

Species parameter estimation using traits4models

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Outline

1. Why package `traits4models`?
2. Harmonization of plant trait databases
3. Harmonization of allometry databases
4. Creating species parameter tables for `medfate`

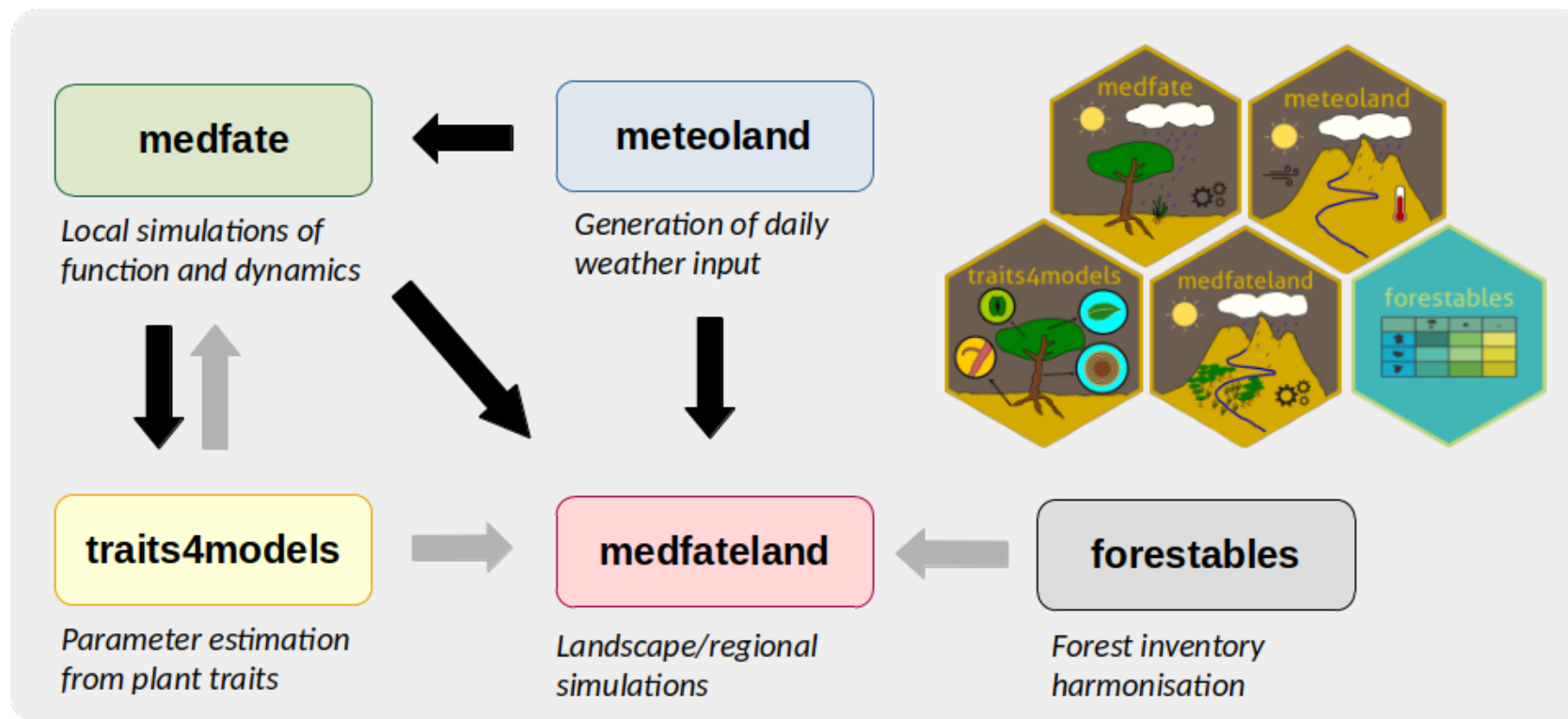


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1. Why package `traits4models`?

