

Sample: Electricity utility, Houston: report

Project: Sample: Electricity utility, Houston

Goal: Describe the project Sample: Electricity utility, Houston: run the analyses that tell the most about its data, draw every result, and write a cited report.

Run: 370b2dd2-5561-44b3-aa6f-5fe633bbe222 (running, 11 agent run(s))

Generated: 2026-10-18T05:29:19Z, version 1

Model cost: USD 0.0000 over 0 model call(s)

Data used

Data	Kind	Rows	Time span	Summary	Source
Substations	vector, Point	14		14 point features; 'voltage_kv' 35 to 69 (mean 64.14); 'capacity_mva' 40 to 120 (mean 68.57); 'commissioned' 1,970 to 2,017 (mean 1994); named by 'name' (e.g. Juniper Rise Substation, Kingsmead Substation, Larchfield Substation); extent -95.4070,29.7335 to -95.3261,29.7908. Point locations of Substations.	[98]
Feeder lines	vector, LineString	79		79 line features; 'construction' has 2 values (top: overhead 46, underground 33); 'conductor' has 4 values (top: 1/0 ACSR 24, 477 AAC 21, 750 Cu UG 19); 'install_year' 1,964 to 2,022 (mean 1990); 'voltage_kv' 12.47 to 12.47 (mean 12.47); 'length_m' 540 to 3,063 (mean 1690); total length 133.5 km; extent -95.4215,29.7253 to -95.3181,29.7966. Lines (Feeder lines) such as routes or networks.	[99]
Service areas	vector, Polygon	14		14 polygon (area) features; 'customers' 4,420 to 13,419 (mean 7965); 'peak_load_mw' 17.1 to 50.9 (mean 36.91); named by 'name' (e.g. Juniper Rise Substation area, Kingsmead Substation area, Larchfield Substation area); total area 79.96 km ² ; extent -95.4223,29.7234 to -95.3173,29.7974. Areas (Service areas) with customers to compare and map.	[100]
Outages	vector, Point	1,650	2024-10-01 to 2026-09-30	1,650 point features; dated by 'started_at' from 2024-10-01 to 2026-09-30; 'cause' has 6 values (top: vegetation 644, equipment 427, weather 343); 'duration_min' 10 to 2,740 (mean 195); 'customers_affected' 6 to 3,173 (mean 234.9); extent -95.4212,29.7255 to -95.3187,29.7961. Dated point events by cause: where and when Outages happen.	[2]
Vegetation work orders	vector, Point	480	2024-10-04 to 2026-09-21	480 point features; dated by 'date' from 2024-10-04 to 2026-09-21; 'trim_type' has 3 values (top: hazard tree 161, cycle trim 160, hot spot 159); 'spans' 1 to 12 (mean 6.692); 'cost_usd' 566 to 12,478 (mean 2667); extent -95.4210,29.7258 to -95.3186,29.7961. Dated point events by trim_type: where and when Vegetation work orders happen.	[3]
Critical customers	vector, Point	60		60 point features; 'type' has 5 values (top: water plant 20, emergency shelter 11, fire station 10); 'backup_generator' has 2 values (top: False 39, True 21); 'priority' 1 to 3 (mean 1.683); extent -95.4198,29.7261 to -95.3218,29.7961. Point locations of Critical customers by type.	[101]

Data	Kind	Rows	Time span	Summary	Source
Poles	vector, Point	450		450 point features; 'material' has 3 values (top: wood 207, concrete 131, steel 112); 'inspection_grade' has 4 values (top: B 187, D 95, A 87); 'install_year' 1,967 to 2,024 (mean 2001); extent -95.4214,29.7313 to -95.3201,29.7964. Point locations of Poles by material.	[102]
Feeder reliability by year	table	316	2022-01-01 to 2025-01-01	Table of 316 rows and 6 columns without geometry; dated by 'year' from 2022-01-01 to 2025-01-01; 'saidi_min' 35.2 to 486.9 (mean 121.6); 'saifi' 0.45 to 2.49 (mean 1.177); 'caidi_min' 29.3 to 391 (mean 106.5). A table of Feeder reliability by year without locations.	[4]
Transformer assets	table	300		Table of 300 rows and 6 columns without geometry; 'mount' has 2 values (top: pole 164, pad 136); 'kva' 25 to 167 (mean 83.32); 'install_year' 1,970 to 2,024 (mean 1997); 'condition_score' 1 to 10 (mean 5.301). A table of Transformer assets without locations.	[103]
Storm season reliability report	document			1-page pdf document 'Storm season reliability report'; language en; mentions 3 place(s): Juniper Rise Substation (2), Kingsmead Substation (1), Larchfield Substation (1). A document about Juniper Rise Substation, Kingsmead Substation, Larchfield Substation.	[104]
Sample: Electricity utility, Houston	record				[105]
Emerging hot spots: Outages	layer, Polygon	100			[106]
Emerging hot spots: Vegetation work orders	layer, Polygon	89			[107]
Hot spot analysis: Poles	layer, Polygon	79			[108]
Hot spot analysis: Outages	layer, Point	1,650			[109]
Hot spot analysis: Vegetation work orders	layer, Polygon	86			[110]
Calculate density: Poles	layer, Polygon	344			[111]
Calculate density: Outages	layer, Polygon	1,588			[112]
Calculate density: Vegetation work orders	layer, Polygon	350			[113]
Summarize within: Service areas	layer, Polygon	14			[114]
Summarize within: Service areas	layer, Polygon	14			[115]
Summarize within: Service areas	layer, Polygon	14			[116]
Find point clusters: Poles	layer, Point	450			[117]
Find point clusters: cluster hulls	layer, Polygon	12			[118]
Find point clusters: Outages	layer, Point	1,650			[119]

Data	Kind	Rows	Time span	Summary	Source
Find point clusters: cluster hulls	layer, Polygon	12			[120]
Find point clusters: Vegetation work orders	layer, Point	480			[121]
Find point clusters: cluster hulls	layer, Polygon	9			[122]
Find outliers: Service areas	layer, Polygon	14			[123]
Repeat and near repeat classification: Outages	layer, Point	1,650			[124]

Timeline

Timeline: events per quarter by dataset

Per quarter: 19 quarters from 2022-01-01 to 2026-07-01; trend +19.6 per quarter; first half 237, second half 2,209 (+832.1%)

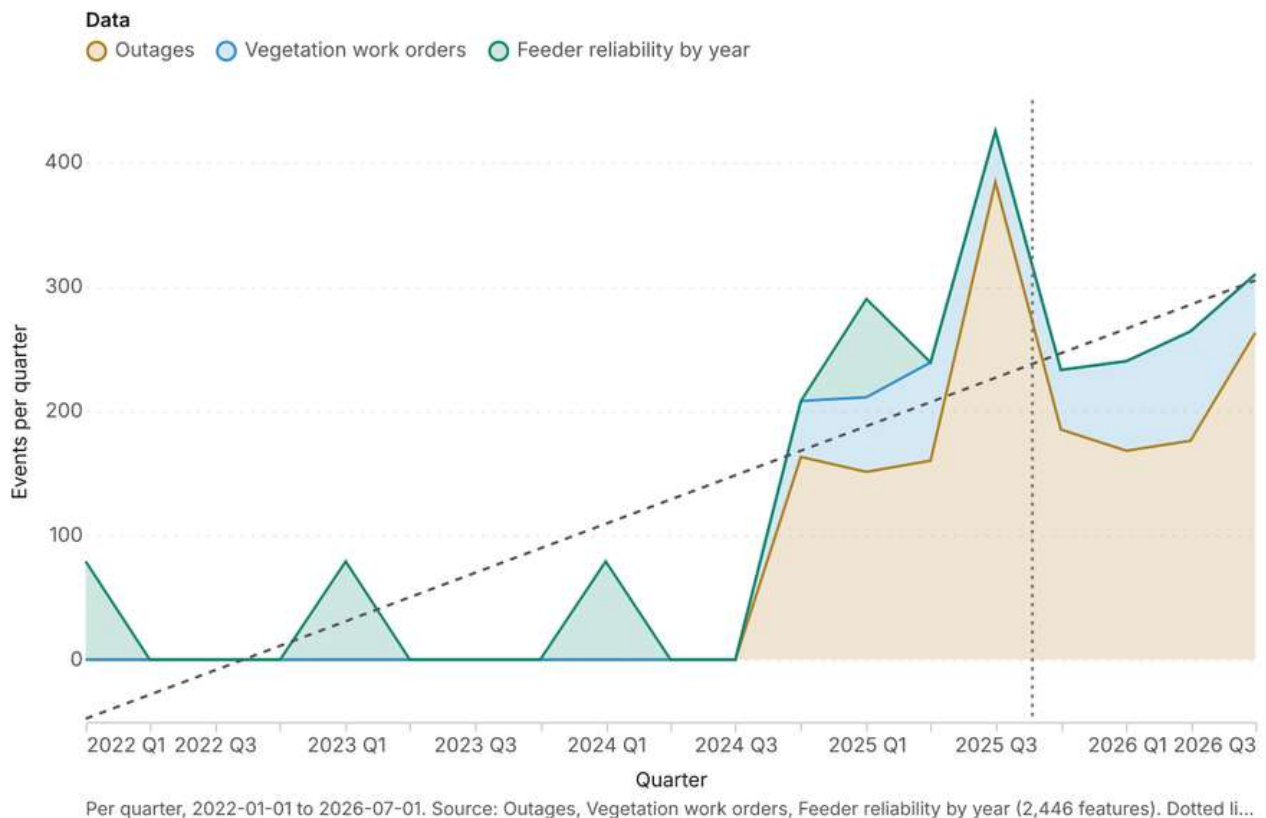


Figure 1. Timeline: events per quarter by dataset [1]. Per quarter, 2022-01-01 to 2026-07-01. Source: Outages, Vegetation work orders, Feeder reliability by year (2,446 features). Dotted lines mark dates named in the project's documents. The data is in the appendix.

The timeline counts 2,446 dated events in Outages, Vegetation work orders, Feeder reliability by year per quarter, from Q1 2022 to Q3 2026 [1][2][3][4]. By dataset: Outages 1,650; Vegetation work orders 480; Feeder reliability by year 316 [1]. The trend is +19.6 events per quarter; the second half of the quarters has 2,209 against 237 in the first (+832.1%) [1]. 8 of the 19 quarters had no events [1]. The project's documents name 1 date inside this span, drawn as dotted lines; the most named is 2025-08-22 (Storm season reliability report, page 1, 1 mention) [5].

Busiest quarters

- Q3 2025: 425 events [1]
- Q3 2026: 310 events [1]
- Q1 2025: 290 events [1]

Quietest quarters with events

- Q1 2022: 79 events [1]
- Q1 2023: 79 events [1]
- Q1 2024: 79 events [1]

Space time hot spots

What this analysis is. Emerging hot spots: Where hot spots are new, consecutive, intensifying, persistent, diminishing, sporadic, oscillating or historical over time [6]. In ArcGIS it is Emerging Hot Spot Analysis or Create Space Time Cube [6].

Why it was run on this data. Outages carry dates in 'started_at': emerging hot spot analysis finds new, intensifying and fading hot spots per month [7].

What it found. The `gp\_space\_time\_hot\_spots` tool utilized the Outages input [9] and generated a result with 100 features [8].

Result	Value
result, count	100
result, elapsed ms	17
result, resolution	8
result, features used	1,650
result, time neighbors	0
billing, cost	0.1825
billing, list price	0.1825
billing, upstream cost	0

Findings

Evidenced: Space time hot spots on Outages: Emerging hot spots: 1 layer saved: Emerging hot spots: Outages (100 features) [8][9].

Evidenced: It reported result, count 100; result, elapsed ms 17; result, resolution 8; result, features used 1,650; result, time neighbors 0; billing, cost 0.1825 [8].

Tool gp_space_time_hot_spots; parameters {"agg": "sum", "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Outages (74249532)"}, "interval": "month", "bin_shape": "h3", "resolution": 8, "time_field": "started_at", "value_field": "customers_affected"}

Space time hot spots

What this analysis is. Emerging hot spots: Where hot spots are new, consecutive, intensifying, persistent, diminishing, sporadic, oscillating or historical over time [6]. In ArcGIS it is Emerging Hot Spot Analysis or Create Space Time Cube [6].

Why it was run on this data. Vegetation work orders carry dates in 'date': emerging hot spot analysis finds new, intensifying and fading hot spots per month [10].

What it found. Space time hot spots on Vegetation work orders: Emerging hot spots: 1 layer saved: Emerging hot spots: Vegetation work orders (89 features) [11][12]. It reported result, count 89; result, elapsed ms 12; result, resolution 8; result, features used 480; result, time neighbors 0; billing, cost 0.124 [11].

Result	Value
result, count	89
result, elapsed ms	12
result, resolution	8
result, features used	480

Result	Value
result, time neighbors	0
billing, cost	0.124
billing, list price	0.124
billing, upstream cost	0

Findings

Evidenced: Space time hot spots on Vegetation work orders: Emerging hot spots: 1 layer saved: Emerging hot spots: Vegetation work orders (89 features) [11][12].

Evidenced: It reported result, count 89; result, elapsed ms 12; result, resolution 8; result, features used 480; result, time neighbors 0; billing, cost 0.124 [11].

Tool gp_space_time_hot_spots; parameters {"project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Vegetation work orders (d3eba75a)"}, "interval": "month", "bin_shape": "h3", "resolution": 8, "time_field": "date"}

Hot spots

What this analysis is. Hot spot analysis: Getis-Ord Gi* hot and cold spots with z-scores, p-values and confidence bins [13]. In ArcGIS it is Find Hot Spots or Hot Spot Analysis (Getis-Ord Gi*); in QGIS, qgis:hotspot (plugin) [13].

Why it was run on this data. 450 points: Getis-Ord Gi* tests whether the concentrations in Poles are statistically significant [14].

What it found. Hot spots on Poles: Hot spot analysis: 1 layer saved: Hot spot analysis: Poles (79 features) [15][16]. It reported result, bins 79; result, count 79; result, elapsed ms 5; result, cell size m 1,000; result, incidents used 450; result, distance band m 1,000 [15].

Result	Value
result, bins	79
result, count	79
result, elapsed ms	5
result, cell size m	1,000
result, incidents used	450
result, distance band m	1,000
billing, cost	0.059
billing, list price	0.059
billing, upstream cost	0

Findings

Evidenced: Hot spots on Poles: Hot spot analysis: 1 layer saved: Hot spot analysis: Poles (79 features) [15][16].

Evidenced: It reported result, bins 79; result, count 79; result, elapsed ms 5; result, cell size m 1,000; result, incidents used 450; result, distance band m 1,000 [15].

Tool gp_hot_spots; parameters {"project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Poles (cb7cbff1)"}, "aggregation": "hexagon", "cell_size_m": 1000.0, "distance_band_m": 1000.0}

Hot spots

What this analysis is. Hot spot analysis: Getis-Ord Gi* hot and cold spots with z-scores, p-values and confidence bins [13]. In ArcGIS it is Find Hot Spots or Hot Spot Analysis (Getis-Ord Gi*); in QGIS, qgis:hotspot (plugin) [13].

Why it was run on this data. 1650 points: Getis-Ord Gi* tests whether the concentrations in Outages are statistically significant [17].

What it found. The hot spot analysis used the Outages layer as the input data [9]. The analysis generated a total of 1,650 features, with the process completing in 27 ms [18].

Result	Value
result, count	1,650
result, elapsed ms	27
result, excluded null	0
result, distance band m	500
billing, cost	0.083
billing, list price	0.083
billing, upstream cost	0

Findings

Evidenced: Hot spots on Outages: Hot spot analysis: 1 layer saved: Hot spot analysis: Outages (1650 features) [9][18].

Evidenced: It reported result, count 1,650; result, elapsed ms 27; result, excluded null 0; result, distance band m 500; billing, cost 0.083; billing, list price 0.083 [18].

Tool gp_hot_spots; parameters {"field": "customers_affected", "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Outages (74249532)"}, "aggregation": "hexagon", "cell_size_m": 500.0, "distance_band_m": 500.0}

Hot spots

What this analysis is. Hot spot analysis: Getis-Ord Gi* hot and cold spots with z-scores, p-values and confidence bins [13]. In ArcGIS it is Find Hot Spots or Hot Spot Analysis (Getis-Ord Gi*); in QGIS, qgis:hotspot (plugin) [13].

Why it was run on this data. 480 points: Getis-Ord Gi* tests whether the concentrations in Vegetation work orders are statistically significant [19].

What it found. Hot spots on Vegetation work orders: Hot spot analysis: 1 layer saved: Hot spot analysis: Vegetation work orders (86 features) [12][20]. It reported result, bins 86; result, count 86; result, elapsed ms 6; result, cell size m 1,000; result, incidents used 480; result, distance band m 1,000 [20].

Result	Value
result, bins	86
result, count	86
result, elapsed ms	6
result, cell size m	1,000
result, incidents used	480
result, distance band m	1,000
billing, cost	0.0596
billing, list price	0.0596
billing, upstream cost	0

Findings

Evidenced: Hot spots on Vegetation work orders: Hot spot analysis: 1 layer saved: Hot spot analysis: Vegetation work orders (86 features) [12][20].

Evidenced: It reported result, bins 86; result, count 86; result, elapsed ms 6; result, cell size m 1,000; result, incidents used 480; result, distance band m 1,000 [20].

Tool gp_hot_spots; parameters {"project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Vegetation work orders (d3eba75a)"}, "aggregation": "hexagon", "cell_size_m": 1000.0, "distance_band_m": 1000.0}

Calculate density

What this analysis is. Calculate density: Kernel density per square kilometer on a grid [21]. In ArcGIS it is Calculate Density or Kernel Density; in QGIS, native:heatmapkerneldensityestimation [21].

Why it was run on this data. 450 points in Poles: a density surface shows where they concentrate [22].

What it found. Calculate density on Poles: Calculate density: 1 layer saved: Calculate density: Poles (344 features) [16][23]. It reported result, count 344; result, elapsed ms 10; result, bandwidth m 1,000; result, cell size m 500; result, excluded null 0; result, max density per km2 24.11 [23].

Result	Value
result, count	344
result, elapsed ms	10
result, bandwidth m	1,000
result, cell size m	500
result, excluded null	0
result, max density per km2	24.11
billing, cost	0.059
billing, list price	0.059
billing, upstream cost	0

Findings

Evidenced: Calculate density on Poles: Calculate density: 1 layer saved: Calculate density: Poles (344 features) [16][23].

Evidenced: It reported result, count 344; result, elapsed ms 10; result, bandwidth m 1,000; result, cell size m 500; result, excluded null 0; result, max density per km2 24.11 [23].

A model draft was discarded because a sentence did not cite a source of this section.

Tool gp_calculate_density; parameters {"kernel": "quartic", "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Poles (cb7cbff1)"}, "bandwidth_m": 1000.0, "cell_size_m": 500.0}

Calculate density

What this analysis is. Calculate density: Kernel density per square kilometer on a grid [21]. In ArcGIS it is Calculate Density or Kernel Density; in QGIS, native:heatmapkerneldensityestimation [21].

Why it was run on this data. 1650 points in Outages: a density surface shows where they concentrate [24].

What it found. Calculate density on Outages: Calculate density: 1 layer saved: Calculate density: Outages (1588 features) [9][25]. It reported result, count 1,588; result, elapsed ms 45; result, bandwidth m 500; result, cell size m 200; result, excluded null 0; result, max density per km2 4.538e+04 [25].

Result	Value
result, count	1,588
result, elapsed ms	45
result, bandwidth m	500
result, cell size m	200
result, excluded null	0
result, max density per km2	4.538e+04
billing, cost	0.083
billing, list price	0.083
billing, upstream cost	0

Findings

Evidenced: Calculate density on Outages: Calculate density: 1 layer saved: Calculate density: Outages (1588 features) [9][25].

Evidenced: It reported result, count 1,588; result, elapsed ms 45; result, bandwidth m 500; result, cell size m 200; result, excluded null 0; result, max density per km2 4.538e+04 [25].

Tool gp_calculate_density; parameters {"kernel": "quartic", "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Outages (74249532)"}, "bandwidth_m": 500.0, "cell_size_m": 200.0, "weight_field": "customers_affected"}

Calculate density

What this analysis is. Calculate density: Kernel density per square kilometer on a grid [21]. In ArcGIS it is Calculate Density or Kernel Density; in QGIS, native:heatmapkerneldensityestimation [21].

Why it was run on this data. 480 points in Vegetation work orders: a density surface shows where they concentrate [26].

What it found. The maximum density calculated was 24.16 per km2 [27].

Result	Value
result, count	350
result, elapsed ms	10
result, bandwidth m	1,000
result, cell size m	500
result, excluded null	0
result, max density per km2	24.16
billing, cost	0.0596
billing, list price	0.0596
billing, upstream cost	0

Findings

Evidenced: Calculate density on Vegetation work orders: Calculate density: 1 layer saved: Calculate density: Vegetation work orders (350 features) [12][27].

Evidenced: It reported result, count 350; result, elapsed ms 10; result, bandwidth m 1,000; result, cell size m 500; result, excluded null 0; result, max density per km2 24.16 [27].

Tool gp_calculate_density; parameters {"kernel": "quartic", "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Vegetation work orders (d3eba75a)"}, "bandwidth_m": 1000.0, "cell_size_m": 500.0}

Summarize within

What this analysis is. Summarize within: Count and aggregate the features inside each polygon (or bin), proportionally for lines and polygons [28]. In ArcGIS it is Summarize Within or Aggregate Points; in QGIS, native:countpointsinpolygon or native:sumlinelengths [28].

Why it was run on this data. Count Poles inside each feature of Service areas by material; the counts map as a choropleth (natural breaks, sequential colors) [29].

What it found. Summarize within on Poles, Service areas: Summarize within: 1 layer saved: Summarize within: Service areas (14 features) [16][30][31]. It reported result, count 14; result, elapsed ms 1; billing, cost 0.0193; billing, list price 0.0193; billing, upstream cost 0 [30].

Result	Value
result, count	14
result, elapsed ms	1
billing, cost	0.0193
billing, list price	0.0193

Result	Value
billing, upstream cost	0

Findings

Evidenced: Summarize within on Poles, Service areas: Summarize within: 1 layer saved: Summarize within: Service areas (14 features) [16][30][31].

Evidenced: It reported result, count 14; result, elapsed ms 1; billing, cost 0.0193; billing, list price 0.0193; billing, upstream cost 0 [30].

Tool gp_summarize_within; parameters {"stats": [{"stat": "sum", "field": "install_year"}], "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Poles (cb7cbff1)", "group_by": "material", "polygons": {"layer": "Service areas (af824cfb)"}}

Summarize within

What this analysis is. Summarize within: Count and aggregate the features inside each polygon (or bin), proportionally for lines and polygons [28]. In ArcGIS it is Summarize Within or Aggregate Points; in QGIS, native:countpointsinpolygon or native:sumlinelengths [28].

Why it was run on this data. Count Poles inside each feature of Service areas by material; the counts map as a choropleth (natural breaks, sequential colors) [29].

What it found. Summarize within on Outages, Service areas: Summarize within: 1 layer saved: Summarize within: Service areas (14 features) [9][31][32]. It reported result, count 14; result, elapsed ms 3; billing, cost 0.0433; billing, list price 0.0433; billing, upstream cost 0 [32].

Result	Value
result, count	14
result, elapsed ms	3
billing, cost	0.0433
billing, list price	0.0433
billing, upstream cost	0

Findings

Evidenced: Summarize within on Outages, Service areas: Summarize within: 1 layer saved: Summarize within: Service areas (14 features) [9][31][32].

Evidenced: It reported result, count 14; result, elapsed ms 3; billing, cost 0.0433; billing, list price 0.0433; billing, upstream cost 0 [32].

Tool gp_summarize_within; parameters {"stats": [{"stat": "sum", "field": "customers_affected"}], "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Outages (74249532)", "group_by": "cause", "polygons": {"layer": "Service areas (af824cfb)"}}

Summarize within

What this analysis is. Summarize within: Count and aggregate the features inside each polygon (or bin), proportionally for lines and polygons [28]. In ArcGIS it is Summarize Within or Aggregate Points; in QGIS, native:countpointsinpolygon or native:sumlinelengths [28].

Why it was run on this data. Count Poles inside each feature of Service areas by material; the counts map as a choropleth (natural breaks, sequential colors) [29].

What it found. Summarize within on Vegetation work orders, Service areas: Summarize within: 1 layer saved: Summarize within: Service areas (14 features) [12][31][33]. It reported result, count 14; result, elapsed ms 1; billing, cost 0.0199; billing, list price 0.0199; billing, upstream cost 0 [33].

Result	Value
result, count	14

Result	Value
result, elapsed ms	1
billing, cost	0.0199
billing, list price	0.0199
billing, upstream cost	0

Findings

Evidenced: Summarize within on Vegetation work orders, Service areas: Summarize within: 1 layer saved: Summarize within: Service areas (14 features) [12][31][33].

Evidenced: It reported result, count 14; result, elapsed ms 1; billing, cost 0.0199; billing, list price 0.0199; billing, upstream cost 0 [33].

Tool gp_summarize_within; parameters {"stats": [{"stat": "sum", "field": "spans"}], "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Vegetation work orders (d3eba75a)", "group_by": "trim_type", "polygons": {"layer": "Service areas (af824cfb)"}}

Find point clusters

What this analysis is. Find point clusters: Density-based clusters (DBSCAN, HDBSCAN or OPTICS, optionally space-time) with hulls and noise [34]. In ArcGIS it is Find Point Clusters or Density-based Clustering; in QGIS, native:dbscanclustering or native:stdbcanclustering [34].

Why it was run on this data. DBSCAN finds dense groups of Poles and separates noise [35].

What it found. Find point clusters on Poles: Find point clusters: 2 layers saved: Find point clusters: Poles (450 features); Find point clusters: cluster hulls (12 features) [16][36]. It reported result, count 450; result, noise 149; result, distance m 500; result, elapsed ms 9; result, min points 11; billing, cost 0.059 [36].

Result	Value
result, count	450
result, noise	149
result, distance m	500
result, elapsed ms	9
result, min points	11
billing, cost	0.059
billing, list price	0.059
billing, upstream cost	0

Findings

Evidenced: Find point clusters on Poles: Find point clusters: 2 layers saved: Find point clusters: Poles (450 features); Find point clusters: cluster hulls (12 features) [16][36].

Evidenced: It reported result, count 450; result, noise 149; result, distance m 500; result, elapsed ms 9; result, min points 11; billing, cost 0.059 [36].

Tool gp_find_point_clusters; parameters {"method": "dbscan", "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Poles (cb7cbff1)", "distance_m": 500.0, "min_points": 11}}

Find point clusters

What this analysis is. Find point clusters: Density-based clusters (DBSCAN, HDBSCAN or OPTICS, optionally space-time) with hulls and noise [34]. In ArcGIS it is Find Point Clusters or Density-based Clustering; in QGIS, native:dbscanclustering or native:stdbcanclustering [34].

