

BioScape Vegetation Plots, Cape Floristic Region, South Africa, 2023

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Summary

This dataset holds vegetation composition and cover at 189 field plots in the Greater Cape Floristic Region of South Africa, collected for the Biodiversity Survey of the Cape (BioScape) project. Each plot was surveyed once between 2023-05-03 and 2023-11-01 and divided into four quadrants (NE, NW, SE, SW). The product reports quadrant-level and plot-level fractional cover of bare soil, bare rock, dead vegetation, and live vegetation, together with species-level percent cover, stem counts, and canopy diameter for 709 species. Line-intercept hits along the north-south and west-east plot diameters are also included. All species with at least 5% cover were included in the dataset, plus additional species when needed to make up 80% of the total cover. The data were collected in the field by botanists. The data are provided in comma-separated values (CSV) format along with spatial information for plots in a GeoPackage file.

This dataset includes five files in comma-separated values (CSV) format and one GeoPackage file.

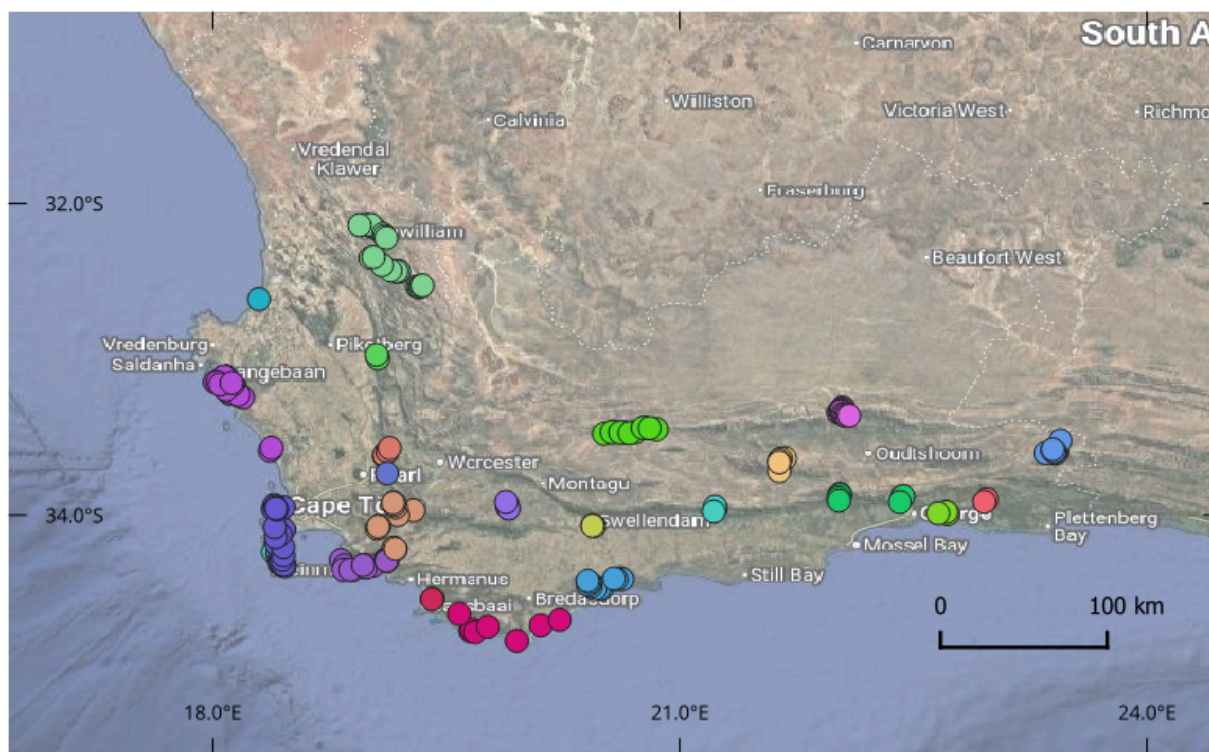


Figure 1. Locations of vegetation plots in the Greater Cape Floristic Region of South Africa colored by sampling region. Basemap: Google Maps Satellite Imagery

Citation

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1. Dataset Overview

This dataset holds vegetation composition and cover at 189 field plots in the Greater Cape Floristic Region of South Africa, collected for the Biodiversity Survey of the Cape (BioSCape) project. Each plot was surveyed once between 2023-05-03 and 2023-11-01 and divided into four quadrants (NE, NW, SE, SW). The product reports quadrant-level and plot-level fractional cover of bare soil, bare rock, dead vegetation, and live vegetation, together with species-level percent cover, stem counts, and canopy diameter for 709 species. Line-intercept hits along the north–south and west–east plot diameters are also included. All species with at least 5% cover were included in the dataset, plus additional species when needed to make up 80% of the total cover. The data were collected in the field by botanists.

