LECTURE #7
Mapping Freiburg – Quantifying spatial relationships

OBJECTIVE

- COMPUTE THE AREA OF SPATIAL FEATURES IN QGIS
- CALCULATE THE AREA AFFECTED BY A PROXIMITY BUFFER (E.G., WITHIN 50 M OF WATER)
- DETERMINE THE PERCENTAGE OF A NEIGHBORHOOD AFFECTED BY A SPATIAL CONDITION
- GENERATE CENTROIDS FROM BUILDING POLYGONS FOR POINT-BASED ANALYSIS
- COUNT FEATURES INSIDE POLYGONS (E.G., NUMBER OF BUILDINGS PER NEIGHBORHOOD)
- ANSWER QUANTITATIVE SPATIAL QUESTIONS USING GIS OPERATIONS

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QUICK TUTORIAL

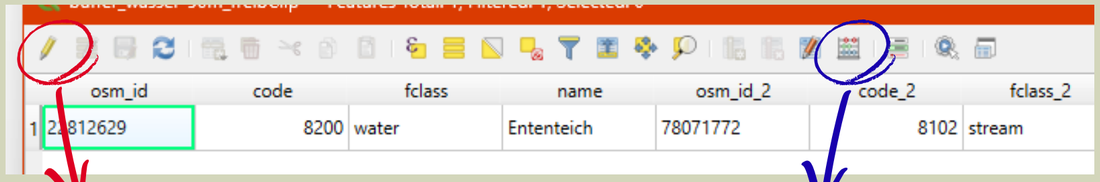
1. AREA CALCULATION

WHAT IS THE TOTAL AREA WITHIN 50 M OF WATER IN FREIBURG?

TO ANSWER THIS QUESTION, WE NEED TO:

- PREPARE THE BUFFER LAYER (FROM LAST CLASS);
- CLIP THE BUFFER TO THE FREIBURG BOUNDARY;
- CALCULATE THE BUFFER AREA:

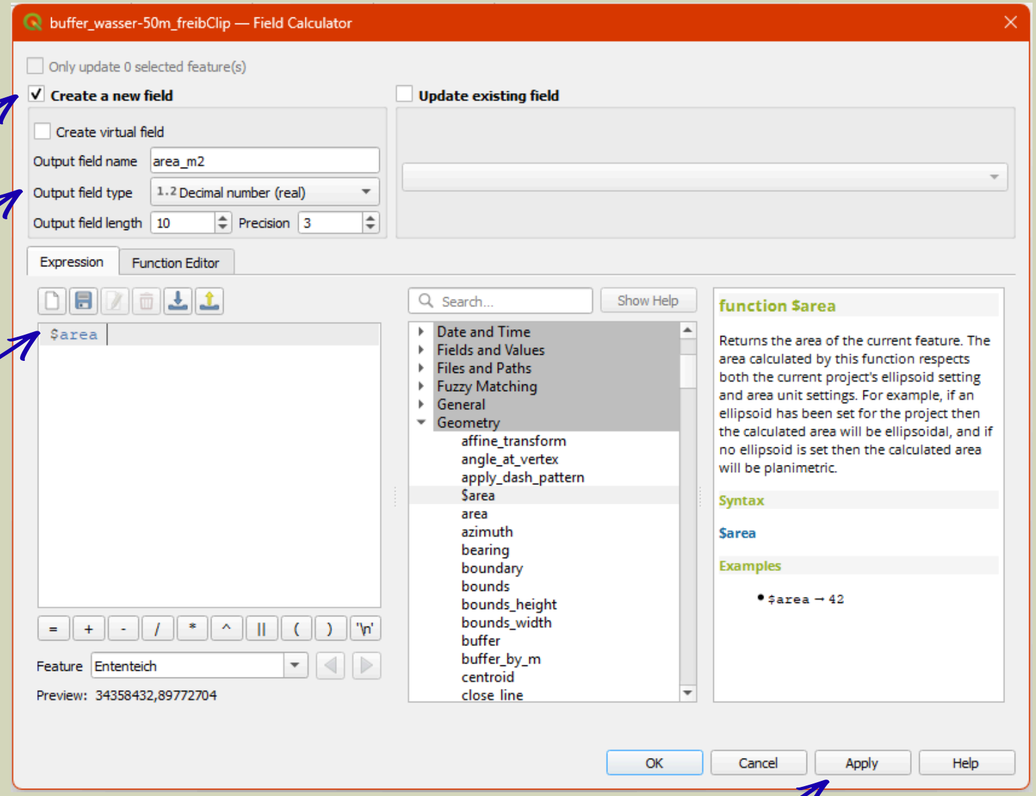
OPEN ATTRIBUTE TABLE



TOGGLE EDITION

FIELD CALCULATOR

OPEN ATTRIBUTE TABLE → TOGGLE EDITION MODE → FIELD CALCULATOR



TOGGLE EDITION AFTER CALCULATION

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QUICK TUTORIAL

1. AREA CALCULATION

OPEN ATTRIBUTE TABLE → TOGGLE EDITION MODE → FIELD CALCULATOR

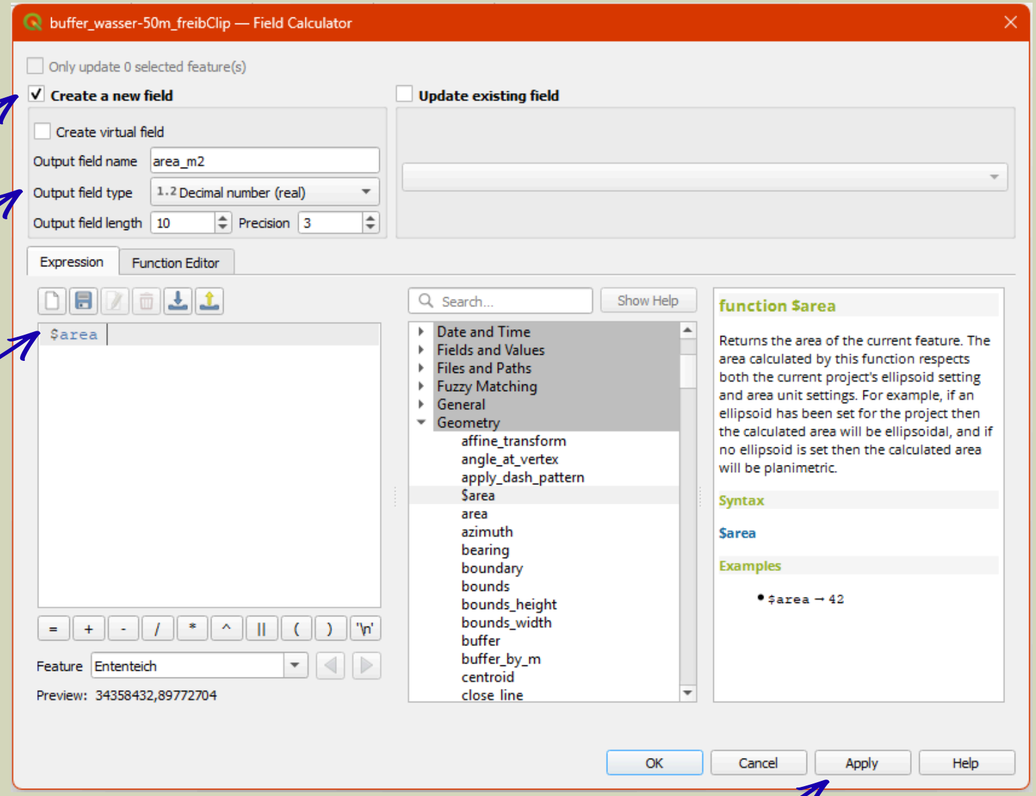
CREATE A NEW FIELD (COLUMN)

NAME: AREA_M2

FIELD TYPE: DECIMAL (LENGH 10 | PRECISION:3)

EXPRESSION: $AREA

IF YOU WANT AREA IN KM_2 THE EXPRESSION IS: $AREA/1000000



TOGGLE EDITION AFTER CALCULATION

ANSWER:

area_m2	area_km2
34358433	34,358

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QUICK TUTORIAL

1. AREA CALCULATION

WHAT IS THE AREA OF EACH NEIGHBORHOOD IN FREIBURG?