Why it was run on this data. DBSCAN finds dense groups of Outages and separates noise [37].

What it found. Find point clusters on Outages: Find point clusters: 2 layers saved: Find point clusters: Outages (1650 features); Find point clusters: cluster hulls (12 features) [9][38]. It reported result, count 1,650; result, noise 985; result, distance m 200; result, elapsed ms 22; result, min points 20; billing, cost 0.083 [38].

Result	Value
result, count	1,650
result, noise	985
result, distance m	200
result, elapsed ms	22
result, min points	20
billing, cost	0.083
billing, list price	0.083
billing, upstream cost	0

Findings

Evidenced: Find point clusters on Outages: Find point clusters: 2 layers saved: Find point clusters: Outages (1650 features); Find point clusters: cluster hulls (12 features) [9][38].

Evidenced: It reported result, count 1,650; result, noise 985; result, distance m 200; result, elapsed ms 22; result, min points 20; billing, cost 0.083 [38].

Tool gp_find_point_clusters; parameters {"method": "dbscan", "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Outages (74249532)"}, "distance_m": 200.0, "min_points": 20}

Find point clusters

What this analysis is. Find point clusters: Density-based clusters (DBSCAN, HDBSCAN or OPTICS, optionally space-time) with hulls and noise [34]. In ArcGIS it is Find Point Clusters or Density-based Clustering; in QGIS, native:dbscanclustering or native:stdbcanclustering [34].

Why it was run on this data. DBSCAN finds dense groups of Vegetation work orders and separates noise [39].

What it found. Find point clusters on Vegetation work orders: Find point clusters: 2 layers saved: Find point clusters: Vegetation work orders (480 features); Find point clusters: cluster hulls (9 features) [12][40]. It reported result, count 480; result, noise 157; result, distance m 500; result, elapsed ms 9; result, min points 12; billing, cost 0.0596 [40].

Result	Value
result, count	480
result, noise	157
result, distance m	500
result, elapsed ms	9
result, min points	12
billing, cost	0.0596
billing, list price	0.0596
billing, upstream cost	0

Findings

Evidenced: Find point clusters on Vegetation work orders: Find point clusters: 2 layers saved: Find point clusters: Vegetation work orders (480 features); Find point clusters: cluster hulls (9 features) [12][40].

Evidenced: It reported result, count 480; result, noise 157; result, distance m 500; result, elapsed ms 9; result, min points 12; billing, cost 0.0596 [40].

Tool gp_find_point_clusters; parameters {"method": "dbscan", "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Vegetation work orders (d3eba75a)"}, "distance_m": 500.0, "min_points": 12}

Outliers

What this analysis is. Find outliers: Anselin local Moran's I: HH, LL clusters and HL, LH outliers [41]. In ArcGIS it is Find Outliers or Cluster and Outlier Analysis (Anselin Local Moran's I) [41].

Why it was run on this data. Local Moran's I maps clusters and outliers of 'customers' [42].

What it found. Outliers on Service areas: Find outliers: 1 layer saved: Find outliers: Service areas (14 features) [31][43]. It reported result, count 14; result, elapsed ms 2; result, permutations 199; result, excluded null 0; result, distance band m 2,472; billing, cost 0.05042 [43].

Result	Value
result, count	14
result, elapsed ms	2
result, permutations	199
result, excluded null	0
result, distance band m	2,472
billing, cost	0.05042
billing, list price	0.05042
billing, upstream cost	0

Findings

Evidenced: Outliers on Service areas: Find outliers: 1 layer saved: Find outliers: Service areas (14 features) [31][43].

Evidenced: It reported result, count 14; result, elapsed ms 2; result, permutations 199; result, excluded null 0; result, distance band m 2,472; billing, cost 0.05042 [43].

Tool gp_outliers; parameters {"field": "customers", "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Service areas (af824cfb)"}, "aggregation": "hexagon"}

Spatial autocorrelation

What this analysis is. Spatial autocorrelation: Global Moran's I: is the pattern clustered, dispersed or random [44]. In ArcGIS it is Spatial Autocorrelation (Global Moran's I) [44].

Why it was run on this data. Global Moran's I says whether similar values of 'customers' sit next to each other [45].

What it found. The spatial autocorrelation tool was run using Service areas [31], yielding a Moran's I of 0.02059 [46]. Analysis of this result showed a p value of 0.6627 [46] and a z score of 0.4361 [46]. Furthermore, the expected I value for the analysis was calculated to be -0.07692 [46].

Result	Value
result, n	14
result, p value	0.6627
result, z score	0.4361
result, morans i	0.02059
result, variance	0.04999
result, elapsed ms	1
result, expected i	-0.07692
result, excluded null	0
result, distance band m	2,472
result, p value normality	0.671
result, z score normality	0.4248
result, variance normality	0.05269

Result	Value
billing, cost	0.02
billing, list price	0.02
billing, upstream cost	0

Findings

Evidenced: Spatial autocorrelation on Service areas: Spatial autocorrelation: done; no map output [31][46].

Evidenced: It reported result, n 14; result, p value 0.6627; result, z score 0.4361; result, morans i 0.02059; result, variance 0.04999; result, elapsed ms 1 [46].

Tool gp_spatial_autocorrelation; parameters {"field": "customers", "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Service areas (af824cfb)"}}

Near repeat

What this analysis is. Repeat and near repeat classification: Classify incidents as originators, repeats (same place) or near repeats within a distance and time window, with a Knox test table [47]. In ArcGIS it is Repeat and Near Repeat Classification or Near Repeat Calculator [47].

Why it was run on this data. Near repeat analysis tests whether Outages close in space also follow each other within 30 days [48].

What it found. Near repeat on Outages: Repeat and near repeat classification: 1 layer saved: Repeat and near repeat classification: Outages (1650 features) [9][49]. It reported result, days 30; result, count 1,650; result, chains 266; result, distance m 200; result, elapsed ms 42; result, pairs linked 1,171 [49].

Result	Value
result, days	30
result, count	1,650
result, chains	266
result, distance m	200
result, elapsed ms	42
result, pairs linked	1,171
billing, cost	0.0995
billing, list price	0.0995
billing, upstream cost	0

Findings

Evidenced: Near repeat on Outages: Repeat and near repeat classification: 1 layer saved: Repeat and near repeat classification: Outages (1650 features) [9][49].

Evidenced: It reported result, days 30; result, count 1,650; result, chains 266; result, distance m 200; result, elapsed ms 42; result, pairs linked 1,171 [49].

Tool gp_near_repeat; parameters {"days": 30, "project": "99e378b8-9e64-42f5-8930-fca7c2a73f57", "features": {"layer": "Outages (74249532)"}, "distance_m": 200.0, "time_field": "started_at"}

Maps and charts

The run also made 20 map image(s) [50][51][52][53][54][55][56][57][58][59][60][61][62][63][64][65][66][67][68][69] and 28 chart(s) [70][71][72][73][74][75][76][77][78][79][80][81][82][83][84][85][86][87][88][89][90][91][92][93][94][95][96][97].

Emerging hot spots: Outages

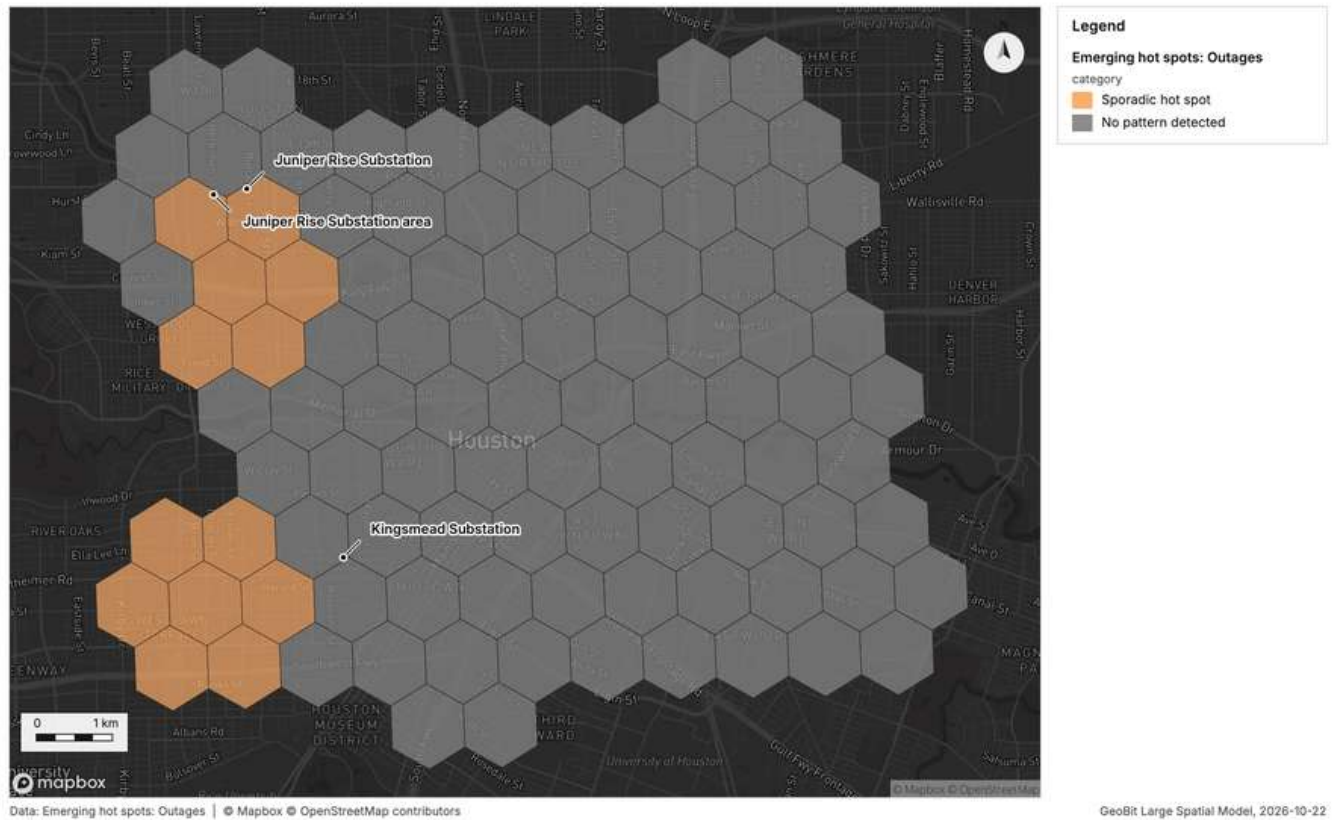


Figure 2. Emerging hot spots: Outages [50]

Emerging hot spots: Vegetation work orders

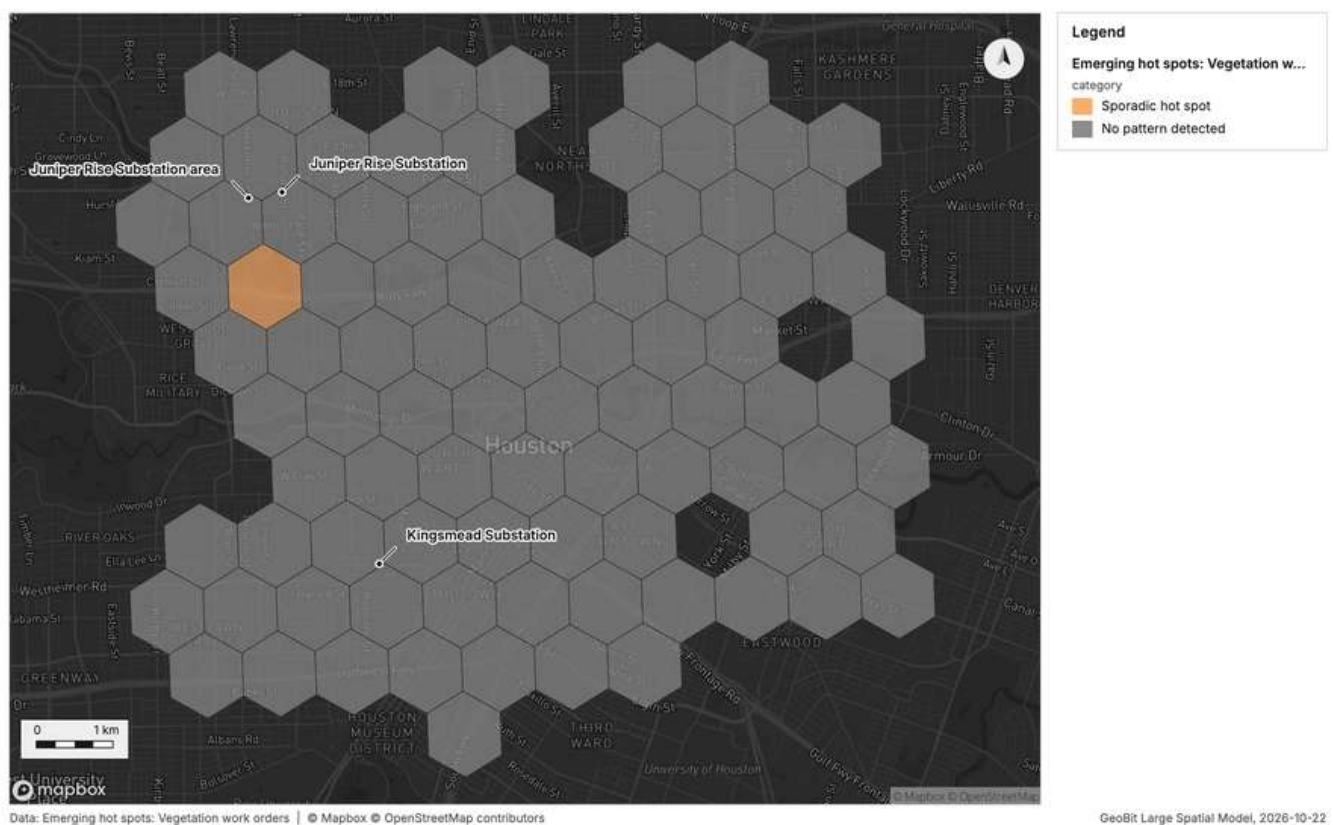


Figure 3. Emerging hot spots: Vegetation work orders [51]

Hot spot analysis: Poles

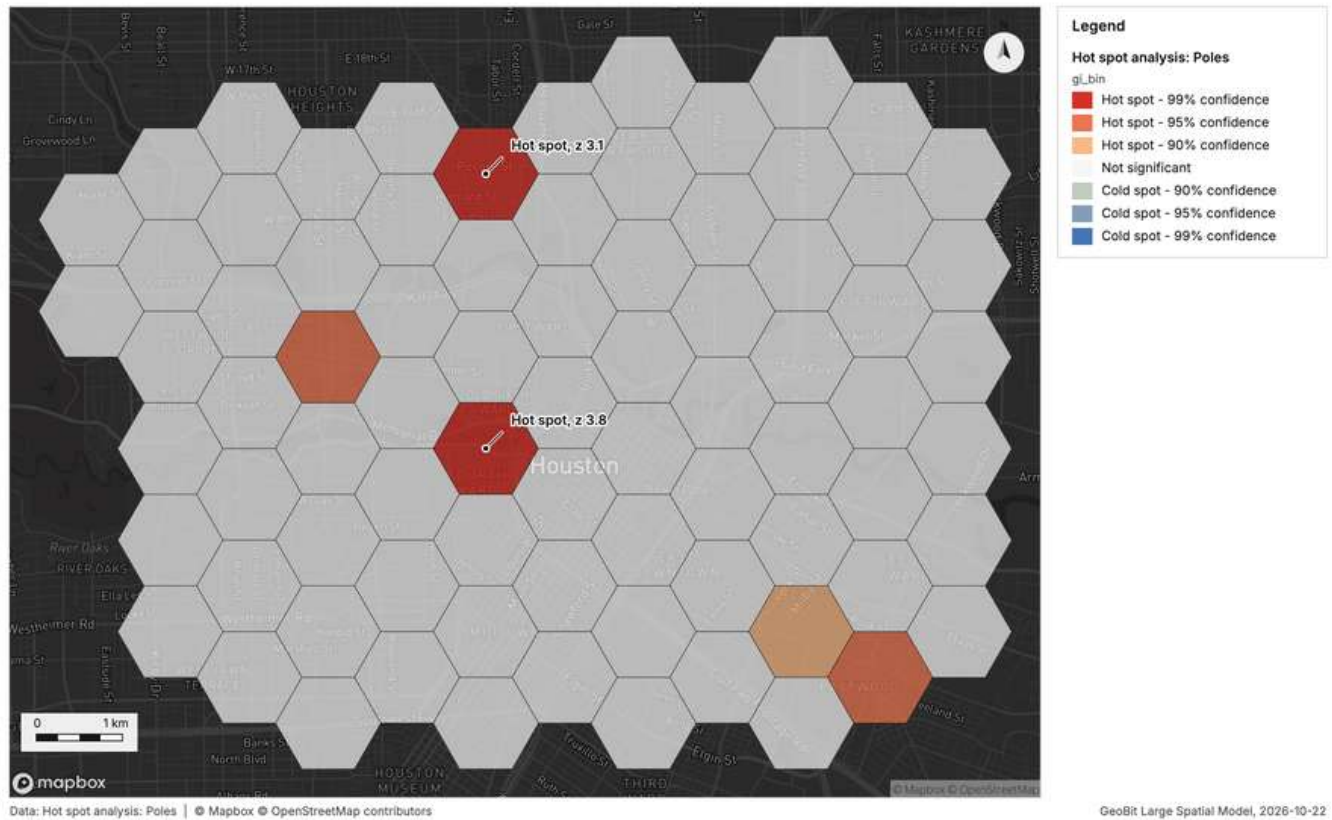


Figure 4. Hot spot analysis: Poles [52]

Hot spot analysis: Outages



Figure 5. Hot spot analysis: Outages [53]

Hot spot analysis: Vegetation work orders

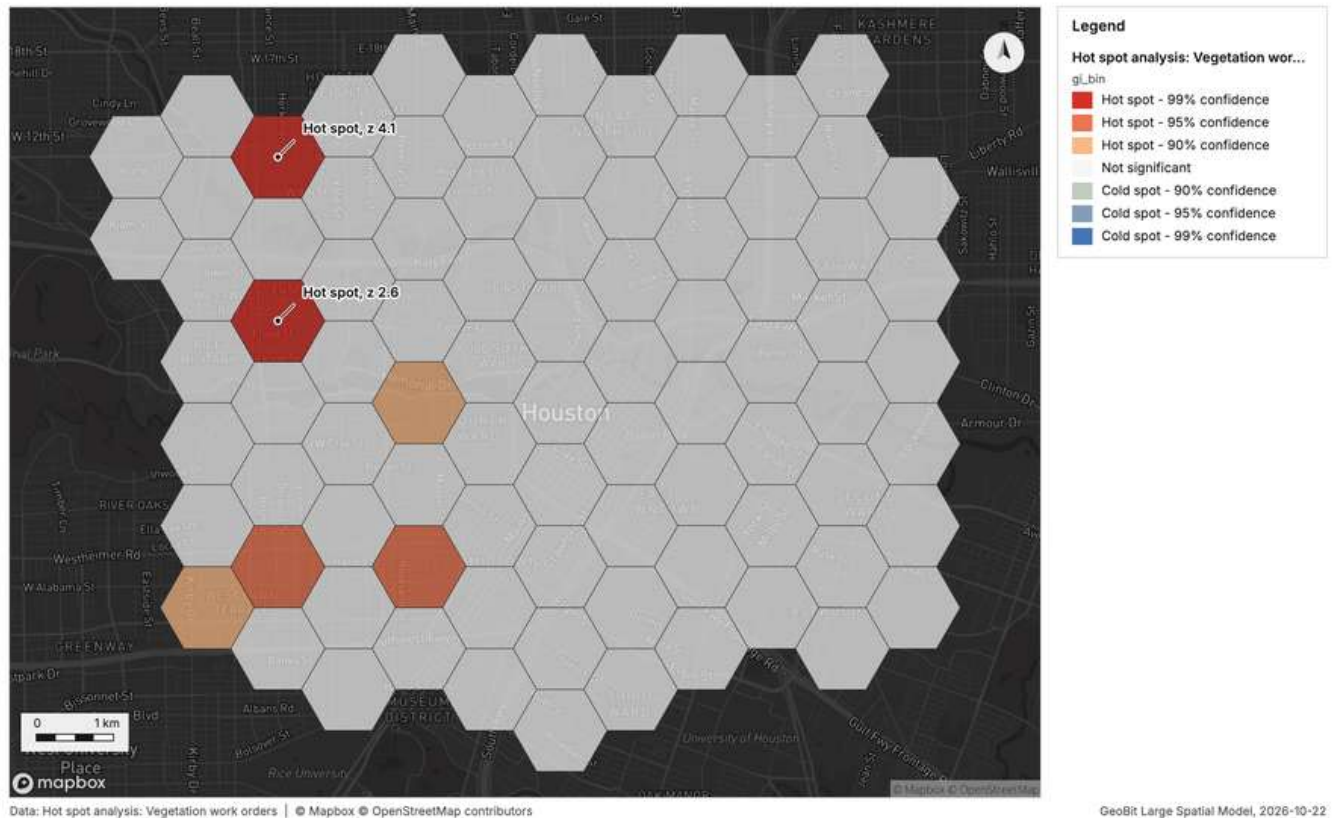


Figure 6. Hot spot analysis: Vegetation work orders [54]

Calculate density: Poles

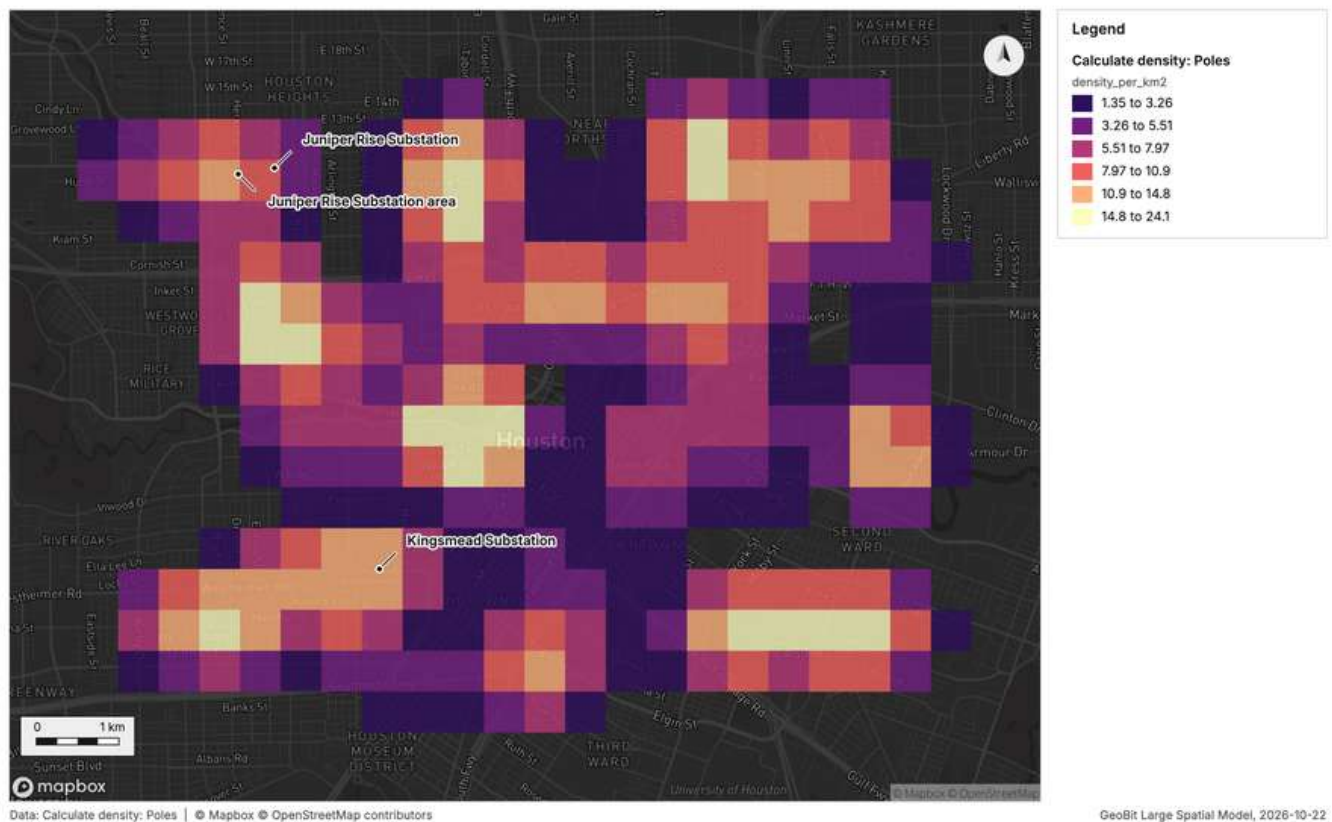


Figure 7. Calculate density: Poles [55]

Calculate density: Outages



Figure 8. Calculate density: Outages [56]

Calculate density: Vegetation work orders



Figure 9. Calculate density: Vegetation work orders [57]

Summarize within: Service areas

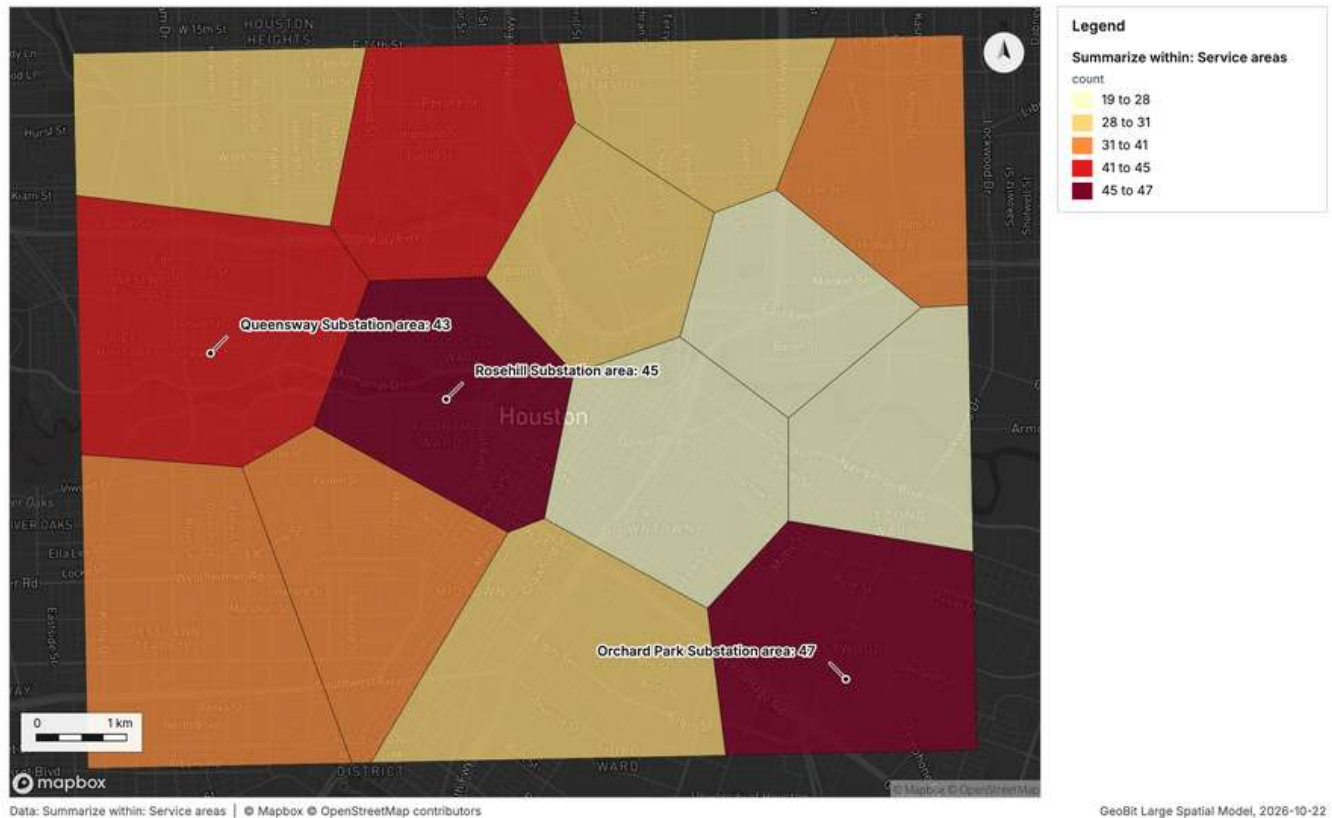


Figure 10. Summarize within: Service areas [58]

