Elevate research projects with Quarto

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2025-03-23

1 Content


```
1 https://vhgauto.quarto.pub/seminario2-gulich/
```

2 Introduction

Research project

To estimate water quality indicators in Paraná River middle basin for algorithm development using satellite remote sensing techniques

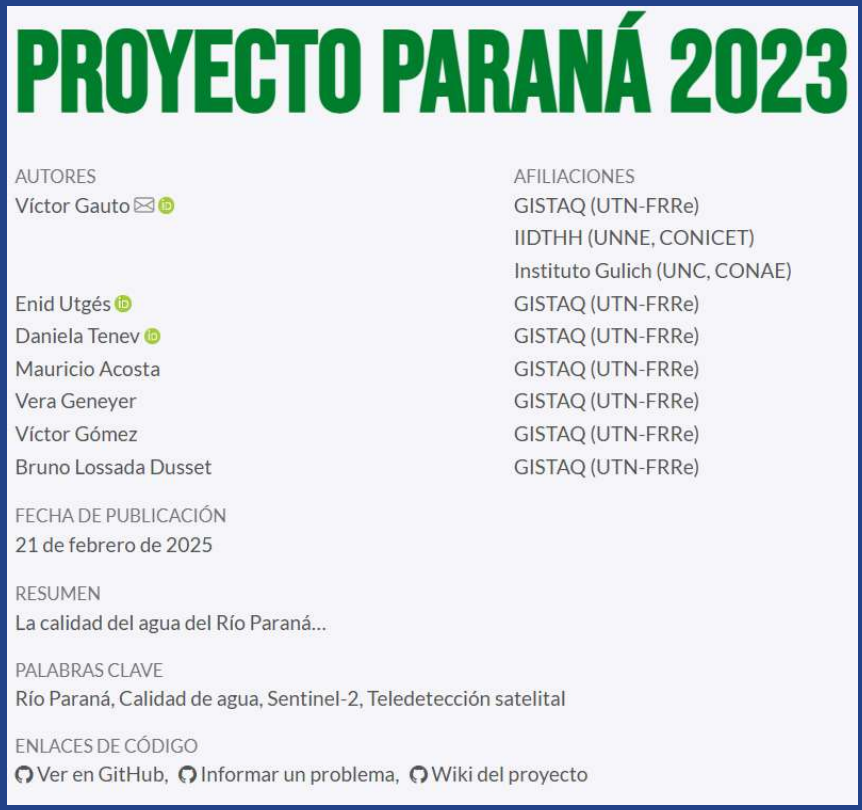
UNIVERSIDAD TECNOLÓGICA NACIONAL
FACULTAD REGIONAL RESISTENCIA

GISTAQ

Collaborative website with automatic running, interactive and open source.

2.1 Front page

- Authors
- Affiliation
- Last modified date
- Keywords
- More resources links



PROYECTO PARANÁ 2023

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FECHA DE PUBLICACIÓN
21 de febrero de 2025

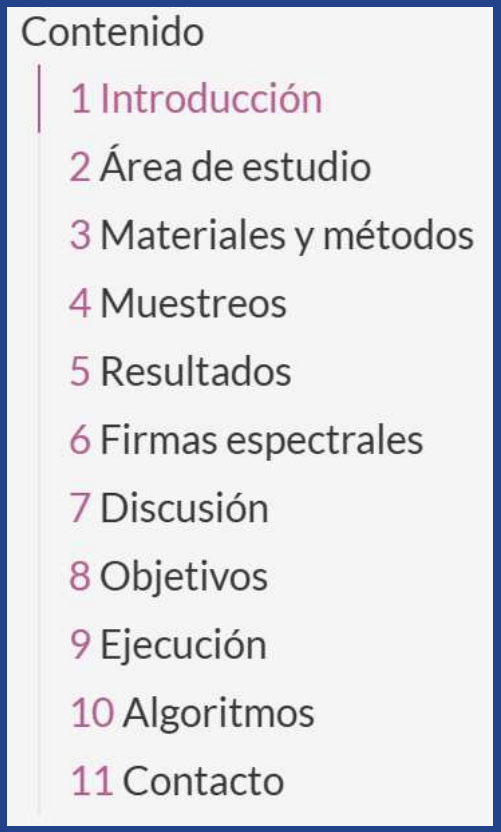
RESUMEN
La calidad del agua del Río Paraná...