OPEN ATTRIBUTE TABLE → TOGGLE EDITION MODE → FIELD CALCULATOR

REPEAT THE PROCESS FROM PREVIOUS SLIDES

NEXT QUESTION: WHAT IS THE TOTAL AREA OF FREIBURG?

...AND YOU GET THE ATTRIBUTE TABLE UPDATED WITH NEIGHBOHOODS AREA

name	bezeichnun	flaeche	umfang	area_m2	area_km2
Brühl-Beurbaru...	233 / Brühl-Beu...	513240,748969...	3243,80482423...	513146,942	0,513
Günterstal	430 / Günterstal	15103407,6537...	26520,0611888...	15100897,586	15,101
Kappel	340 / Kappel	13821536,5290...	19022,7794496...	13819323,348	13,819
Brühl-Industrie...	232 / Brühl-Ind...	10065375,4979...	15639,9745309...	10064789,302	10,065
Waltershofen	560 / Waltersho...	7583373,83357...	19386,2140290...	7580590,167	7,581
Opfingen	630 / Opfingen	14624327,1860...	23011,7583862...	14620600,243	14,621
Unterwiehre-Süd	424 / Unterwie...	1914685,58153...	6502,87310379...	1914344,385	1,914
Herdern-Nord	212 / Herdern-...	1431989,18383...	5101,2 6502,873	3799917772 924	1,432
St. Georgen-Süd	622 / St. Georg...	2545402,54099...	782 9041...	2545884,164	2,546
Vauban	680 / Vauban	412814,513817	297 41834763...	412799,915	0,413
Herdern-Süd	211 / Herdern-...	2862708 0571...	9 01,77991682...	2861908,257	2,862
		4822002,47791...	12239,9166475...	4821186,097	4,821
	dt-...	570028,091620...	3087,20053596...	569925,337	0,57
	val...	659556,226759...	3708,85509023...	659432,747	0,659
Mittelwiehre	422 / Mittelwie...	1362133,81605...	5927,07273127...	1361888,755	1,362
Alt-Stühlinger	513 / Alt-Stühli...	837999,297458...	3986,36698807...	837842,958	0,838
Alt-Betzenhausen	532 / Alt-Betze...	798023,793315...	5021,52731244...	797869,291	0,798
Altstadt-Ring	112 / Altstadt-R...	617913,651668...	4216,49596228...	617800,753	0,618
Unterwiehre-N...	423 / Unterwie...	782465,383203...	4116,76120453...	782321,275	0,782
Neuburg	120 / Neuburg	1636432,60775...	7141,30579814...	1636141,667	1,636

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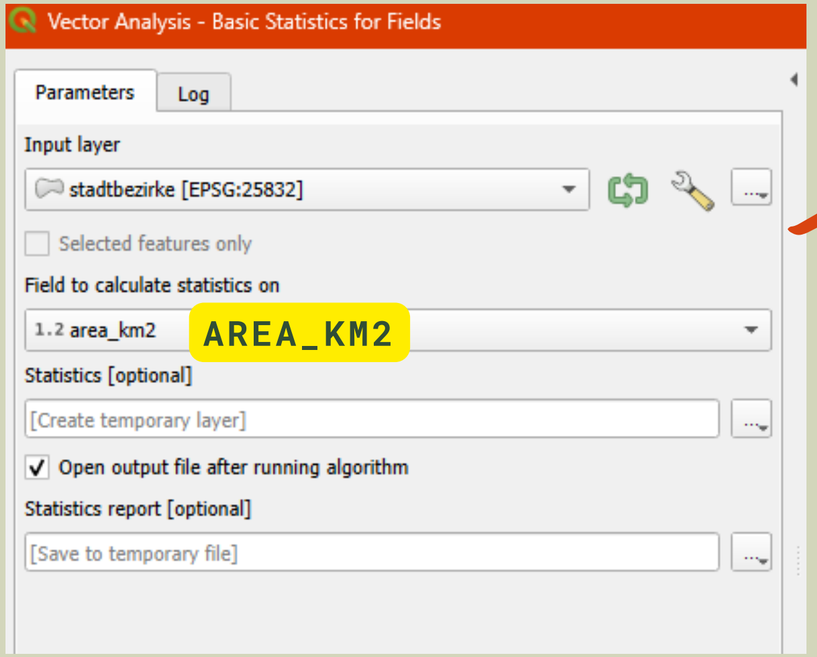
QUICK TUTORIAL