Summarize within: Service areas

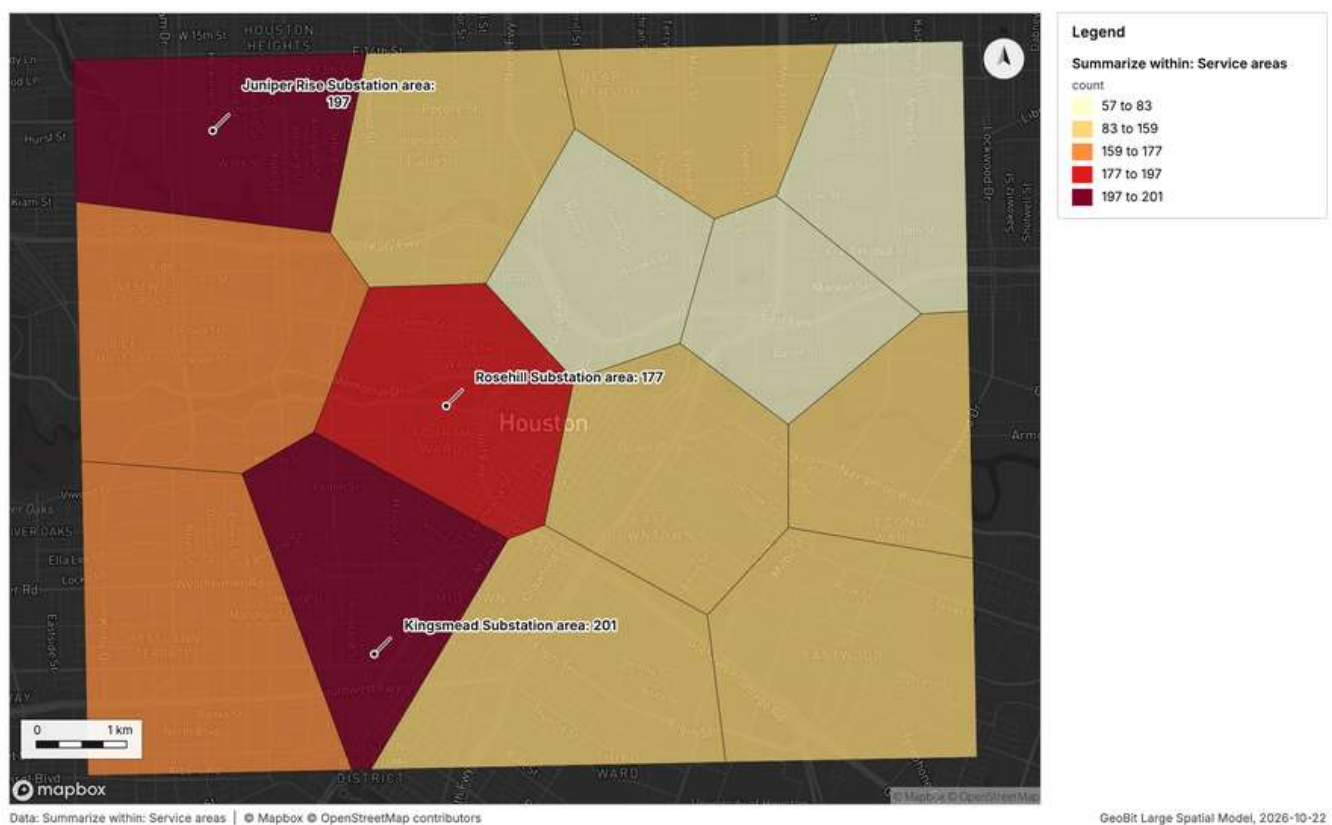


Figure 11. Summarize within: Service areas [59]

Summarize within: Service areas

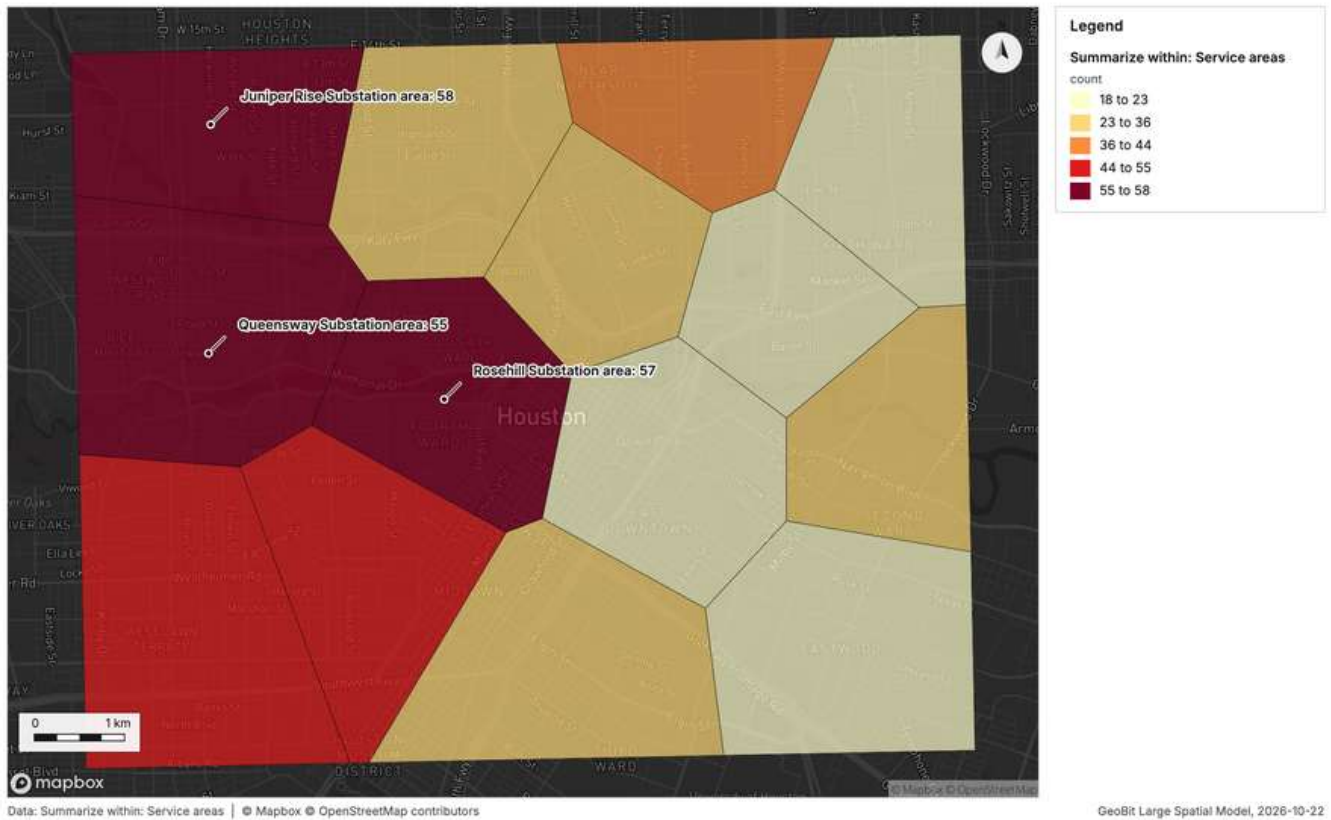


Figure 12. Summarize within: Service areas [60]

Find point clusters: Poles



Figure 13. Find point clusters: Poles [61]

Find point clusters: cluster hulls

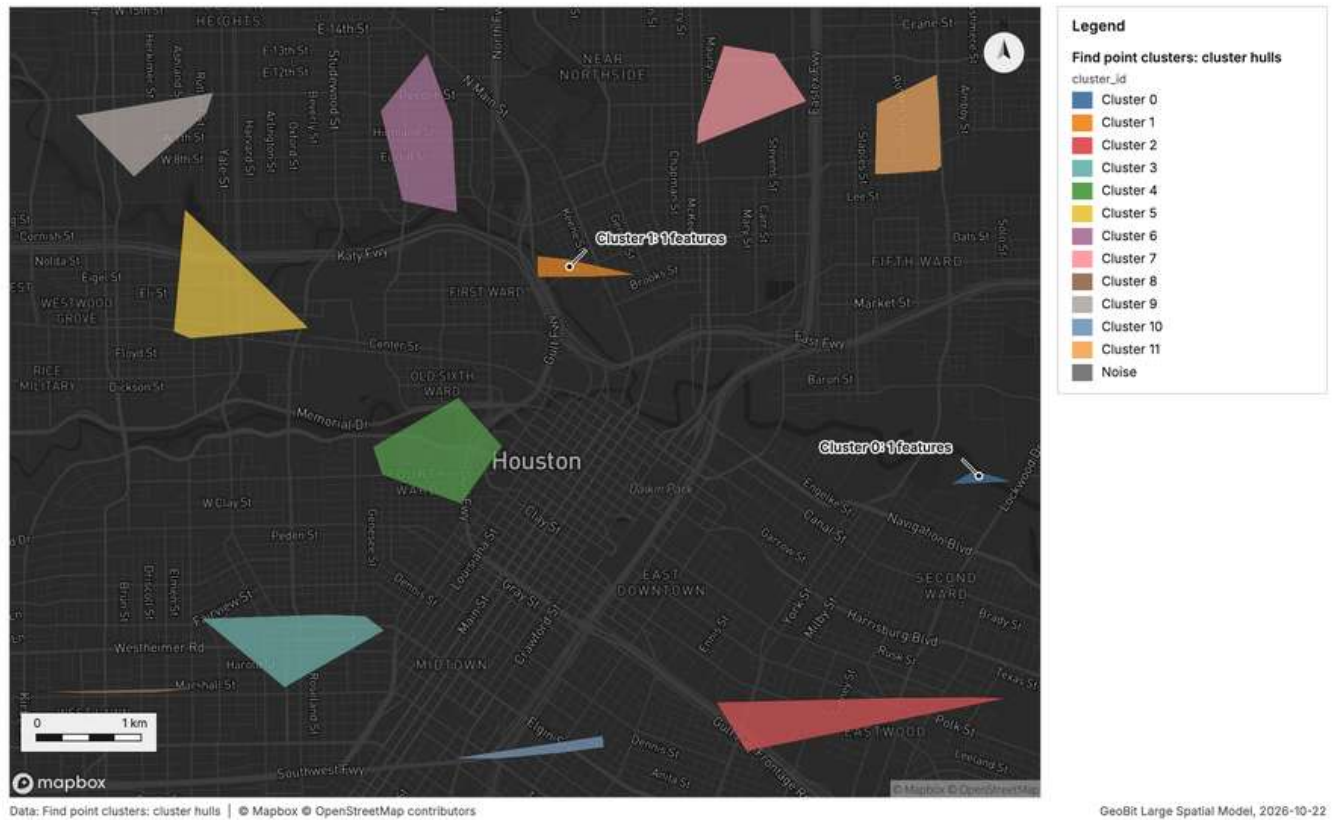


Figure 14. Find point clusters: cluster hulls [62]

Find point clusters: Outages



Figure 15. Find point clusters: Outages [63]

Find point clusters: cluster hulls

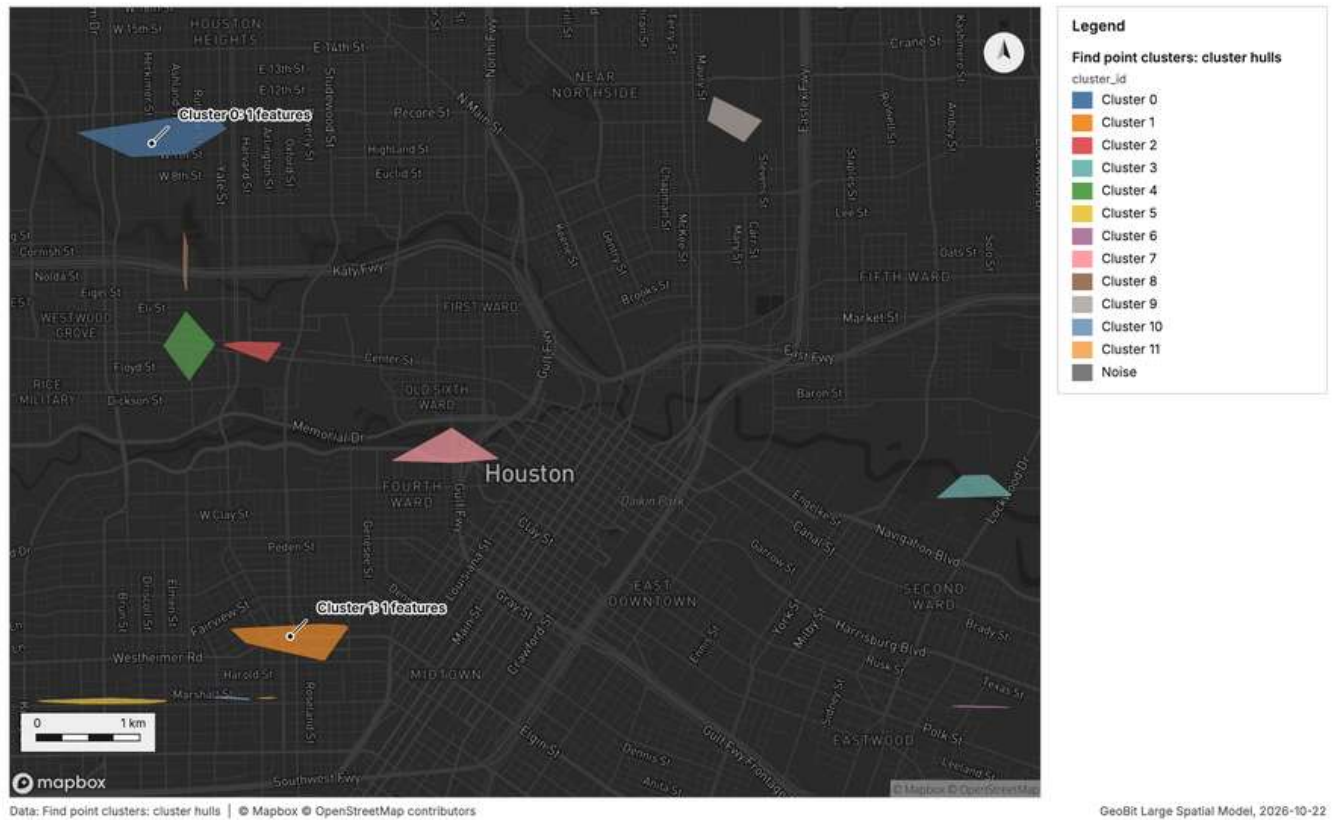


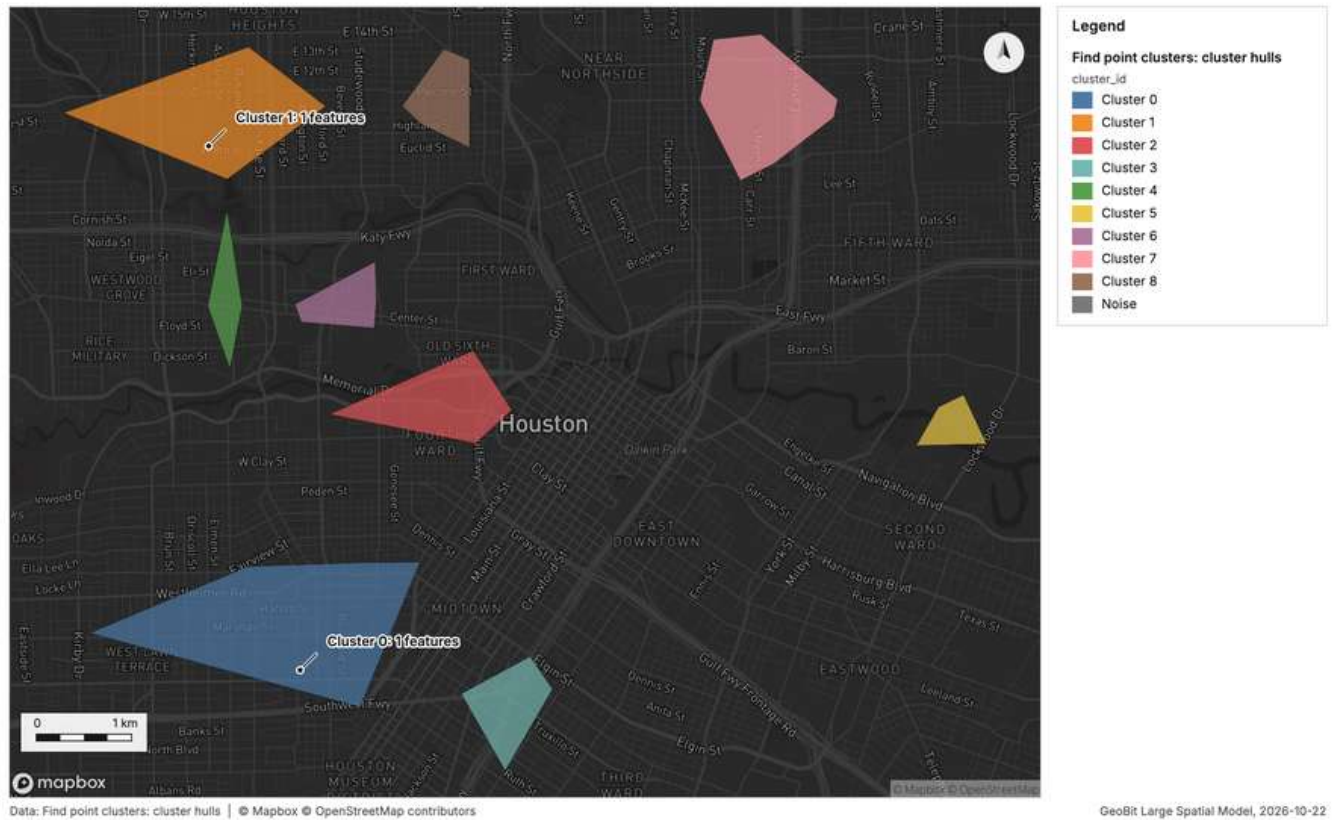
Figure 16. Find point clusters: cluster hulls [64]

Find point clusters: Vegetation work orders



Figure 17. Find point clusters: Vegetation work orders [65]

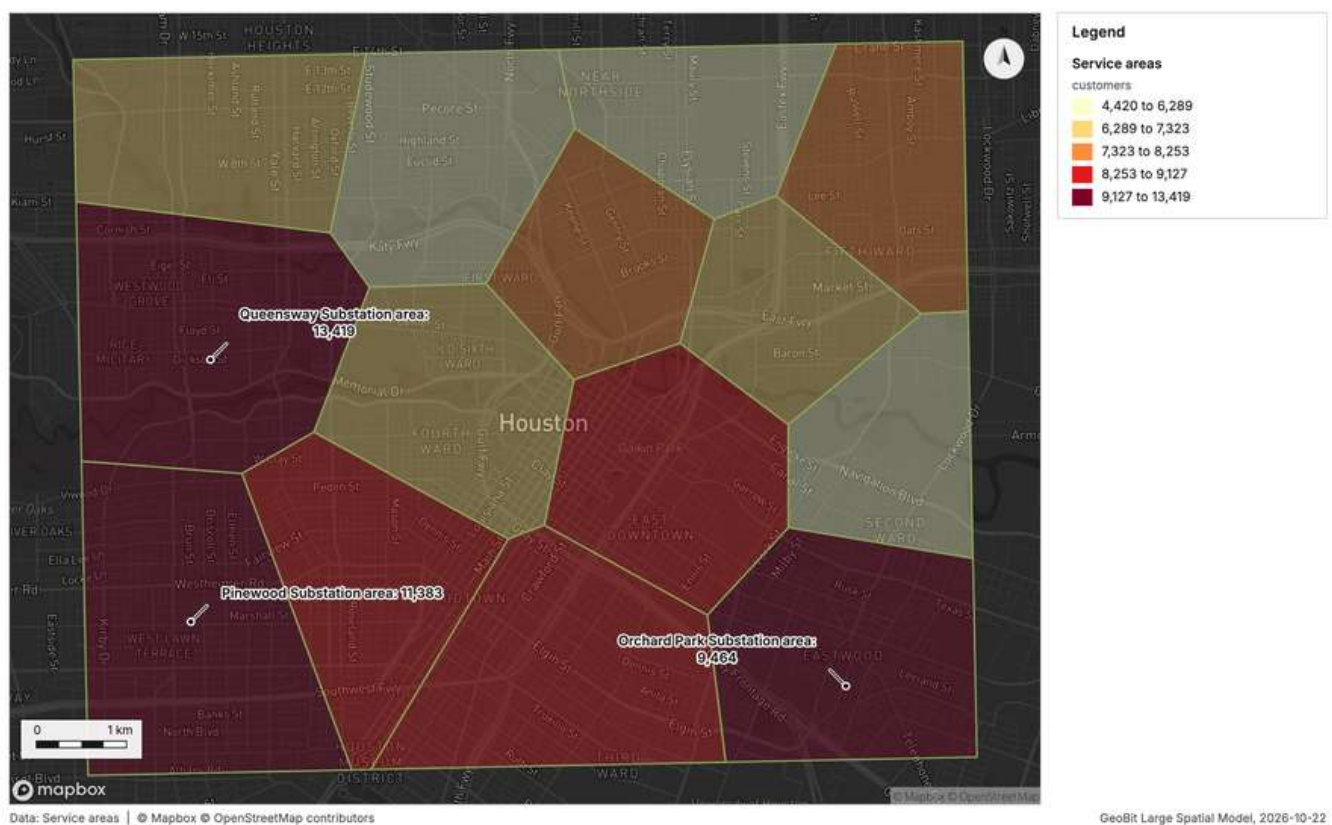
Find point clusters: cluster hulls



GeoBit Large Spatial Model, 2026-10-22

Figure 18. Find point clusters: cluster hulls [66]

Service areas by customers



GeoBit Large Spatial Model, 2026-10-22

Figure 19. Service areas by customers [67]

Find outliers: Service areas



Figure 20. Find outliers: Service areas [68]

Repeat and near repeat classification: Outages

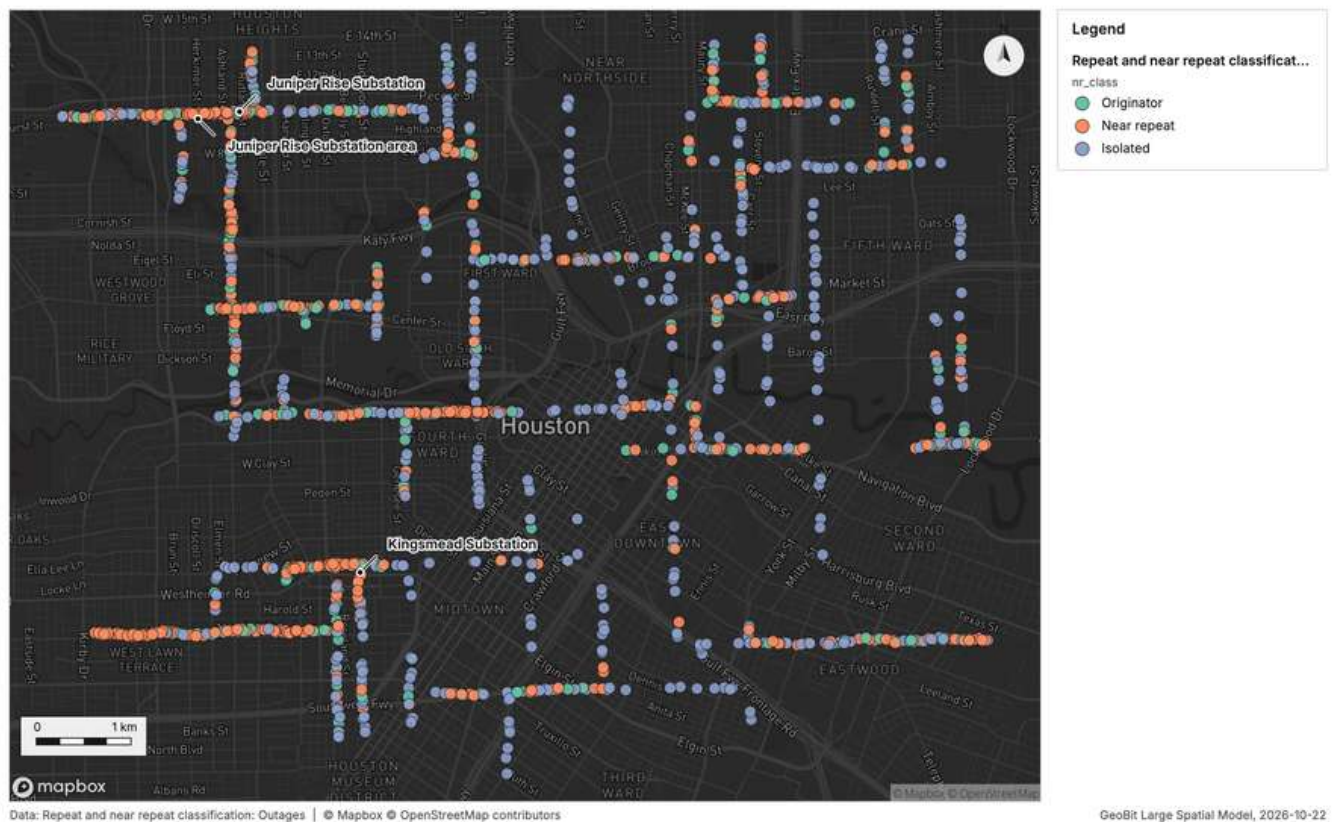


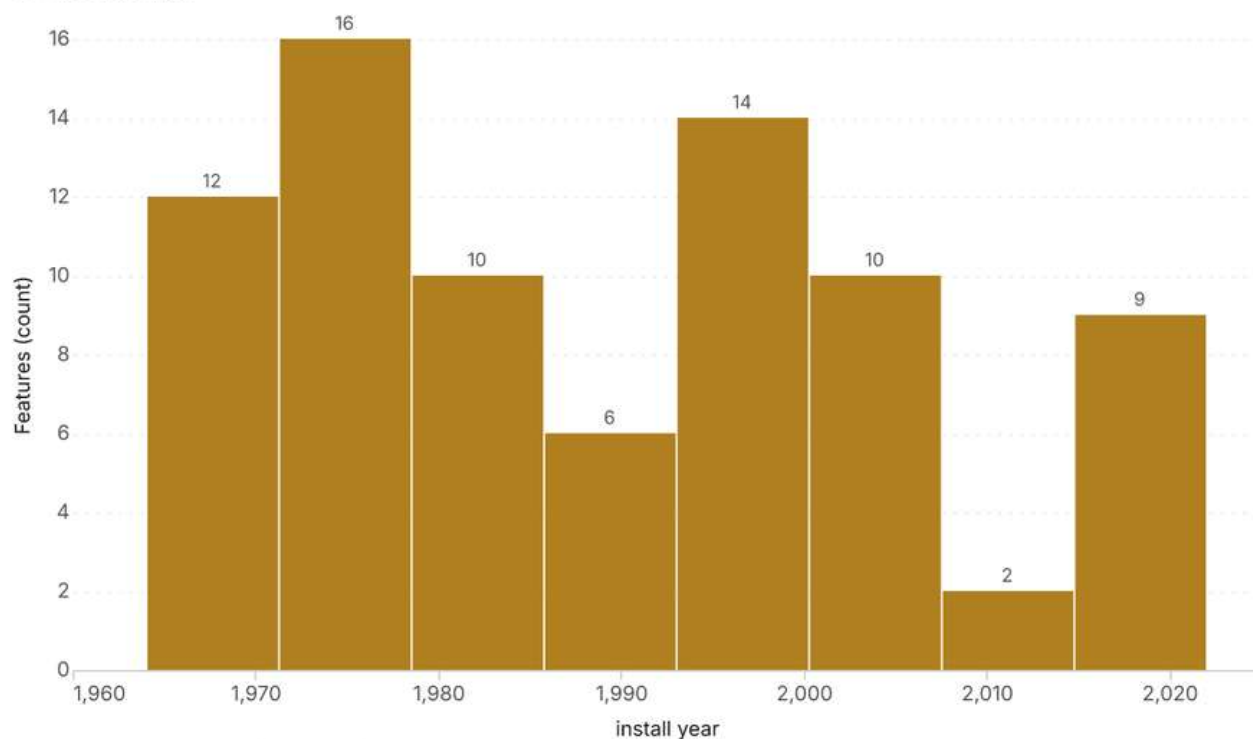
Figure 21. Repeat and near repeat classification: Outages [69]

What the map shows. The map visualizes a hot spot analysis for vegetation work orders, classifying areas as having a pattern or having none. The majority of [51]

Inferred: read from the image by gemma4:e4b, not evidence.

