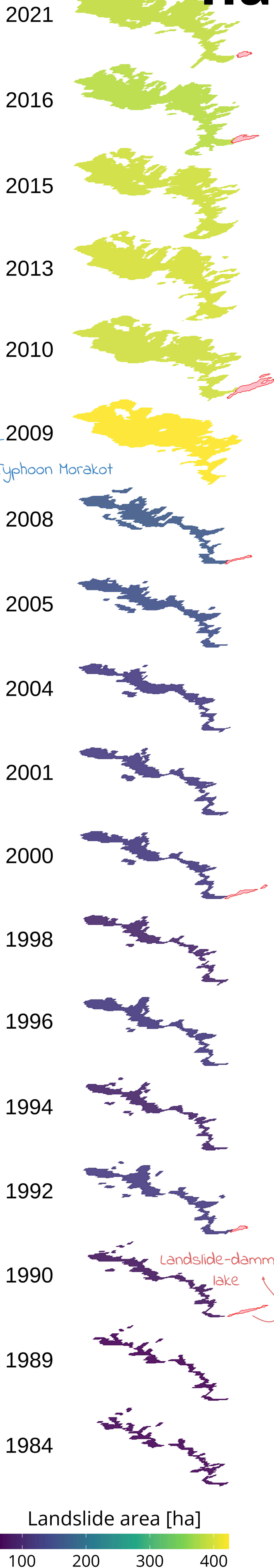


R for spatio-temporal handling of moving polygons

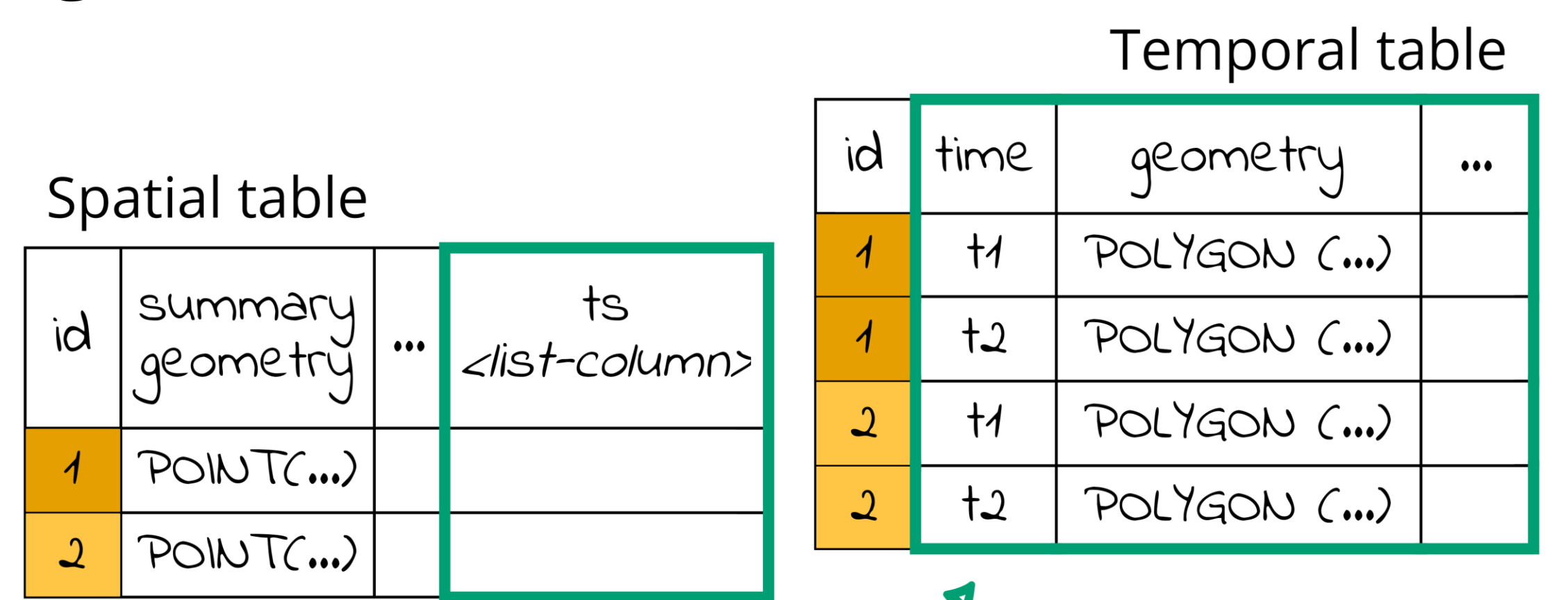
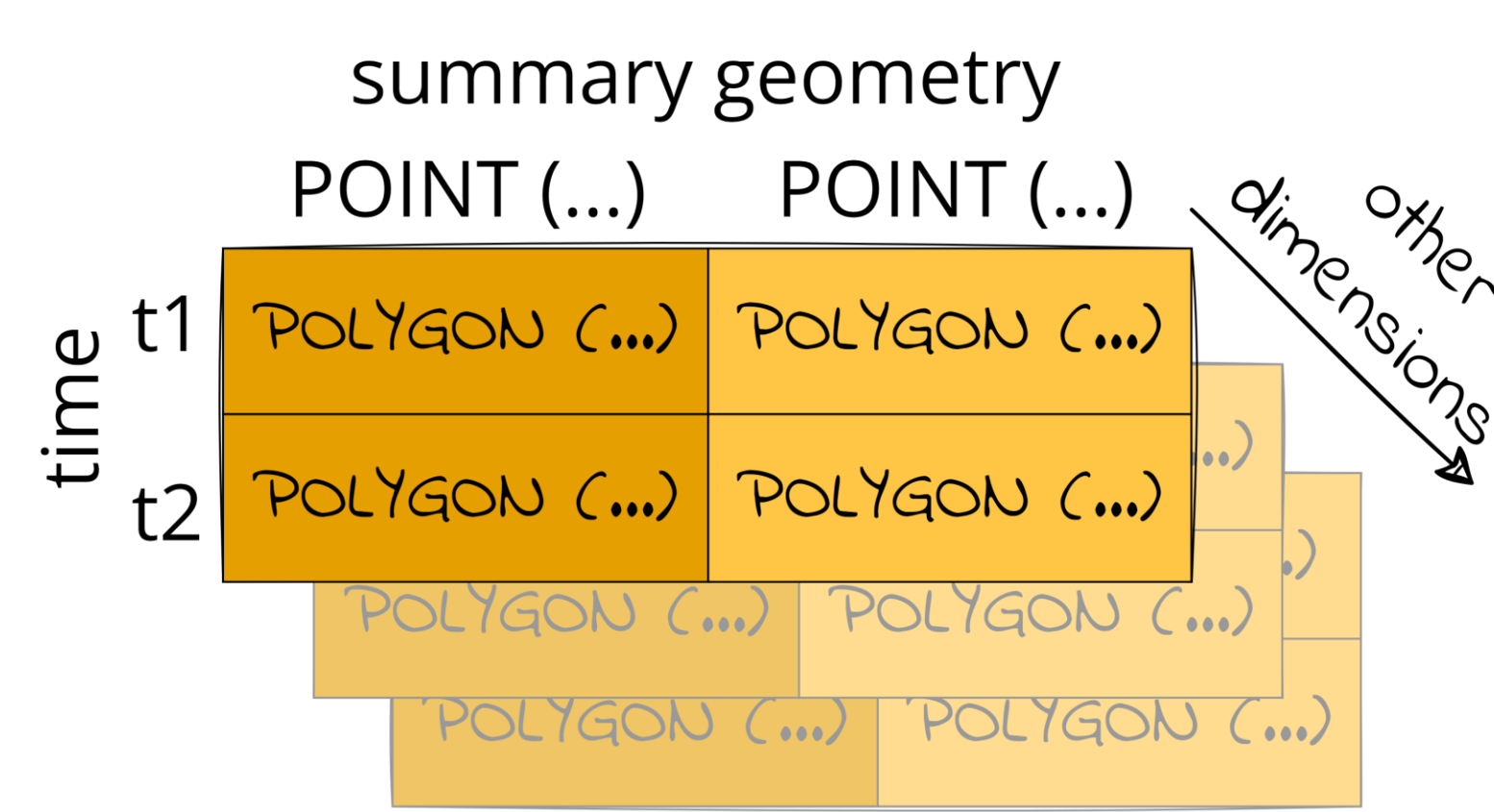


Background & Introduction

Data cubes allow handling and analysing spatio-temporal data as raster or vector. I propose using vector data cubes (VDC) to structure polygons with changing geometry and move over time.

Implementation

The concept¹ is implemented in R using {stars} and {cubble}.



