Package 'nilsier'

October 6, 2025

Type Package

Title Design-Based Estimators for NILS

Version 0.1.1

Description Estimators and variance estimators tailored to the NILS hierarchical design (Adler et al. 2020, <https://res.slu.se/id/publ/105630>; Grafström et al. 2023, <https://res.slu.se/id/publ/128235>).
The National Inventories of Landscapes in Sweden (NILS) is a long-term national monitoring program that collects, analyses and presents data on Swedish nature, covering both common and rare habitats <https://www.slu.se/om-slu/organisation/institutioner/skoglig-resurshushallning/miljoanalys/nils/>.

License AGPL-3

Encoding UTF-8

Language en-GB

Depends R (>= 4.2)

Imports Rcpp (>= 1.0.14)

LinkingTo Rcpp

URL <https://github.com/envisim/nilsier/>

NeedsCompilation yes

LazyData true

RoxygenNote 7.3.2

Author Wilmer Prentius [aut, cre] (ORCID: <https://orcid.org/0000-0002-3561-290X>)

Maintainer Wilmer Prentius <wilmer.prentius@slu.se>

Repository CRAN

Date/Publication 2025-10-06 08:10:07 UTC

Contents

---

nilsier-package   *nilsier: Design-Based Estimators for NILS*

Description

Estimators and variance estimators tailored to the NILS hierarchical design (Adler et al. 2020, https://res.slu.se/id/publ/105630; Grafström et al. 2023, https://res.slu.se/id/publ/128235). The National Inventories of Landscapes in Sweden (NILS) is a long-term national monitoring program that collects, analyses and presents data on Swedish nature, covering both common and rare habitats https://www.slu.se/om-slu/organisation/institutioner/skoglig-resurshushallning/miljoanalys/nils/.

Details

Estimates are produced per category and tract, and subsequently combined. Variance estimation takes into account some of the dependencies that exists between categories.

If the PSU collections were drawn using some spatially balanced design, the variance estimator assuming OSU sampling of PSUs will overestimate the variance. An alternative variance, such as the local mean variance estimator, can be used in order to reduce this overestimation somewhat (Grafström & Schelin, 2014).

Conceptual overview of NILS hierarchical design:

The primary sampling unit is a tract, and in the first step, a large number of tracts are selected (PSU1). From the collection PSU1, a smaller sample of tracts is drawn to form PSU2, and this process continues to subsequent levels.

Each tract consists of a grid of 14 x 14 circular plots, each with a 10 m radius.

Amongst PSU1, some categories (strata) are identified. The plots in the tracts are assigned to one of these categories or marked as unclassified (considered uninteresting at that stage). Within each tract, a sample of plots is then drawn from each category.

At lower PSU levels, additional categories are introduced, and previously unclassified plots are assigned to one of these new categories.

For further details on the design (in Swedish), see e.g. Adler et al. (2020) and Grafström et al. (2023).

Author(s)

Wilmer Prentius <wilmer.prentius@slu.se>.

References

Adler, S., Christensen, P., Gardfjell, H., Grafström, A., Hagner, Å., Hedenås, H., & Ranlund, Å. (2020). Ny design för riktade naturtypsinventeringar inom NILS och THUF. Arbetsrapport 513. Institutionen för skoglig resurshushållning, Sveriges lantbruksuniversitet, SLU.

Grafström, A., Randlund, Å., & Adler, S. (2023). Skattningar baserade på hierarkiska urval. Arbetsrapport 558. Institutionen för skoglig resurshushållning, Sveriges lantbruksuniversitet, SLU.

Grafström, A., & Schelin, L. (2014). How to select representative samples. Scandinavian Journal of Statistics, 41(2), 277-290.

See Also

Useful links:

- <https://github.com/envisim/nilsier/>

---

coef.NilsEstimate   *Estimates of a NILS estimate*

Description

Accesses the estimate and variance estimate of a NilsEstimate object.

Usage

```
## S3 method for class 'NilsEstimate'
coef(object, ...)
```

Arguments

object	A NilsEstimate object.
...	Additional arguments (currently unused).

Value

A named vector with the following elements:

estimate Estimated total of the target variable.

variance Estimated variance of the total estimator.

Examples

```
obj = NilsEstimate(plots, tracts, psus, category_psu_map);
coef(obj);
```

---

efilter   *Filter NILS estimates*

Description

Filters a NilsEstimate object by PSU level or category.

