```sql
10  USING gist (ST_ConvexHull(rast));
11
12  --schema::name table_name::name raster_column::name
13  SELECT AddRasterConstraints('schema_drozdz'::name, 'intersects'::name,'rast'::name);
14
15  --ST_clip
16  CREATE TABLE schema_drozdz.clip AS
17  SELECT ST_Clip(a.rast, b.geom, true), b.municipality
18  FROM rasters.dem AS a, vectors.porto_parishes AS b
19  WHERE ST_Intersects(a.rast, b.geom) AND b.municipality like 'PORTO';
20
21  CREATE TABLE schema_drozdz.union AS
22  SELECT ST_Union(ST_Clip(a.rast, b.geom, true))
23  FROM rasters.dem AS a, vectors.porto_parishes AS b
24  WHERE b.municipality ilike 'porto' and ST_Intersects(b.geom,a.rast);
25
26
27
28
```

Data Output | Explain | Messages | Notifications

addrasterconstraints boolean
1 true

```sql
15  --ST_clip
16  CREATE TABLE schema_drozdz.clip AS
17  SELECT ST_Clip(a.rast, b.geom, true), b.municipality
18  FROM rasters.dem AS a, vectors.porto_parishes AS b
19  WHERE ST_Intersects(a.rast, b.geom) AND b.municipality like 'PORTO';
20
21  CREATE TABLE schema_drozdz.union AS
22  SELECT ST_Union(ST_Clip(a.rast, b.geom, true))
23  FROM rasters.dem AS a, vectors.porto_parishes AS b
24  WHERE b.municipality ilike 'porto' and ST_Intersects(b.geom,a.rast);
25
26
27
28  --st_asRaster
29  CREATE TABLE schema_drozdz.porto_parishes AS
30  WITH r AS (
31  SELECT rast FROM rasters.dem
32  LIMIT 1
33  )
```

Data Output | Explain | Messages | Notifications

	st_clip raster
1	0100000100617 2BF3E4D5A374080318D6907CA3EC02C208A402D31E3C00097907709D5404410000000000000000000000000000000B30E0003000000B004501800180018001800180018001800180018001800180018001800180018001800180(...
2	0100000100617 2BF3E4D5A374080318D6907CA3EC0574768843454E3C0474F11FE054A0441000000000000000000000000000000B30E030042005D004501800180018001800180018001800180018001800180180095D0(...
3	0100000100617 2BF3E4D5A374080318D6907CA3EC025E358E1A7B3E2C079DC7A05D060844100000000000000000000000000000B30E0000F0020004501800180018001800180018001800180018001800180018001800180019(...
4	0100000100617 2BF3E4D5A374080318D6907CA3EC02E3C8390DL87L2C0BB6D93EAFA7D04410000000000000000000000000000000B30E000046003600045018001800180018001800180018001800180018001800180018001800180(...
5	0100000100617 2BF3E4D5A374080318D6907CA3EC00962D67B5CE2E2C0474F11FE054A0441000000000000000000000000000000B30E0001F005300045018001800180018001800180018001800180018001800180018001800180(...
6	0100000100617 2BF3E4D5A374080318D6907CA3EC02E3C8390DL87L2C0474F11FL054A04410000000000000000000000000000000B30E0000640057004501807A00E7B00079007A007A007500710060006C0036006000060064006650(...
7	0100000100617 2BF3E4D5A374080318D6907CA3EC018E3F2CAF563E1C018D5974A973B04410000000000000000000000000000000B30E000011001E0045018001800180018001800180018001800180018001800180018001800180(...
8	0100000100617 2BF3E4D5A374080318D6907CA3EC0E4906FD64BB6E5C0CA65352F399104410000000000000000000000000000000B30E00004F004A0004501800180018001800180018001800180018001800180018001800180018001800180(...

```sql
21  CREATE TABLE schema_drozdz.union AS
22  SELECT ST_Union(ST_Clip(a.rast, b.geom, true))
23  FROM rasters.dem AS a, vectors.porto_parishes AS b
24  WHERE b.municipality ilike 'porto' and ST_Intersects(b.geom,a.rast);
25
26
27
28  --st_asRaster
29  CREATE TABLE schema_drozdz.porto_parishes AS
30  WITH r AS (
31  SELECT rast FROM rasters.dem
32  LIMIT 1
33  )
```