Project: Biodiversity Survey of the Cape ([BioSCape](#))

The Biodiversity Survey of the Cape (BioSCape) is a research project that uses remote sensing and field data to understand the distribution, function, and importance of biodiversity on land and in the water around the Greater Cape Floristic Region (GCFR). Located in southwestern South Africa along the Atlantic coast, the GCFR is one of the world’s 36 biodiversity hotspots. BioSCape is a collaboration between the US and South Africa. The team conducted an integrated field and airborne campaign in the hyperdiverse region in 2023. Researchers collected laser altimetry LiDAR data and UV/visible to short wavelength infrared (UVSWIR) and thermal imaging spectroscopy data over terrestrial and aquatic targets using four airborne instruments: [AVIRIS-NG](#), [PRISM](#), [LVIS](#), and [HyTES](#). This airborne dataset is unique in its size and scope and unprecedented in its instrument combination and level of detail. These airborne data are accompanied by a range of biodiversity-related field observations.

Related Publication:

Cardoso, A.W., E.L. Hestir, J.A. Slingsby, C.J. Forbes, G.R. Moncrieff, W. Turner, A.L. Skowno, J. Nessler, P.G. Brodrick, K.D. Gaddis, and A.M. Wilson. 2025. The biodiversity survey of the Cape (BioSCape), integrating remote sensing with biodiversity science. *npj Biodiversity* 4. <https://doi.org/10.1038/s44185-024-00071-5>

Related Datasets:

Fitzpatrick, M.C., D. Spalink, A.J. Elmore, J. Measey, and S. Kritzing-Klopper. 2026. BioSCape: Vegetation Composition at Plots with Woody Invasives, CFR, South Africa. ORNL Distributed Active Archive Center. <https://doi.org/10.3334/ORNLDAAAC/2511>

Slimp, M., J. Malindi, R. Meyer, A. Cunningham, J. Rourke, M. Hayden, A. Hargey, J. Nessler, S. Johnson, M. Rossi, and N. Stavros. 2025. BioSCape Vegetation Surveys Berg and Eerste River Catchments, South Africa, 2022-2023. ORNL Distributed Active Archive Center. <https://doi.org/10.3334/ORNLDAAAC/2425>

Acknowledgements:

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2. Data Characteristics

Spatial Coverage: Greater Cape Floristic Region; Western Cape and Eastern Cape, South Africa

Spatial Resolution: field plots 10-m in diameter

Temporal Coverage: 2023-05-03 to 2023-11-01

Temporal Resolution: One time sample per plot

Study Area: Latitude and longitude are given in decimal degrees.

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
South Africa	18.0121	23.4480	-32.1368	-34.8096

Data File Information

This dataset includes five files in comma-separated values (CSV) format containing the plot data and one GeoPackage file holding spatial information for the plots (Table 1).

The vegetation data are organized by site. There are multiple plots per site. Each plot is divided into four quadrants (NE, NW, SE, SW). In addition, plant and non-vegetation cover were sampled along two line-intercept transects (NS, WE) in each plot.

In the CSV files, missing data are indicated by NA for text fields and -9999 for numeric fields.

Table 1. Files in this dataset.

Filename	Description	Records
<i>bioscape_veg_plot_summary.csv</i>	Mean fractional cover, vegetation height, and soil depth for each plot	189
<i>bioscape_veg_plot_species.csv</i>	Live and dead cover and abundance for each plant species by plot	1974
<i>bioscape_veg_quadrat_summary.csv</i>	Percent cover and biophysical characteristics for each quadrant within each plot	756
<i>bioscape_veg_quadrat_species.csv</i>	Live and dead cover and abundance for vegetation species by quadrant	4795
<i>bioscape_veg_line_intercepts.csv</i>	Line intercept counts by species at each plot	8316
<i>bioscape_veg_plot_spatial_info.gpkg</i>	Coordinates for plot centers and polygons of plot boundaries	499

Table 2. Variables in *bioscape_veg_plot_summary.csv*.