Purpose

- Process-based models like **medfate** are challenging to parameterize for new areas!
- Package **traits4models** is designed to facilitate creating plant species parameter tables for process-based models of forest function and/or dynamics.
- Utility functions are provided to:
 - a. Harmonize *plant trait* databases.
 - b. Harmonize *plant allometry* databases.
 - c. Populate model *species parameter tables* from harmonized data.



2. Harmonization of plant trait databases

Why harmonization?

1. Species parameter values cannot be drawn from a single data source.
2. The availability of plant trait data **progressively increases**, as additional efforts are made in observational or experimental studies.
3. Multiple data sources need to be harmonized before species parameter tables are build.

Harmonization procedure

General procedure

For each trait data source, harmonization needs to be conducted in terms of:

- **Task a** - Definition and nomenclature of measured traits
- **Task b** - Trait measurement units
- **Task c** - Taxonomy of the plant entities

How it is done in traits4models?

- The package provides a data table called `HarmonizedTraitDefinition` that presents plant trait definitions and their required notation and units.
- Tasks **a** and **b** should be performed manually using **tidyverse** functions.
- Task **c** is conducted with the help of the taxonomic backbone provided by [World Flora Online](#)¹ and using function `harmonize_taxonomy_WFO()`.
- Function `check_harmonized_trait()` allows checking that the harmonized source is acceptable.
- Results are stored as `csv` or `rds` (compressed) format.
- The procedure is illustrated in vignette [Trait database harmonization](#).

1. Kindt, Roeland. 2020. "WorldFlora: An R Package for Exact and Fuzzy Matching of Plant Names Against the World Flora Online Taxonomic Backbone Data." *Applications in Plant Sciences* 8 (9): e11288. <https://doi.org/10.1002/app2.11288>

3. Harmonization of allometry databases

Harmonization procedure

General procedure

For each allometry data source, harmonization needs to be conducted in terms of:

- **Task a** - Definition and nomenclature of **response** and **predictor** variables
- **Task b** - Formulation of allometric equation
- **Task c** - Taxonomy of the plant entities

How it is done in traits4models?

- Tasks **a** and **b** should be performed manually using **tidyverse** functions but following a **harmonized vocabulary** to describe the *equation*, the *response variable*, the *predictor variables* and the *parameter names*.
- Task **c** is conducted with the help of the taxonomic backbone provided by [World Flora Online](#)¹ and using function `harmonize_taxonomy_WFO()`.
- Function `check_harmonized_allometry()` allows checking that the harmonized source is acceptable.
- Results are stored as `csv` or `rds` (compressed) format.
- The procedure is illustrated in vignette [Allometry database harmonization](#).

1. Kindt, Roeland. 2020. "WorldFlora: An R Package for Exact and Fuzzy Matching of Plant Names Against the World Flora Online Taxonomic Backbone Data." *Applications in Plant Sciences* 8 (9): e11288. <https://doi.org/10.1002/app2.11288>

4. Creating species parameter tables for medfate

Parameter estimation procedure

The following sections describe the main steps used to create a species parameter table for **medfate** and the functions in **traits4models** that assist the process:

#	Step	Function(s)
1	Initialize the parameter table with target taxonomic entities	<code>init_medfate_params()</code>
2	Populate species parameters from forest inventory data	<code>fill_medfate_inventory_traits()</code>
3	Populate plant allometric coefficients from suitable databases	<code>fill_medfate_allometries()</code>
4	Populate plant functional traits from harmonized data bases	<code>fill_medfate_traits()</code>
5	Checking the final parameter table	<code>check_medfate_params()</code>
6	If necessary, completing strict parameters	<code>complete_medfate_strict()</code>

The procedure is illustrated in vignette [Building species parameter tables for medfate](#).



Warning

- Unfortunately, this procedure is not sufficient, as it does not include **metamodelling** and **calibration** exercises that are needed for some specific parameters!
- In the future, function `check_medfate_params()` should include verification of the relationships between physiological traits.

SpParamsMED vs. traits4models

Species trait parameter table [SpParamsMED](#) was created before **traits4models** and is provided in **medfate** as default parameter table:

```
1 dim(medfate::SpParamsMED)
```

```
[1] 217 157
```

However, the taxonomy of [SpParamsMED](#) is a **simplification** of that of the Spanish National Forest Inventory (IFN).