1. AREA CALCULATION

WHAT IS THE TOTAL AREA OF FREIBURG?

VECTOR → ANALYSIS TOOLS → BASIC STATISTICS FOR FIELDS




```
COUNT: 42
UNIQUE: 42
EMPTY: 0
FILLED: 42
MIN: 0.413
MAX: 15.101
CV: 1.1134624536400204
SUM: 153.04699999999997
MEAN: 3.643976190476190
STD_DEV: 4.057430670053432
RANGE: 14.688
MEDIAN: 1.5474999999999999
MINORITY: 0.413
MAJORITY: 0.413
FIRSTQUARTILE: 0.9
THIRDQUARTILE: 4.821
IQR: 3.921
```

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1. AREA CALCULATION

WHAT IS THE PERCENTAGE OF FREIBURG WITHIN 50 M OF ANY WATER BODY?

$$\frac{\text{AREA\_BUFFER\_WATER\_50M}}{\text{AREA\_FREIBURG}} \times 100$$

$$\frac{34.358 \text{ KM2}}{153.047 \text{ KM2}} \times 100$$

= 22.45%

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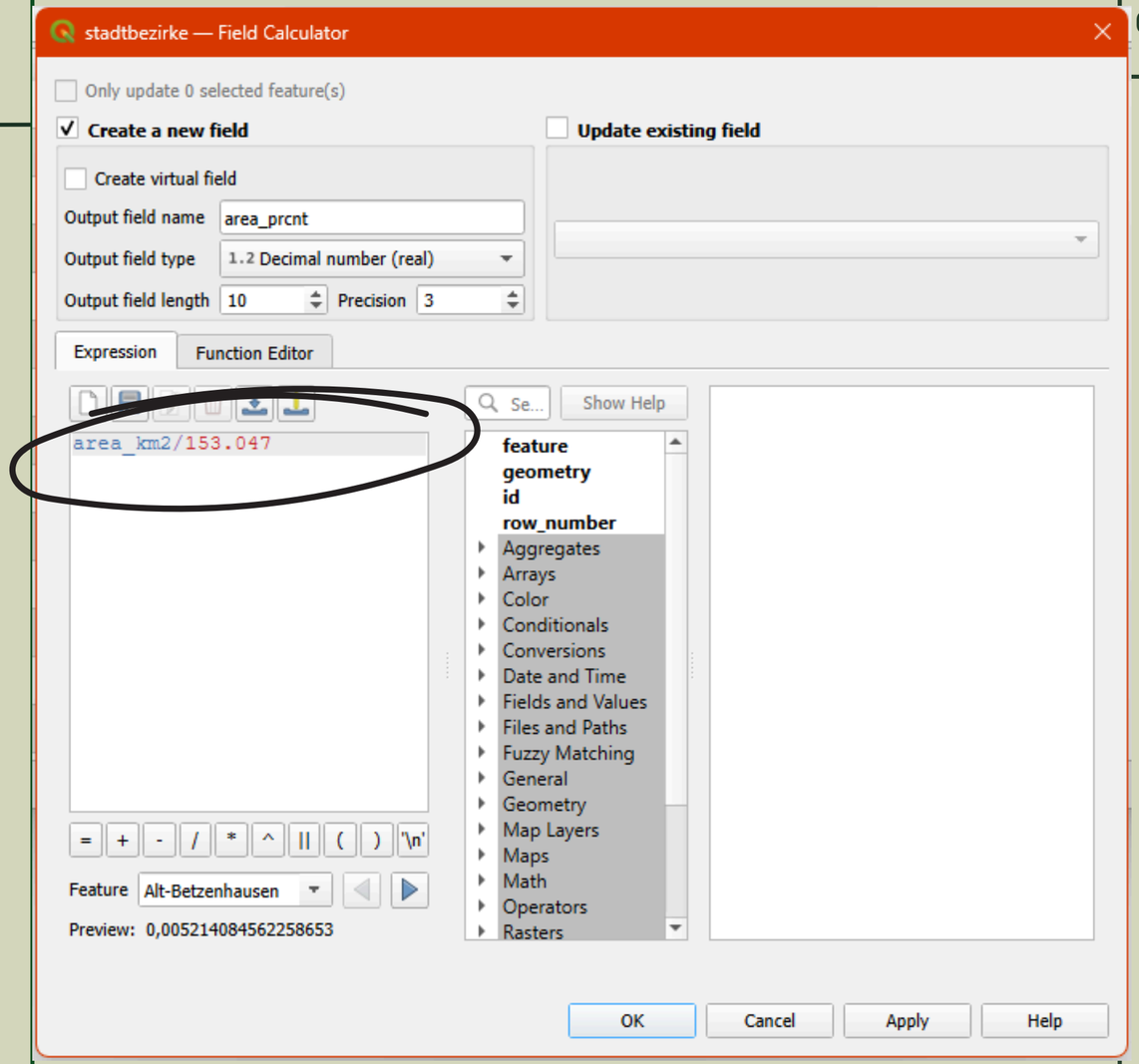
QUICK TUTORIAL

