

# Supporting Information 1: R package usage

2026-02-03

This vignette contains the code and figures for comparing the relative usage of the R packages `gllvm` (Niku et al. 2025), `hmsc` (Tikhonov et al. 2025), `boral` (Hui 2025), `ecoCopula` (Popovic et al. 2019), `glmmTMB` (McGillycuddy et al. 2025) and `VGAM` (Yee 2025), which are all used for latent variable modelling, with the `vegan` package (Oksanen et al. 2025), a go-to for classical ordination, based on monthly downloads of each package from the Comprehensive R Archive Network (CRAN).

Note that `glmmTMB` and `VGAM` are packages that are also heavily used for general-purpose GLMM- and GAM modeling in addition to GLLVMs. As such, the numbers for these packages likely are not really very informative with regards to their use for latent variable modelling among ecologists, compared to the other packages.

## Data setup

```
# load required R packages
library(cranlogs) # get package download data from cran
library(dplyr) # data handling
library(lubridate) # aggregate data by date
library(ggplot2) # plotting
```

We begin by loading the data, from the beginning of 2020 to the end of 2025.

```
data_downloads <- cran_downloads/packages=c("vegan","gllvm","Hmsc","boral",
                                             "ecoCopula","glmmTMB","VGAM"),
                                             from = "2020-01-01", to = "2025-12-31")
downloads_monthly <- data_downloads |>
  group_by(month=floor_date(date, "month"),package) |>
  summarise(count=sum(count))
```

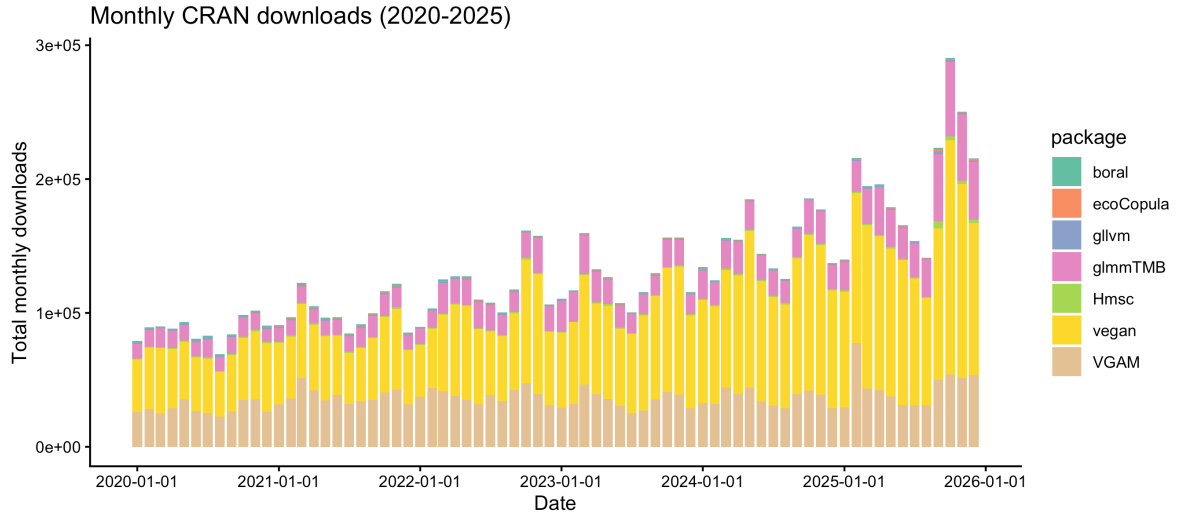
We also calculate the monthly ratio of downloads for each package:

```
downloads_monthly <- downloads_monthly |> mutate(ratio=count/sum(count))
```