Variable	Units	Description
record_id	-	Unique row number in this file
plot	-	Plot code: "T" plus three digits. Unique in this file (e.g., "T001")
site_code	-	Survey area name
site_code_plot	-	Site and plot joined by "_". Unique row key.
gps_plot_centre	-	Text note on how the center was recorded
observer	-	Botanist named on the field sheet
percent_bare_soil	percent	Mean cover of bare soil of the four quadrant estimates
percent_bare_rock	percent	Mean cover of bare rock of the four quadrant estimates
percent_dead_vegetation	percent	Mean cover of dead vegetation of the four quadrant estimates
percent_live_vegetation	percent	Mean cover of living vegetation of the four quadrant estimates
veg_height_mean_cm	cm	Mean vegetation height across quadrants
soil_depth_cm	cm	Mean soil depth across quadrants
groundwater	-	Drainage class taken from the quadrants: "Well-drained, Impeded drainage", "Seepage", "Swamp", "Stream bank", "Suurvlaakte"
access_notes	-	Free-text access note
sampled	flag	Completed-survey flag; always 1.

Table 3. Variables in *bioscape_veg_plot_species.csv*.

Variable	Units	Description
record_id	-	Unique row number in this file
plot	-	Plot code
site_code	-	Survey area name
site_code_plot	-	Site and plot joined by "_"
accepted_genus	-	Accepted genus
accepted_species	-	Accepted species epithet
name_check	-	Name-check code copied from the field sheet.
genus_species_combo	-	Accepted genus and species as one label
percent_cover_alive	percent	Sum of quadrant live cover divided by 4
percent_cover_dead	percent	Sum of quadrant dead cover divided by 4
abundance_alive_count	count	Sum of live counts across quadrants
abundance_dead_count	count	Sum of dead counts across quadrants
mean_canopy_diameter_cm	cm	Mean of recorded quadrant canopy diameters
clonal	-	Is specimen clonal: "yes", "no", or NA
seasonally_apparent	-	Maximum of the quadrant values

Table 4. Variables in *bioscape_veg_quadrat_summary.csv*.

Variable	Units	Description
record_id	-	Unique row number in this file.
plot	-	Plot code.

Variable	Units	Description
site_code	-	Survey area name.
site_code_plot	-	Site and plot joined by " _ "
site_code_plot_quadrant	-	Site, plot, and quadrant joined by " _ ". Unique row key.
quadrant	-	NE, NW, SE, or SW.
gps_plot_centre	-	Text note
observer	-	Botanist named on the field sheet.
date	YYYY-MM-DD	Survey date
percent_bare_soil	percent	Percent cover of bare soil for quadrant
percent_bare_rock	percent	Percent cover of bare rock for quadrant
percent_dead_vegetation	percent	Percent cover of dead vegetation for quadrant
percent_live_vegetation	percent	Percent cover of living vegetation for quadrant
total_cover_check	percent	Sum of the four cover fractions. 14 quadrants are not 100 (Table 7).
veg_height_cm	cm	Vegetation height
post_fire_age_years	-	Time since fire as written on the sheet. The column is text because some entries are notes or Excel date serials rather than ages.
soil_depth_cm	cm	Soil depth
groundwater	-	Drainage class.
parking_gps	-	Text note that a parking location was recorded. Not a coordinate.
access_notes	-	Free-text access note.
comments	-	Free-text site description.
sheet_name	-	Source workbook: "Ross01", "Ross01b", "Ross01c", "Bio02", "Bio03", or "Bio04"
old_plot	-	Plot number before the Swartberg renumbering

Table 5. Variables in *bioscape_veg_quadrat_species.csv*.

