labeleR: an R package to optimize the generation of collection labels and scientific documents

Julia G. de Aledo[1,2,3], **Jimena Mateo-Martín**[3], **Francisco Rodríguez-Sánchez**[4], **and Ignacio Ramos-Gutiérrez**[3,4]

1 Estación Biológica de Doñana **2** Universidad Rey Juan Carlos **3** Universidad Autónoma de Madrid **4** Universidad de Sevilla

Summary

`labeleR` is an R package designed to automate the creation of collection labels and documents for scientific events. It simplifies repetitive and time-consuming tasks, offering a practical alternative to manual or costly tools. With `labeleR`, users can generate a wide variety of customizable PDF documents that can also be automatically emailed.

The package provides a set of functions classified into two groups: scientific collections (e.g. labels for herbarium or insects) and scientific events organization (e.g. personal badges, abstract books and certificates of attendance and participation). Starting from a tidy dataset, users can easily customize content, incorporate QR codes, logos, images, and edit their own templates. `labeleR` transforms tedious and repetitive workflows into an efficient, reproducible process, contributing to greater scientific productivity. The package is available under an open-source license and can be freely downloaded from CRAN or the GitHub repository (https://ecologyr.github.io/labeleR/).

Statement of need

The management and design of scientific labels and event documents is a time-consuming task. Large-scale label generation tools for herbarium and scientific collections (used by institutions such as museums or botanical gardens) are often paid and proprietary software (e.g. "BRAHMS" (2025) "IrisBG" (2024)). Microsoft Excel-Word integration through mailing lists is commonly used at a smaller scale, although still involving paid software with limited large database management capacity. Most free alternatives are not open-source, require installing a program with limited customization, and are often only compatible with Windows operating system (e.g. Pando, Lujano, & Cezón (2019) "pLabel" (2020)), or designed for very specific purposes (e.g. "EntomoLabels" (2022) for insects, "LichenLabler" (2025) for lichens or Zhang, Zhu, Liu, & Fischer (2016) for plant vouchers). Additionally, credentials and certificates for scientific events are either created manually one at a time, through paid online servers, or by hiring an event organization company. To our knowledge, there are no free, customizable tools for the bulk production and distribution of these documents. `labeleR` fills this gap facilitating the creation of scientific collection labels, conference badges, attendance and participation certificates, and abstract books, among others.
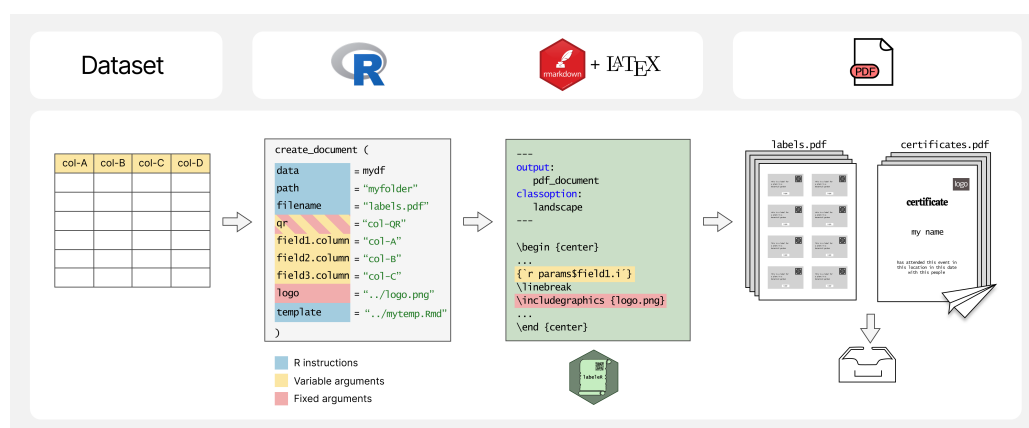
Figure 1: Figure 1. `labeleR` package workflow. Information stored in a dataset passes through an R function into a parameterized `RMarkdown` file using LaTeX syntax, and is then rendered as PDF. `labeleR` functions accept three argument types: R instructions which specify the dataset, paths to images or add custom templates (in blue); fixed arguments, such as titles or subtitles (in red), and variable arguments, linked to columns of the dataset (in yellow). Users work directly on R to introduce the parameters, while `labeleR` works in the background with markdown and latex to produce the results. Output PDF documents can be automatically emailed to participants.

Package description

The `labeleR` package builds upon the `RMarkdown` ecosystem (Allaire et al. (2024)) to generate PDF documents from a tidy data frame in R (Figure 1). `labeleR` functions include three types of arguments: (1) R instructions, such as the data object, paths and file name of the rendered document; (2) "fixed" arguments, text that remains constant across output documents (e.g. event name or image path); (3) "variable" arguments, linked to columns in the dataframe, thus changing between documents (e.g. taxonomic names in labels or attendee names in certificates). A QR code can be included either through a fixed argument or a variable argument, without the need for external software. Users can also edit and adapt the default `RMarkdown` templates provided by the package for their own purposes.

Documents that can be generated with `labeleR`

Labels for collections

Appropriate labelling of samples is a fundamental step of the scientific process (i.e., labelling test tubes in laboratories, storing animal or plant materials or displaying collections in museums or botanical gardens). A user-friendly bulk rendering tool is vital for efficiently producing crafted, uniform labels in a reproducible manner. We present three label types: "herbarium" (most complex), "collection" (most aesthetic) and "tinylabels" (compact and simplified, for small insect collections) (Figure 2). These labels can include QR codes (e.g. links to websites, images, or identification codes) without additional tools, making it easy to quickly access and link to external information.

Herbarium labels

Herbarium labels are one of the documents with more variable parameters. Note that the `family.column` content will always be capitalized, and the `taxon.column` one in italics,

recommended to be used as originally defined, while the rest ca be interchangeable. The QR can stand for a free text (and therefore remain identical in all labels), or be a column name, and the codes will be rendered with the individual information of each row. Four different labels will fit in each of the A4 pdf pages.

```
create_herbarium_label(
  data = herbarium.table,
  path = "labeleR_output",
  filename = "herbarium_labels",
  qr = "QR_code",
  title ="Magical flora of the British Isles" ,
  subtitle = "Project: Eliminating plant blindness in Hogwarts students",
  family.column = "Family",
  taxon.column = "Taxon",
  author.column = "Author",
  det.column = "det",
  date.det.column = "Det_date",
  location.column = "Location",
  area.description.column = "Area_description",
  latitude.column = "Latitude",
  longitude.column = "Longitude",
  elevation.column = "Elevation",
  field1.column = "life_form",
  field2.column = "Observations",
  field3.column = "Height",
  collector.column = "Collector",
  collection.column = "Collection_number",
  assistants.column = "Assistants",
  date.column = "Date"
)
```

Collection labels

They count with five variable parameters, which are not recommended to be too long, along with the possibility of including a QR code (fixed or variable) and an image (logo or picture). Field 1 will be always capitalized, and Field 2 italicized. Any field can be left blank. The user may manually fix the backgroud and text colors to their preference, using HTML color codes. Eight different labels will fit in each of the A4 pdf pages.

```
create_collection_label(
  data = collection.table,
  path = "labeleR_output",
  filename = "labels",
  qr = "QR_code",
  field1.column = "field1",
  field2.column = "field2",
  field3.column = "field3",
  field4.column = "field6",
  field5.column = "field7",
  system.file("rmarkdown/pictures/Hogwarts_BnW.png", package = "labeleR"),
  bgcolor = "D0ECC1",  #White is "FFFFFF",
  textcolor = "1E3F20" #Black is "000000"
)
```