CRAN 0.6-5

`install_github("r-spatial/stars")`

CRAN 0.3.0

`install_github("huizezhang-sherry/cubble")`

```
vdc |> mutate(area = st_area(geometry))

stars object with 2 dimensions and 2
attributes
attribute(s):
  geometry      area [m^2]
MULTIPOLYGON : 2   Min.   : 54517
POLYGON       :28   1st Qu.: 287810
epsg:3057     : 0   Median : 963505
+proj=lcc ... : 0   Mean   :1677119
              3rd Qu.:3084240
              Max.   :4848672

dimension(s):
  from to   refsys  point
geom_sum  1  1   EPSG:3057 TRUE
datetime  1 30   POSIXct  FALSE
              values
geom_sum    POINT (339860 380008)
datetime 2021-03-20, ..., 2021-09-30
```

```
vdc |> face_temporal() |>
  mutate(diff = difference(area))

# cubble: key: id, index: datetime, long form
# temporal: 2021-03-20 - 2021-09-30, has gaps!
# spatial: x, y, geom_sum [POINT [m]]
  id datetime geometry area diff
<int> <dtm> <POLYGON [m]> [ha] [ha]
1 1 2021-03-20 ((339233.7 380... 5.45 NA
2 1 2021-03-21 ((339159.3 380... 7.41 1.95
3 1 2021-03-22 ((339355.4 380... 13.7 6.26
```