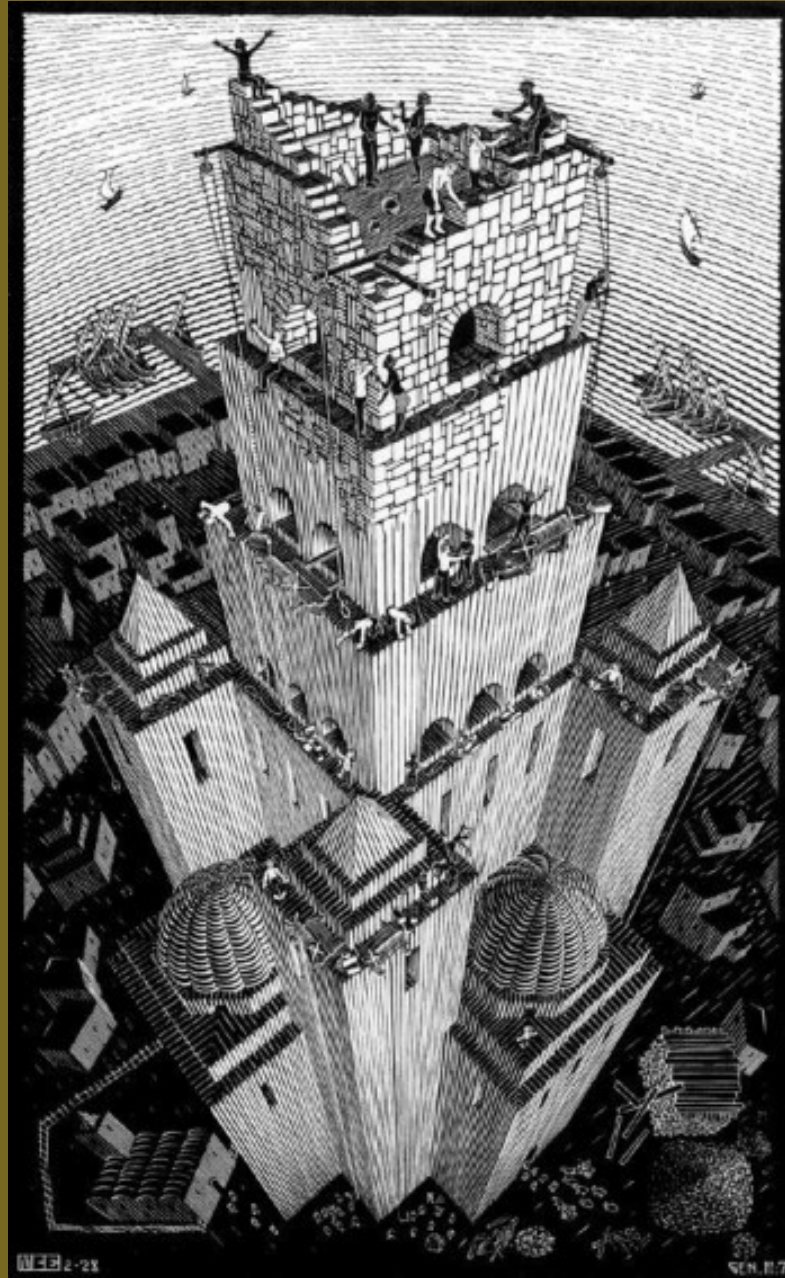
Package **traits4models** provides [SpParamsES](#) which has more taxonomic entities, matching IFN taxonomy and ready to be used when parsing forest plot data with package **forestables**:

```
1 dim(traits4models::SpParamsES)
```

```
[1] 530 156
```

Data sets [SpParamsES](#), [SpParamsFR](#) and [SpParamsUS](#) provided in **traits4models** follow the populating procedure explained here.

[SpParamsMED](#) is still supported, but [SpParamsES](#), [SpParamsFR](#) and [SpParamsUS](#) are more likely to be **maintained** and **curated** in the long term.



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