Usage

```
efilter(obj, ...)

## S3 method for class 'NilsEstimate'
efilter(obj, psus = NULL, categories = NULL, ...)
```

Arguments

obj	A NilsEstimate object.
...	Additional arguments (currently unused)
psus	An optional vector of PSU IDs to keep.
categories	An optional vector of the category IDs to keep.

Value

a filtered NilsEstimate object.

Examples

```
obj = NilsEstimate(plots, tracts, psus, category_psu_map);

# Keep only category with ID 1
efilter(obj, categories = 1)

# Keep PSU 5
efilter(obj, psus = 5)
```

NilsEstimate   *Estimate totals using the NILS hierarchical design*

Description

Estimates the total of some variable surveyed under the NILS hierarchical sampling framework.

Usage

```
NilsEstimate(
  plot_data,
  tract_data,
  psus,
  category_psu_map,
  area = 46519242.1175867,
  tract_area = 196 * 100 * pi
)

NilsEstimateBalanced(
  plot_data,
  tract_data,
  auxiliaries,
  psus,
  category_psu_map,
  area = 46519242.1175867,
  tract_area = 196 * 100 * pi,
  size_of_neighbourhood = NULL
)
```

Arguments

plot_data
: A data frame with information about observations at the plot level. Must contain (in order):
    1. The tract ID (integer) of the parent tract.
    2. The category ID (integer) recorded for the plot.
    3. The design weight (double) for the plot, conditional on the tract.
    4. The observed value of the target variable (double).

tract_data
: A matrix with information about all sampled tracts, including those where no relevant categories were found. Must contain (in order):
    1. The tract ID (integer) of each sampled tract.
    2. The PSU collection ID (integer) of the smallest PSU that contains the tract.

psus
: An ordered vector of PSU levels, from largest to smallest.

category_psu_map
: A matrix describing the categories used in the design. Must contain (in order):
    1. The category ID (integer), as used in `plot_data`.
    2. The PSU collection ID (integer) of the smallest PSU in which the category is sampled.

area
: The size of the area frame. Typically larger than the actual area of interest.

tract_area
: The area of a tract, expressed in the same units as the target variable.

auxiliaries
: A numeric matrix of auxiliary variables used for balancing. Must have the same dimensions and order as `tract_data`.

size_of_neighbourhood
: An optional numeric vector specifying the neighbourhood size for each PSU level.

Details

The function combines plot-level observations (`plot_data`), tract-level information (`tract_data`), PSU hierarchy (`psus`), and category assignments (`category_psu_map`) to estimate totals under the NILS sampling design.

> **Variance estimation for spatially balanced sampling:** `NilsEstimateBalanced`:
>
> In the balanced variant, variance is estimated using a local neighbourhood deviance measure. The neighbourhood size defaults to 4 for the smallest PSU level and increases linearly with PSU level size.
>
> Covariance between categories belonging to different PSU levels are measured over their intersection, i.e. on the smaller PSU collections. Consequently, the smaller PSU collection also determines the local neighbourhood size.
>
> It is possible to provide a matrix as `psus` instead of a vector. This matrix should contain:
>
> 1. PSU IDs, ordered from largest to smallest (by PSU size).
> 2. The neighbourhood size for each PSU.
>
> If `psus` is provided as a vector, the neighbourhood size of PSU k defaults to
>
> $$4 \frac{n_k}{n_{(0)}},$$
>
> where n_k is the size of PSU collection k, and $n_{(0)}$ is the size of the smallest PSU collection.

Value

A `NilsEstimate` object, essentially a data frame with one row per category and the following columns:

Cat. ID The category ID number.

Est. total The estimated total of the target variable within the category.

Est. variance The estimated variance of the total estimator within the category.

Positive tracts The number of tracts with at least one positive value of the target variable in the category.

Examples

```
obj = NilsEstimate(plots, tracts, psus, category_psu_map);

obj = NilsEstimateBalanced(
  plots,
  tracts,
  tract_auxiliaries,
  psus,
  category_psu_map
);
```

PreparePlotData   *Prepare plot-level data*

Description

Reorders and extracts columns from a data frame to create a valid `plot_data` object. Column names are supplied as formulas for convenience.

Usage

```
PreparePlotData(data, tid, cat, dw, y)
```

Arguments

data	A data.frame containing plot-level information.
tid	A formula specifying the column containing tract IDs.
cat	A formula specifying the column containing category IDs.
dw	A formula specifying the column containing design weights.
y	A formula specifying the column containing the variable of interest.