PALABRAS CLAVE
Río Paraná, Calidad de agua, Sentinel-2, Teledetección satelital

ENLACES DE CÓDIGO
Ver en GitHub, Informar un problema, Wiki del proyecto

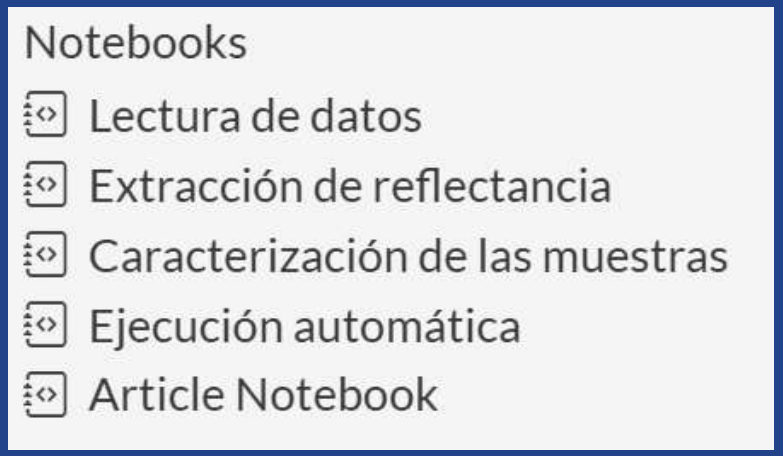
2.2 Table of content

- Sections and subsections
- Ease website navigation
- Variable content according to the development



2.3 Notebooks

- Source code description
- Processing data justification
- Calculus methodology explanation to promote reproducibility



2.4 References

- Formatted references according to desired style (`.csl`)
- Reference preview on citation hover

Referencias

[1] United Nations General Assembly, «Work of the Statistical Commission Pertaining to the 2030 Agenda for Sustainable Development», 2017.

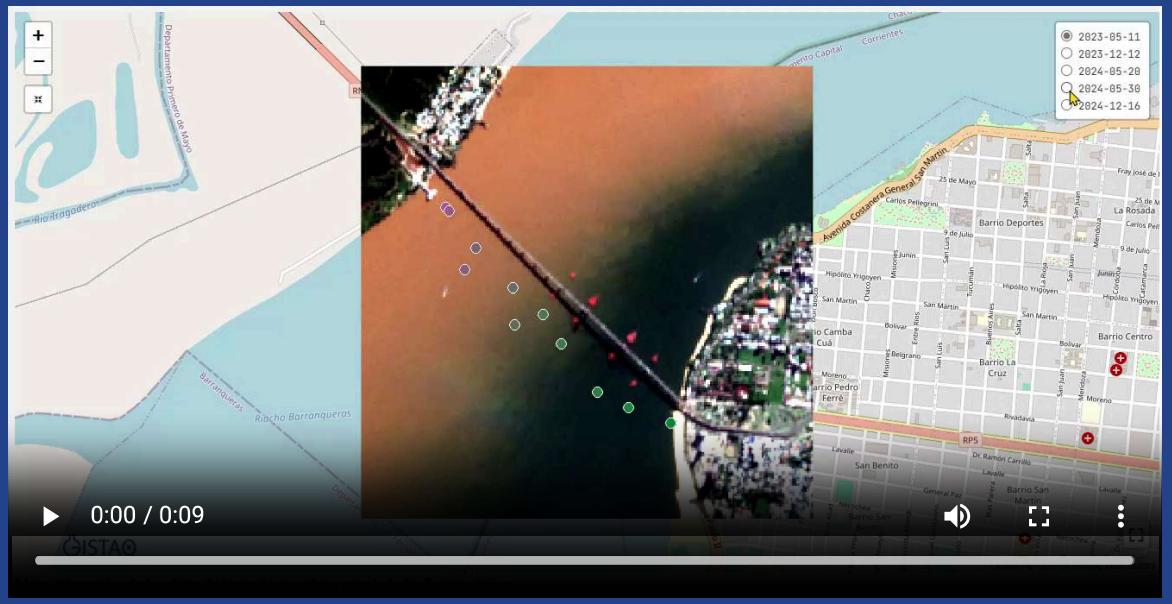
[2] M. Bonansea *et al.*, «Evaluating the feasibility of using Sentinel-2 imagery for water clarity assessment in a reservoir», *Journal of South American Earth Sciences*, vol. 95, nov. 2019, doi: 10.1016/j.jsames.2019.102265.