Distribution of install_year

79 values in 8 bins



Source: Feeder lines (79 features).

Figure 22. Feeder lines over time (install_year) [70]. Source: Feeder lines (79 features). The data is in the appendix.

Count per month by date and trim_type

Per month: 24 months from 2024-10-01 to 2026-09-01; trend +0.164 per month; first half 225, second half 255 (+13.3%)

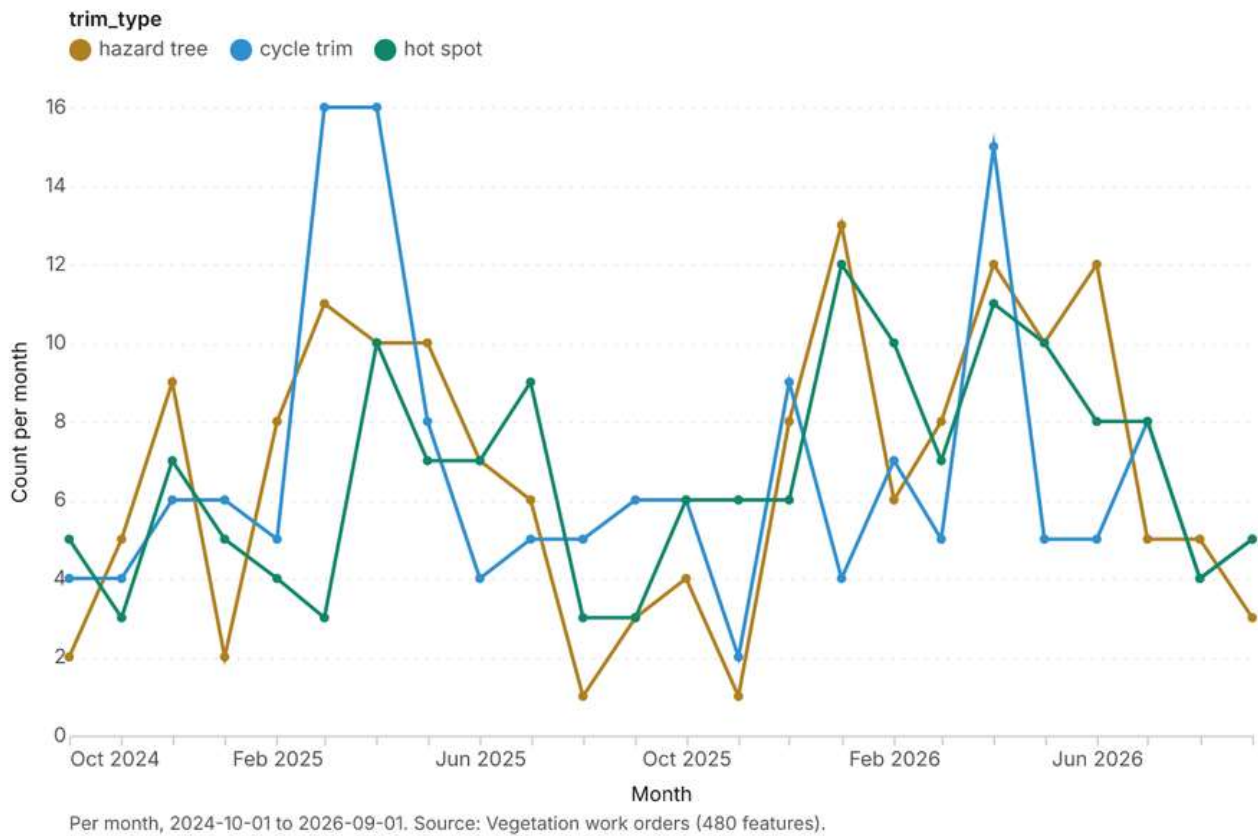


Figure 23. Vegetation work orders over time (date) [71]. Per month, 2024-10-01 to 2026-09-01. Source: Vegetation work orders (480 features). The data is in the appendix.

Distribution of install_year

450 values in 10 bins

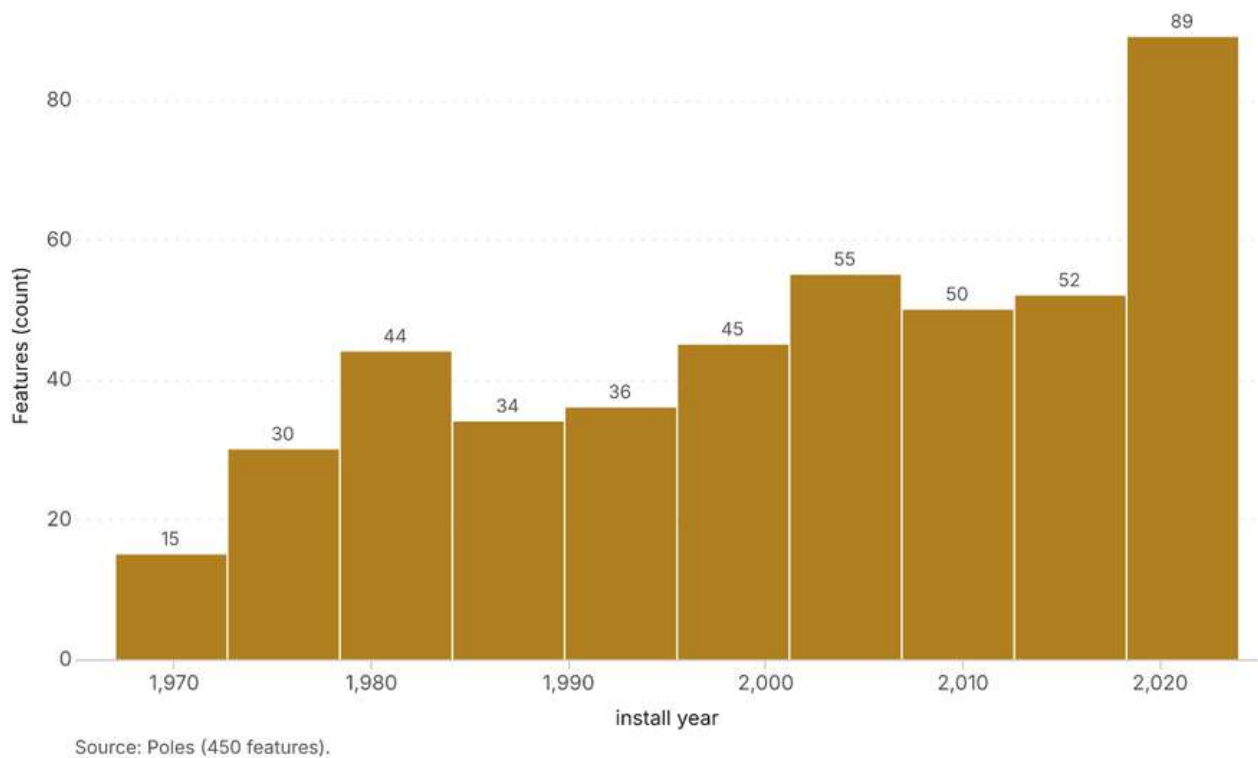


Figure 24. Poles over time (install_year) [72]. Source: Poles (450 features). The data is in the appendix.

Count per month by year

Per month: 37 months from 2022-01-01 to 2025-01-01; trend +0 per month; first half 158, second half 158 (+0.0%)

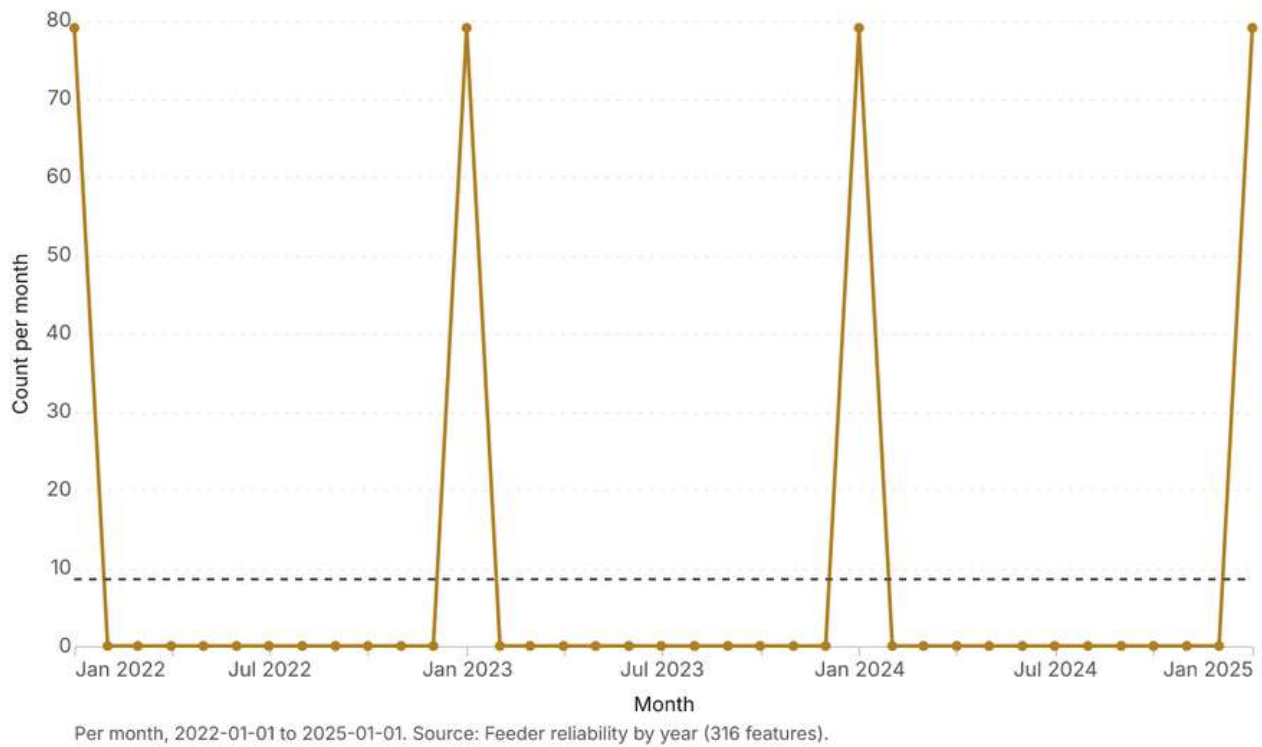


Figure 25. Feeder reliability by year over time (year) [73]. Per month, 2022-01-01 to 2025-01-01. Source: Feeder reliability by year (316 features). The data is in the appendix.

Distribution of kva

300 values in 10 bins

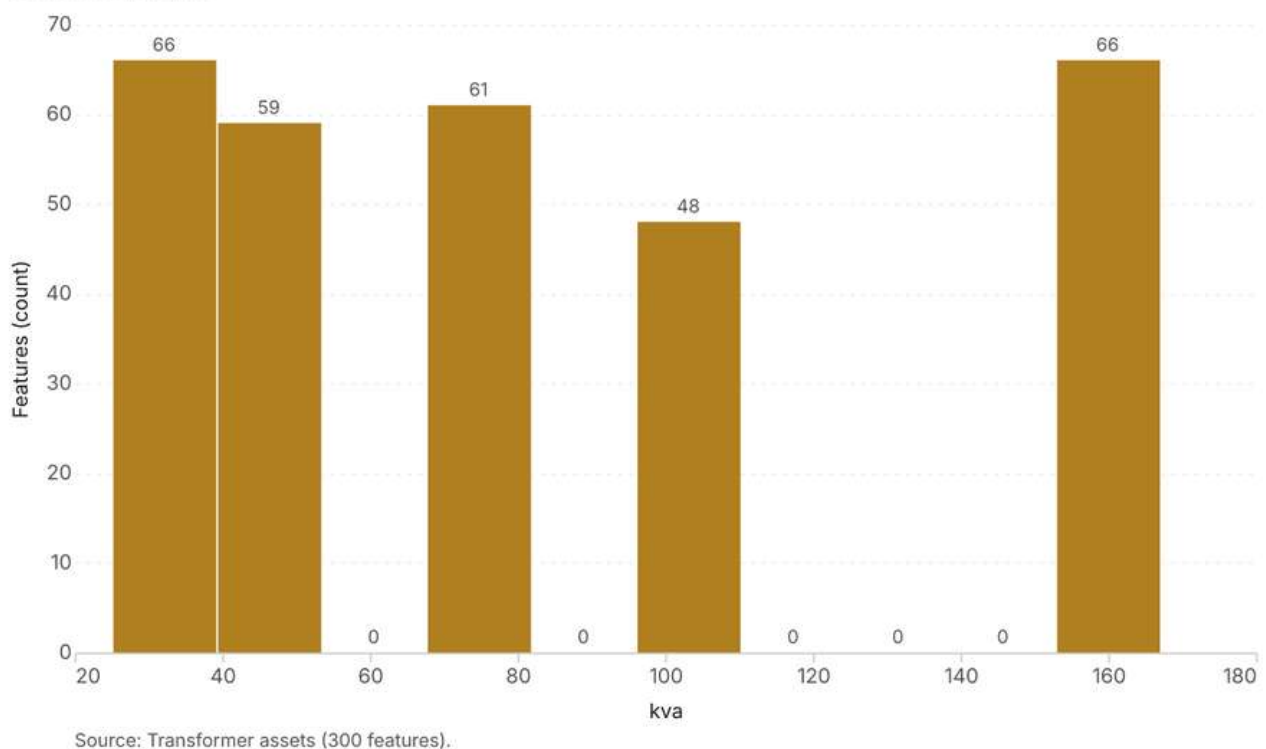
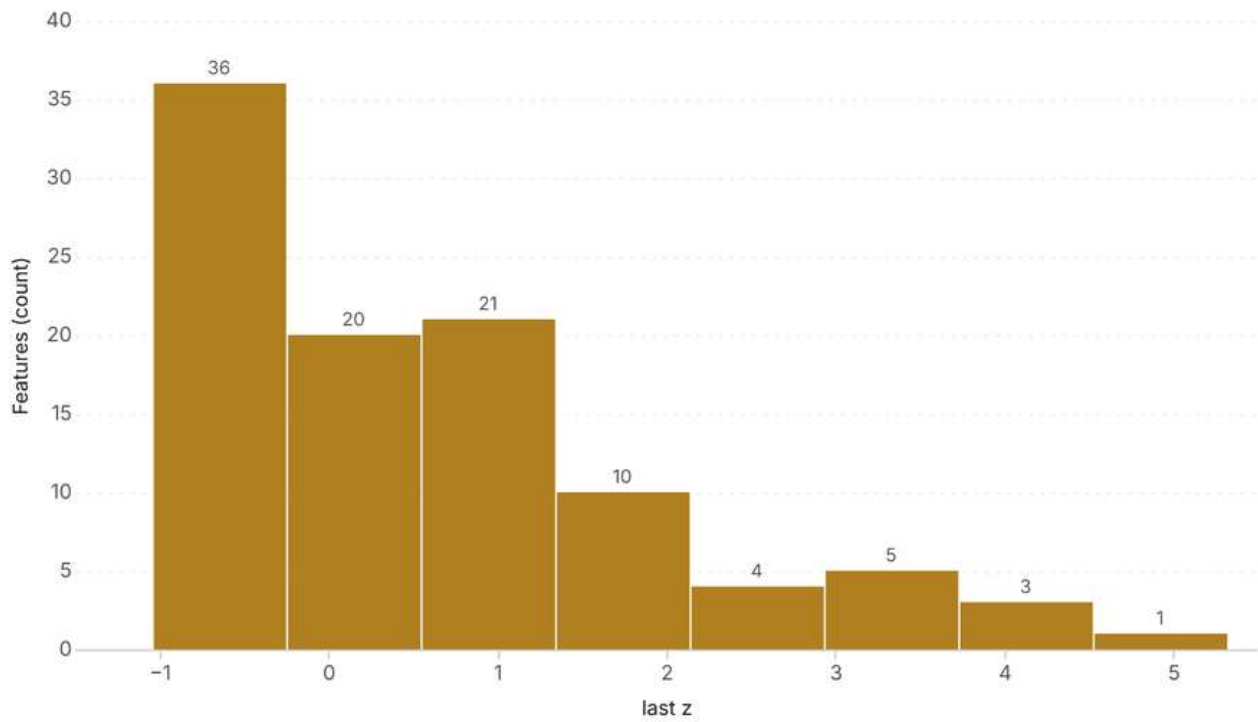


Figure 26. Transformer assets over time (install_year) [74]. Source: Transformer assets (300 features). The data is in the appendix.

Distribution of last_z

100 values in 8 bins

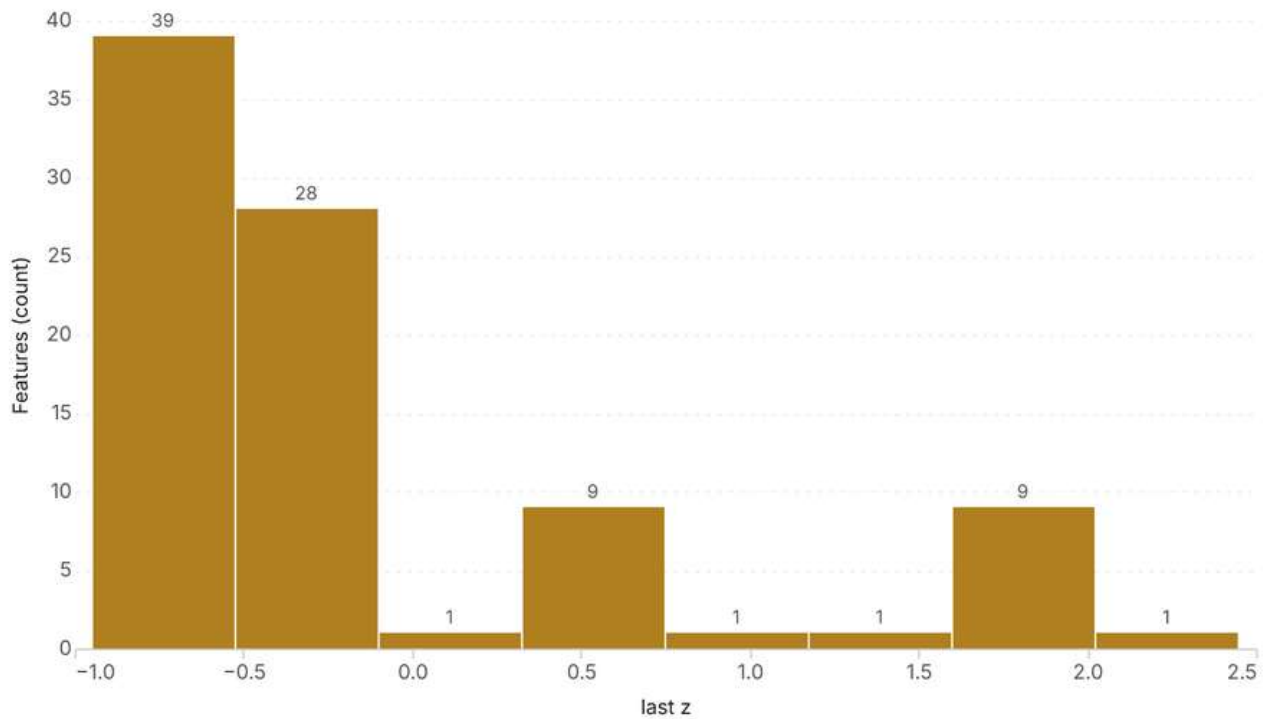


Source: Emerging hot spots: Outages (100 features).

Figure 27. Emerging hot spots: Outages [75]. Source: Emerging hot spots: Outages (100 features). The data is in the appendix.

Distribution of last_z

89 values in 8 bins

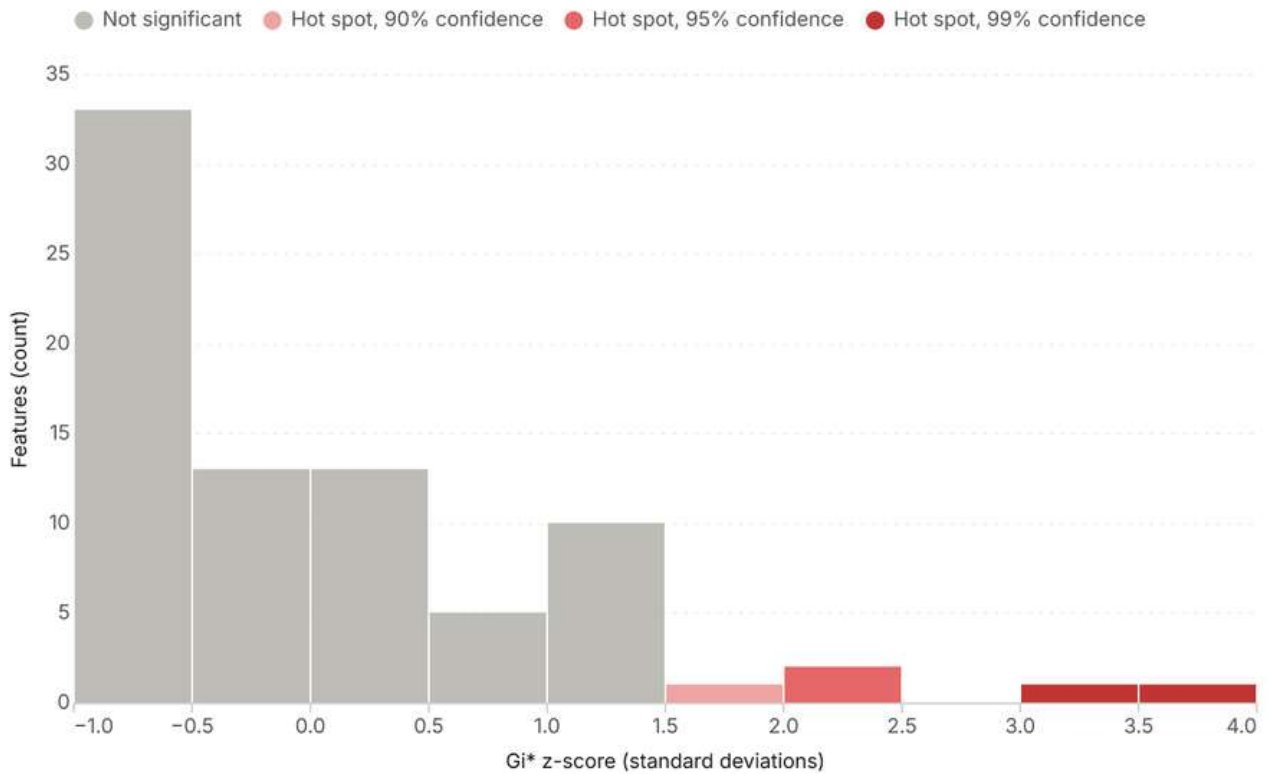


Source: Emerging hot spots: Vegetation work orders (89 features).

Figure 28. Emerging hot spots: Vegetation work orders [76]. Source: Emerging hot spots: Vegetation work orders (89 features). The data is in the appendix.