Variable	Units	Description
record_id	-	Unique row number in this file
plot	-	Plot code
site_code	-	Survey area name
site_code_plot	-	Site and plot joined by " _ "
site_code_plot_quadrant	-	Site, plot, and quadrant joined by " _ "
quadrant	-	NE, NW, SE, or SW
accepted_genus	-	Accepted genus
accepted_species	-	Accepted species epithet. NA when the record is genus only
subspecies_or_variant	-	Subspecies or variant when one was recorded
genus_species_combo	-	Genus and species label
name_check	-	Name-check code (NA on 164 of 4795 rows)
new_species	-	Field note for a new or uncertain taxon. iNaturalist URLs are stored as inat_id. Remaining values can be notes or times.
clonal_yes_no	-	yes, no, or NA.
mean_canopy_diameter_cm	cm	Canopy diameter of the taxon in the quadrant

Variable	Units	Description
abundance_alive_count	count	Live individuals
percent_cover_alive	percent	Live cover in the quadrant
percent_cover_dead	percent	Dead cover in the quadrant
abundance_dead_count	count	Dead individuals
seasonally_apparent	flag	0, 1, or -9999 (missing)
comment	-	Note on the taxon in that quadrant. iNaturalist URLs are stored as <code>inat_id</code> ; other residual text is kept.
clonal	-	Is specimen clonal: "yes", "no", or NA
taxon	-	Same label as <code>genus_species_combo</code>
old_plot	-	Plot number before Swartberg renumbering
inat_id	-	iNaturalist observation id extracted from <code>new_species</code> or <code>comment</code> . Reconstruct the observation page URL as <a href="https://www.inaturalist.org/observations/<inat_id>">https://www.inaturalist.org/observations/<inat_id> .

Table 6. Variables in *bioscape_veg_line_intercepts.csv*.

Variable	Description
record_id	Unique row number in this file
plot	Plot code
site_code	Survey area name
site_code_plot	Site and plot joined by "_"
site_code_plot_line_transect	Site plot and transect joined by "_"
line_transect	NS (north-south) or WE (west-east)
metres_along_line	Meter mark along transect and left/right side of the rope, for example "0L" or "10R"
accepted_genus	Accepted genus when the hit is a plant
accepted_species	Accepted species epithet. NA when the record is genus only or a non-plant hit
subspecies_or_variant	Subspecies or variant when one was recorded
genus_species_combo	Genus and species label, NA for non-plant hits
name_check	Name-check code
other_cover_type	Non-plant cover at the intercept when no taxon was recorded or when both were noted: "Bare soil", "Bare rock", "Bare soil and rock", "Dead plant", or "Other"
comments	Free-text note. iNaturalist URLs are stored as <code>inat_id</code> .
old_plot	Plot number before Swartberg renumbering
inat_id	iNaturalist observation id extracted from <code>new_species</code> or <code>comment</code> . Reconstruct the observation page URL as <a href="https://www.inaturalist.org/observations/<inat_id>">https://www.inaturalist.org/observations/<inat_id> .

Spatial information for each plot is provided in *bioscape_veg_plot_spatial_info.gpkg*. The GeoPackage file holds three layers:

- `plot_centers`: 189 points and 189 unique plot IDs. The `bioscape_plot_id` attribute matches `plot` in the CSV files.
- `plot_parking`: 122 points where a vehicle was parked for the survey.
- `plot_polygons`: 188 patches of vegetation the botanists deemed to be representative of the plot (e.g. similar species, post-fire age, soil) that are at least 15 meters in radius and ideally over 50 meters.

The spatial data use geographic coordinates in the WGS-84 datum (EPSG: 4326).

Table 7. Data dictionary for attributes in *bioscape_veg_plot_spatial_info.gpkg*.

Variable	Description
<code>bioscape_plot_id</code>	Name of the BioScape plot. Matches <code>plot</code> variables in the CSVs.