[3] M. H. Gholizadeh, A. M. Melesse, y L. Reddi, «A Comprehensive Review on Water Quality Parameters Estimation Using Remote Sensing Techniques», *Sensors (Switzerland)*, vol. 16, n.º 8, 2016, doi: 10.3390/s16081298.

[4] A. Ferral *et al.*, «In-Situ and Satellite Monitoring of Water Quality of an Eutrophic Lake with an Artificial Air Diffusion System», *IEEE Latin America Transactions*, vol. 16, pp. 627-633, 2018, doi: 10.1109/TLA.2018.8327422.

2.5 Maps, tables & interactive plots

- Results visualization
- Correlation between parameters exploration
- Spectral properties description
- Sample site location

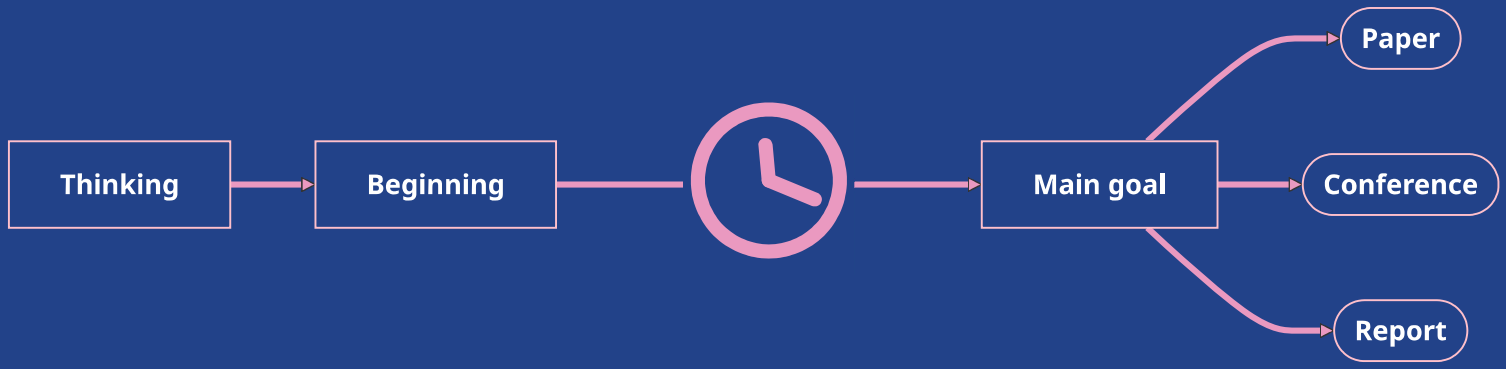


Web site

```
1 https://vhgauto.quarto.pub/gistaq-parana/
```

3 Motivation

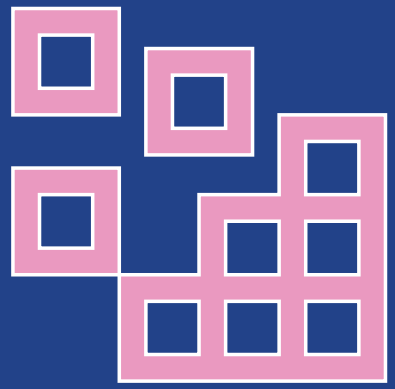
Research project typical life journey.



- Water sampling
- Physicochemical test
- Partial results analyses
- Reference reading
- Other tasks

3.1 During the project development

- Dynamic document, that adapts to the current project state.
- Easy access site to check the latest results.
- Unified reference search.
- Script code execution and results reproducibility.
- All project members can work seamless and without problems and no fear of disarranging the document.
- Consultation resource and to admire all the effort done.



4 Tools

- R y Python: reading and data collection; processing and results storage; plots, tables and maps generation.
- Git y GitHub: version control management and project members collaboration.
- Quarto: to content compilation and website publishing.
  - `manuscript` allows website creation with an emphasis in reproducibility and targeted to scientific and academic documents.