1. AREA CALCULATION

WHAT IS THE AREA PERCENTAGE OF EACH NEIGHBORHOOD IN FREIBURG?

$$\frac{\text{AREA\_NEIGHBORHOOD}}{\text{AREA\_FREIBURG}} \times 100$$

AREA_FREIBURG = 153.047 KM2



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1. COUNTING QUANTITIES

WHAT IS THE QUANTITY OF BUILDINGS IN FREIBURG?

IS THE QUANTITY (COUNT) OF LINES IN THE ATTRIBUTE TABLE (SHAPE BUILDINGS)

WHAT IS THE QUANTITY OF APARTMENTS IN FREIBURG?

IS THE QUANTITY (COUNT) OF LINES IN THE ATTRIBUTE TABLE (SHAPE BUILDINGS WITH FIELD 'TYPE' FILTERED TO APARTMENTS)

VECTOR → ANALYSIS TOOLS → BASIC STATISTICS FOR FIELDS

BUILDINGS (WITHOUT FILTER)

```
COUNT: 57463
UNIQUE: 57463
EMPTY: 0
FILLED: 57463
MIN: 1000071563
MAX: 999985672
MIN_LENGTH: 4
MAX_LENGTH: 10
MEAN_LENGTH: 8.926631049544925
MINORITY: 1000071563
MAJORITY: 1000071563
```

APARTMENT (FILTERED)

```
COUNT: 8038
UNIQUE: 8038
EMPTY: 0
FILLED: 8038
MIN: 100015755
MAX: 99480450
MIN_LENGTH: 7
MAX_LENGTH: 10
MEAN_LENGTH: 8.834660363274446
MINORITY: 100015755
MAJORITY: 100015755
```

