CORILIS version 3 - A short technical description

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1. Introduction

The purpose of CORILIS is to calculate "intensities" or "potentials" of a given theme in each point of a territory. CORILIS results into probability surfaces (varying from 0 to 100) for the presence of a certain Corine land cover (CLC) class within a defined smoothing radius (here: 5 km). Individual CORILIS layers from a given level can be aggregated to upper levels by simple addition. This technical document describes the preparation of CORILIS version 3 datasets. More about the CORILIS methodology can be found at http://www.eea.europa.eu/data-and-maps/data/ds_resolveuid/3631928A-32B1-426F-A85B-34757A424140

2. Source data: Corine land cover, 100 meter raster data, version 12/2009

CLC 1990: lceugr100_90.tif, available at http://www.eea.europa.eu/data-and-maps/data/ds_resolveuid/FBE8EA2C-9224-4725-B06B-93BBB05F29F2

CLC 2000: lceugr100_00.tif, available at http://www.eea.europa.eu/data-and-maps/data/ds_resolveuid/BA3B85C7-9045-465B-907B-154C3A52B3A0

CLC 2006: lceugr100_06.tif, available at http://www.eea.europa.eu/data-and-maps/data/ds_resolveuid/CBFBD826-8608-480E-8884-D8365F49F6A6

3. GIS data processing

The following description is based on land cover class 1 (Continuous urban fabric) from source layer lceugr100_00 (CLC 2000), which serves as an example. Steps 2 and 4 have to be done once per source dataset (CLC 1990, 2000, 2006). Step 3 has to be applied in analogy to all land cover classes (1...43). Land cover class 44 (Sea and ocean) is not present in CLC raster data version 12.

All data processing has been done with GRASS 6.4 GIS (see http://www.osgeo.org/grass).

Step 1: Import source datasets, define region

```
$ r.in.gdal input=lceugr100_90.tif output=lceugr100_90
$ r.in.gdal input=lceugr100_00.tif output=lceugr100_00
$ r.in.gdal input=lceugr100_06.tif output=lceugr100_06
$ g.region  n=5500000 s=900000 w=1500000 e=6600000 res=1000
```

Step 2: Create a new layer LAND and resample it according to 1 km EEA reference grid

In this step, a new layer LAND is created in form of a binary raster map (1 = land, 0 = no land). The new layer (which has the resolution of the source dataset, i.e. 100 meters) is resampled to a coarser grid (1000m) using the aggregation method: sum. This means that values from 100 cells (100 x 100m each) are summed up as category value for temporary layer c0 (with 1000 x 1000m cell size).

```
# Create a rules file for r.reclass
printf "255 = 0\n* = 1\n" > reclass.rule

# Reclass the original CLC 100m raster layer
r.reclass lceugr100_00 out=LAND rules=reclass.rule

# Resample according to 1 km EEA reference grid
r.resamp.stats LAND out=c0 method=sum

# Apply spatial smoothing (for details see step 3)
r.neighbors c0 out=c0_smth size=9 weight=weights.txt method=sum
```

Step 3: Processing of Corine land cover classes 1...43

```
# Create a rules file for r.reclass
printf "1 = 1\n* = 0\n" > reclass.rule

# Reclass the original CLC 100m raster layer
r.reclass lceugr100_00 out=tmpmap rules=reclass.rule

# Resample according to 1 km EEA reference grid
r.resamp.stats tmpmap out=c1 method=sum
```

The subsequent spatial smoothing generates weighted sums based on cell values in a defined radius. Weights (w) are calculated according to the function: $w = (1- (d / R)^2)^2$ # for $d \leq R$