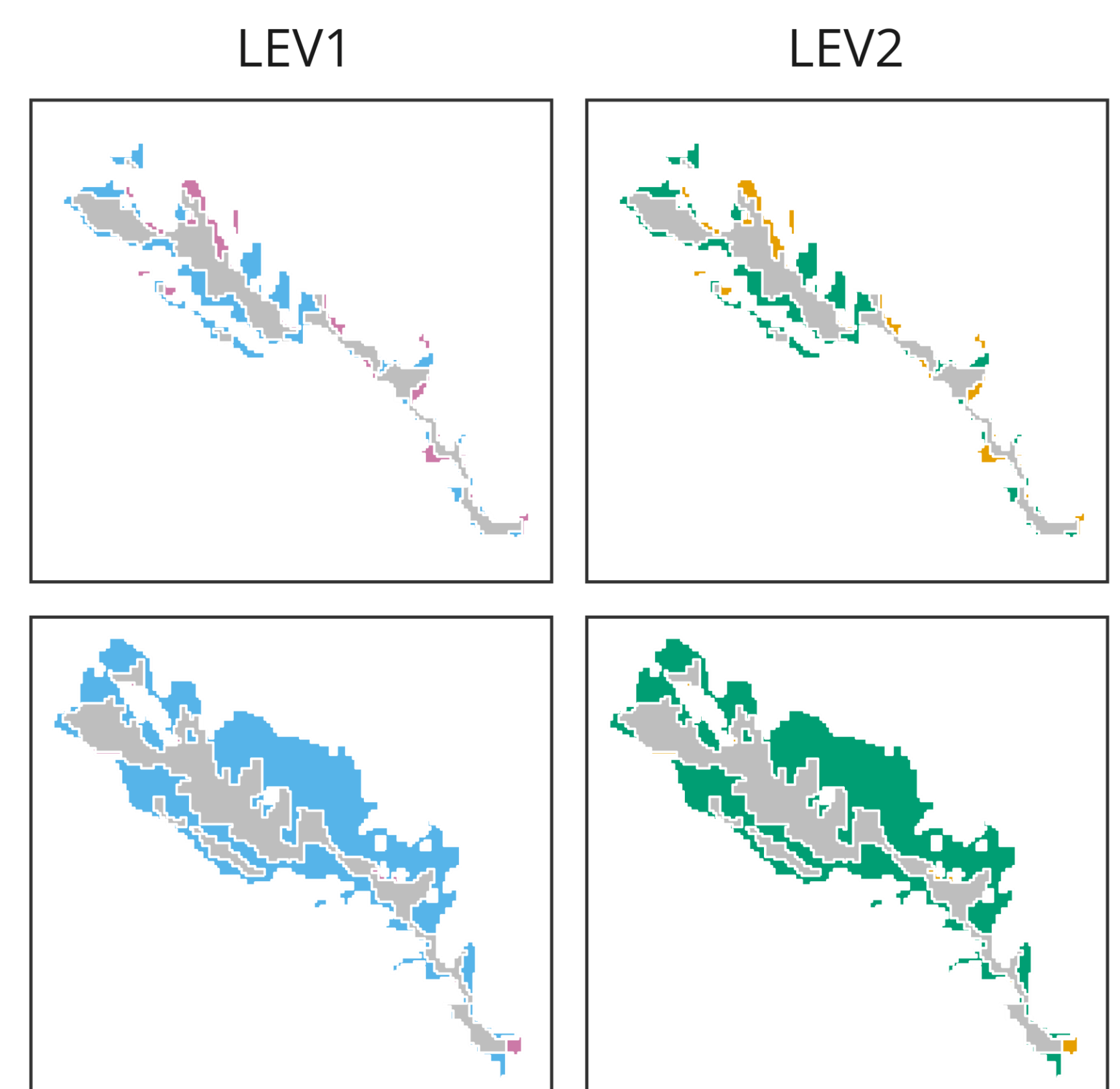
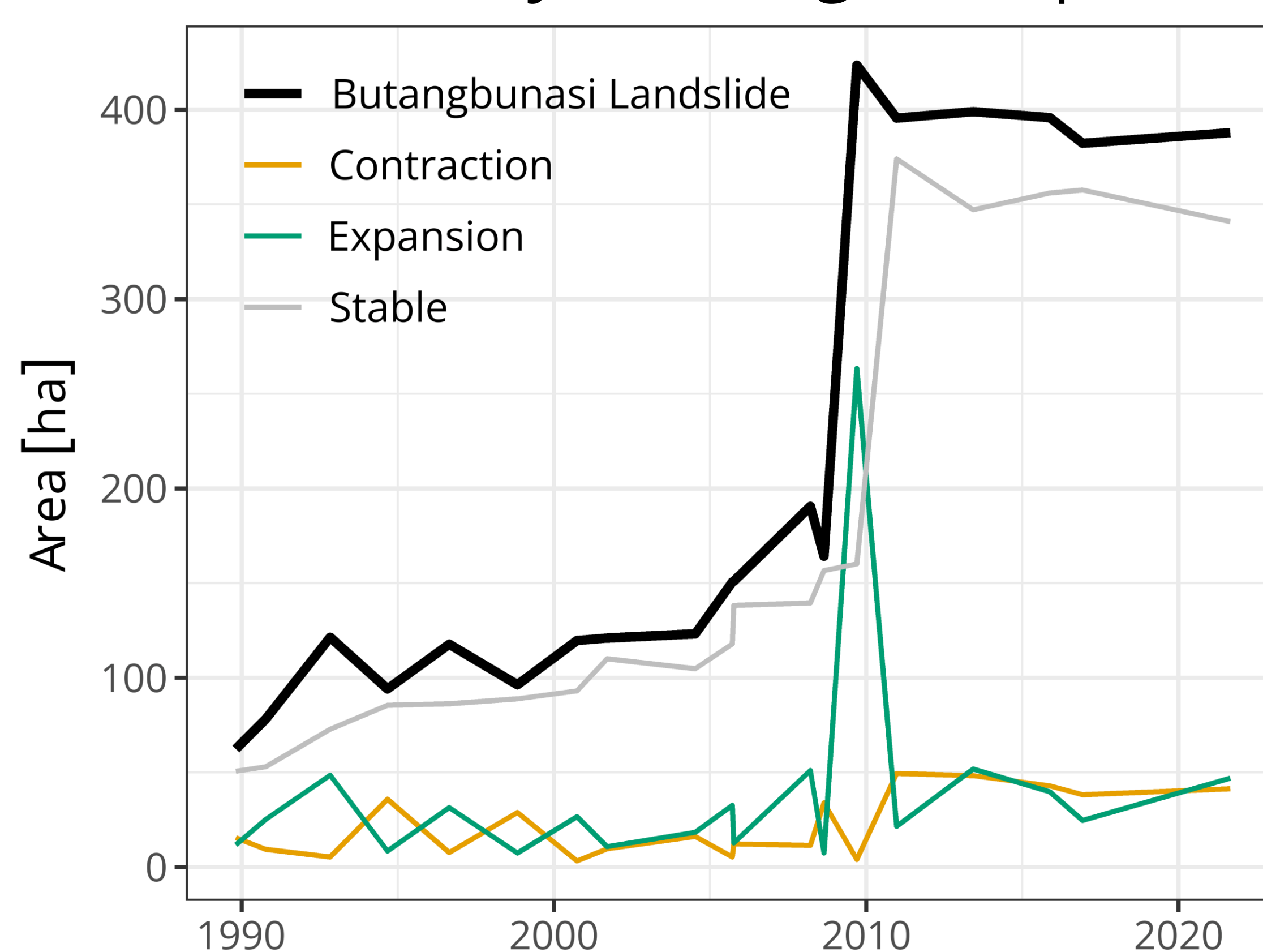
Common cube operations and data wrangling can be applied. Spatiotemporal analyses can be performed with {sf} and {tsibble}.

Further integration

STAMP² allows change analysis between polygons, including longer time series. VDC data structures can be integrated with these analyses using {stampr}.

STAMP categories

- Disappearance
- Stable
- Generation
- Contraction
- Expansion



`install_github("jedalong/stampr")` CRAN 0.3.1

¹ Abad, L. et al. 2024. "Vector data cubes for features evolving in space and time". AGILE GIScience Series. 5 (16). DOI: 10.5194/agile-giss-5-16-2024

² Robertson, C. et al. 2007. "STAMP: Spatial-Temporal Analysis of Moving Polygons". Journal of Geographical Systems 9 (3): 207-27. DOI: 10.1007/s10109-007-0044-2