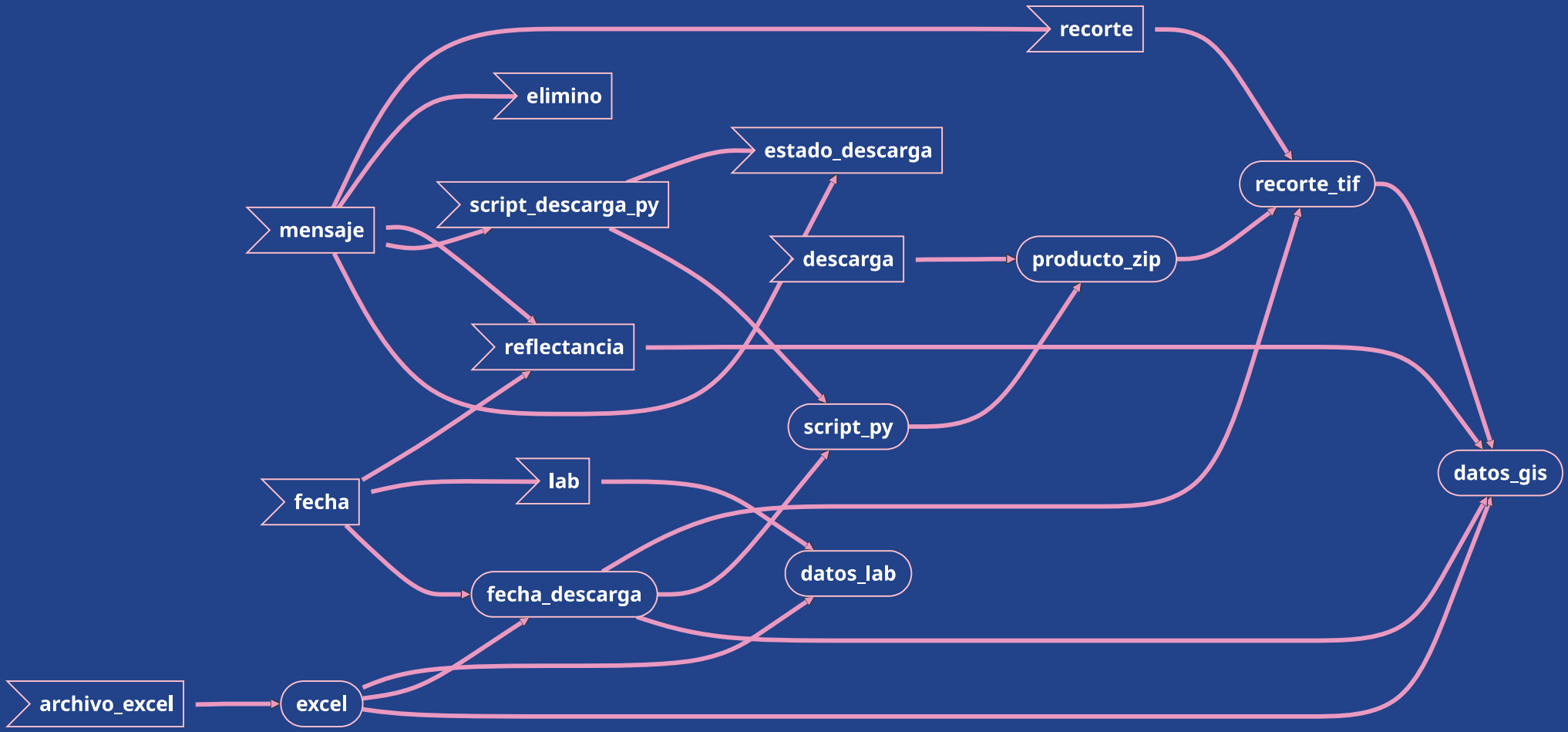
4.1 R

targets allows automatic functions execution and dependencies management between them.

Check current workflow state and execute only outdated targets.

File monitoring and code re-execution when change detection.