region	General region where the plot is located.
botanist	Name of the botanist who conducted the vegetation survey.
date_time	Clock time of the GPS measurement (YYYY-MM-DDThh:mm:ss); the source text did not include a timezone.
name	Name the botanist gave the plot
description	Notes made by the botanist
plot_note	Short free-text note.
quality_flag ¹	Flag assigned by the Townsend team while visiting the plot during BioSCape: 24 = Low vegetation, 10 = Boundary, 7 = Other, 3 = Trampled, 2 = Accessibility, 2 = Removed invasive, 1 = Grazing.
quality_flag_2 ¹	Second Townsend team visit flag. One plot is Boundary.
location_flag ¹	The original GPS may not have been taken at the plot center. This flag is set when that plot's BioSCape center and its own Townsend center differ by more than 10 m. The stored value is See Townsend alternative location. See townsend_long and townsend_lat.
pt_plot_a ¹	Townsend opportunistic plot associated with this BioSCape plot. Additional plots were collected where the original plot had a quality flag, where nearby vegetation was similar but had a different dominant species, or where a nearby patch was a single species.
pt_plot_b ¹	A second Townsend plot label. See pt_plot_a.
pt_plot_c ¹	A third Townsend plot label. See pt_plot_a.
pt_plot_d ¹	A fourth Townsend plot label. See pt_plot_a.
townsend_long ¹	Alternative longitude in decimal degrees of the plot center marked by the Townsend team.
townsend_lat ¹	Alternative latitude in decimal degrees of the plot center marked by the Townsend team.

¹The Townsend team set up additional plots nearby to record the distinct communities (pt_plot_a through pt_plot_d).

"Low vegetation" means cover was very low, and an alternative plot was often marked nearby where cover was higher. "Boundary" means the plot was placed on the boundary of two vegetation types. "Trampled" means previous visitors had trampled the plot. "Removed invasive" means a Townsend-team botanist removed an invasive individual that could have been present during the flights. "Grazing" means there was evidence of grazing. "Other" and "Accessibility" indicate notes recorded for some plots.

3. Application and Derivation

These plots are the environmentally stratified vegetation surveys for BioSCape. They are the ground observations for comparing field composition and structure with the campaign airborne imaging spectroscopy and lidar (AVIRIS-NG, PRISM, LVIS, and HyTES) over the Greater Cape Floristic Region (Cardoso et al., 2025).

Use the plot-level data for one cover and count per taxon per plot. Use the quadrat tables when the within-plot measurements are important. Use *bioscape_veg_line_intercepts.csv* for point hits along the plot diameters. The woody-invasive plots (Fitzpatrick et al., 2026) were sited near this network and are comparable only after that placement difference is taken into account.

4. Quality Assessment

Cover fractions are visual estimates. This version does not add an uncertainty column. The variable `total_cover_check` in *bioscape_veg_quadrat_summary.csv* is the field sum of bare soil, bare rock, dead vegetation, and live vegetation; some quadrants do not sum to 100% (Table 8).

Table 8. Fourteen quadrants with `total_cover_check` not equal to 100% in *bioscape_veg_quadrat_summary.csv*

site_code_plot_quadrant	total_cover_check
capepoint_T070_NE	104
capepoint_T070_NW	105
capepoint_T070_SE	102
capepoint_T070_SW	105
capepoint_T265_NE	120
capepoint_T265_NW	130

capepoint_T265_SE	150
capepoint_T265_SW	140
gardenroute_T148_SW	101
langeberg_T117_NE	107
langeberg_T117_NW	105
outeniqua_T261_NW	90
rooiberg_3_SW	103
swartberg_T026_NW	115

This is Version 1 (i.e., v20261007) of this dataset and incorporates these changes from the source tables:

- Site codes on 0 plots in the species tables were replaced with the plot-summary spelling so `site_code_plot` joins.
- One identical quadrat-species row was removed.
- iNaturalist observation URLs in `new_species`, `comment`, and `line_comments` were moved to `inat_id` (37 quadrat-species rows and 20 line-intercept rows had an iNaturalist URL). Residual free-text notes were kept. Non-iNaturalist URLs were left in place.
- Personal contact details in `access_notes` were redacted.
- The observer value "deb" and the spatial botanist name "Doug Euston-Brown" are stored as "Douglas Euston-Brown".
- Spatial source drops the duplicate T114 center and its location flag, sets T074 region to CapePoint, links T183 to associated plot pt183, stores `pt_plot_d` as one column, and uses real missing values instead of the text NA in Townsend plot labels.

Relative to the data pre-release v20241104, the v20261007 sources rename T222 *Senecio subcanescens* to *Senecio rigidus* and set T091 *Metalasia densa* live abundance from 20 to 1 (with a note on the inconsistent cover versus count).