Value

A data frame with the required column order for use as `plot_data`:

1. Tract ID (integer).
2. Category ID (integer).
3. Design weight (double).
4. Value of the variable of interest (double).

Examples

```
wide_df = data.frame(
  variable_y = runif(16),
  variable_x = runif(16),
  variable_z = runif(16),
  grassland_cover = plots[, 4],
  design_weight = plots[, 3],
  category = plots[, 2],
  tract_id = plots[, 1]
);

plot_data = PreparePlotData(
  wide_df,
  ~tract_id,
  ~category,
  ~design_weight,
  ~grassland_cover
);
```

---

print.NilsEstimate   *Print a NILS estimate*

Description

Prints a summary of a NilsEstimate object.

Usage

```
## S3 method for class 'NilsEstimate'
print(x, complete = TRUE, ...)
```

Arguments

x	A NilsEstimate object.
complete	Logical. If FALSE (default), excludes apparent zero-tracts from the printed output.
...	Additional arguments (currently unused)

Value

Invisibly returns the input NilsEstimate object.

---

summary.NilsEstimate   *Summarize a NILS estimate*

Description

Produces summary statistics for a NilsEstimate object.

Usage

```
## S3 method for class 'NilsEstimate'
summary(object, ...)

## S3 method for class 'summary.NilsEstimate'
print(x, ...)
```

Arguments

object	A NilsEstimate object.
...	Additional arguments (currently unused).
x	A summary.NilsEstimate.

Value

The returned list has the following components:

estimate Estimated total of the target variable.

variance Estimated variance of the total estimator.

rel_se Estimated relative standard error of the total estimator.

nonnil_tracts Number of non-nil tracts. Not shown if filtering has been applied.

Examples

```
obj = NilsEstimate(plots, tracts, psus, category_psu_map);
summary(obj);
```

---

tracts   *Sample data on cover of lawns from the NILS, 2024.*

Description

The dataset includes information collected in the southern boreal region of Sweden (i.e. the boreal region South of the Dal River).

Usage

```
tracts

tract_auxiliaries

plots

psus

category_psu_map
```

Format

`tracts`:
A matrix with 300 rows (tracts)

tid the tract id number
psu the id number of the collection of primary sampling units (PSU) of the tract

`tract_auxiliaries`:
A matrix with 300 rows (auxiliary information about the tracts)

x longitude of the tract centre
y latitude of the tract centre

elev_max the tract's maximum elevation

elev_range the tract's elevation range

nmd_artificial the area of the tract covered by buildings

nmd_open_land the area of the tract covered by open land

nmd_forest the area of the tract covered by forest

nmd_mountain_forest the area of the tract covered by low-growth mountain forest

wetness_mean the tract's mean wetness

decidiuous_sum the area of the tract covered by deciduous forest

arable the area of the tract covered by arable land

pasture the area of the tract covered by pasture

`plots`:

A matrix with 16 rows (plots)

tid the tract id number of the tract containing this plot

cat the category (stratum) of the plot

dw the conditional design weight of the plot (inverse inclusion probability)

y the variable of interest – the area of the (r=10) plot covered by grassland

`psus`:

A length 2 ordered vector of PSU collection id numbers, ranging from the largest PSU level to the smallest PSU level

`category_psu_map`:

A matrix with 2 rows (categories), containing the mapping of the largest PSU that the category map to.

category the category (stratum) id number

psu the id number of the largest PSU that the category can be observed in

Details

This sample is a reduced version of the original data, containing only the two sparsest subsamples and the two strata (selection classes/categories) sampled within them.

Source

https://www.slu.se/om-slu/organisation/institutioner/skoglig-resurshushallning/miljoanalys/nils/

vcov.NilsEstimate   *Covariance matrix for NILS category estimates*

Description

Accesses the covariance matrix of a NilsEstimate object.

Usage

```
## S3 method for class 'NilsEstimate'
vcov(object, complete = TRUE, ...)
```

Arguments

object	A NilsEstimate object.
complete	Logical. If FALSE, excludes apparent zero-tracts.
...	Additional arguments (currently unused).

Value

the covariance matrix of the NilsEstimate object.

Examples

```
obj = NilsEstimate(plots, tracts, psus, category_psu_map);
vcov(obj);
```

Index