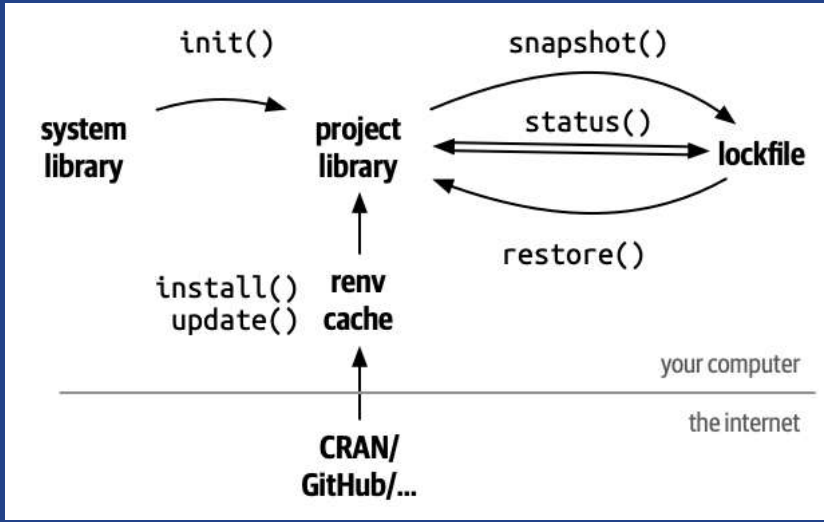
4.2 R


recorte
elimino
estado_descarga
recorte_tif
script_descarga_py
mensaje
descarga
producto_zip
reflectancia
script_py
datos_gis
lab
fecha
datos_lab
fecha_descarga
archivo_excel
excel

4.3 R

renv execution environment management, package version and its dependencies.

Log file that allows environment reproducibility.



4.4 R

tidyverse with multiple packages for general purpose data processing and manipulation.

terra for geographic data processing and vector and raster reading.

corrr linear correlation coefficient calculation.

4.5 R

ggplot2 for basic plot creation (`.png`).

ggiraph for interactive plot creation (`.html`).

leaflet for interactive map creation (`.html`).

4.6 PYTHON

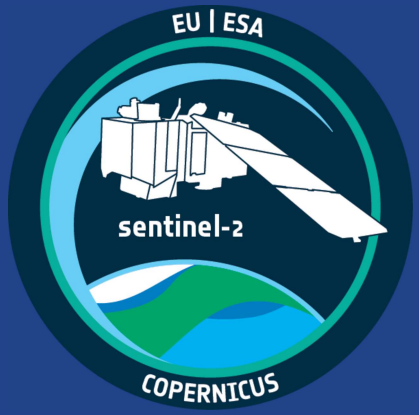
Copernicus Data Space

PROGRAMME OF
THE EUROPEAN UNION

Copernicus
Europe's eyes on Earth

esa

- Collection
- Processing level
- Region of interest
- Time range
- Credentials



4.7 GIT

Version control management and simultaneous collaboration between project members.

`github` cloud storage service.

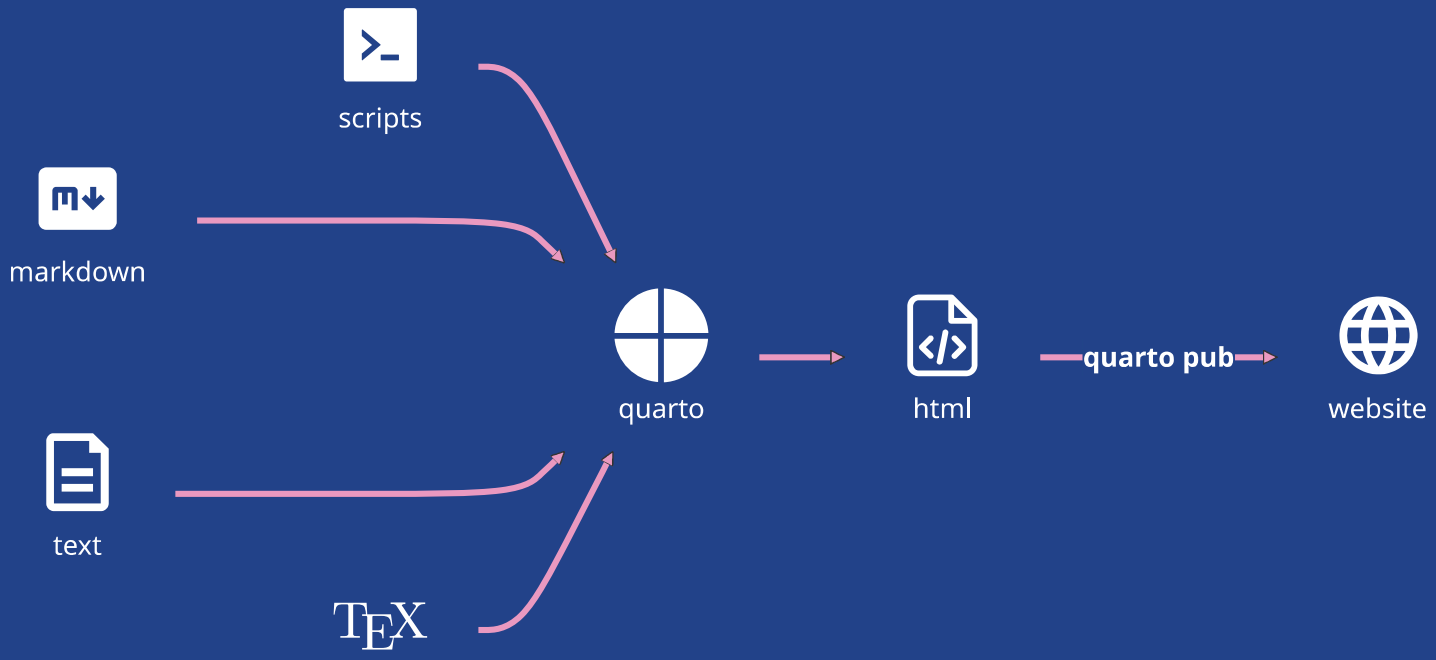
`branch` per member, so each one works in a specific section without interfering with the remaining repository.