Data Output | Explain | Messages | Notifications

	st_union raster
1	0100000100617 2BF3E4D5A374080318D6907CA3EC0D6994F2F0BE0E6C0D9E35DC0089604410000000000000000000000000000000B30E0000F201AC0045018001800180018001800180018001800180018001800180018001800180018001800180(...

```sql
26
27
28   --st_asRaster
29   CREATE TABLE schema_drozdz.porto_parishes AS
30   WITH r AS (
31   SELECT rast FROM rasters.dem
32   LIMIT 1
33   )
34   SELECT ST_AsRaster(a.geom,r.rast,'8BUI',a.id,-32767) AS rast
35   FROM vectors.porto_parishes AS a, r
36   WHERE a.municipality ilike 'porto';
37
38
```

Data Output | Explain | Messages | Notifications

addrasterconstraints boolean
1	true

QGIS:

```sql
38   --st_union
39
40   DROP TABLE schema_drozdz.porto_parishes; --> drop table porto_parishes first
41   CREATE TABLE schema_drozdz.porto_parishes AS
42   WITH r AS (
43   SELECT rast FROM rasters.dem
44   LIMIT 1
45   )
46   SELECT st_union(ST_AsRaster(a.geom,r.rast,'8BUI',a.id,-32767)) AS rast
47   FROM vectors.porto_parishes AS a, r
48   WHERE a.municipality ilike 'porto';
49
```

Data Output | Explain | Messages | Notifications

st_union raster
1	01000001006172BF3E4D5A374080318D6907CA3EC0D6994F2F0BE0E6C0D9E35DC008960441000000000000000000000000000000000B30E0000F201AC004501800180018001800180018001800180018001800180018001800180018001800180018001...

```sql
51
52  DROP TABLE schema_drozdz.porto_parishes; --> drop table porto_parishes first
53  CREATE TABLE schema_drozdz.porto_parishes AS
54  WITH r AS (
55  SELECT rast FROM rasters.dem
56  LIMIT 1 )
57  SELECT st_tile(st_union(ST_AsRaster(a.geom,r.rast,'8BUI',a.id,-32767)),128,128,true,-32767) AS rast
58  FROM vectors.porto_parishes AS a, r
59  WHERE a.municipality ilike 'porto';
60
```

Data Output Explain Messages Notifications

st_union raster
1 010000001006172BF3E4D5A374080318D6907CA3EC0D6994F2F0BE0E6C0D9E35DC008960441000000000000000000000000000000000000B30E0000F201AC0045018001800180018001800180018001800180018001800180018001

```sql
60
61  --ST_Intersection
62  create table schema_drozdz.intersection as
63  SELECT a.rid,(ST_Intersection(b.geom,a.rast)).geom,(ST_Intersection(b.geom,a.rast)).val
64  FROM rasters.landsat8 AS a, vectors.porto_parishes AS b
65  WHERE b.parish ilike 'paranhos' and ST_Intersects(b.geom,a.rast);
```

Data Output Explain Messages Notifications

st_union raster
1 010000001006172BF3E4D5A374080318D6907CA3EC0D6994F2F0BE0E6C0D9E35DC008960441000000000000000000000000000000000000B30E0000F201AC004501800180018001800180018001800180018001800180018001800180

```sql
66
67  --ST_DumpAsPolygons
68  CREATE TABLE schema_drozdz.dumppolygons AS
69  SELECT a.rid,(ST_DumpAsPolygons(ST_Clip(a.rast,b.geom))).geom,(ST_DumpAsPolygons(ST_Clip(a.rast,b.geom))).val
70  FROM rasters.landsat8 AS a, vectors.porto_parishes AS b
71  WHERE b.parish ilike 'paranhos' and ST_Intersects(b.geom,a.rast);
```

Data Output Explain Messages Notifications

st_union raster
1 010000001006172BF3E4D5A374080318D6907CA3EC0D6994F2F0BE0E6C0D9E35DC008960441000000000000000000000000000000000000B30E0000F201AC00450180018001800180018001800180018001800180018001800180018

```sql
71  WHERE b.parish ilike 'paranhos' and ST_Intersects(b.geom,a.rast);
72
73  --ST_Band
74  CREATE TABLE schema_drozdz.landsat_nir AS
75  SELECT rid, ST_Band(rast,4) AS rast
76  FROM rasters.landsat8;
```

Data Output Explain Messages Notifications

SELECT 630

Query returned successfully in 661 msec.

```sql
75   SELECT rid, ST_Band(rast,4) AS rast
76   FROM rasters.landsat8;
77
78   --ST_clip
79   CREATE TABLE schema_drozdz.paranhos_dem AS
80   SELECT a.rid,ST_Clip(a.rast, b.geom,true) as rast
81   FROM rasters.dem AS a, vectors.porto_parishes AS b
82   WHERE b.parish ilike 'paranhos' and ST_Intersects(b.geom,a.rast);
```