Gi* z-score distribution

79 features: 5 hot and 0 cold at 90% confidence or more

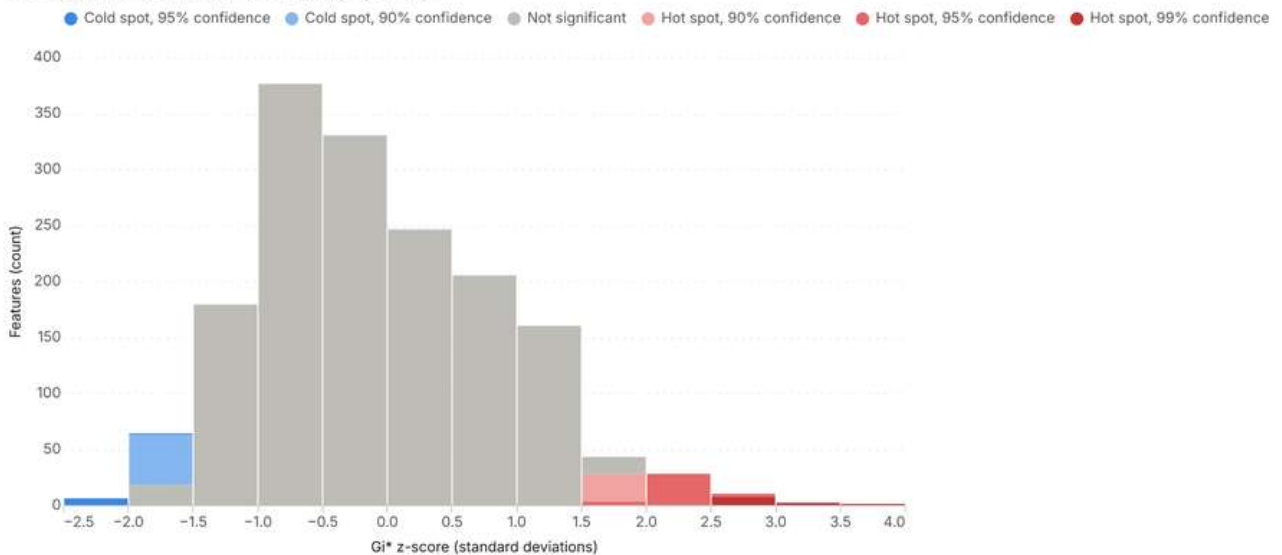


Source: Hot spot analysis: Poles (79 features).

Figure 29. Hot spot analysis: Poles [77]. Source: Hot spot analysis: Poles (79 features). The data is in the appendix.

Gi* z-score distribution

1,650 features: 69 hot and 52 cold at 90% confidence or more

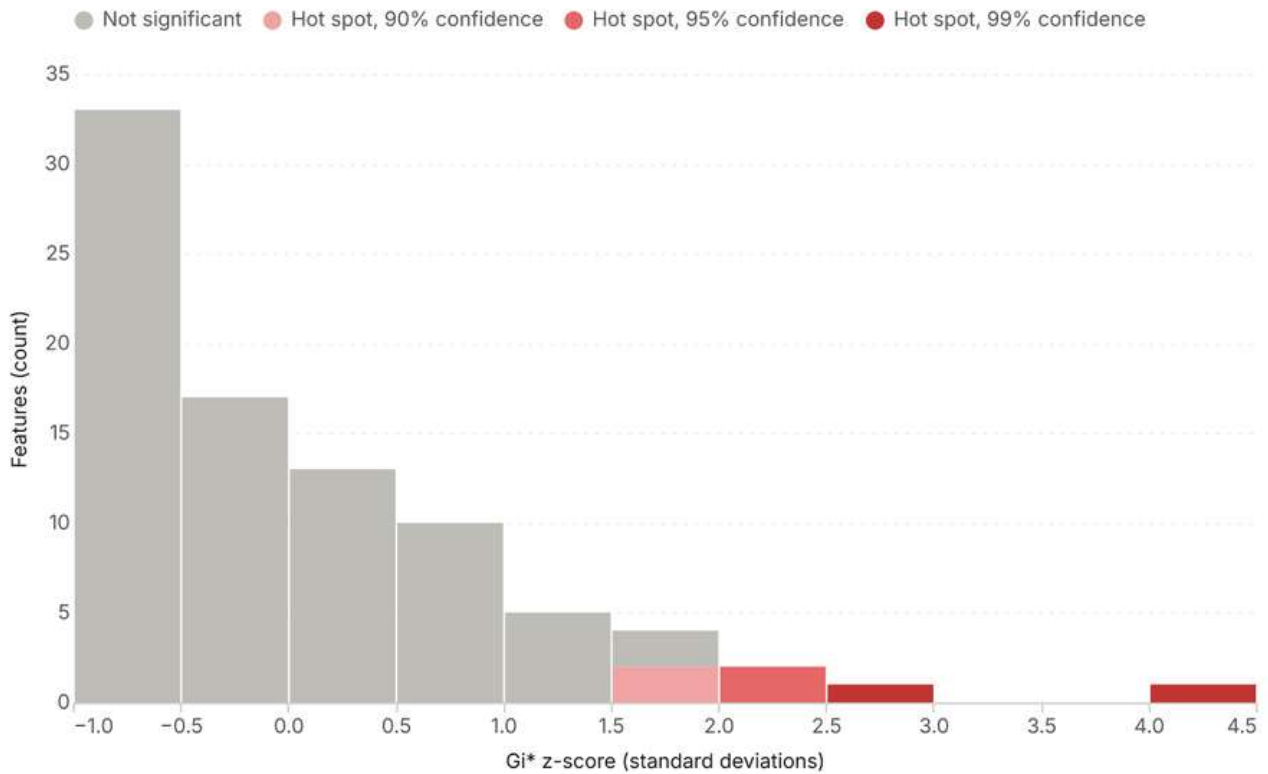


Period: 2024-10-01 to 2026-09-30 (started_at). Source: Hot spot analysis: Outages (1,650 features).

Figure 30. Hot spot analysis: Outages [78]. Period: 2024-10-01 to 2026-09-30 (started_at). Source: Hot spot analysis: Outages (1,650 features). The data is in the appendix.

Gi* z-score distribution

86 features: 6 hot and 0 cold at 90% confidence or more

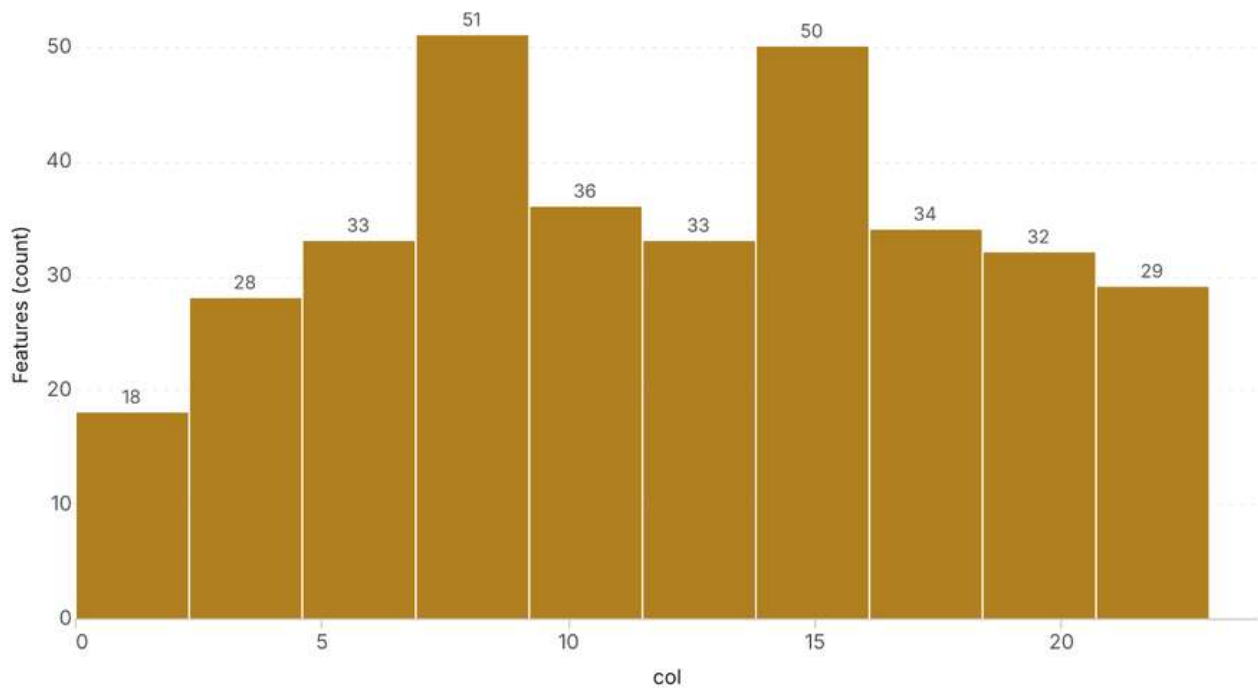


Source: Hot spot analysis: Vegetation work orders (86 features).

Figure 31. Hot spot analysis: Vegetation work orders [79]. Source: Hot spot analysis: Vegetation work orders (86 features). The data is in the appendix.

Distribution of col

344 values in 10 bins

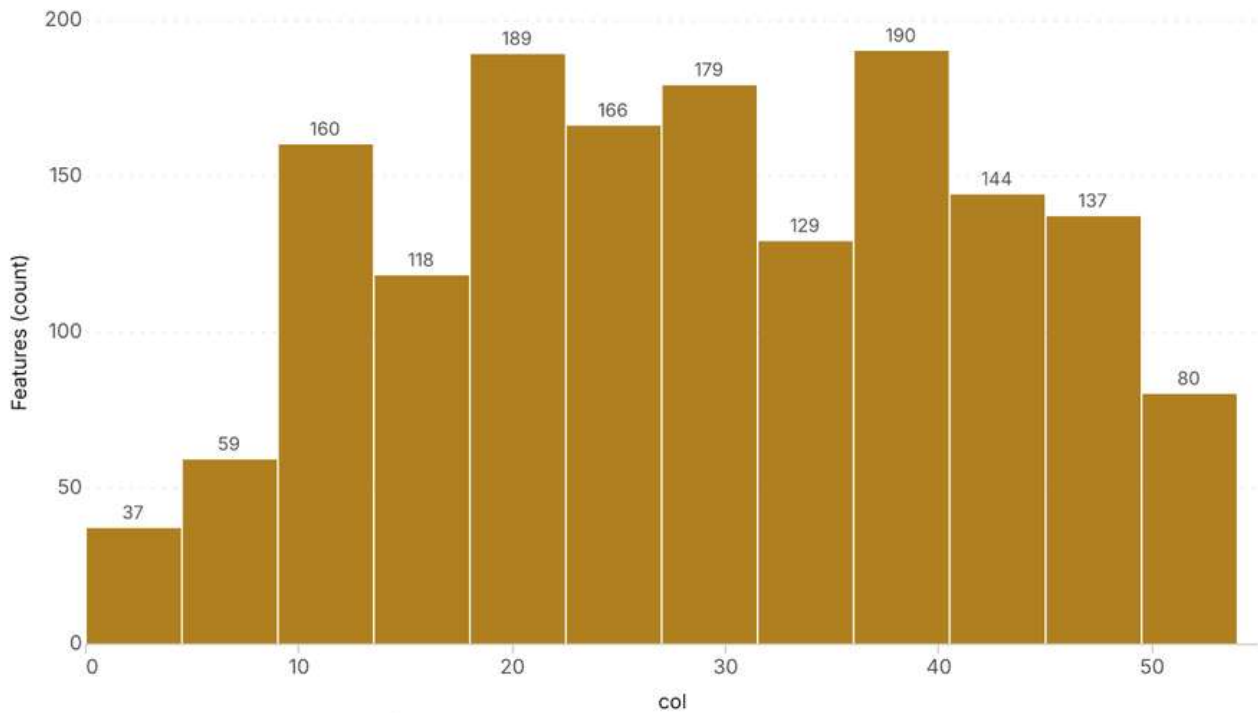


Source: Calculate density: Poles (344 features).

Figure 32. Calculate density: Poles [80]. Source: Calculate density: Poles (344 features). The data is in the appendix.

Distribution of col

1,588 values in 12 bins

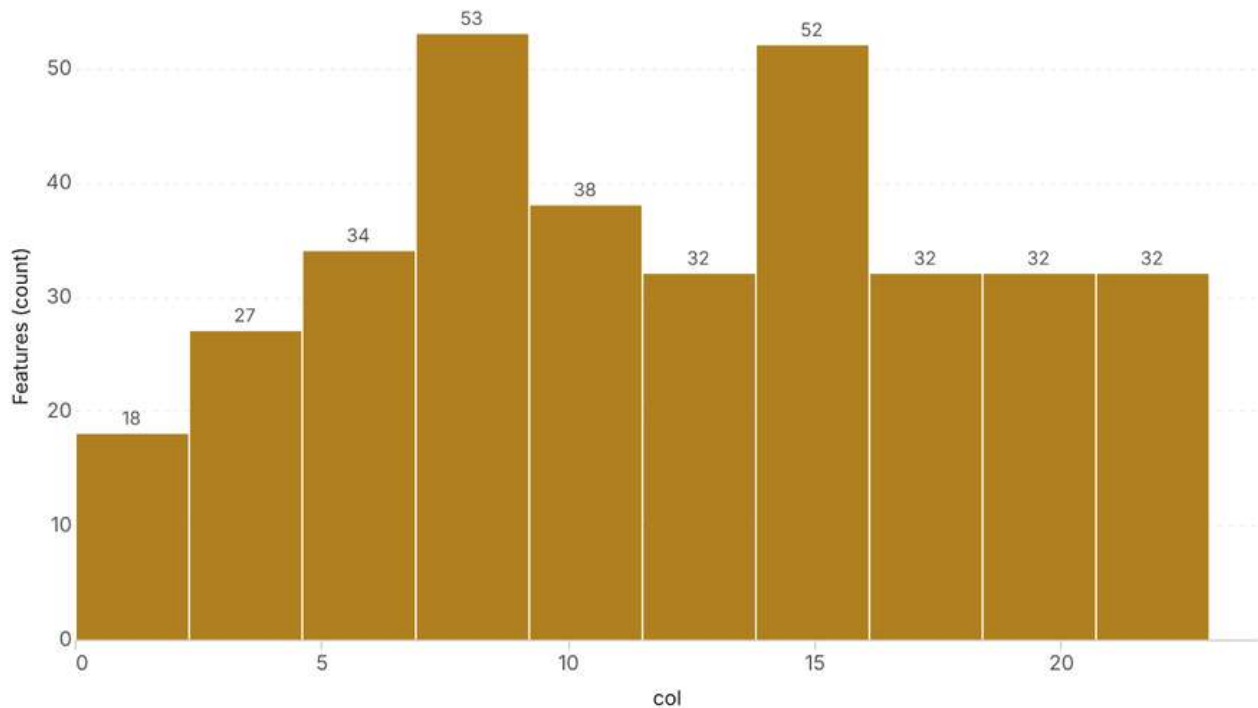


Source: Calculate density: Outages (1,588 features).

Figure 33. Calculate density: Outages [81]. Source: Calculate density: Outages (1,588 features). The data is in the appendix.

Distribution of col

350 values in 10 bins

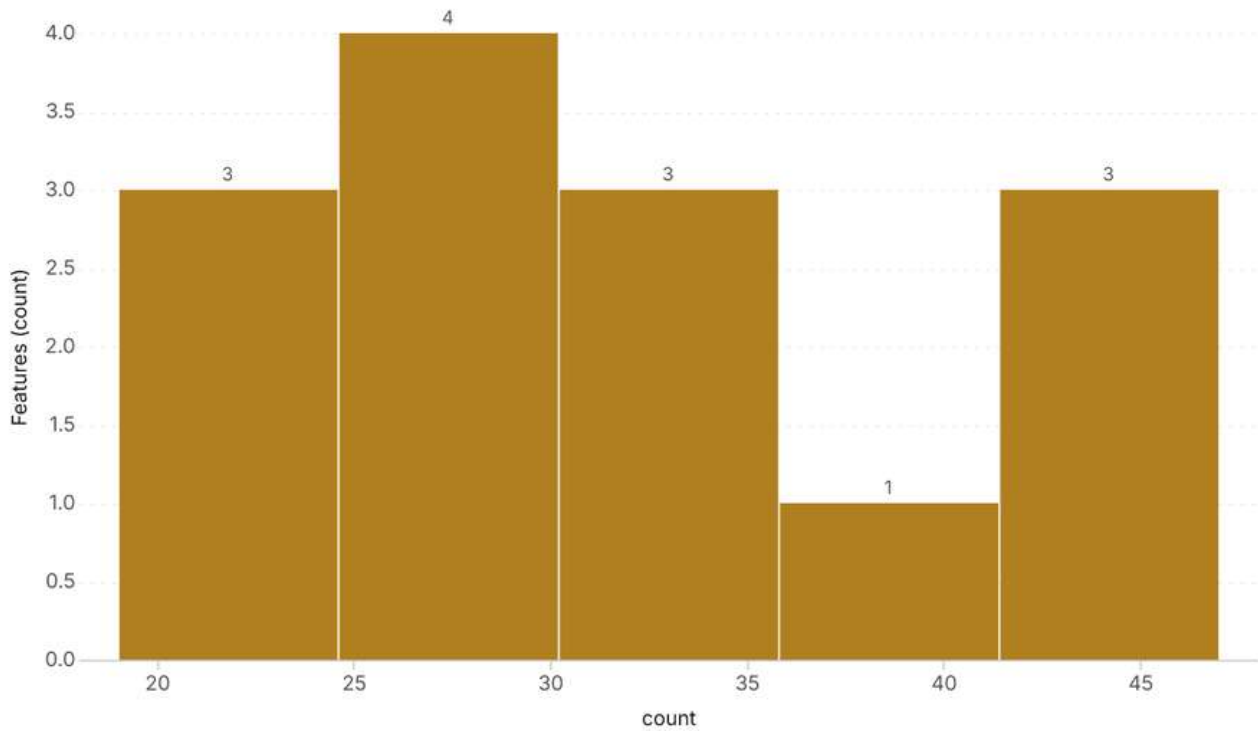


Source: Calculate density: Vegetation work orders (350 features).

Figure 34. Calculate density: Vegetation work orders [82]. Source: Calculate density: Vegetation work orders (350 features). The data is in the appendix.

Distribution of count

14 values in 5 bins

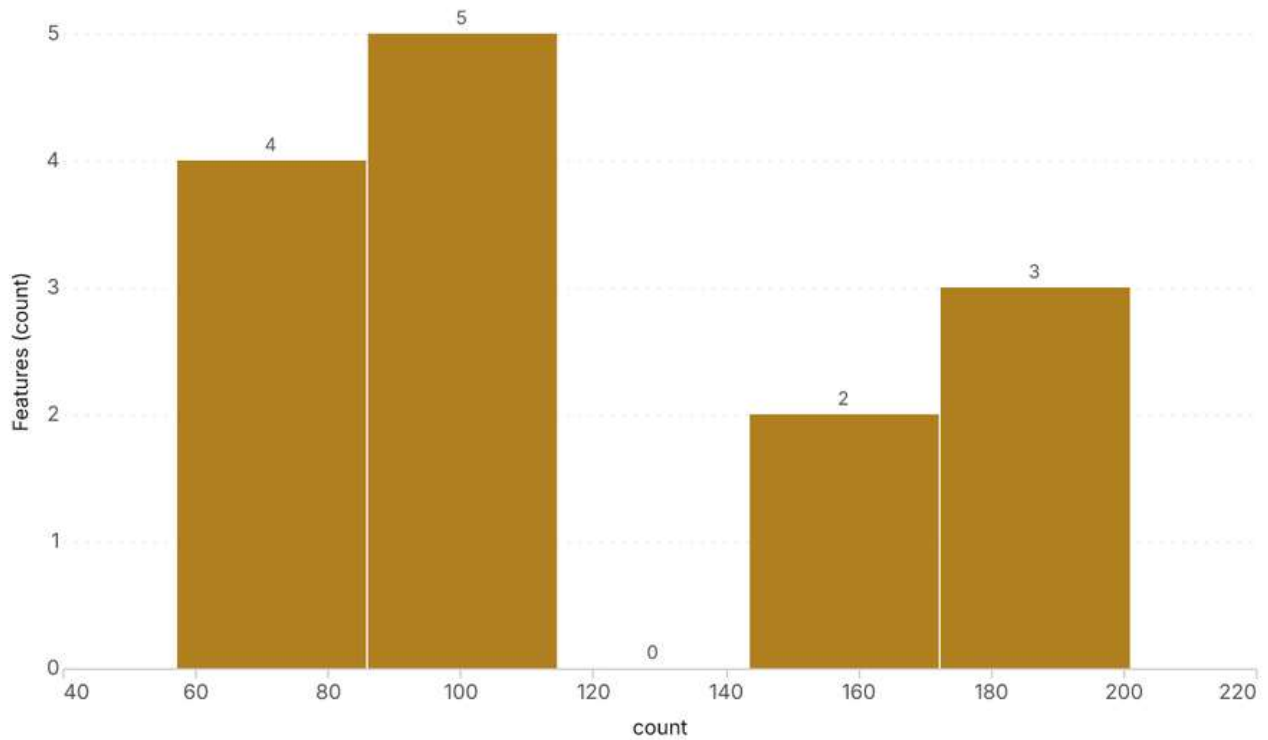


Source: Summarize within: Service areas (14 features).

Figure 35. Summarize within: Service areas [83]. Source: Summarize within: Service areas (14 features). The data is in the appendix.

Distribution of count

14 values in 5 bins

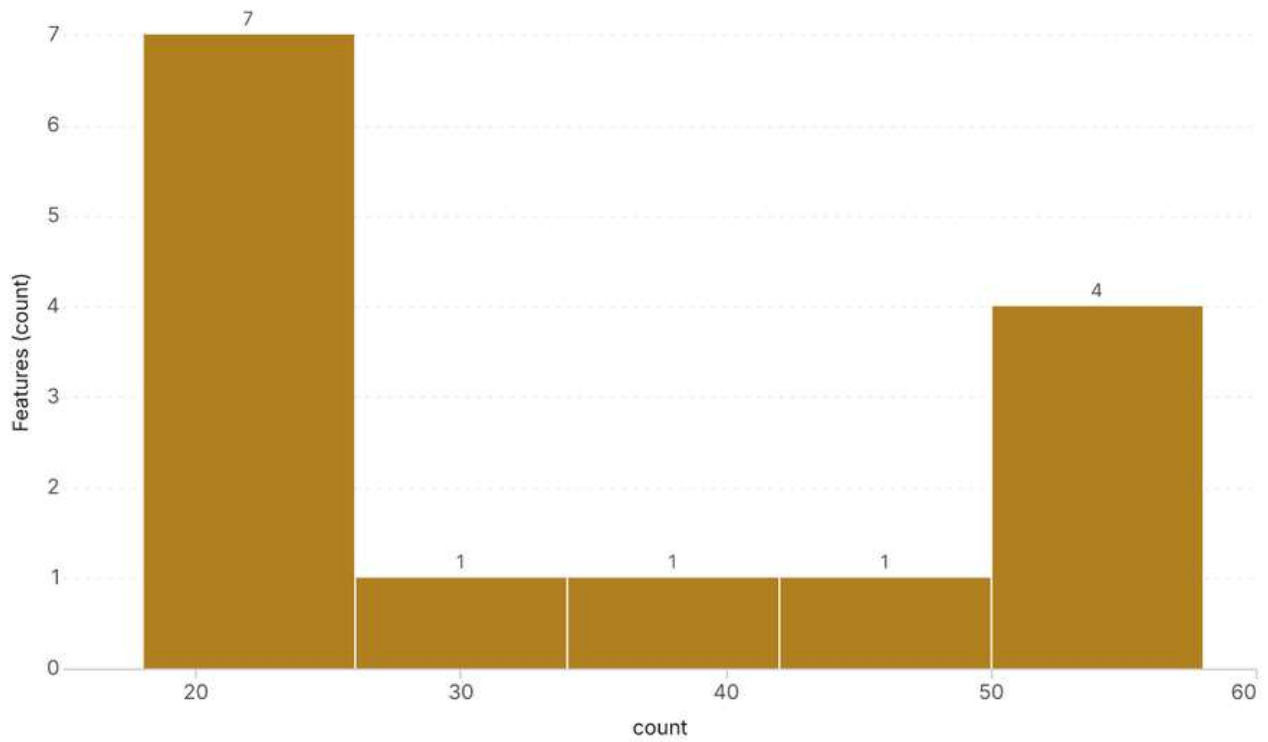


Source: Summarize within: Service areas (14 features).

Figure 36. Summarize within: Service areas [84]. Source: Summarize within: Service areas (14 features). The data is in the appendix.

Distribution of count

14 values in 5 bins



Source: Summarize within: Service areas (14 features).

Figure 37. Summarize within: Service areas [85]. Source: Summarize within: Service areas (14 features). The data is in the appendix.

Cluster sizes

12 clusters over 450 features

cluster	features	share
Noise	149	33.1%
2	49	10.9%
5	35	7.8%
4	34	7.6%
6	31	6.9%
8	26	5.8%
3	23	5.1%
7	21	4.7%
9	19	4.2%
11	17	3.8%
0	16	3.6%
1	15	3.3%
10	15	3.3%

Source: Find point clusters: Poles (450 features).

Figure 38. Find point clusters: Poles [86]. Source: Find point clusters: Poles (450 features). The data is in the appendix.

Cluster sizes

12 clusters over 12 features

cluster	features	share
0	1	8.3%
1	1	8.3%
10	1	8.3%
11	1	8.3%
2	1	8.3%
3	1	8.3%
4	1	8.3%
5	1	8.3%
6	1	8.3%
7	1	8.3%
8	1	8.3%
9	1	8.3%

Source: Find point clusters: cluster hulls (12 features).

Figure 39. Find point clusters: cluster hulls [87]. Source: Find point clusters: cluster hulls (12 features). The data is in the appendix.

Cluster sizes

12 clusters over 1,650 features

cluster	features	share
Noise	985	59.7%
5	121	7.3%
0	112	6.8%
1	81	4.9%
7	76	4.6%
3	56	3.4%
4	54	3.3%
6	34	2.1%
8	34	2.1%
2	32	1.9%
9	31	1.9%
10	20	1.2%
11	14	0.8%

Period: 2024-10-01 to 2026-09-30 (started_at). Source: Find point clusters: Outages (1,650 f...

Figure 40. Find point clusters: Outages [88]. Period: 2024-10-01 to 2026-09-30 (started_at). Source: Find point clusters: Outages (1,650 features). The data is in the appendix.

Cluster sizes

12 clusters over 12 features

cluster	features	share
0	1	8.3%
1	1	8.3%
10	1	8.3%
11	1	8.3%
2	1	8.3%
3	1	8.3%
4	1	8.3%
5	1	8.3%
6	1	8.3%
7	1	8.3%
8	1	8.3%
9	1	8.3%

Source: Find point clusters: cluster hulls (12 features).

Figure 41. Find point clusters: cluster hulls [89]. Source: Find point clusters: cluster hulls (12 features). The data is in the appendix.