(8038/57463)*100 = 14%

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1. COUNTING QUANTITIES

QUICK TUTORIAL

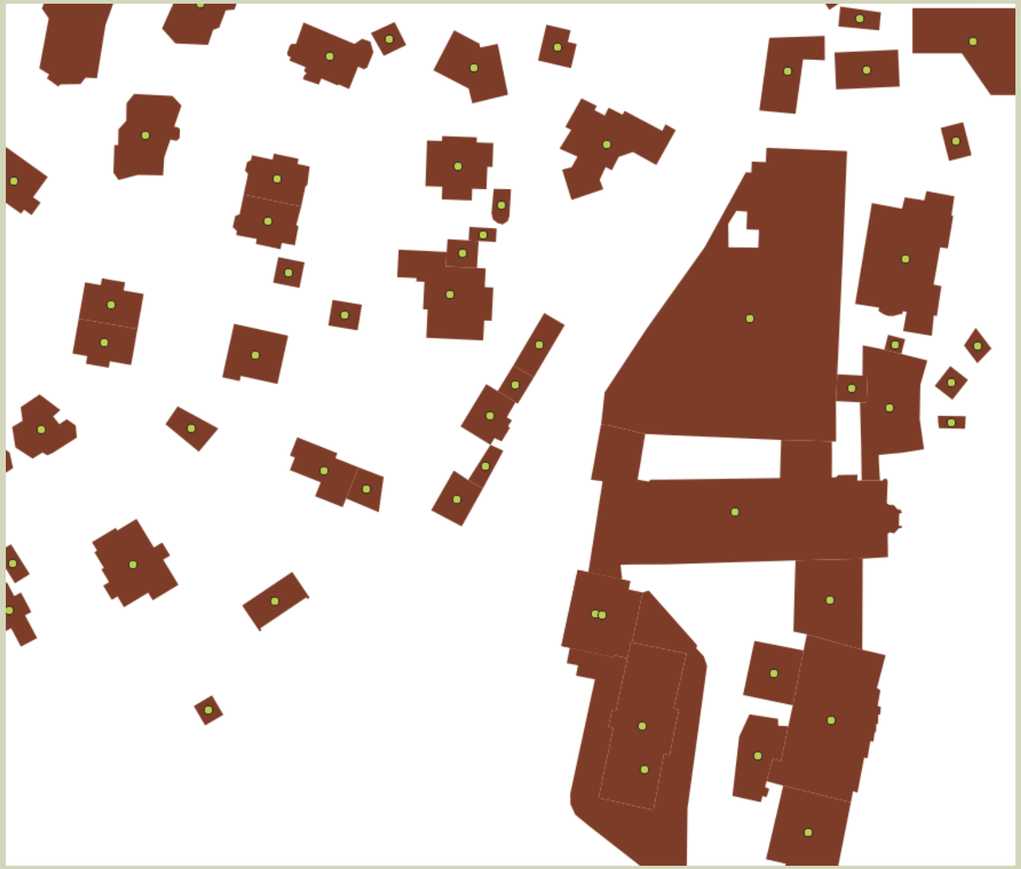
WHAT IS THE QUANTITY OF BUILDINGS IN EACH NEIGHBORHOOD?

STEPS:

1. CONVERT BUILDINGS (POLYG.) TO CENTROIDES (POINTS);
   - VECTOR > GEOMETRY TOOLS > CENTROIDS

1. COUNT POINTS IN POLYGON.
   - VECTOR → ANALYSIS TOOLS → COUNT POINTS IN POLYGON

2 LAYERS:
BUILDINGS AS POLYGONS
BUILDINGS AS POINT (CENTROID)



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QUICK TUTORIAL

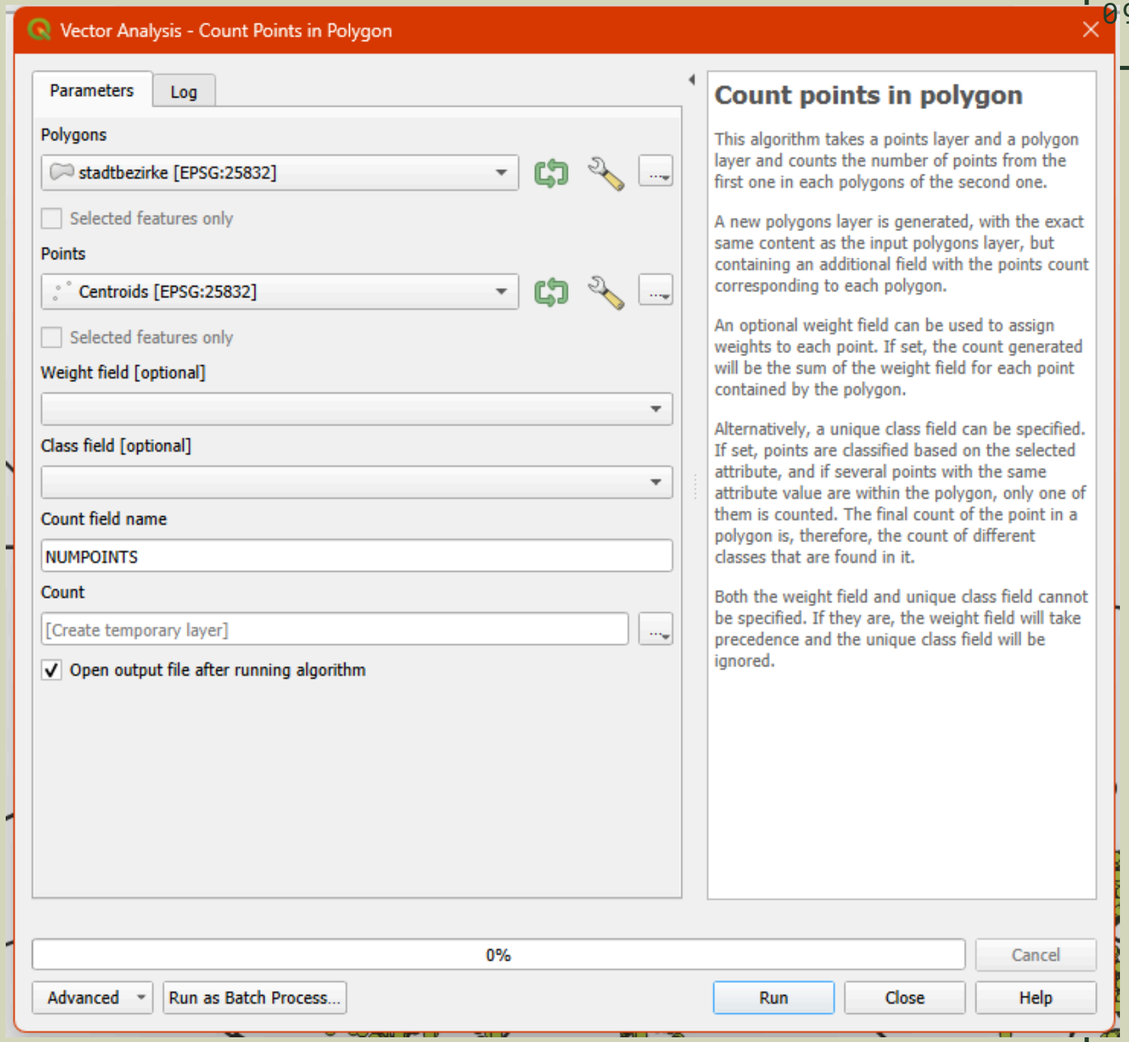
1. COUNTING QUANTITIES

WHAT IS THE QUANTITY OF BUILDINGS IN EACH NEIGHBORHOOD?

STEPS:

1. CONVERT BUILDINGS (POLYG.) TO CENTROIDES (POINTS);
   - VECTOR > GEOMETRY TOOLS > CENTROIDS

1. COUNT POINTS IN POLYGON.
   - VECTOR → ANALYSIS TOOLS → COUNT POINTS IN POLYGON



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1. COUNTING QUANTITIES

WHAT IS THE QUANTITY OF BUILDINGS IN EACH NEIGHBORHOOD?

STEPS:

1. **CONVERT BUILDINGS (POLYG.) TO CENTROIDES (POINTS);**
   - **VECTOR > GEOMETRY TOOLS > CENTROIDS**

1. **COUNT POINTS IN POLYGON.**
   - **VECTOR → ANALYSIS TOOLS → COUNT POINTS IN POLYGON**

A NEW POLYG. LAYER IS CREATED (NAMED 'COUNT') WITH A FIELD 'NUMPOINTS' - QUANTITY OF BUILDINGS IN EACH NEIGHBORHOOD.