Data Output | **Explain** | **Messages** | **Notifications**

```
SELECT 4

Query returned successfully in 53 msec.
```

```sql
84   --ST_Slope
85
86   CREATE TABLE schema_drozdz.paranhos_slope AS
87   SELECT a.rid,ST_Slope(a.rast,1,'32BF','PERCENTAGE') as rast
88   FROM schema_drozdz.paranhos_dem AS a;
```

Data Output | **Explain** | **Messages** | **Notifications**

```
SELECT 4

Query returned successfully in 168 msec.
```

```sql
88
89   --ST_Reclass
90   CREATE TABLE schema_drozdz.paranhos_slope_reclass AS
91   SELECT a.rid,ST_Reclass(a.rast,1,']0-15]:1, (15-30]:2, (30-9999:3', '32BF',0)
92   FROM schema_drozdz.paranhos_slope AS a;
```

Data Output | **Explain** | **Messages** | **Notifications**

```
SELECT 4

Query returned successfully in 50 msec.
```

```
91   SELECT a.fid,ST_Reclass(a.rast,1, '0 15]:1, (15 30]:2, (30 9999:3',
92   FROM schema_drozdz.paranhos_slope AS a;
93
94   --ST_SummaryStats
95   SELECT st_summarystats(a.rast) AS stats
96   FROM schema_drozdz.paranhos_dem AS a;
```

Data Output   Explain   Messages   Notifications

	stats 🔒 summarystats
1	(2616,278385,106.41628440366972,11.622628762211638,87,143)
2	(6463,816615,126.35231316725978,14.0438229209133,94,158)
3	(682,95581,140.14809384164224,12.078072186605759,103,158)
4	(216,31874,147.5648148148148,4.262830628315728,137,158)

```
98   --ST_SummaryStats, ST_Union
99   SELECT st_summarystats(ST_Union(a.rast))
100  FROM schema_drozdz.paranhos_dem AS a;
```

Data Output   Explain   Messages   Notifications

	st_summarystats 🔒 summarystats
1	(9977,1222455,122.52731281948482,16.908004202736272,87,158)

```sql
100  FROM schema_drozdz.paranhos_dem AS a;
101
102  --ST_SummaryStats
103  WITH t AS (
104  SELECT st_summarystats(ST_Union(a.rast)) AS stats
105  FROM schema_drozdz.paranhos_dem AS a
106  )
107  SELECT (stats).min,(stats).max,(stats).mean FROM t;
```

Data Output | Explain | Messages | Notifications

	min double precision 🔒	max double precision 🔒	mean double precision 🔒
1	87	158	122.52731281948482

```sql
108
109  --ST_SummaryStats with Group By
110  WITH t AS (
111  SELECT b.parish AS parish, st_summarystats(ST_Union(ST_Clip(a.rast, b.geom,true))) AS stats
112  FROM rasters.dem AS a, vectors.porto_parishes AS b
113  WHERE b.municipality ilike 'porto' and ST_Intersects(b.geom,a.rast)
114  group by b.parish
115  )
116  SELECT parish,(stats).min,(stats).max,(stats).mean FROM t;
```

Data Output | Explain | Messages | Notifications

	parish character varying (254) 🔒	min double precision 🔒	max double precision 🔒	mean double precision 🔒
1	Bonfim	1	159	107.5658842667906
2	Campanhã	0	178	74.66732213085449
3	Paranhos	87	158	122.52731281948482
4	Ramalde	48	108	77.58444444444444
5	União das freguesias de Aldoar, Foz do Douro e Nevogilde	-4	83	34.66735489791237
6	União das freguesias de Cedofeita, Santo Ildefonso, Sé, Miragaia, São Nicolau e Vitória	1	157	95.00277741039545
7	União das freguesias de Lordelo do Ouro e Massarelos	-1	117	49.50051440329218

✓ Successfully run. Total query run

```
118    --ST_Value
119    SELECT b.name,st_value(a.rast,(ST_Dump(b.geom)).geom)
120    FROM
121    rasters.dem a, vectors.places AS b
122    WHERE ST_Intersects(a.rast,b.geom)
123    ORDER BY b.name;
```