Cluster sizes

9 clusters over 480 features

cluster	features	share
Noise	157	32.7%
0	83	17.3%
1	56	11.7%
2	39	8.1%
4	36	7.5%
7	36	7.5%
6	20	4.2%
3	19	4.0%
5	19	4.0%
8	15	3.1%

Period: 2024-10-04 to 2026-09-21 (date). Source: Find point clusters: Vegetation work order...

Figure 42. Find point clusters: Vegetation work orders [90]. Period: 2024-10-04 to 2026-09-21 (date). Source: Find point clusters: Vegetation work orders (480 features). The data is in the appendix.

Cluster sizes

9 clusters over 9 features

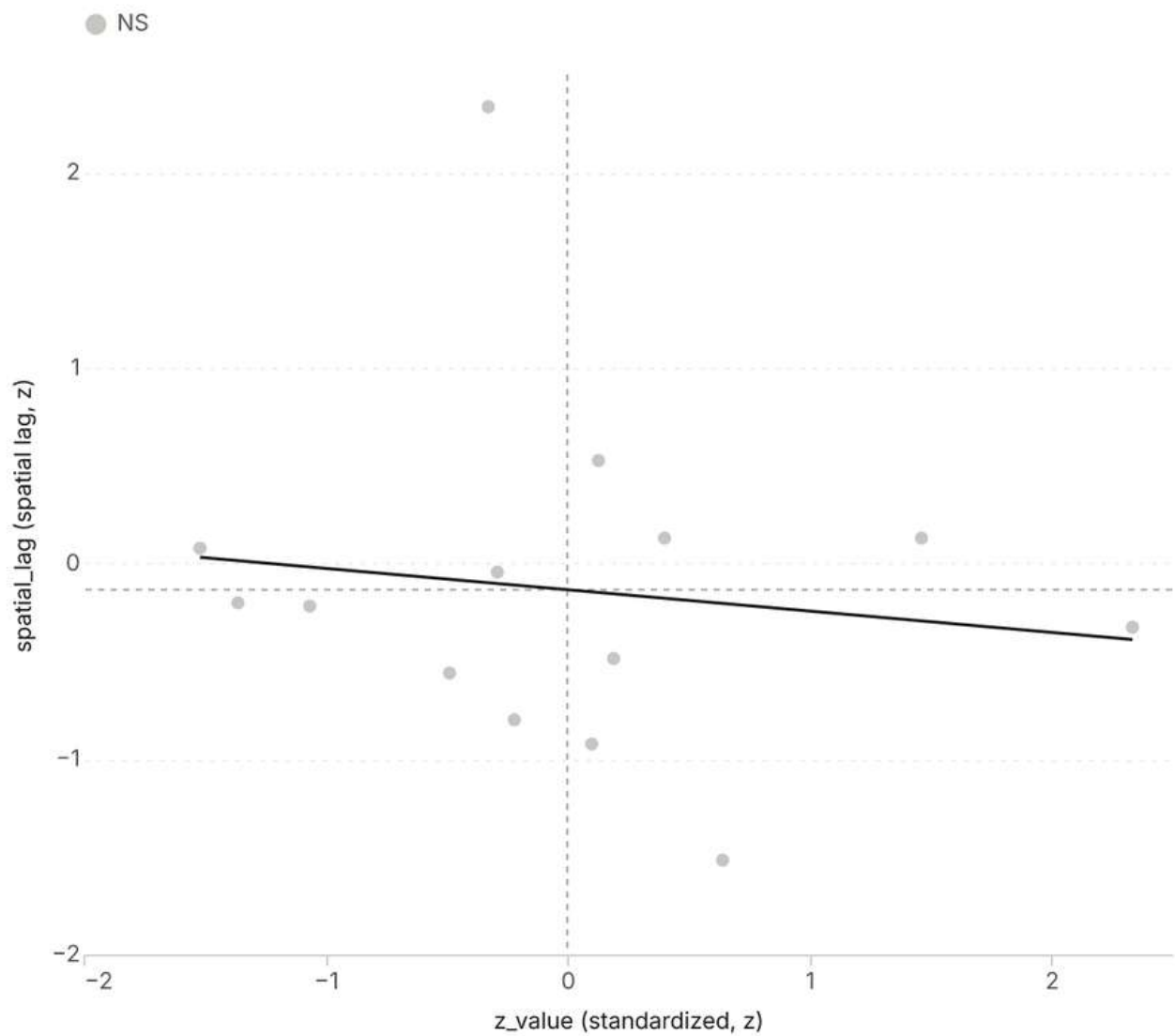
cluster	features	share
0	1	11.1%
1	1	11.1%
2	1	11.1%
3	1	11.1%
4	1	11.1%
5	1	11.1%
6	1	11.1%
7	1	11.1%
8	1	11.1%

Source: Find point clusters: cluster hulls (9 features).

Figure 43. Find point clusters: cluster hulls [91]. Source: Find point clusters: cluster hulls (9 features). The data is in the appendix.

Moran scatter

14 features; slope -0.109 (the Moran's I of these standardized values)



Source: Find outliers: Service areas (14 features).

Figure 44. Find outliers: Service areas [92]. Source: Find outliers: Service areas (14 features). The data is in the appendix.

Count per month by started_at and cause

Per month: 24 months from 2024-10-01 to 2026-09-01; trend +0.789 per month; first half 858, second half 792 (-7.7%)

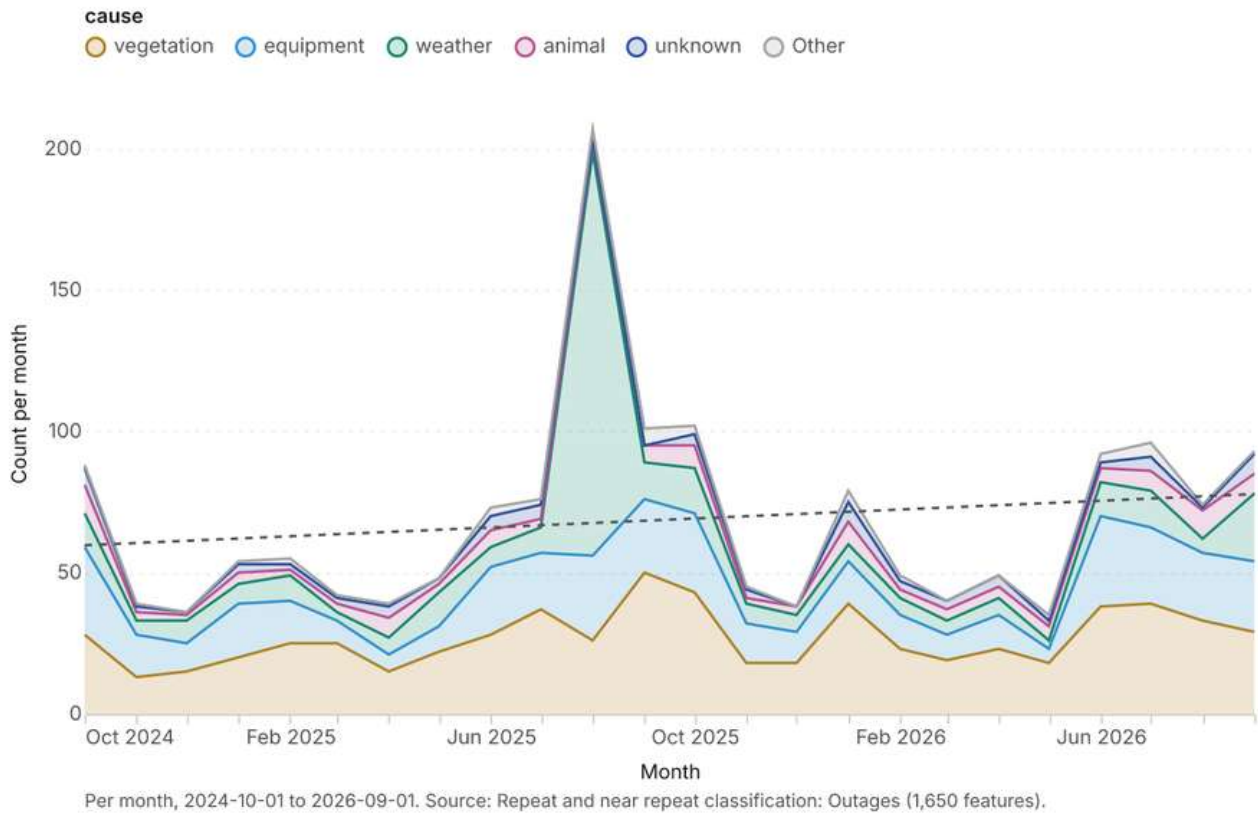


Figure 45. Repeat and near repeat classification: Outages [93]. Per month, 2024-10-01 to 2026-09-01. Source: Repeat and near repeat classification: Outages (1,650 features). The data is in the appendix.

Count per month by started_at and cause

Per month: 24 months from 2024-10-01 to 2026-09-01; trend +0.789 per month; first half 858, second half 792 (-7.7%)

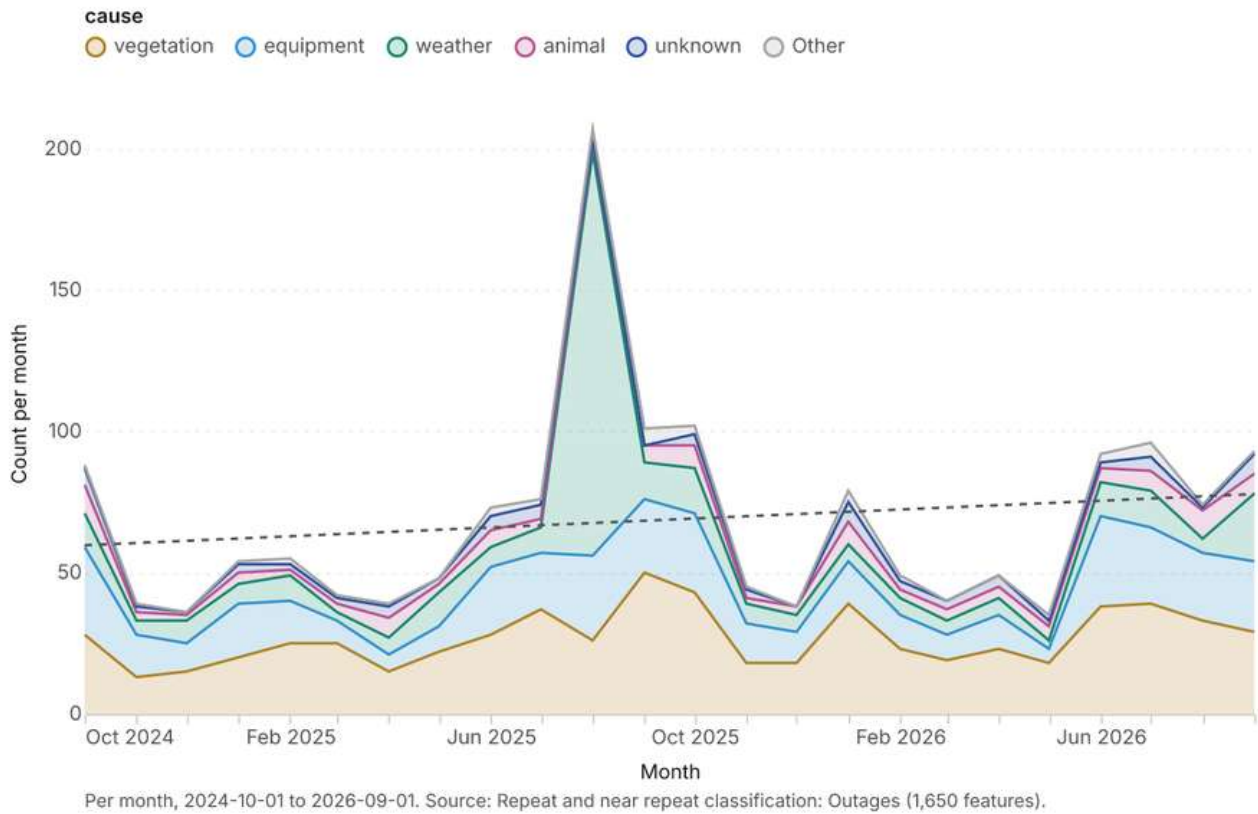


Figure 46. Repeat and near repeat classification: Outages over time [94]. Per month, 2024-10-01 to 2026-09-01. Source: Repeat and near repeat classification: Outages (1,650 features). The data is in the appendix.

Count per month by date and spans

Per month: 24 months from 2024-10-01 to 2026-09-01; trend +0.164 per month; first half 225, second half 255 (+13.3%)

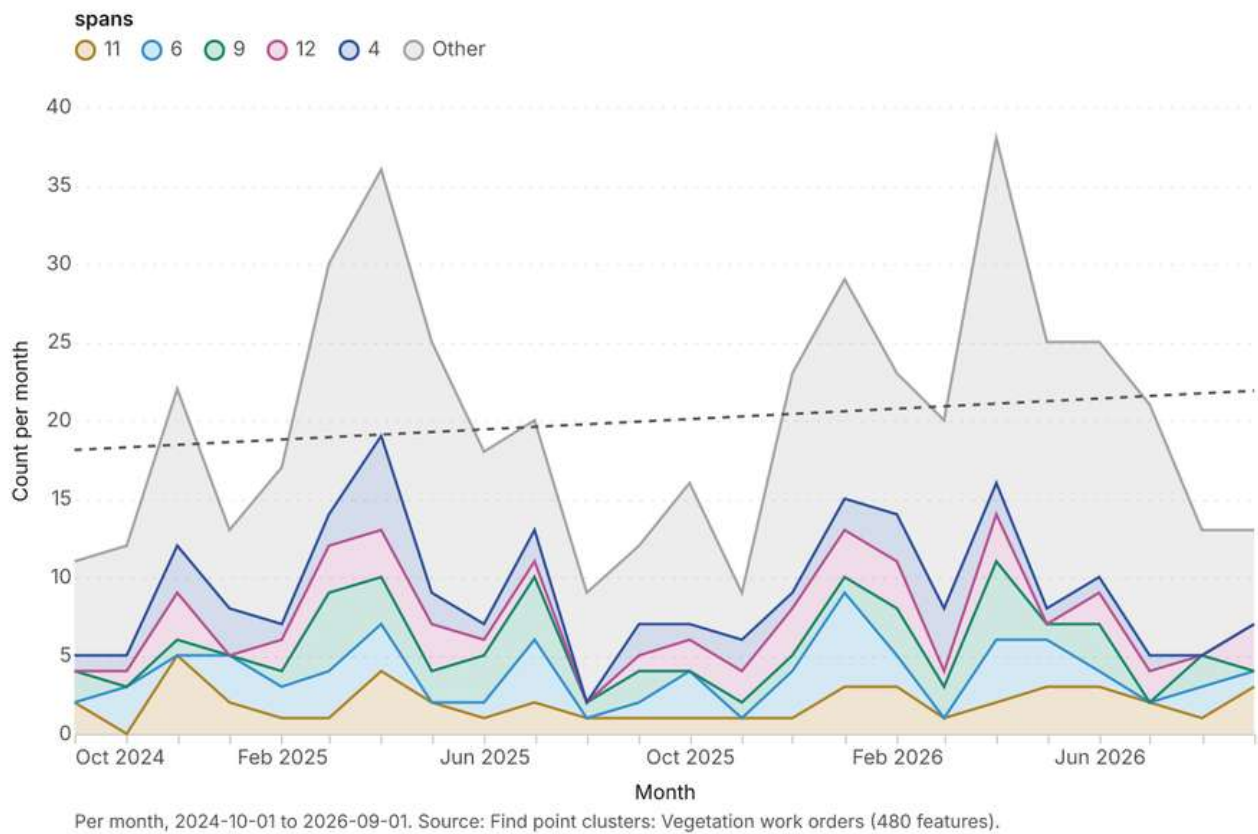


Figure 47. Find point clusters: Vegetation work orders over time [95]. Per month, 2024-10-01 to 2026-09-01. Source: Find point clusters: Vegetation work orders (480 features). The data is in the appendix.

Count per month by started_at and cause

Per month: 24 months from 2024-10-01 to 2026-09-01; trend +0.789 per month; first half 858, second half 792 (-7.7%)

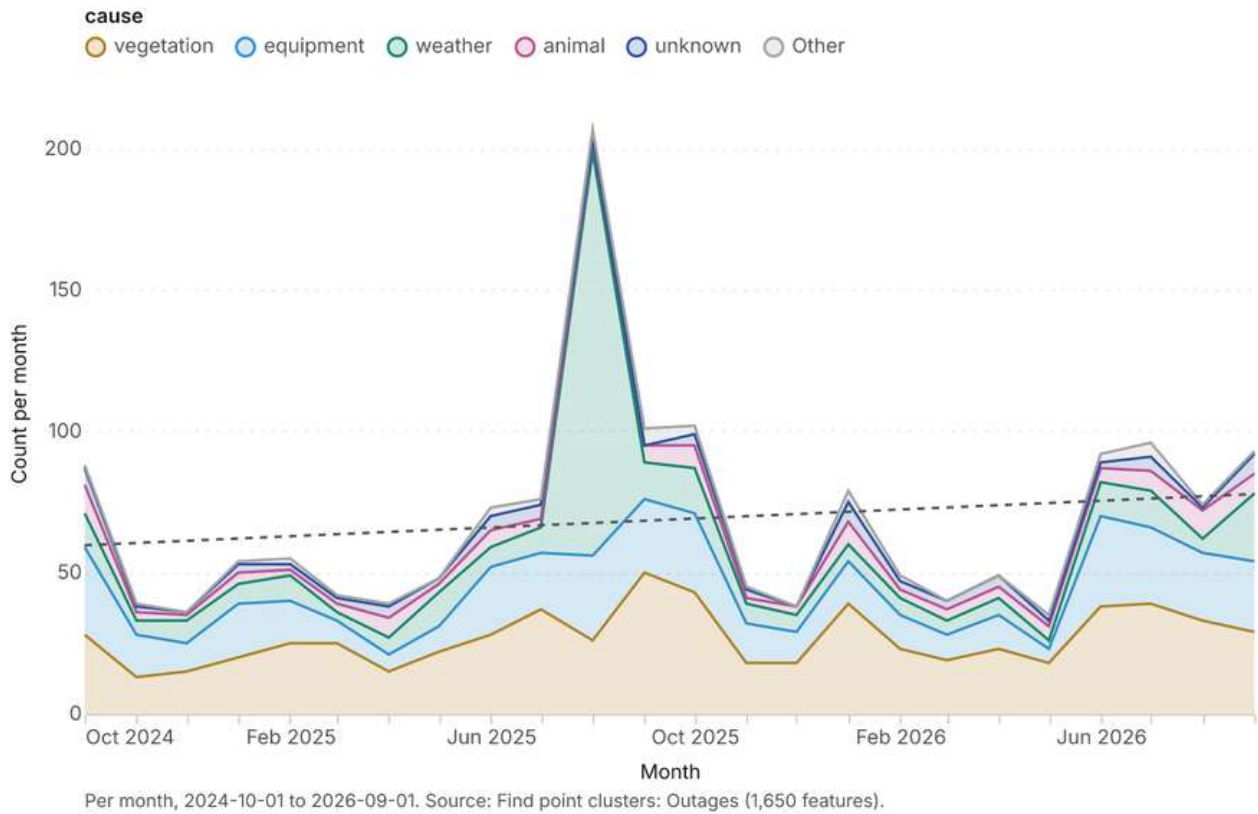


Figure 48. Find point clusters: Outages over time [96]. Per month, 2024-10-01 to 2026-09-01. Source: Find point clusters: Outages (1,650 features). The data is in the appendix.

Count per month by started_at and cause

Per month: 24 months from 2024-10-01 to 2026-09-01; trend +0.789 per month; first half 858, second half 792 (-7.7%)

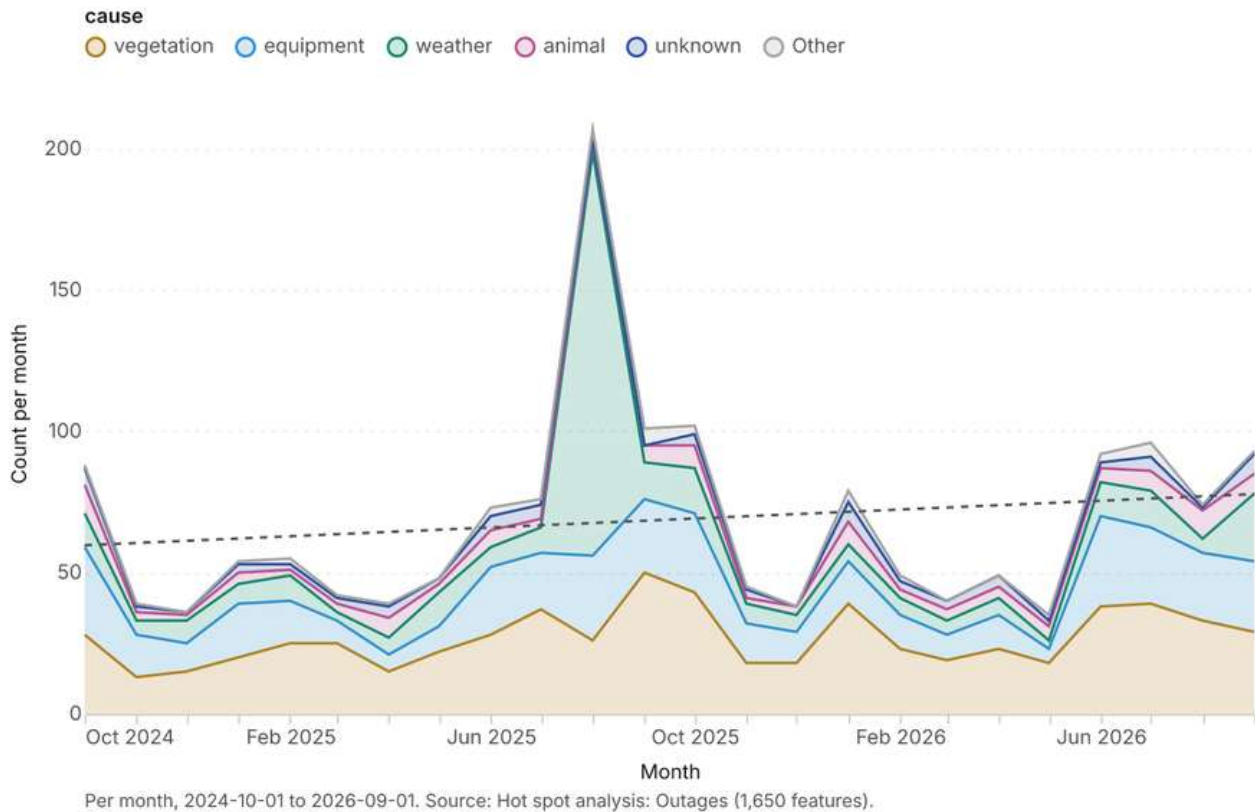


Figure 49. Hot spot analysis: Outages over time [97]. Per month, 2024-10-01 to 2026-09-01. Source: Hot spot analysis: Outages (1,650 features). The data is in the appendix.

Changes since the last run

This is the first report of this project.