`pull request` to request adding changes.

`merge` to combine changes once checked and accepted.

4.8 QUARTO

- Combines code execution by programming language and narrative text to create a product in multiple formatted options
- Offers a publishing platform for the output and to access it as a website



4.9 QUARTO

4.10 QUARTO

- **Manuscript** is design for scientific document authoring, with emphasis in reproducibility, since it encourages the readers to explore processing scripts (notebooks).

- Offers multiple static outputs that follow an specific template from a magazine.

- It allows to deploy the website in Quarto Pub or GitHub Pages .

- In combination with targets, plots/tables/maps are regenerated with new data input, or script modification, updating the results.

4.11 QUARTO

File and directories tree.

```
quarto_manuscript
├── bibliography
│   ├── ieee.csl
│   └── reference.bib
├── data
│   ├── laboratory.csv
│   └── reflectance.csv
├── plot
│   ├── boxplot.png
│   └── time_series.png
├── manuscript.qmd
├── notebooks
│   ├── plots.qmd
│   └── data_reading.qmd
├── _publish.yml
├── raster
├── scripts
│   ├── functions.R
│   └── support.R
├── vectors
├── _quarto.yml
└── _targets.R
```

4.12 QUARTO

manuscript.qmd

```
---
title: Research Project
author: Víctor Gauto
date: last modified
---

# Introducción

**Paraná River** has <i>water</i>.

```{r}
ggplot(data, aes(x, y)) +
  geom_point()
```
```

4.13 QUARTO

_quarto.yml

```yaml
project:
  type: manuscript

manuscript:
  article: manuscrito.qmd
  notebooks:
    - notebooks/data_reading.qmd

format:
  html:
    lang: es
    include-in-header:
      - extras/favicon.html
    theme:
      - extras/my_style.scss
    toc: true
    code-link: true
    code-copy: true
    tbl-cap-location: margin
    fig-cap-location: bottom
    bibliography: bibliography/reference.bib
    csl: bibliography/ieee.csl
    html-math-method: katex
```

4.14 QUARTO

_publish.yml

```yaml
- source: project
  quarto-pub:
    - id: ff90d76c-20c0-4210-8791-5d868ede4c50
      url: https://vhgauto.quarto.pub/gistaq-parana
```

5 Conclusion

The **Research Project** development allowed us to learn a new set of tools.

6 Future improvements

- Rewrite functions used by targets.
  - Define arguments clearly.
  - Return descriptive messages during runtime and in case of errors.
  - Incorporate website rendering.
- Optimize satellite data download, avoiding to get the entire product.
  - Google Earth Engine.
  - rsi package.
- Organice website visual features (colors, fonts, styles, margins) in the `.scss` file.
- Use the full potential of **Manuscript**, so the results are created by the notebooks.

Thanks for your time

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/vhgauto

7 Resources

Download

This presentation repository

Reproducible Manuscripts with Quarto - posit::conf(2023)

Quarto for Academics | Mine Çetinkaya-Rundel

Quarto | Get started

Quarto Manuscripts

The {targets} R package user manual

Introduction to renv

R for Data Science (2e)

ggiraph-book

Quarto: The Definitive Guide

Website repository

Quarto Extensions

Official repository for Citation Style Language (CSL) citation styles

The End