But I can't preregister my research

Improving the reproducibility and transparency of ecology and conservation with adaptive preregistration for model-based research

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Abstract

1. Preregistration is an open-science practice adopted in scientific disciplines that have begun to confront the 'reproducibility crisis', which aims to improve research transparency and mitigate questionable research practices within a study. There has been little uptake of preregistration in ecology and conservation, and many modellers and researchers engaged in non-hypothesis testing research both within and outside of ecology have eschewed preregistration on the grounds that existing templates are irrelevant because they are focussed on null-hypothesis significance testing. **2.** We advocate that preregistration can and should be used in model-based research in ecology and conservation but that preregistration should reflect the norms and practice of the research context in which it is applied in order to adequately restrict researcher degrees of freedom that are unique to a domain-specific methodology. We took a user-centred design approach to the task of translating preregistration into model-based research contexts for ecology and conservation. **3.** We identified a generalised 'modelling workflow' that captures critical analysis decisions in the process of the model development cycle. The workflow informed the content and structure of a preregistration template to be used in model-based research. The iterative nature of model development was identified as a key barrier to implementing preregistration for modelling research because it conflicts with the current format and linear process of preregistration. To better align the internal logic of preregistration with the iterative and non-linear process of ecological modelling, we propose a methodology for implementing 'adaptive preregistration' leveraging git and GitHub. We tested and evaluated the preregistration template and methodology using a case-study of environmental flows modelling for decision-support in Victoria, Australia. **4.** This research provides a template and methodology for implementing adaptive preregistration of ecological models in either pure or applied settings, and will facilitate the wider uptake of preregistration in ecology. Although we focus on ecology and conservation in this paper, the template is extensible to alternative fields and methods, and the proposed methodology for implementing adaptive preregistration can be applied in model-based research within science more broadly. Modellers need no longer cry "but, I can't preregister my research."

Keywords: preregistration, transparency, reproducibility, modelling, ecology, conservation, open-science, research software engineering

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1. Bibliography styles

Here are two sample references: **?** **?**.

By default, natbib will be used with the `authoryear` style, set in `classoption` variable in YAML. You can sets extra options with `natbiboptions` variable in YAML header. Example

```
natbiboptions: longnamesfirst,angle,semicolon
```

There are various more specific bibliography styles available at https://support.stmdocs.in/wiki/index.php?title=Model-wise_bibliographic_style_files. To use one of these, add it in the header using, for example, `biblio-style: model1-num-names`.

1.1. Using CSL

If `cite-method` is set to `citeproc` in `elsevier_article()`, then pandoc is used for citations instead of `natbib`. In this case, the `csl` option is used to format the references. By default, this template will provide an appropriate style, but alternative `csl` files are available from https://www.zotero.org/styles?q=elsevier. These can be downloaded and stored locally, or the url can be used as in the example header.

2. Equations

Here is an equation:

$$f_X(x) = \left(\frac{\alpha}{\beta}\right)\left(\frac{x}{\beta}\right)^{\alpha-1} e^{-\left(\frac{x}{\beta}\right)^{\alpha}}; \alpha, \beta, x > 0.$$

Inline equations work as well: $\sum_{i=2}^{\infty}\{\alpha_i^{\beta}\}$

3. Figures and tables

Figure 1 is generated using an R chunk.

4. Tables coming from R

Tables can also be generated using R chunks, as shown in Table 1 example.

```
knitr::kable(head(mtcars)[,1:4])
```

Table 1: Caption centered above table

	mpg	cyl	disp	hp
Mazda RX4	21.0	6	160	110
Mazda RX4 Wag	21.0	6	160	110
Datsun 710	22.8	4	108	93
Hornet 4 Drive	21.4	6	258	110
Hornet Sportabout	18.7	8	360	175

Table 1: Caption centered above table

	mpg	cyl	disp	hp
Valiant	18.1	6	225	105

References

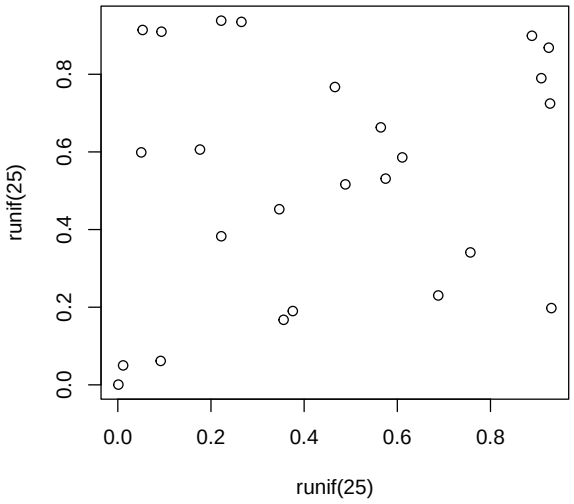

Figure 1: A meaningless scatterplot