Sources

- [1] Rendering: Chart: Timeline: events per quarter by dataset. 57 rows (id 4819230f-295d-49a7-99bf-6b7163fc6b06)
- [2] Dataset: Outages. vector, 1650 rows (id 39df98b3-8a4f-4af6-838d-170705e0bb48)
- [3] Dataset: Vegetation work orders. vector, 480 rows (id 3aea1163-22b4-4a72-88d7-bcae1ecdad23)
- [4] Dataset: Feeder reliability by year. table, 316 rows (id 887e0000-0f49-451b-93f4-5d68b309bfad)
- [5] Document page: Storm season reliability report, page 1. 22 August 2025 (id 32e35a86-4090-49ec-8ae9-87f7b6be0d6b:1)
- [6] Catalog: Emerging hot spots (operation catalog, gp_space_time_hot_spots). Where hot spots are new, consecutive, intensifying, persistent, diminishing, sporadic, oscillating or historical over time. ArcGIS: Emerging Hot Spot Analysis, Create Space Time Cube. (id gp_space_time_hot_spots)
- [7] Plan: Space time hot spots of Outages (the Start plan's candidate c_de6ee55db604). Outages carry dates in 'started_at': emerging hot spot analysis finds new, intensifying and fading hot spots per month. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_de6ee55db604)
- [8] Tool result: gp_space_time_hot_spots, step 0. Emerging hot spots: 1 layer saved: Emerging hot spots: Outages (100 features). (id 7e39f2a8-86e1-4856-b7a7-61e069df845f:0)
- [9] Layer: Outages. 1,650 features (id 74249532-c045-44c9-a616-0fafb7c162a0)
- [10] Plan: Space time hot spots of Vegetation work orders (the Start plan's candidate c_90f82b668b6e). Vegetation work orders carry dates in 'date': emerging hot spot analysis finds new, intensifying and fading hot spots per month. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_90f82b668b6e)
- [11] Tool result: gp_space_time_hot_spots, step 1. Emerging hot spots: 1 layer saved: Emerging hot spots: Vegetation work orders (89 features). (id 7e39f2a8-86e1-4856-b7a7-61e069df845f:1)
- [12] Layer: Vegetation work orders. 480 features (id d3eba75a-4345-496b-b3c1-cfad466d3d73)

[13] Catalog: Hot spot analysis (operation catalog, gp_hot_spots). Getis-Ord Gi* hot and cold spots with z-scores, p-values and confidence bins. ArcGIS: Find Hot Spots, Hot Spot Analysis (Getis-Ord Gi*). QGIS: qgis:hotspot (plugin). (id gp_hot_spots)

[14] Plan: Hot spots of Poles (the Start plan's candidate c_8543237d7e01). 450 points: Getis-Ord Gi* tests whether the concentrations in Poles are statistically significant. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_8543237d7e01)

[15] Tool result: gp_hot_spots, step 0. Hot spot analysis: 1 layer saved: Hot spot analysis: Poles (79 features). (id dd7f4187-7acb-4060-a294-8f874d038e7b:0)

[16] Layer: Poles. 450 features (id cb7cbff1-729f-45fd-bbbc-a31c0a2b6043)

[17] Plan: Hot spots of Outages (the Start plan's candidate c_2edeaea7ec43). 1650 points: Getis-Ord Gi* tests whether the concentrations in Outages are statistically significant. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_2edeaea7ec43)

[18] Tool result: gp_hot_spots, step 1. Hot spot analysis: 1 layer saved: Hot spot analysis: Outages (1650 features). (id dd7f4187-7acb-4060-a294-8f874d038e7b:1)

[19] Plan: Hot spots of Vegetation work orders (the Start plan's candidate c_63c929cc68f4). 480 points: Getis-Ord Gi* tests whether the concentrations in Vegetation work orders are statistically significant. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_63c929cc68f4)

[20] Tool result: gp_hot_spots, step 2. Hot spot analysis: 1 layer saved: Hot spot analysis: Vegetation work orders (86 features). (id dd7f4187-7acb-4060-a294-8f874d038e7b:2)

[21] Catalog: Calculate density (operation catalog, gp_calculate_density). Kernel density per square kilometer on a grid. ArcGIS: Calculate Density, Kernel Density. QGIS: native:heatmapkerneldensityestimation. (id gp_calculate_density)

[22] Plan: Kernel density of Poles (the Start plan's candidate c_39401f3daf3b). 450 points in Poles: a density surface shows where they concentrate. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_39401f3daf3b)

[23] Tool result: gp_calculate_density, step 0. Calculate density: 1 layer saved: Calculate density: Poles (344 features). (id cddccd9e-fca2-4947-ac52-4a032f65ccd9:0)

[24] Plan: Kernel density of Outages (the Start plan's candidate c_5f4ad3832af3). 1650 points in Outages: a density surface shows where they concentrate. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_5f4ad3832af3)

[25] Tool result: gp_calculate_density, step 1. Calculate density: 1 layer saved: Calculate density: Outages (1588 features). (id cddccd9e-fca2-4947-ac52-4a032f65ccd9:1)

[26] Plan: Kernel density of Vegetation work orders (the Start plan's candidate c_fcff6300c7b4). 480 points in Vegetation work orders: a density surface shows where they concentrate. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_fcff6300c7b4)

[27] Tool result: gp_calculate_density, step 2. Calculate density: 1 layer saved: Calculate density: Vegetation work orders (350 features). (id cddccd9e-fca2-4947-ac52-4a032f65ccd9:2)

[28] Catalog: Summarize within (operation catalog, gp_summarize_within). Count and aggregate the features inside each polygon (or bin), proportionally for lines and polygons. ArcGIS: Summarize Within, Aggregate Points. QGIS: native:countpointsinpolygon, native:sumlinelengths. (id gp_summarize_within)

[29] Plan: Poles per feature of Service areas (the Start plan's candidate c_0abb031a5451). Count Poles inside each feature of Service areas by material; the counts map as a choropleth (natural breaks, sequential colors). (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_0abb031a5451)

[30] Tool result: gp_summarize_within, step 0. Summarize within: 1 layer saved: Summarize within: Service areas (14 features). (id 7abde2bd-08d7-47d0-ac4b-96744e82d444:0)

[31] Layer: Service areas. 14 features (id af824cfb-eb9c-4c01-a5c2-df454a844893)

[32] Tool result: gp_summarize_within, step 1. Summarize within: 1 layer saved: Summarize within: Service areas (14 features). (id 7abde2bd-08d7-47d0-ac4b-96744e82d444:1)

[33] Tool result: gp_summarize_within, step 2. Summarize within: 1 layer saved: Summarize within: Service areas (14 features). (id 7abde2bd-08d7-47d0-ac4b-96744e82d444:2)

[34] Catalog: Find point clusters (operation catalog, gp_find_point_clusters). Density-based clusters (DBSCAN, HDBSCAN or OPTICS, optionally space-time) with hulls and noise. ArcGIS: Find Point Clusters, Density-based Clustering. QGIS: native:dbscanclustering, native:stdbscanclustering. (id gp_find_point_clusters)

[35] Plan: Cluster points of Poles (the Start plan's candidate c_49349f7319f8). DBSCAN finds dense groups of Poles and separates noise. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_49349f7319f8)

[36] Tool result: gp_find_point_clusters, step 0. Find point clusters: 2 layers saved: Find point clusters: Poles (450 features); Find point clusters: cluster hulls (12 features). (id a1a5ebf4-55fc-498c-bc42-232278d7fd50:0)

[37] Plan: Cluster points of Outages (the Start plan's candidate c_9d082d10c718). DBSCAN finds dense groups of Outages and separates noise. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_9d082d10c718)

[38] Tool result: gp_find_point_clusters, step 1. Find point clusters: 2 layers saved: Find point clusters: Outages (1650 features); Find point clusters: cluster hulls (12 features). (id a1a5ebf4-55fc-498c-bc42-232278d7fd50:1)

[39] Plan: Cluster points of Vegetation work orders (the Start plan's candidate c_ec3997c2afdb). DBSCAN finds dense groups of Vegetation work orders and separates noise. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_ec3997c2afdb)

[40] Tool result: gp_find_point_clusters, step 2. Find point clusters: 2 layers saved: Find point clusters: Vegetation work orders (480 features); Find point clusters: cluster hulls (9 features). (id a1a5ebf4-55fc-498c-bc42-232278d7fd50:2)

[41] Catalog: Find outliers (operation catalog, gp_outliers). Anselin local Moran's I: HH, LL clusters and HL, LH outliers. ArcGIS: Find Outliers, Cluster and Outlier Analysis (Anselin Local Moran's I). (id gp_outliers)

[42] Plan: Local morans i of Service areas (the Start plan's candidate c_14f3a517187f). Local Moran's I maps clusters and outliers of 'customers'. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_14f3a517187f)

[43] Tool result: gp_outliers, step 0. Find outliers: 1 layer saved: Find outliers: Service areas (14 features). (id 0eeb802a-0001-4240-800b-19f28e01e992:0)

[44] Catalog: Spatial autocorrelation (operation catalog, gp_spatial_autocorrelation). Global Moran's I: is the pattern clustered, dispersed or random. ArcGIS: Spatial Autocorrelation (Global Moran's I). (id gp_spatial_autocorrelation)

[45] Plan: Global morans i of Service areas (the Start plan's candidate c_ce02f9951480). Global Moran's I says whether similar values of 'customers' sit next to each other. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_ce02f9951480)

[46] Tool result: gp_spatial_autocorrelation, step 1. Spatial autocorrelation: done; no map output. (id 0eeb802a-0001-4240-800b-19f28e01e992:1)

[47] Catalog: Repeat and near repeat classification (operation catalog, gp_near_repeat). Classify incidents as originators, repeats (same place) or near repeats within a distance and time window, with a Knox test table. ArcGIS: Repeat and Near Repeat Classification, Near Repeat Calculator. (id gp_near_repeat)

[48] Plan: Near repeat of Outages (the Start plan's candidate c_c8acd413fa13). Near repeat analysis tests whether Outages close in space also follow each other within 30 days. (id a5b6c9d4-e26f-4c51-adac-5b8547525805:c_c8acd413fa13)

[49] Tool result: gp_near_repeat, step 0. Repeat and near repeat classification: 1 layer saved: Repeat and near repeat classification: Outages (1650 features). (id 7d19f92c-f4e9-48f3-93b0-dae3bf87b4ee:0)

[50] Rendering: Map: Emerging hot spots: Outages (id 85c7e950-dc12-47d7-9698-4f3e33d102c5)

[51] Rendering: Map: Emerging hot spots: Vegetation work orders (id d57a1eed-7833-4fa0-ba3b-1d34a14adf8d)

[52] Rendering: Map: Hot spot analysis: Poles (id 9c171d35-6e8a-404e-b179-3a277cac6680)

[53] Rendering: Map: Hot spot analysis: Outages (id 8b2915ad-3dc8-4c93-8998-6f8c60edde26)

[54] Rendering: Map: Hot spot analysis: Vegetation work orders (id 1951c285-f42c-4fe7-a12b-c61e0f8e89b1)

[55] Rendering: Map: Calculate density: Poles (id 77494a3a-e8bf-4ba9-8c9f-bbca3ed39699)

[56] Rendering: Map: Calculate density: Outages (id 2539e062-6c7a-48d8-915c-ceb004cf1c30)

[57] Rendering: Map: Calculate density: Vegetation work orders (id 90718fcc-1e9e-4189-b307-dd23cdc248d7)

[58] Rendering: Map: Summarize within: Service areas (id aaf8c40e-6ba8-477d-9349-b080f65d9f6f)

[59] Rendering: Map: Summarize within: Service areas (id 205c58ca-663e-465b-b5da-e58df3a3a282)

[60] Rendering: Map: Summarize within: Service areas (id baad37d3-dcec-4a96-add7-fa1a886f6434)

[61] Rendering: Map: Find point clusters: Poles (id 244f950b-322a-4f47-9af0-a30ad8fb8bad)

[62] Rendering: Map: Find point clusters: cluster hulls (id d83dd986-dc80-4bfd-886c-ff9fb5202ae7)

[63] Rendering: Map: Find point clusters: Outages (id a84598e8-6ff6-4f96-960b-18389e35387e)

[64] Rendering: Map: Find point clusters: cluster hulls (id f19bdfd5-1091-44cd-baae-dbac01077b12)

[65] Rendering: Map: Find point clusters: Vegetation work orders (id f99266a6-079b-44d5-852d-676355c69c8f)

[66] Rendering: Map: Find point clusters: cluster hulls (id d61dc500-d849-4c67-8699-7c2b54d04ac2)

[67] Rendering: Map: Service areas by customers (id 053475d3-62c9-4ca9-9150-1780c6628edd)

[68] Rendering: Map: Find outliers: Service areas (id 40748e31-9982-4c38-83df-2e829b1cd052)

[69] Rendering: Map: Repeat and near repeat classification: Outages (id 2dd79f43-b1db-44d1-b050-cb0ad8062f39)

[70] Rendering: Chart: Feeder lines over time (install_year). 8 rows (id a6ddfdb0-4d56-4fd4-95e4-dccff9b3fe14)

[71] Rendering: Chart: Vegetation work orders over time (date). 72 rows (id fe31e6f1-8de6-4739-b859-5ca5639a090e)

[72] Rendering: Chart: Poles over time (install_year). 10 rows (id 1a338811-8c8f-4624-affb-5f6f2a386c21)

[73] Rendering: Chart: Feeder reliability by year over time (year). 37 rows (id 81342282-782d-4f77-a6ab-c97a78fe8806)

[74] Rendering: Chart: Transformer assets over time (install_year). 10 rows (id 8b1d0ff4-f186-4254-b010-9684ed1844c3)

[75] Rendering: Chart: Emerging hot spots: Outages. 8 rows (id d57c5b66-d8b2-462a-85ae-76e9926eb3b1)

[76] Rendering: Chart: Emerging hot spots: Vegetation work orders. 8 rows (id d126a2b6-196d-4f93-93d5-5ce7f5d9f891)

[77] Rendering: Chart: Hot spot analysis: Poles. 9 rows (id b3100e77-5cbe-4a62-b253-290a5d536bb5)

-
- [78] Rendering: Chart: Hot spot analysis: Outages. 18 rows (id cec85df8-5d0a-4af6-ba88-696eca4ce437)
- [79] Rendering: Chart: Hot spot analysis: Vegetation work orders. 10 rows (id 1a614d2a-305a-4dfc-a43d-d303a95fb7b7)
- [80] Rendering: Chart: Calculate density: Poles. 10 rows (id 2ea4b4d0-a10d-4113-b8f2-fb2372244db4)
- [81] Rendering: Chart: Calculate density: Outages. 12 rows (id a201fc49-4d81-4320-8155-2f3eb69bd7da)
- [82] Rendering: Chart: Calculate density: Vegetation work orders. 10 rows (id 1a66e57b-240e-4644-ab5f-f5d3fceebe6)
- [83] Rendering: Chart: Summarize within: Service areas. 5 rows (id ac78768b-6dc9-4d58-b972-2cf6dec976ea)
- [84] Rendering: Chart: Summarize within: Service areas. 5 rows (id 0ee3a30f-bde2-4bb4-9019-791dd822ac96)
- [85] Rendering: Chart: Summarize within: Service areas. 5 rows (id 1cd10d51-b513-49a7-b54f-6694f693c6a5)
- [86] Rendering: Chart: Find point clusters: Poles. 13 rows (id 4d716dc4-27b8-4ca0-8c8b-b4246f0cf77f)
- [87] Rendering: Chart: Find point clusters: cluster hulls. 12 rows (id d68e61ee-9527-48bd-93b1-e6d214930ddb)
- [88] Rendering: Chart: Find point clusters: Outages. 13 rows (id 658b2721-1008-4707-8089-5fc9e67e755d)
- [89] Rendering: Chart: Find point clusters: cluster hulls. 12 rows (id 3c8e6159-5e84-4f48-a0a3-71bc429bc627)
- [90] Rendering: Chart: Find point clusters: Vegetation work orders. 10 rows (id 77d5d6a0-286e-48b2-83b6-f1379a2b6e25)
- [91] Rendering: Chart: Find point clusters: cluster hulls. 9 rows (id ebdaf978-c973-42d9-b815-55c700b8af71)
- [92] Rendering: Chart: Find outliers: Service areas. 14 rows (id c9960c12-89e8-43ab-83aa-898a65c8d7e1)
- [93] Rendering: Chart: Repeat and near repeat classification: Outages. 144 rows (id 59506424-cd43-4c06-82b9-310f05aa3ef1)
- [94] Rendering: Chart: Repeat and near repeat classification: Outages over time. 144 rows (id e21c9039-2700-4091-9c70-031cd03ca122)
- [95] Rendering: Chart: Find point clusters: Vegetation work orders over time. 144 rows (id 17f450e3-64de-4bba-a8b9-1f01286c5da9)
- [96] Rendering: Chart: Find point clusters: Outages over time. 144 rows (id 7c632546-38e2-4ef7-a37f-a50b9e7200a4)
- [97] Rendering: Chart: Hot spot analysis: Outages over time. 144 rows (id 89489499-b4a2-4e58-b157-ba3c649aecd2)
- [98] Dataset: Substations. vector, 14 rows (id f259f42c-1706-41ba-a78a-1361f3914e06)
- [99] Dataset: Feeder lines. vector, 79 rows (id ecfb48ff-6d02-430b-9ebb-f111ab17967c)
- [100] Dataset: Service areas. vector, 14 rows (id f3d1d854-cd9c-48c7-8f7a-a2e854a8ceb6)
- [101] Dataset: Critical customers. vector, 60 rows (id e19506c9-69b8-4925-bb88-2c0235b75a70)
- [102] Dataset: Poles. vector, 450 rows (id 3786e568-d7a4-4d47-b594-453c79329fb0)
- [103] Dataset: Transformer assets. table, 300 rows (id 2e9131d9-123c-4a43-986c-82f9c9221692)
- [104] Dataset: Storm season reliability report. document, ? rows (id b535c355-1229-4d0f-9126-2fe58457bcec)
- [105] Record: Sample: Electricity utility, Houston (id 99e378b8-9e64-42f5-8930-fca7c2a73f57)
- [106] Layer: Emerging hot spots: Outages. 100 features (id c053bfd3-6311-4cf3-a811-669d5782bdb3)
- [107] Layer: Emerging hot spots: Vegetation work orders. 89 features (id 1cbdbfca-5f5d-4277-87ce-4d482b63ec8e)
- [108] Layer: Hot spot analysis: Poles. 79 features (id ddab229d-5eab-4322-8c2b-76442371347b)
- [109] Layer: Hot spot analysis: Outages. 1,650 features (id 152d5bad-10c2-42e3-98ef-f598b1d425bd)
- [110] Layer: Hot spot analysis: Vegetation work orders. 86 features (id aa682980-c78f-45bf-a39c-e6c25235ecf0)
- [111] Layer: Calculate density: Poles. 344 features (id 092a4943-ffb6-462a-afdb-cfca08b63795)
- [112] Layer: Calculate density: Outages. 1,588 features (id c9cfc32c-1601-4e5a-9160-a0a02112b586)
- [113] Layer: Calculate density: Vegetation work orders. 350 features (id c3b70581-64dc-4b78-82c2-af051c400b18)
- [114] Layer: Summarize within: Service areas. 14 features (id 080e40ba-f7ec-49b3-856b-2145df7839bf)
- [115] Layer: Summarize within: Service areas. 14 features (id 9f88918e-62a5-4499-b99b-d19d559ee0a7)
- [116] Layer: Summarize within: Service areas. 14 features (id a4302e84-efd6-417d-9791-39532ad03ea3)
- [117] Layer: Find point clusters: Poles. 450 features (id d8bd47c0-3090-477e-9f4e-99798bfd2778)
- [118] Layer: Find point clusters: cluster hulls. 12 features (id 99b9ab3e-1fc2-4630-afb7-f5a5db637828)
- [119] Layer: Find point clusters: Outages. 1,650 features (id 402ad5f6-a892-490a-a647-e6e94f591e27)
- [120] Layer: Find point clusters: cluster hulls. 12 features (id 56caa497-390e-42c8-9f4d-6813ec441e8c)
- [121] Layer: Find point clusters: Vegetation work orders. 480 features (id 9ab95317-7431-4636-b94c-06bb41924b25)
- [122] Layer: Find point clusters: cluster hulls. 9 features (id 134428d0-3eb6-4afb-b65a-2f63ca197338)

[123] Layer: Find outliers: Service areas. 14 features (id 31a2a6ae-e1c2-4384-bdb2-7d30ebff9f80)

[124] Layer: Repeat and near repeat classification: Outages. 1,650 features (id 9fd9267d-3aae-4cac-90a0-3de6c177fa4f)

Appendix: the data behind the charts

Figure 1. Timeline: events per quarter by dataset [1]

period	series	value
2022-01-01	Outages	0
2022-01-01	Vegetation work orders	0
2022-01-01	Feeder reliability by year	79
2022-04-01	Outages	0
2022-04-01	Vegetation work orders	0
2022-04-01	Feeder reliability by year	0
2022-07-01	Outages	0
2022-07-01	Vegetation work orders	0
2022-07-01	Feeder reliability by year	0
2022-10-01	Outages	0
2022-10-01	Vegetation work orders	0
2022-10-01	Feeder reliability by year	0
2023-01-01	Outages	0
2023-01-01	Vegetation work orders	0
2023-01-01	Feeder reliability by year	79
2023-04-01	Outages	0
2023-04-01	Vegetation work orders	0
2023-04-01	Feeder reliability by year	0
2023-07-01	Outages	0
2023-07-01	Vegetation work orders	0
2023-07-01	Feeder reliability by year	0
2023-10-01	Outages	0
2023-10-01	Vegetation work orders	0
2023-10-01	Feeder reliability by year	0
2024-01-01	Outages	0
2024-01-01	Vegetation work orders	0
2024-01-01	Feeder reliability by year	79
2024-04-01	Outages	0
2024-04-01	Vegetation work orders	0
2024-04-01	Feeder reliability by year	0
2024-07-01	Outages	0
2024-07-01	Vegetation work orders	0
2024-07-01	Feeder reliability by year	0
2024-10-01	Outages	163
2024-10-01	Vegetation work orders	45
2024-10-01	Feeder reliability by year	0
2025-01-01	Outages	151
2025-01-01	Vegetation work orders	60
2025-01-01	Feeder reliability by year	79

period	series	value
2025-04-01	Outages	160
2025-04-01	Vegetation work orders	79
2025-04-01	Feeder reliability by year	0
2025-07-01	Outages	384
2025-07-01	Vegetation work orders	41
2025-07-01	Feeder reliability by year	0
2025-10-01	Outages	185
2025-10-01	Vegetation work orders	48
2025-10-01	Feeder reliability by year	0
2026-01-01	Outages	168
2026-01-01	Vegetation work orders	72
2026-01-01	Feeder reliability by year	0
2026-04-01	Outages	176
2026-04-01	Vegetation work orders	88
2026-04-01	Feeder reliability by year	0
2026-07-01	Outages	263
2026-07-01	Vegetation work orders	47
2026-07-01	Feeder reliability by year	0

Figure 22. Feeder lines over time (install_year) [70]

bin_start	bin_end	count
1,964	1,971	12
1,971	1,978	16
1,978	1,986	10
1,986	1,993	6
1,993	2,000	14
2,000	2,008	10
2,008	2,015	2
2,015	2,022	9

Figure 23. Vegetation work orders over time (date) [71]

period	series	value
2024-10-01	hazard tree	2
2024-10-01	cycle trim	4
2024-10-01	hot spot	5
2024-11-01	hazard tree	5
2024-11-01	cycle trim	4
2024-11-01	hot spot	3
2024-12-01	hazard tree	9
2024-12-01	cycle trim	6
2024-12-01	hot spot	7
2025-01-01	hazard tree	2
2025-01-01	cycle trim	6
2025-01-01	hot spot	5

period	series	value
2025-02-01	hazard tree	8
2025-02-01	cycle trim	5
2025-02-01	hot spot	4
2025-03-01	hazard tree	11
2025-03-01	cycle trim	16
2025-03-01	hot spot	3
2025-04-01	hazard tree	10
2025-04-01	cycle trim	16
2025-04-01	hot spot	10
2025-05-01	hazard tree	10
2025-05-01	cycle trim	8
2025-05-01	hot spot	7
2025-06-01	hazard tree	7
2025-06-01	cycle trim	4
2025-06-01	hot spot	7
2025-07-01	hazard tree	6
2025-07-01	cycle trim	5
2025-07-01	hot spot	9
2025-08-01	hazard tree	1
2025-08-01	cycle trim	5
2025-08-01	hot spot	3
2025-09-01	hazard tree	3
2025-09-01	cycle trim	6
2025-09-01	hot spot	3
2025-10-01	hazard tree	4
2025-10-01	cycle trim	6
2025-10-01	hot spot	6
2025-11-01	hazard tree	1
2025-11-01	cycle trim	2
2025-11-01	hot spot	6
2025-12-01	hazard tree	8
2025-12-01	cycle trim	9
2025-12-01	hot spot	6
2026-01-01	hazard tree	13
2026-01-01	cycle trim	4
2026-01-01	hot spot	12
2026-02-01	hazard tree	6
2026-02-01	cycle trim	7
2026-02-01	hot spot	10
2026-03-01	hazard tree	8
2026-03-01	cycle trim	5
2026-03-01	hot spot	7
2026-04-01	hazard tree	12

period	series	value
2026-04-01	cycle trim	15
2026-04-01	hot spot	11
2026-05-01	hazard tree	10
2026-05-01	cycle trim	5
2026-05-01	hot spot	10
2026-06-01	hazard tree	12
2026-06-01	cycle trim	5
2026-06-01	hot spot	8
2026-07-01	hazard tree	5
2026-07-01	cycle trim	8
2026-07-01	hot spot	8
2026-08-01	hazard tree	5
2026-08-01	cycle trim	4
2026-08-01	hot spot	4
2026-09-01	hazard tree	3
2026-09-01	cycle trim	5
2026-09-01	hot spot	5

Figure 24. Poles over time (install_year) [72]

bin_start	bin_end	count
1,967	1,973	15
1,973	1,978	30
1,978	1,984	44
1,984	1,990	34
1,990	1,996	36
1,996	2,001	45
2,001	2,007	55
2,007	2,013	50
2,013	2,018	52
2,018	2,024	89

Figure 25. Feeder reliability by year over time (year) [73]

period	value
2022-01-01	79
2022-02-01	0
2022-03-01	0
2022-04-01	0
2022-05-01	0
2022-06-01	0
2022-07-01	0
2022-08-01	0
2022-09-01	0
2022-10-01	0
2022-11-01	0

period	value
2022-12-01	0
2023-01-01	79
2023-02-01	0
2023-03-01	0
2023-04-01	0
2023-05-01	0
2023-06-01	0
2023-07-01	0
2023-08-01	0
2023-09-01	0
2023-10-01	0
2023-11-01	0
2023-12-01	0
2024-01-01	79
2024-02-01	0
2024-03-01	0
2024-04-01	0
2024-05-01	0
2024-06-01	0
2024-07-01	0
2024-08-01	0
2024-09-01	0
2024-10-01	0
2024-11-01	0
2024-12-01	0
2025-01-01	79

Figure 26. Transformer assets over time (install_year) [74]

bin_start	bin_end	count
25	39.2	66
39.2	53.4	59
53.4	67.6	0
67.6	81.8	61
81.8	96	0
96	110.2	48
110.2	124.4	0
124.4	138.6	0
138.6	152.8	0
152.8	167	66

Figure 27. Emerging hot spots: Outages [75]

bin_start	bin_end	count
-1.044	-0.2486	36
-0.2486	0.5467	20

bin_start	bin_end	count
0.5467	1.342	21
1.342	2.138	10
2.138	2.933	4
2.933	3.728	5
3.728	4.524	3
4.524	5.319	1

Figure 28. Emerging hot spots: Vegetation work orders [76]

bin_start	bin_end	count
-0.951	-0.5264	39
-0.5264	-0.1017	28
-0.1017	0.3229	1
0.3229	0.7475	9
0.7475	1.172	1
1.172	1.597	1
1.597	2.021	9
2.021	2.446	1

Figure 29. Hot spot analysis: Poles [77]

bin_start	bin_end	band	band_label	count
-1	-0.5	not_significant	Not significant	33
-0.5	0	not_significant	Not significant	13
0	0.5	not_significant	Not significant	13
0.5	1	not_significant	Not significant	5
1	1.5	not_significant	Not significant	10
1.5	2	hot_90	Hot spot, 90% confidence	1
2	2.5	hot_95	Hot spot, 95% confidence	2
3	3.5	hot_99	Hot spot, 99% confidence	1
3.5	4	hot_99	Hot spot, 99% confidence	1

Figure 30. Hot spot analysis: Outages [78]

bin_start	bin_end	band	band_label	count
-2.5	-2	cold_95	Cold spot, 95% confidence	6
-2	-1.5	cold_90	Cold spot, 90% confidence	45
-2	-1.5	cold_95	Cold spot, 95% confidence	1
-2	-1.5	not_significant	Not significant	18
-1.5	-1	not_significant	Not significant	179
-1	-0.5	not_significant	Not significant	376
-0.5	0	not_significant	Not significant	330
0	0.5	not_significant	Not significant	246

bin_start	bin_end	band	band_label	count
0.5	1	not_significant	Not significant	205
1	1.5	not_significant	Not significant	160
1.5	2	hot_90	Hot spot, 90% confidence	25
1.5	2	hot_95	Hot spot, 95% confidence	3
1.5	2	not_significant	Not significant	15
2	2.5	hot_95	Hot spot, 95% confidence	28
2.5	3	hot_95	Hot spot, 95% confidence	3
2.5	3	hot_99	Hot spot, 99% confidence	7
3	3.5	hot_99	Hot spot, 99% confidence	2
3.5	4	hot_99	Hot spot, 99% confidence	1

Figure 31. Hot spot analysis: Vegetation work orders [79]

bin_start	bin_end	band	band_label	count
-1	-0.5	not_significant	Not significant	33
-0.5	0	not_significant	Not significant	17
0	0.5	not_significant	Not significant	13
0.5	1	not_significant	Not significant	10
1	1.5	not_significant	Not significant	5
1.5	2	hot_90	Hot spot, 90% confidence	2
1.5	2	not_significant	Not significant	2
2	2.5	hot_95	Hot spot, 95% confidence	2
2.5	3	hot_99	Hot spot, 99% confidence	1
4	4.5	hot_99	Hot spot, 99% confidence	1

Figure 32. Calculate density: Poles [80]

bin_start	bin_end	count
0	2.3	18
2.3	4.6	28
4.6	6.9	33
6.9	9.2	51
9.2	11.5	36
11.5	13.8	33
13.8	16.1	50
16.1	18.4	34
18.4	20.7	32
20.7	23	29