Thirteen quadrat-by-taxon keys occur more than once because the cover or count differed in source data (Table 9). The `record_id` variable keeps those rows distinct. The plot species file was summed from the source table, so those repeated measurements are included in its cover and counts.

Line intercepts are present for 188 of 189 plots (missing: T086). Plot T096 has two hits at every transect mark (88 rows). `post_fire_age_years` remains text. `name_check` is the code written on the field sheet; the taxonomic authority list is not in these tables.

Table 9. Cases wherein the quadrat-by-taxon keys occur more than once in quadrant data.

site_code_plot_quadrant	genus_species_combo	number of occurrences
anysberg_T106_SE	<i>Elytropappus rhinocerotis</i>	2
anysberg_T108_NW	<i>Ruschia pungens</i>	2
cederberg_T243_SW	<i>Anthospermum aethiopicum</i>	2
dehoop_T132_NE	<i>Pterocelastrus tricuspidatus</i>	2
gardenroute_T147_NE	<i>Helichrysum patulum</i>	2
gardenroute_T147_NW	<i>Helichrysum patulum</i>	2
gardenroute_T147_SE	<i>Helichrysum patulum</i>	2
gardenroute_T147_SW	<i>Helichrysum patulum</i>	2
langeberg_T186_SE	<i>Erica anguliger</i>	2
langeberg_T186_SE	<i>Penaea mucronata</i>	2
outeniqua_T185_SE	<i>Protea neriifolia</i>	2
rooiberg_3_SW	<i>Drosanthemum</i>	2
rooiberg_T245_SW	<i>Agathosma mundtii</i>	2

5. Data Acquisition, Materials, and Methods

Plots were placed across reserves and passes in the Greater Cape Floristic Region for the 2023 BioSCape field campaign (Cardoso et al., 2025). Each surveyed plot has four quadrants: NE, NW, SE, and SW. In each quadrant, the botanist recorded fractional cover of bare soil, bare rock, dead vegetation, and live vegetation; vegetation height; soil depth; drainage; and, for each vascular plant taxon, live and dead percent cover, live and dead counts, and canopy diameter. Centers were located with a Trimble GPS. The coordinate values are in the `plot_centers` layer of *bioscape_veg_plot_spatial_info.gpkg*.

Two perpendicular line-intercept transects crossed at the plot center along the north–south (NS) and west–east (WE) diameters. At each 1 m mark from 0 to 10 m, the botanist recorded the plant or other cover immediately left (L) and right (R) of the rope from a canopy view. Those hits are stored in the line-intercepts table.

Field records were kept in six Google Sheets workbooks (Ross01, Ross01b, Ross01c, Bio02, Bio03, Bio04). This Version 1 (v20261007) compilation was built from workbook downloads dated 2026-10-07. An R script *workflow/plot_data_compile_xlsx.R* (see GitHub URL below) was used to stack the SiteData tabs, plot tabs, and line-intercept tabs, and rebuilt the `plot` and `quadrant` identifiers. The Swartberg plot numbers that collided with numbers used at other sites were renumbered; the previous number is `old_plot`. The source script maps Swartberg 20 to T110, 22 to T012, 23 to T013, and 24 to T014.

Plot-level summary cover, height, and soil depth are the mean of the four quadrants. Plot species live and dead cover are the sum of that taxon's quadrant covers divided by 4, and counts are sums. Unrecorded quadrant occurrences add nothing to the sum. With four quadrants in every released plot, dividing by 4 is that taxon's mean contribution to the plot.

This dataset release was compiled from v20261007 vegetation tables and the v20261002 spatial GeoPackage from the BioSCape team GitHub repository (<https://github.com/BioSCape-io/BioSCape-terrestrial>). It was updated to conform to ORNL data standards as v20261007. This is the first submission of these tables to the ORNL DAAC.

6. References

- Cardoso, A.W., E.L. Hestir, J.A. Slingsby, C.J. Forbes, G.R. Moncrieff, W. Turner, A.L. Skowno, J. Nesslage, P.G. Brodrick, K.D. Gaddis, and A.M. Wilson. 2025. The biodiversity survey of the Cape (BioSCape), integrating remote sensing with biodiversity science. *npj Biodiversity* 4. <https://doi.org/10.1038/s44185-024-00071-5>
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