NATURILIS version 2 - A short technical description

Hermann Peifer, EEA, November 2009

1. Introduction

The NATURILIS dataset is an application of the CORILIS methodology on available geospatial data about designated areas. The raster shows the "potential in the neighbourhood" of designated areas, in a range of 0 - 100%. The layer was created by combining Natura 2000 data and CDDA data. The radius used for the spatial smoothing process was 5 km. For more information about CORILIS, see:
http://www.eea.europa.eu/data-and-maps/3631928A-32B1-426F-A85B-34757A424140

2. Source data

a) CDDA raster data

Title:	Common Database on Designated Areas (CDDA) 100m raster
Brief abstract:	Consolidated raster containing the original CDDA polygons
Data file:	CDDA_2009_polygon_Merge_100.tif, dated 2009-11-11
Base vector data:	CDDA_2009_polygon_Merge.shp, dated 2009-10-21

b) Natura 2000 raster data

Title:	Natura 2000 sites 100m raster
Brief abstract:	Consolidated raster containing the original Natura2000 sites polygons
Data file:	N2K100K_LAEA_100.tif, dated 2009-11-12
Base vector data:	N2Kmid20009.gdb, dated 2009-09-09

Both source datasets are available at EEA as internal working data. Unfortunately, they can not be made available publicly, due to usage restrictions imposed by original data providers.

3. GIS data processing

Step 1: Patching source datasets into a composite raster layer: basemap

The source datasets are binary raster maps (i.e. they only contain the values 1 and 0, indicating presence and absence of designated areas). Both datasets have the same cell size (100 x 100m), but different spatial extents. As a first processing step, source rasters have been patched into a new 100m raster layer: basemap. Patching in this context means generating a new composite raster layer by combining data values (i.e. value: 1) from both input layers as illustrated below:

CDDA data	+	Natura 2000	=	Patched raster
1 1 1 1 0 0		0 0 0 0 0 0		1 1 1 1 0 0
1 1 1 1 0 0		0 0 0 0 0 0		1 1 1 1 0 0
1 1 1 1 0 0		0 0 1 1 1 1		1 1 1 1 1 1
1 1 1 1 0 0		0 0 1 1 1 1		1 1 1 1 1 1
0 0 0 0 0 0		1 1 1 1 1 1		1 1 1 1 1 1

The GIS data processing has been done in a GRASS 6.4 GIS environment. The modules and commands used are given below (see http://www.osgeo.org/grass for more information).

```
# Import source data, adjust region, create patch, fill NODATA areas
$ r.in.gdal input= CDDA_2009_polygon_Merge_100.tif output=cdda
$ r.in.gdal input= N2K100K_LAEA_100.tif output=natura2000
$ g.region rast=cdda,natura2000
$ r.patch -z input=cdda,natura2000 output=basemap
$ r.null map=basemap null=0
```

Step 2: Resampling basemap raster to 1 km EEA reference grid

In this step, the basemap raster layer (which is in 100m resolution) is resampled to a coarser grid (1000m) using the aggregation method: sum. This means that values from 100 basemap cells (100 x 100m each) are summed up as value for layer basemap1000 (with 1000 x 1000m cell size).

```
# Change resolution to 1000m, resample basemap
$ g.region -a res=1000
$ r.resamp.stats input=basemap output=basemap1000 method=sum
```

Step 3: Smoothing of basemap1000 in a 5km radius, according to CORILIS methodology

The spatial smoothing process generates weighted averages based on cell values in a defined radius. The applied radius was 5 km, translating into a 9x9 neighbourhood with the given 1000m raster cell size. Weighting factors are calculated according to the function: $w = (1- (d / R)^2)^2$ where w is the weight, d is the distance and R is the chosen radius. The weights decrease to 0 as the distance between considered point and the centre of the 9x9 window increases:

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

The calculation for a 9x9 window is: weighted average = sum(cell[i] * weight[i]) / sum(weight[i]). More information about smoothing radius, resulting neighbourhood size and related weighting factors can be found in the CORILIS methodology (see the URL above).

```
# Calculate weighted averages, in a 9x9 neighbourhood
$ r.neighbors input=basemap1000 output=naturilis_float \
              size=9 method=average weight=weights.txt
```

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 compressed GeoTIFF
$ r.mapcalc 'naturilis_v2 = round(naturilis_float)'
$ r.out.gdal naturilis_v2 output=naturilis_v2.tif createopt=compress=lzw
```