Data Output   Explain   Messages   Notifications

name character varying (48) 🔒	st_value double precision 🔒
1	Aldeia São Miguel	96
2	Alpendurada e Matos	145
3	Amarante	71
4	Baião	581
5	Cabeceiras de Basto	[null]
6	Castelo de Paiva	284
7	Celorico de Basto	227
8	Cinfães	405
9	Espinho	14

```
125    --ST_TPI
126    create table schema_drozdz.tpi30 as
127    select ST_TPI(a.rast,1) as rast
128    from rasters.dem a;
```

Data Output   Explain   Messages   Notifications

SELECT 589

Query returned successfully in 33 secs 829 msec.

```
129
130    --index
131    CREATE INDEX idx_tpi30_rast_gist ON schema_drozdz.tpi30
132    USING gist (ST_ConvexHull(rast));
```

Data Output   Explain   Messages   Notifications

CREATE INDEX

Query returned successfully in 50 msec.

```
133
134    SELECT AddRasterConstraints('schema_drozdz'::name, 'tpi30'::name,'rast'::name);
```

Data Output Explain Messages Notifications

	addrasterconstraints 🔒 boolean
1	true

```
134    SELECT AddRasterConstraints('schema_drozdz'::name, 'tpi30'::name,'rast'::name);
135
136    --problem
137    create table schema_drozdz.tpi30_porto as
138    SELECT ST_TPI(a.rast,1) as rast
139    FROM rasters.dem AS a, vectors.porto_parishes AS b
140    WHERE ST_Intersects(a.rast, b.geom) AND b.municipality ilike 'porto'
141
142
143    CREATE INDEX idx_tpi30_porto_rast_gist ON schema_drozdz.tpi30_porto
144    USING gist (ST_ConvexHull(rast));
145
146    SELECT AddRasterConstraints('schema_drozdz'::name, 'tpi30_porto'::name,'rast'::name);
147    --NDVI
148    CREATE TABLE schema_drozdz.porto_ndvi AS
149    WITH r AS (
150    SELECT a.rid,ST_Clip(a.rast, b.geom,true) AS rast
151
```

Data Output Explain **Messages** Notifications

```
SELECT 25

Query returned successfully in 7 secs 195 msec.
```

Qgis
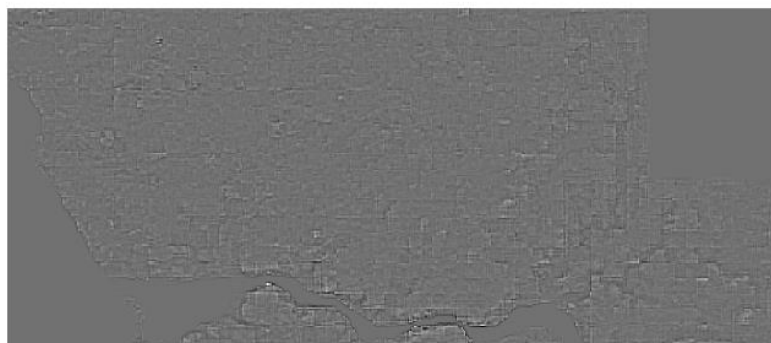
```sql
137   --NDVI
138   CREATE TABLE schema_drozdz.porto_ndvi AS
139   WITH r AS (
140   SELECT a.rid,ST_Clip(a.rast, b.geom,true) AS rast
141   FROM rasters.landsat8 AS a, vectors.porto_parishes AS b
142   WHERE b.municipality ilike 'porto' and ST_Intersects(b.geom,a.rast)
143   )
144   SELECT
145   r.rid,ST_MapAlgebra(
146   r.rast, 1,
147   r.rast, 4,
148   '([rast2.val] - [rast1.val]) / ([rast2.val] + [rast1.val])::float','32BF'
149   ) AS rast
150   FROM r;
```

Data Output   Explain   **Messages**   Notifications

SELECT 29

Query returned successfully in 298 msec.

```sql
150   FROM r;
151
152   CREATE INDEX idx_porto_ndvi_rast_gist ON schema_drozdz.porto_ndvi
153   USING gist (ST_ConvexHull(rast));
```

Data Output   Explain   **Messages**   Notifications

CREATE INDEX

Query returned successfully in 51 msec.

```sql
151
152   CREATE INDEX idx_porto_ndvi_rast_gist ON schema_drozdz.porto_ndvi
153   USING gist (ST_ConvexHull(rast));
154
155   SELECT AddRasterConstraints('schema_drozdz'::name, 'porto_ndvi'::name,'rast'::name);
```