Count — Features Total: 42, Filtered: 42, Selected: 0

	nr	gid	name	bezeichnun	flaeche	umfang	area_m2	area_km2	area_prcnt	NUMPOINTS
1	233,000000000...	9	Brühl-Beurbaru...	233 / Brühl-Beu...	513240,748969...	3243,80482423...	513146,942	0,513	0,003	327
2	430,000000000...	20	Günterstal	430 / Günterstal	15103407,6537...	26520,0611888...	15100897,580	15,101	0,099	956
3	340,000000000...	14	Kappel	340 / Kappel	13821536,5290...	19022,7794496...	13819323,340	13,819	0,09	1271
4	232,000000000...	8	Brühl-Industrie...	232 / Brühl-Ind...	10065375,4979...	15639,9745309...	10064789,300	10,065	0,066	1447
5	560,000000000...	29	Waltershofen	560 / Waltersho...	7583373,83357...	19386,2140290...	7580590,167	7,581	0,05	1400
6	630,000000000...	37	Opfingen	630 / Opfingen	14624327,1860...	23011,7583862...	14620600,240	14,621	0,096	2244
7	424,000000000...	19	Unterwiehre-Süd	424 / Unterwie...	1914685,58153...	6502,87310379...	1914344,385	1,914	0,013	1726
8	212,000000000...	5	Herdern-Nord	212 / Herdern-...	1431989,18383...	5101,23849894...	1431808,924	1,432	0,009	1711
9	622,000000000...	36	St. Georgen-Süd	622 / St. Georg...	2545402,54099...	7837,75159041...	2545884,164	2,546	0,017	960
10	680,000000000...	42	Vauban	680 / Vauban	412814,513817...	2979,41834763...	412799,915	0,413	0,003	508
11	211,000000000...	4	Herdern-Süd	211 / Herdern-...	2862793,60571...	9501,77991682...	2861908,257	2,862	0,019	1283
12	310,000000000...	11	Waldsee	310 / Waldsee	4822002,47791...	12239,9166475...	4821186,097	4,821	0,032	2212
13	111,000000000...	1	Altstadt-Mitte	111 / Altstadt-...	570028,091620...	3087,20053596...	569925,337	0,57	0,004	1098
14	522,000000000...	24	Mooswald-Ost	522 / Mooswal...	659556,226759...	3708,85509023...	659432,747	0,659	0,004	945
15	422,000000000...	17	Mittelwiehre	422 / Mittelwie...	1362133,81605...	5927,07273127...	1361888,755	1,362	0,009	992
16	513,000000000...	22	Alt-Stühlinger	513 / Alt-Stühli...	837999,297458...	3986,36698807...	837842,958	0,838	0,005	1183
17	532,000000000...	26	Alt-Betzenhausen	532 / Alt-Betze...	798023,793315...	5021,52731244...	797869,291	0,798	0,005	1054
18	112,000000000...	2	Altstadt-Ring	112 / Altstadt-R...	617913,651668...	4216,49596228...	617800,753	0,618	0,004	860
19	423,000000000...	18	Unterwiehre-N...	423 / Unterwie...	782465,383203...	4116,76120453...	782321,275	0,782	0,005	1076
20	120,000000000...	3	Neuburg	120 / Neuburg	1636432,60775...	7141,30579814...	1636141,667	1,636	0,011	925
21	231,000000000...	7	Brühl-Güterbah...	231 / Brühl-Güt...	900034,954494...	4039,23334973...	899872,313	0,9	0,006	863
22	521,000000000...	23	Mooswald-West	521 / Mooswal...	968797,148604...	4031,36407260...	968612,582	0,969	0,006	2247

Show All Features

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LECTURE #7
Mapping Freiburg – Quantifying spatial relationships

EXERCISE

CHOOSE ONE NEIGHBORHOOD IN FREIBURG AND ANSWER:

- **WHAT IS THE NEIGHBORHOOD'S AREA?**
- **WHAT PERCENTAGE OF THIS NEIGHBORHOOD LIES WITHIN 50 M OF ANY WATER BODY?**
- **HOW MANY APARTMENTS ARE LOCATED IN THIS NEIGHBORHOOD?**

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