Foster: Horticultural Crops Research Laboratory, USDA Agricultural Research Service, Corvallis, OR 97330, USA

# ABSTRACT

Abstracts are mandatory and limited to one 200 word paragraph.

# MAIN TEXT

Reproductibility and replicability in scientific research have once again been highlighted recently (Nature 2016; Baker 2016) as an issue.

Patil et al. (2016) have provided several definitions to clarify the concepts surrounding reproducibility and replicability. For the purposes of this paper we follow the definitions as given by Patil et al. (2016).

* Why reproducible research

## BEST METHODS FOR REPRODUCIBLE RESEARCH

* Provide definitions (provide defintions for terms used so it's clear)
* Data
* Data formatting (flat files; use Comma Chameleon, Table Tool, others?)
* Data storage (don't edit raw data files; use file permissions to prevent changes to raw data files, use data bases where possible and appropriate; etc.)
* When publishing
* Provide data
* Provide code
* Using GitHub for code (and small data?)
* Using Figshare or Zenodo vs a lab website (DOIs, other reasons)

## WHAT IS THE STATE OF REPRODUCIBLE RESEARCH IN PLANT PATHOLOGY?

* Madden et al. (2015) supply an *e-****X****tra*\* with repoducible examples for readers.
* Duku et al. (2016) provide models, data and code, (<http://adamhsparks.github.io/MICCORDEA/>) necessary to replicate the entire study modelling the effects of climate change on rice bacterial blight and rice leaf blast in Tanzania.
* Sparks et al. (2011, 2014) provide models, data and code, (<http://adamhsparks.github.io/Global-Late-Blight-MetaModelling/>) necessary to replicate model development and the subsequent the study on the effects of climate change on potato late blight.
* Other examples from plant pathology providing e-Xtras or supplemental material

## RANDOM SAMPLING OF ARTICLES FROM THE TOP 20 PLANT PATHOLOGY JOURNALS

The top 20 plant pathology discipline journals as ranked by Google Scholar, <https://scholar.google.com/> (accessed 05 Dec. 2016), were used to create a database of journals from which to randomly select articles for inspection. One hundred articles were randomly selected from 2012 to 2016 from a list of randomly selected start pages assigned to a randomised list of the 20 journals (Sparks et al. 2017). Where start pages were numbered from page one and went to 150. This was done since some journals restart their numbering with each issue and also ensures that the journal is more likely to have a page number corresponding to the randomly generated value. This also assumes that there is no effect or bias on reproducibility based on the time of year that an article was published, since most journals start with page number one at the beginning of the year.

The list of journals was saved as a comma separated value (CSV) file and imported into R (R2016).

## DISCUSSION

## ACKOWLEDGEMENTS

### Notes

These are links to resources that may be useful for writing this or as suggested resources in the final document that aren't easily printable for inclusion in the Dropbox folder.

<https://www.r-statistics.com/2016/07/the-reproducibility-crisis-in-science-and-prospects-for-r/>

<https://github.com/ropensci/rrrpkg>

### LITERATURE CITED

Baker, M. 2016. Is there a reproducibility crisis? Nature. 533:453–454.

Duku, C., Sparks, A. H., and Zwart, S. J. 2016. Spatial modelling of rice yield losses in tanzania due to bacterial leaf blight and leaf blast in a changing climate. Climatic Change. 135:569–583 Available at: <http://dx.doi.org/10.1007/s10584-015-1580-2>.

Madden, L. V., Shah, D. A., and Esker, P. D. 2015. Does the *P* value have a future in plant pathology? Phytopathology. 105:1400–1407.

Nature. 2016. Reality check on reproduciblity. Nature. 533:437.

Patil, P., Peng, R. D., and Leek, J. 2016. A statistical definition for reproducibility and replicability. bioRxiv. Available at: <http://biorxiv.org/content/early/2016/07/29/066803>.

Sparks, A. H., Forbes, G. A., Hijmans, R. J., and Garrett, K. A. 2011. A metamodeling framework for extending the application domain of process-based ecological models. Ecosphere. 2:art90 Available at: <http://www.esajournals.org/doi/abs/10.1890/ES11-00128.1>.

Sparks, A. H., Forbes, G. A., Hijmans, R. J., and Garrett, K. A. 2014. Climate change may have limited effect on global risk of potato late blight. Global Change Biology.:3621–3631 Available at: <http://dx.doi.org/10.1111/gcb.12587>.

Sparks, A. H., Ponte, E. M. D., Grünwald, N. J., and Foster, Z. 2017. Reproducible-research-in-plant-pathology. Available at: <https://github.com/adamhsparks/Reproducible-Research-in-Plant-Pathology> [Accessed ].