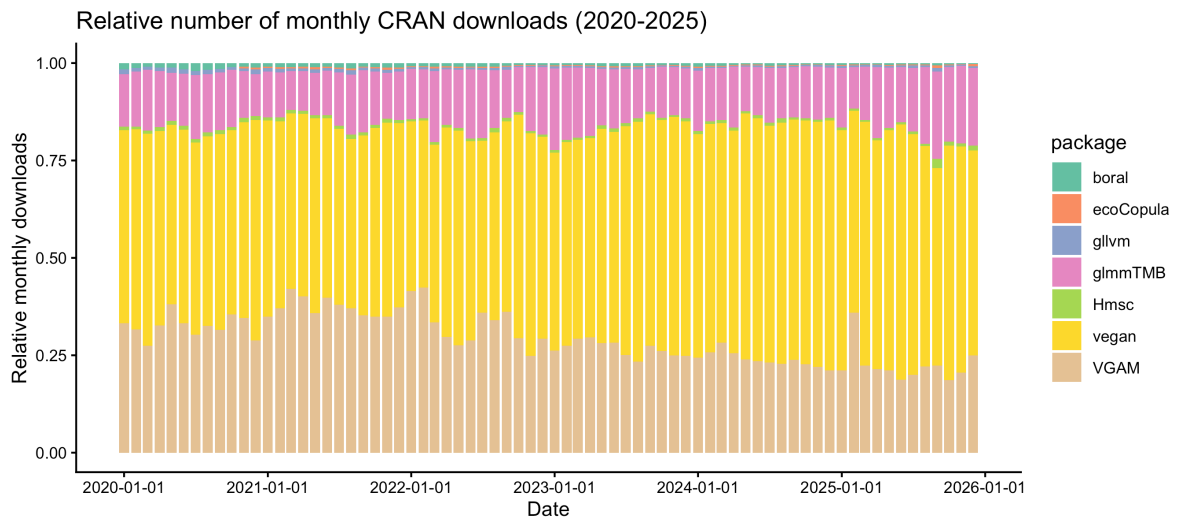
## Plotting

We then plot the data in a graph:

```
ggplot(downloads_monthly) + # total downloads/month
  geom_histogram(aes(x=month, y=count, fill=package),stat="identity") +
  theme_classic() +
  labs(color="Package", y="Total monthly downloads", x="Date",
        title="Monthly CRAN downloads (2020-2025)") +
  scale_fill_brewer(palette="Set2") +
  scale_x_date(date_breaks = "1 year")
ggplot(downloads_monthly) + # relative downloads/month
  geom_histogram(aes(x=month, y=ratio, fill=package),stat="identity") +
  labs(color="Package", y="Relative monthly downloads", x="Date",
        title="Relative number of monthly CRAN downloads (2020-2025)") +
  scale_fill_brewer(palette="Set2") +
  theme_classic() +
  scale_x_date(date_breaks = "1 year")
```



(a) Total number of monthly citations for each package



(b) Percentage of total citations across all packages per month

Supplementary Figure 1. 1: Monthly downloads of the vegan R package (classical ordination tools), and R packages containing GLLVM functionality (boral, gllvm, hmsc, ecoCopula, glmmTMB and VGAM).

## References

- Hui, Francis K. C. 2025. *Boral: Bayesian Ordination and Regression AnaLysis*. <https://doi.org/10.32614/CRAN.package.boral>.
- McGillycuddy, Maeve, David I. Warton, Gordana Popovic, and Benjamin M. Bolker. 2025. “Parsimoniously Fitting Large Multivariate Random Effects in glmmTMB.” *Journal of Statistical Software* 112 (1): 1–19. <https://doi.org/10.18637/jss.v112.i01>.
- Niku, Jenni, Wesley Brooks, Riki Herliansyah, Francis K. C. Hui, Pekka Korhonen, Sara Taskinen, Bert van der Veen, and David I. Warton. 2025. *Gllvm: Generalized Linear Latent Variable Models*. <https://doi.org/10.32614/CRAN.package.gllvm>.
- Oksanen, Jari, Gavin L. Simpson, F. Guillaume Blanchet, Roeland Kindt, Pierre Legendre, Peter R. Minchin, R. B. O’Hara, et al. 2025. *Vegan: Community Ecology Package*. <https://doi.org/10.32614/CRAN.package.vegan>.
- Popovic, Gordana C., David I. Warton, Fiona J. Thomson, and Angela T. Moles. 2019. “Untangling Direct Species Associations from Indirect Mediator Species Effects with Graphical Models.” *Methods in Ecology and Evolution* 10 (9): 1571–83. <https://doi.org/10.1111/2041-210X.13247>.
- Tikhonov, Gleb, Otso Ovaskainen, Jari Oksanen, Melinda de Jonge, Oystein Opedal, and Tad Dallas. 2025. *Hmsc: Hierarchical Model of Species Communities*. <https://doi.org/10.32614/CRAN.package.Hmsc>.
- Yee, T. W. 2025. *VGAM: Vector Generalized Linear and Additive Models*. <https://doi.org/10.32614/CRAN.package.VGAM>.