Figure 33. Calculate density: Outages [81]

bin_start	bin_end	count
0	4.5	37
4.5	9	59
9	13.5	160
13.5	18	118
18	22.5	189
22.5	27	166
27	31.5	179
31.5	36	129
36	40.5	190
40.5	45	144
45	49.5	137
49.5	54	80

Figure 34. Calculate density: Vegetation work orders [82]

bin_start	bin_end	count
0	2.3	18
2.3	4.6	27
4.6	6.9	34
6.9	9.2	53
9.2	11.5	38
11.5	13.8	32
13.8	16.1	52
16.1	18.4	32
18.4	20.7	32
20.7	23	32

Figure 35. Summarize within: Service areas [83]

bin_start	bin_end	count
19	24.6	3
24.6	30.2	4
30.2	35.8	3
35.8	41.4	1
41.4	47	3

Figure 36. Summarize within: Service areas [84]

bin_start	bin_end	count
57	85.8	4
85.8	114.6	5
114.6	143.4	0
143.4	172.2	2
172.2	201	3

Figure 37. Summarize within: Service areas [85]

bin_start	bin_end	count
18	26	7

bin_start	bin_end	count
26	34	1
34	42	1
42	50	1
50	58	4

Figure 38. Find point clusters: Poles [86]

cluster	features	fraction	share
Noise	149	0.3311	33.1%
2	49	0.1089	10.9%
5	35	0.07778	7.8%
4	34	0.07556	7.6%
6	31	0.06889	6.9%
8	26	0.05778	5.8%
3	23	0.05111	5.1%
7	21	0.04667	4.7%
9	19	0.04222	4.2%
11	17	0.03778	3.8%
0	16	0.03556	3.6%
1	15	0.03333	3.3%
10	15	0.03333	3.3%

Figure 39. Find point clusters: cluster hulls [87]

cluster	features	fraction	share
0	1	0.08333	8.3%
1	1	0.08333	8.3%
10	1	0.08333	8.3%
11	1	0.08333	8.3%
2	1	0.08333	8.3%
3	1	0.08333	8.3%
4	1	0.08333	8.3%
5	1	0.08333	8.3%
6	1	0.08333	8.3%
7	1	0.08333	8.3%
8	1	0.08333	8.3%
9	1	0.08333	8.3%

Figure 40. Find point clusters: Outages [88]

cluster	features	fraction	share
Noise	985	0.597	59.7%
5	121	0.07333	7.3%
0	112	0.06788	6.8%
1	81	0.04909	4.9%
7	76	0.04606	4.6%
3	56	0.03394	3.4%
4	54	0.03273	3.3%

cluster	features	fraction	share
6	34	0.02061	2.1%
8	34	0.02061	2.1%
2	32	0.01939	1.9%
9	31	0.01879	1.9%
10	20	0.01212	1.2%
11	14	0.008485	0.8%

Figure 41. Find point clusters: cluster hulls [89]

cluster	features	fraction	share
0	1	0.08333	8.3%
1	1	0.08333	8.3%
10	1	0.08333	8.3%
11	1	0.08333	8.3%
2	1	0.08333	8.3%
3	1	0.08333	8.3%
4	1	0.08333	8.3%
5	1	0.08333	8.3%
6	1	0.08333	8.3%
7	1	0.08333	8.3%
8	1	0.08333	8.3%
9	1	0.08333	8.3%

Figure 42. Find point clusters: Vegetation work orders [90]

cluster	features	fraction	share
Noise	157	0.3271	32.7%
0	83	0.1729	17.3%
1	56	0.1167	11.7%
2	39	0.08125	8.1%
4	36	0.075	7.5%
7	36	0.075	7.5%
6	20	0.04167	4.2%
3	19	0.03958	4.0%
5	19	0.03958	4.0%
8	15	0.03125	3.1%

Figure 43. Find point clusters: cluster hulls [91]

cluster	features	fraction	share
0	1	0.1111	11.1%
1	1	0.1111	11.1%
2	1	0.1111	11.1%
3	1	0.1111	11.1%
4	1	0.1111	11.1%
5	1	0.1111	11.1%
6	1	0.1111	11.1%
7	1	0.1111	11.1%

cluster	features	fraction	share
8	1	0.1111	11.1%

Figure 44. Find outliers: Service areas [92]

value	lag	type
-0.3267	2.336	NS
0.129	0.5255	NS
-1.064	-0.2187	NS
-0.2187	-0.8003	NS
-0.4868	-0.5612	NS
0.642	-1.518	NS
1.464	0.129	NS
2.336	-0.3267	NS
-0.289	-0.0449	NS
0.4018	0.129	NS
-1.361	-0.2016	NS
-1.518	0.0776	NS
0.1915	-0.4868	NS
0.1007	-0.924	NS

Figure 45. Repeat and near repeat classification: Outages [93]

period	series	value
2024-10-01	vegetation	28
2024-10-01	equipment	31
2024-10-01	weather	12
2024-10-01	animal	10
2024-10-01	unknown	6
2024-10-01	Other	1
2024-11-01	vegetation	13
2024-11-01	equipment	15
2024-11-01	weather	5
2024-11-01	animal	3
2024-11-01	unknown	2
2024-11-01	Other	1
2024-12-01	vegetation	15
2024-12-01	equipment	10
2024-12-01	weather	8
2024-12-01	animal	2
2024-12-01	unknown	1
2024-12-01	Other	0
2025-01-01	vegetation	20
2025-01-01	equipment	19
2025-01-01	weather	7
2025-01-01	animal	4
2025-01-01	unknown	3

period	series	value
2025-01-01	Other	1
2025-02-01	vegetation	25
2025-02-01	equipment	15
2025-02-01	weather	9
2025-02-01	animal	2
2025-02-01	unknown	2
2025-02-01	Other	2
2025-03-01	vegetation	25
2025-03-01	equipment	8
2025-03-01	weather	3
2025-03-01	animal	3
2025-03-01	unknown	2
2025-03-01	Other	1
2025-04-01	vegetation	15
2025-04-01	equipment	6
2025-04-01	weather	6
2025-04-01	animal	7
2025-04-01	unknown	4
2025-04-01	Other	1
2025-05-01	vegetation	22
2025-05-01	equipment	9
2025-05-01	weather	12
2025-05-01	animal	3
2025-05-01	unknown	2
2025-05-01	Other	0
2025-06-01	vegetation	28
2025-06-01	equipment	24
2025-06-01	weather	7
2025-06-01	animal	6
2025-06-01	unknown	5
2025-06-01	Other	3
2025-07-01	vegetation	37
2025-07-01	equipment	20
2025-07-01	weather	9
2025-07-01	animal	3
2025-07-01	unknown	5
2025-07-01	Other	2
2025-08-01	vegetation	26
2025-08-01	equipment	30
2025-08-01	weather	143
2025-08-01	animal	4
2025-08-01	unknown	1
2025-08-01	Other	3

period	series	value
2025-09-01	vegetation	50
2025-09-01	equipment	26
2025-09-01	weather	13
2025-09-01	animal	6
2025-09-01	unknown	0
2025-09-01	Other	6
2025-10-01	vegetation	43
2025-10-01	equipment	28
2025-10-01	weather	16
2025-10-01	animal	8
2025-10-01	unknown	4
2025-10-01	Other	3
2025-11-01	vegetation	18
2025-11-01	equipment	14
2025-11-01	weather	7
2025-11-01	animal	2
2025-11-01	unknown	3
2025-11-01	Other	1
2025-12-01	vegetation	18
2025-12-01	equipment	11
2025-12-01	weather	6
2025-12-01	animal	3
2025-12-01	unknown	0
2025-12-01	Other	0
2026-01-01	vegetation	39
2026-01-01	equipment	15
2026-01-01	weather	6
2026-01-01	animal	8
2026-01-01	unknown	7
2026-01-01	Other	4
2026-02-01	vegetation	23
2026-02-01	equipment	12
2026-02-01	weather	6
2026-02-01	animal	3
2026-02-01	unknown	3
2026-02-01	Other	2
2026-03-01	vegetation	19
2026-03-01	equipment	9
2026-03-01	weather	5
2026-03-01	animal	4
2026-03-01	unknown	3
2026-03-01	Other	0
2026-04-01	vegetation	23

period	series	value
2026-04-01	equipment	12
2026-04-01	weather	6
2026-04-01	animal	4
2026-04-01	unknown	4
2026-04-01	Other	0
2026-05-01	vegetation	18
2026-05-01	equipment	5
2026-05-01	weather	3
2026-05-01	animal	5
2026-05-01	unknown	2
2026-05-01	Other	2
2026-06-01	vegetation	38
2026-06-01	equipment	32
2026-06-01	weather	12
2026-06-01	animal	5
2026-06-01	unknown	2
2026-06-01	Other	3
2026-07-01	vegetation	39
2026-07-01	equipment	27
2026-07-01	weather	13
2026-07-01	animal	7
2026-07-01	unknown	5
2026-07-01	Other	5
2026-08-01	vegetation	33
2026-08-01	equipment	24
2026-08-01	weather	5
2026-08-01	animal	10
2026-08-01	unknown	1
2026-08-01	Other	1
2026-09-01	vegetation	29
2026-09-01	equipment	25
2026-09-01	weather	24
2026-09-01	animal	7
2026-09-01	unknown	7
2026-09-01	Other	1

Figure 46. Repeat and near repeat classification: Outages over time [94]

period	series	value
2024-10-01	vegetation	28
2024-10-01	equipment	31
2024-10-01	weather	12
2024-10-01	animal	10
2024-10-01	unknown	6
2024-10-01	Other	1

period	series	value
2024-11-01	vegetation	13
2024-11-01	equipment	15
2024-11-01	weather	5
2024-11-01	animal	3
2024-11-01	unknown	2
2024-11-01	Other	1
2024-12-01	vegetation	15
2024-12-01	equipment	10
2024-12-01	weather	8
2024-12-01	animal	2
2024-12-01	unknown	1
2024-12-01	Other	0
2025-01-01	vegetation	20
2025-01-01	equipment	19
2025-01-01	weather	7
2025-01-01	animal	4
2025-01-01	unknown	3
2025-01-01	Other	1
2025-02-01	vegetation	25
2025-02-01	equipment	15
2025-02-01	weather	9
2025-02-01	animal	2
2025-02-01	unknown	2
2025-02-01	Other	2
2025-03-01	vegetation	25
2025-03-01	equipment	8
2025-03-01	weather	3
2025-03-01	animal	3
2025-03-01	unknown	2
2025-03-01	Other	1
2025-04-01	vegetation	15
2025-04-01	equipment	6
2025-04-01	weather	6
2025-04-01	animal	7
2025-04-01	unknown	4
2025-04-01	Other	1
2025-05-01	vegetation	22
2025-05-01	equipment	9
2025-05-01	weather	12
2025-05-01	animal	3
2025-05-01	unknown	2
2025-05-01	Other	0
2025-06-01	vegetation	28

period	series	value
2025-06-01	equipment	24
2025-06-01	weather	7
2025-06-01	animal	6
2025-06-01	unknown	5
2025-06-01	Other	3
2025-07-01	vegetation	37
2025-07-01	equipment	20
2025-07-01	weather	9
2025-07-01	animal	3
2025-07-01	unknown	5
2025-07-01	Other	2
2025-08-01	vegetation	26
2025-08-01	equipment	30
2025-08-01	weather	143
2025-08-01	animal	4
2025-08-01	unknown	1
2025-08-01	Other	3
2025-09-01	vegetation	50
2025-09-01	equipment	26
2025-09-01	weather	13
2025-09-01	animal	6
2025-09-01	unknown	0
2025-09-01	Other	6
2025-10-01	vegetation	43
2025-10-01	equipment	28
2025-10-01	weather	16
2025-10-01	animal	8
2025-10-01	unknown	4
2025-10-01	Other	3
2025-11-01	vegetation	18
2025-11-01	equipment	14
2025-11-01	weather	7
2025-11-01	animal	2
2025-11-01	unknown	3
2025-11-01	Other	1
2025-12-01	vegetation	18
2025-12-01	equipment	11
2025-12-01	weather	6
2025-12-01	animal	3
2025-12-01	unknown	0
2025-12-01	Other	0
2026-01-01	vegetation	39
2026-01-01	equipment	15

period	series	value
2026-01-01	weather	6
2026-01-01	animal	8
2026-01-01	unknown	7
2026-01-01	Other	4
2026-02-01	vegetation	23
2026-02-01	equipment	12
2026-02-01	weather	6
2026-02-01	animal	3
2026-02-01	unknown	3
2026-02-01	Other	2
2026-03-01	vegetation	19
2026-03-01	equipment	9
2026-03-01	weather	5
2026-03-01	animal	4
2026-03-01	unknown	3
2026-03-01	Other	0
2026-04-01	vegetation	23
2026-04-01	equipment	12
2026-04-01	weather	6
2026-04-01	animal	4
2026-04-01	unknown	4
2026-04-01	Other	0
2026-05-01	vegetation	18
2026-05-01	equipment	5
2026-05-01	weather	3
2026-05-01	animal	5
2026-05-01	unknown	2
2026-05-01	Other	2
2026-06-01	vegetation	38
2026-06-01	equipment	32
2026-06-01	weather	12
2026-06-01	animal	5
2026-06-01	unknown	2
2026-06-01	Other	3
2026-07-01	vegetation	39
2026-07-01	equipment	27
2026-07-01	weather	13
2026-07-01	animal	7
2026-07-01	unknown	5
2026-07-01	Other	5
2026-08-01	vegetation	33
2026-08-01	equipment	24
2026-08-01	weather	5

period	series	value
2026-08-01	animal	10
2026-08-01	unknown	1
2026-08-01	Other	1
2026-09-01	vegetation	29
2026-09-01	equipment	25
2026-09-01	weather	24
2026-09-01	animal	7
2026-09-01	unknown	7
2026-09-01	Other	1

Figure 47. Find point clusters: Vegetation work orders over time [95]

period	series	value
2024-10-01	11	2
2024-10-01	6	0
2024-10-01	9	2
2024-10-01	12	0
2024-10-01	4	1
2024-10-01	Other	6
2024-11-01	11	0
2024-11-01	6	3
2024-11-01	9	0
2024-11-01	12	1
2024-11-01	4	1
2024-11-01	Other	7
2024-12-01	11	5
2024-12-01	6	0
2024-12-01	9	1
2024-12-01	12	3
2024-12-01	4	3
2024-12-01	Other	10
2025-01-01	11	2
2025-01-01	6	3
2025-01-01	9	0
2025-01-01	12	0
2025-01-01	4	3
2025-01-01	Other	5
2025-02-01	11	1
2025-02-01	6	2
2025-02-01	9	1
2025-02-01	12	2
2025-02-01	4	1
2025-02-01	Other	10
2025-03-01	11	1
2025-03-01	6	3

period	series	value
2025-03-01	9	5
2025-03-01	12	3
2025-03-01	4	2
2025-03-01	Other	16
2025-04-01	11	4
2025-04-01	6	3
2025-04-01	9	3
2025-04-01	12	3
2025-04-01	4	6
2025-04-01	Other	17
2025-05-01	11	2
2025-05-01	6	0
2025-05-01	9	2
2025-05-01	12	3
2025-05-01	4	2
2025-05-01	Other	16
2025-06-01	11	1
2025-06-01	6	1
2025-06-01	9	3
2025-06-01	12	1
2025-06-01	4	1
2025-06-01	Other	11
2025-07-01	11	2
2025-07-01	6	4
2025-07-01	9	4
2025-07-01	12	1
2025-07-01	4	2
2025-07-01	Other	7
2025-08-01	11	1
2025-08-01	6	0
2025-08-01	9	1
2025-08-01	12	0
2025-08-01	4	0
2025-08-01	Other	7
2025-09-01	11	1
2025-09-01	6	1
2025-09-01	9	2
2025-09-01	12	1
2025-09-01	4	2
2025-09-01	Other	5
2025-10-01	11	1
2025-10-01	6	3
2025-10-01	9	0

period	series	value
2025-10-01	12	2
2025-10-01	4	1
2025-10-01	Other	9
2025-11-01	11	1
2025-11-01	6	0
2025-11-01	9	1
2025-11-01	12	2
2025-11-01	4	2
2025-11-01	Other	3
2025-12-01	11	1
2025-12-01	6	3
2025-12-01	9	1
2025-12-01	12	3
2025-12-01	4	1
2025-12-01	Other	14
2026-01-01	11	3
2026-01-01	6	6
2026-01-01	9	1
2026-01-01	12	3
2026-01-01	4	2
2026-01-01	Other	14
2026-02-01	11	3
2026-02-01	6	2
2026-02-01	9	3
2026-02-01	12	3
2026-02-01	4	3
2026-02-01	Other	9
2026-03-01	11	1
2026-03-01	6	0
2026-03-01	9	2
2026-03-01	12	1
2026-03-01	4	4
2026-03-01	Other	12
2026-04-01	11	2
2026-04-01	6	4
2026-04-01	9	5
2026-04-01	12	3
2026-04-01	4	2
2026-04-01	Other	22
2026-05-01	11	3
2026-05-01	6	3
2026-05-01	9	1
2026-05-01	12	0

period	series	value
2026-05-01	4	1
2026-05-01	Other	17
2026-06-01	11	3
2026-06-01	6	1
2026-06-01	9	3
2026-06-01	12	2
2026-06-01	4	1
2026-06-01	Other	15
2026-07-01	11	2
2026-07-01	6	0
2026-07-01	9	0
2026-07-01	12	2
2026-07-01	4	1
2026-07-01	Other	16
2026-08-01	11	1
2026-08-01	6	2
2026-08-01	9	2
2026-08-01	12	0
2026-08-01	4	0
2026-08-01	Other	8
2026-09-01	11	3
2026-09-01	6	1
2026-09-01	9	0
2026-09-01	12	3
2026-09-01	4	0
2026-09-01	Other	6

Figure 48. Find point clusters: Outages over time [96]

period	series	value
2024-10-01	vegetation	28
2024-10-01	equipment	31
2024-10-01	weather	12
2024-10-01	animal	10
2024-10-01	unknown	6
2024-10-01	Other	1
2024-11-01	vegetation	13
2024-11-01	equipment	15
2024-11-01	weather	5
2024-11-01	animal	3
2024-11-01	unknown	2
2024-11-01	Other	1
2024-12-01	vegetation	15
2024-12-01	equipment	10
2024-12-01	weather	8

period	series	value
2024-12-01	animal	2
2024-12-01	unknown	1
2024-12-01	Other	0
2025-01-01	vegetation	20
2025-01-01	equipment	19
2025-01-01	weather	7
2025-01-01	animal	4
2025-01-01	unknown	3
2025-01-01	Other	1
2025-02-01	vegetation	25
2025-02-01	equipment	15
2025-02-01	weather	9
2025-02-01	animal	2
2025-02-01	unknown	2
2025-02-01	Other	2
2025-03-01	vegetation	25
2025-03-01	equipment	8
2025-03-01	weather	3
2025-03-01	animal	3
2025-03-01	unknown	2
2025-03-01	Other	1
2025-04-01	vegetation	15
2025-04-01	equipment	6
2025-04-01	weather	6
2025-04-01	animal	7
2025-04-01	unknown	4
2025-04-01	Other	1
2025-05-01	vegetation	22
2025-05-01	equipment	9
2025-05-01	weather	12
2025-05-01	animal	3
2025-05-01	unknown	2
2025-05-01	Other	0
2025-06-01	vegetation	28
2025-06-01	equipment	24
2025-06-01	weather	7
2025-06-01	animal	6
2025-06-01	unknown	5
2025-06-01	Other	3
2025-07-01	vegetation	37
2025-07-01	equipment	20
2025-07-01	weather	9
2025-07-01	animal	3

period	series	value
2025-07-01	unknown	5
2025-07-01	Other	2
2025-08-01	vegetation	26
2025-08-01	equipment	30
2025-08-01	weather	143
2025-08-01	animal	4
2025-08-01	unknown	1
2025-08-01	Other	3
2025-09-01	vegetation	50
2025-09-01	equipment	26
2025-09-01	weather	13
2025-09-01	animal	6
2025-09-01	unknown	0
2025-09-01	Other	6
2025-10-01	vegetation	43
2025-10-01	equipment	28
2025-10-01	weather	16
2025-10-01	animal	8
2025-10-01	unknown	4
2025-10-01	Other	3
2025-11-01	vegetation	18
2025-11-01	equipment	14
2025-11-01	weather	7
2025-11-01	animal	2
2025-11-01	unknown	3
2025-11-01	Other	1
2025-12-01	vegetation	18
2025-12-01	equipment	11
2025-12-01	weather	6
2025-12-01	animal	3
2025-12-01	unknown	0
2025-12-01	Other	0
2026-01-01	vegetation	39
2026-01-01	equipment	15
2026-01-01	weather	6
2026-01-01	animal	8
2026-01-01	unknown	7
2026-01-01	Other	4
2026-02-01	vegetation	23
2026-02-01	equipment	12
2026-02-01	weather	6
2026-02-01	animal	3
2026-02-01	unknown	3

period	series	value
2026-02-01	Other	2
2026-03-01	vegetation	19
2026-03-01	equipment	9
2026-03-01	weather	5
2026-03-01	animal	4
2026-03-01	unknown	3
2026-03-01	Other	0
2026-04-01	vegetation	23
2026-04-01	equipment	12
2026-04-01	weather	6
2026-04-01	animal	4
2026-04-01	unknown	4
2026-04-01	Other	0
2026-05-01	vegetation	18
2026-05-01	equipment	5
2026-05-01	weather	3
2026-05-01	animal	5
2026-05-01	unknown	2
2026-05-01	Other	2
2026-06-01	vegetation	38
2026-06-01	equipment	32
2026-06-01	weather	12
2026-06-01	animal	5
2026-06-01	unknown	2
2026-06-01	Other	3
2026-07-01	vegetation	39
2026-07-01	equipment	27
2026-07-01	weather	13
2026-07-01	animal	7
2026-07-01	unknown	5
2026-07-01	Other	5
2026-08-01	vegetation	33
2026-08-01	equipment	24
2026-08-01	weather	5
2026-08-01	animal	10
2026-08-01	unknown	1
2026-08-01	Other	1
2026-09-01	vegetation	29
2026-09-01	equipment	25
2026-09-01	weather	24
2026-09-01	animal	7
2026-09-01	unknown	7
2026-09-01	Other	1

Figure 49. Hot spot analysis: Outages over time [97]

period	series	value
2024-10-01	vegetation	28
2024-10-01	equipment	31
2024-10-01	weather	12
2024-10-01	animal	10
2024-10-01	unknown	6
2024-10-01	Other	1
2024-11-01	vegetation	13
2024-11-01	equipment	15
2024-11-01	weather	5
2024-11-01	animal	3
2024-11-01	unknown	2
2024-11-01	Other	1
2024-12-01	vegetation	15
2024-12-01	equipment	10
2024-12-01	weather	8
2024-12-01	animal	2
2024-12-01	unknown	1
2024-12-01	Other	0
2025-01-01	vegetation	20
2025-01-01	equipment	19
2025-01-01	weather	7
2025-01-01	animal	4
2025-01-01	unknown	3
2025-01-01	Other	1
2025-02-01	vegetation	25
2025-02-01	equipment	15
2025-02-01	weather	9
2025-02-01	animal	2
2025-02-01	unknown	2
2025-02-01	Other	2
2025-03-01	vegetation	25
2025-03-01	equipment	8
2025-03-01	weather	3
2025-03-01	animal	3
2025-03-01	unknown	2
2025-03-01	Other	1
2025-04-01	vegetation	15
2025-04-01	equipment	6
2025-04-01	weather	6
2025-04-01	animal	7
2025-04-01	unknown	4
2025-04-01	Other	1
2025-05-01	vegetation	22

period	series	value
2025-05-01	equipment	9
2025-05-01	weather	12
2025-05-01	animal	3
2025-05-01	unknown	2
2025-05-01	Other	0
2025-06-01	vegetation	28
2025-06-01	equipment	24
2025-06-01	weather	7
2025-06-01	animal	6
2025-06-01	unknown	5
2025-06-01	Other	3
2025-07-01	vegetation	37
2025-07-01	equipment	20
2025-07-01	weather	9
2025-07-01	animal	3
2025-07-01	unknown	5
2025-07-01	Other	2
2025-08-01	vegetation	26
2025-08-01	equipment	30
2025-08-01	weather	143
2025-08-01	animal	4
2025-08-01	unknown	1
2025-08-01	Other	3
2025-09-01	vegetation	50
2025-09-01	equipment	26
2025-09-01	weather	13
2025-09-01	animal	6
2025-09-01	unknown	0
2025-09-01	Other	6
2025-10-01	vegetation	43
2025-10-01	equipment	28
2025-10-01	weather	16
2025-10-01	animal	8
2025-10-01	unknown	4
2025-10-01	Other	3
2025-11-01	vegetation	18
2025-11-01	equipment	14
2025-11-01	weather	7
2025-11-01	animal	2
2025-11-01	unknown	3
2025-11-01	Other	1
2025-12-01	vegetation	18
2025-12-01	equipment	11

period	series	value
2025-12-01	weather	6
2025-12-01	animal	3
2025-12-01	unknown	0
2025-12-01	Other	0
2026-01-01	vegetation	39
2026-01-01	equipment	15
2026-01-01	weather	6
2026-01-01	animal	8
2026-01-01	unknown	7
2026-01-01	Other	4
2026-02-01	vegetation	23
2026-02-01	equipment	12
2026-02-01	weather	6
2026-02-01	animal	3
2026-02-01	unknown	3
2026-02-01	Other	2
2026-03-01	vegetation	19
2026-03-01	equipment	9
2026-03-01	weather	5
2026-03-01	animal	4
2026-03-01	unknown	3
2026-03-01	Other	0
2026-04-01	vegetation	23
2026-04-01	equipment	12
2026-04-01	weather	6
2026-04-01	animal	4
2026-04-01	unknown	4
2026-04-01	Other	0
2026-05-01	vegetation	18
2026-05-01	equipment	5
2026-05-01	weather	3
2026-05-01	animal	5
2026-05-01	unknown	2
2026-05-01	Other	2
2026-06-01	vegetation	38
2026-06-01	equipment	32
2026-06-01	weather	12
2026-06-01	animal	5
2026-06-01	unknown	2
2026-06-01	Other	3
2026-07-01	vegetation	39
2026-07-01	equipment	27
2026-07-01	weather	13

period	series	value
2026-07-01	animal	7
2026-07-01	unknown	5
2026-07-01	Other	5
2026-08-01	vegetation	33
2026-08-01	equipment	24
2026-08-01	weather	5
2026-08-01	animal	10
2026-08-01	unknown	1
2026-08-01	Other	1
2026-09-01	vegetation	29
2026-09-01	equipment	25
2026-09-01	weather	24
2026-09-01	animal	7
2026-09-01	unknown	7
2026-09-01	Other	1