Data Output   Explain   Messages   Notifications

	addrasterconstraints 🔒 boolean
1	true

```
156
157  --function
158  create or replace function schema_drozdz.ndvi(
159  value double precision [] [] [],
160  pos integer [][],
161  VARIADIC userargs text []
162  )
163  RETURNS double precision AS
164  $$
165▾ BEGIN
166  --RAISE NOTICE 'Pixel Value: %', value [1][1][1];-->For debug purposes
167  RETURN (value [2][1][1] - value [1][1][1])/(value [2][1][1]+value [1][1][1]); --> NDVI calculation!
168  END;
169  $$
170  LANGUAGE 'plpgsql' IMMUTABLE COST 1000;
```

Data Output   Explain   **Messages**   Notifications

CREATE FUNCTION

Query returned successfully in 44 msec.

```
191
192  SELECT AddRasterConstraints('schema_drozdz'::name, 'porto_ndvi2'::name,'rast'::name);
```

Data Output   Explain   Messages   Notifications

addrasterconstraints 🔒 boolean
1	true

```
194  --ST_AsTiff
195  SELECT ST_AsTiff(ST_Union(rast))
196  FROM schema_drozdz.porto_ndvi;
197
```

Data Output   Explain   Messages   Notifications

st_astiff 🔒 bytea
1	[binary data]

```
197
198  --ST_AsGDALRaster
199  SELECT ST_AsGDALRaster(ST_Union(rast), 'GTiff', ARRAY['COMPRESS=DEFLATE', 'PREDICTOR=2', 'PZLEVEL=9'])
200  FROM schema_drozdz.porto_ndvi;
```

Data Output   Explain   Messages   Notifications

st_asgdalraster 🔒 bytea
1	[binary data]

```
200    FROM schema_drozaz.porto_ndvi;
201
202    SELECT ST_GDALDrivers();
203
```

Data Output Explain Messages Notifications

	st_gdaldrivers record
1	(0,GTiff,'GeoTIFF',t,t,'<CreationOptionList> <Option name='COMPRESS' type='string-select'> <Value>NONE</Value> <Value>LZW</Value> <Value>PACKBITS</Value> <Value>JPEG</Value> <Value>CCITTRLE</Value> <Value>CC
2	(1,AAIGrid,'Arc/Info ASCII Grid',t,t,'<CreationOptionList>
3	(2,DTED,'DTED Elevation Raster',t,t,'')
4	(3,PNG,'Portable Network Graphics',t,t,'<CreationOptionList>
5	(4,JPEG,'JPEG JFIF',t,t,'<CreationOptionList>
6	(5,GIF,'Graphics Interchange Format (.gif)',t,t,'<CreationOptionList>
7	(6,USGSDEM,'USGS Optional ASCII DEM (and CDED)',t,t,'<CreationOptionList> <Option name='PRODUCT' type='string-select' description='Specific Product Type'> <Value>DEFAULT</Value> <Value>CDED50K</Value> </Option> <Option na
8	(7,XYZ,'ASCII Gridded XYZ',t,t,'<CreationOptionList> <Option name='COLUMN_SEPARATOR' type='string' default=' ' description='Separator between fields.'/> <Option

✔ Successfully run. Total query runtime: 51 msec. 8 rows affecte

```
--
CREATE TABLE tmp_out AS
SELECT lo_from_bytea(0,
ST_AsGDALRaster(ST_Union(rast), 'GTiff', ARRAY['COMPRESS=DEFLATE', 'PREDICTOR=2', 'PZLEVEL=9'])
) AS loid
FROM schema_drozdz.porto_ndvi;
----------------------------------------------
SELECT lo_export(loid, 'C:\Users\wikto\Desktop\bazy2\lab6\myraster.tiff') --> Save the file in a place where the user post
FROM tmp_out;
----------------------------------------------
SELECT lo_unlink(loid)
FROM tmp_out; --> Delete the large object.
```

a Output Explain Messages Notifications

.ECT 1

ery returned successfully in 107 msec.

```
210    ----------------------------------------------
211    SELECT lo_export(loid, 'myraster.tiff') --> Save the file in a place where the user postgres have access. In windows a fl
212    FROM tmp_out;
213    ----------------------------------------------
214    SELECT lo_unlink(loid)
215
```

Data Output Explain Messages Notifications

	lo_export 🔒 integer
1	1

```
212    FROM tmp_out;
213    ----------------------------------------------
214    SELECT lo_unlink(loid)
215    FROM tmp_out; --> Delete the large object.
```

Data Output Explain Messages Notifications

	lo_unlink 🔒 integer
1	1