$w = 0$ # for $d > R$

R is the smoothing radius in km. With the given raster cell size of 1 km, the chosen radius (5 km) translates into a 9x9 neighbourhood window. d is the Euclidean distance between considered cell and the centre of the neighbourhood window: $d = sqrt(dx^2 + dy^2)$. Weighting factors decrease to 0 as the distance increases. Here the contents of file weights.txt, that has been used for the calculation:

```
 0.0000  0.0000  0.0400  0.1024  0.1296  0.1024  0.0400  0.0000  0.0000
 0.0000  0.0784  0.2304  0.3600  0.4096  0.3600  0.2304  0.0784  0.0000
 0.0400  0.2304  0.4624  0.6400  0.7056  0.6400  0.4624  0.2304  0.0400
 0.1024  0.3600  0.6400  0.8464  0.9216  0.8464  0.6400  0.3600  0.1024
 0.1296  0.4096  0.7056  0.9216  1.0000  0.9216  0.7056  0.4096  0.1296
 0.1024  0.3600  0.6400  0.8464  0.9216  0.8464  0.6400  0.3600  0.1024
 0.0400  0.2304  0.4624  0.6400  0.7056  0.6400  0.4624  0.2304  0.0400
 0.0000  0.0784  0.2304  0.3600  0.4096  0.3600  0.2304  0.0784  0.0000
 0.0000  0.0000  0.0400  0.1024  0.1296  0.1024  0.0400  0.0000  0.0000
```

```
# Apply spatial smoothing in a 5 km radius
r.neighbors c1 out=c1_smth size=9 weight=weights.txt method=sum

# Calculate the relative weight (in %), apply LAND mask
r.mapcalc "c1_pct = LAND == 0 ? null() : 100 * c1_smth / c0_smth"
```

The resulting raster layer contains float values which are rounded to integer values (in order to reduce the file size) and exported into compressed GeoTIFF format.

```
# Round to integer, export to GeoTIFF
$ r.mapcalc "c1_rnd = round(c1_pct)"
$ r.out.gdal c1_rnd output=corilis00_r5l3_c1.tif createopt=compress=lzw
```

The naming convention for exported raster files is: CORILIS{year}_r{radius}l{level}_c{code}.tif

Step 4: Aggregation to CORILIS level 1

CORILIS level 1 is a customized aggregation level for land accounting purposes. Aggregation has been done by simple addition, according to the below mapping table. Calculation results have again been rounded to integer values, before exporting them into compressed GeoTIFF format.

Corine Land Cover Level 3			CORILIS Level 1	
Code	**Class**	**Label**	**Code**	**Label**
1	111	Continuous urban fabric	1	Artificial areas
2	112	Discontinuous urban fabric	1	Artificial areas
3	121	Industrial or commercial units	1	Artificial areas
4	122	Road and rail networks and associated land	1	Artificial areas
5	123	Port areas	1	Artificial areas
6	124	Airports	1	Artificial areas
7	131	Mineral extraction sites	1	Artificial areas
8	132	Dump sites	1	Artificial areas
9	133	Construction sites	1	Artificial areas
10	141	Green urban areas	1	Artificial areas
11	142	Sport and leisure facilities	1	Artificial areas
12	211	Non-irrigated arable land	2A	Arable land & permanent crops
13	212	Permanently irrigated land	2A	Arable land & permanent crops
14	213	Rice fields	2A	Arable land & permanent crops
15	221	Vineyards	2A	Arable land & permanent crops
16	222	Fruit trees and berry plantations	2A	Arable land & permanent crops
17	223	Olive groves	2A	Arable land & permanent crops
18	231	Pastures	2B1	Pastures
19	241	Annual crops associated with permanent crops	2A	Arable land & permanent crops
20	242	Complex cultivation patterns	2B2	Mosaic farmland
21	243	Land principally occupied by agriculture, with significant areas of natural vegetation	2B2	Mosaic farmland
22	244	Agro-forestry areas	2B2	Mosaic farmland
23	311	Broad-leaved forest	3A1	Standing forests
24	312	Coniferous forest	3A1	Standing forests
25	313	Mixed forest	3A1	Standing forests
26	321	Natural grasslands	3B	Semi-natural vegetation
27	322	Moors and heathland	3B	Semi-natural vegetation
28	323	Sclerophyllous vegetation	3B	Semi-natural vegetation
29	324	Transitional woodland-shrub	3A2	Transitional woodland & shrub
30	331	Beaches, dunes, sands	3C	Open spaces/ bare soils
31	332	Bare rocks	3C	Open spaces/ bare soils
32	333	Sparsely vegetated areas	3C	Open spaces/ bare soils
33	334	Burnt areas	3C	Open spaces/ bare soils
34	335	Glaciers and perpetual snow	3C	Open spaces/ bare soils
35	411	Inland marshes	4	Wetlands
36	412	Peat bogs	4	Wetlands
37	421	Salt marshes	4	Wetlands
38	422	Salines	4	Wetlands
39	423	Intertidal flats	4	Wetlands
40	511	Water courses	5	Water bodies
41	512	Water bodies	5	Water bodies
42	521	Coastal lagoons	5	Water bodies
43	522	Estuaries	5	Water bodies
44	523	Sea and ocean	5	Not occurring in source dataset