

Stochastic Dominance Ranking Utility

Installation

Unzip the archive (ssd_utility.zip) 'with subfolders' into a desired location. The package contains executables, example batch scripts and sample data files.

The stochastic dominance ranking utility includes two units – the pre-processing utility (ssd_.exe) and the ranking utility (sdrank_.exe). The program is designed to work with raster geographical data imported from geographic information system (GIS) software ESRI GIS Arc-Info and ArcGIS (such as multiple maps of invasive species spread created with various spatial stochastic dispersal models). The program is a 32-bit command line application and can be run in a command prompt window in a 32-bit Windows environment (XP, Windows Server, Windows 7 or higher).

Pre-processing utility – ssd_.exe

The pre-processing utility prepares the geographic data (32-bit binary files typically imported from ESRI grid coverages in Arc-Info or ArcGIS programs). The input map files typically represent individual realizations of the geographic invasive patterns or other model-based metrics that depict the likelihood, risk or potential impact of pest invasion.

The maps should be stored as 32-bit binary floating point files; they should all be identical in size (i.e. identical number of rows and columns), resolution and geographic projection. The file format is a 32-bit floating point 'float' and can be generated in Arc-Info Grid GIS via the `gridfloat` command (or via 'Raster to Float' in ArcMap GIS). Make sure that the map files do not have extensions and all are stored in a single directory.

The pre-processing utility has the following command line syntax:

```
SSD_.exe List_file Data_dir OutputPrefix Nreps Nperc
```

`List_file` – the ASCII text file with the list of 32-bit input map files (typically files without extensions generated in GIS via Arc-Info 'gridfloat' command);

`Data_dir` – Directory name with the input map files (all map files should be in a single folder);

`OutputPrefix` – Output file prefix for the intermediate output files. The files generated with the pre-processing utility have names starting from that prefix. The prefix can include the path to subfolders, e.g. \data\Prefix1 – in this case, the output files with names starting from 'Prefix1' will be stored in the subdirectory 'data');

`N_grids` – number of map files to use from the `list_file`;

`N_perc` – number of percentile points for CDF calculations (typically several times less than the number of map files used).

Example:

```
ssd_.exe bindata\_files.txt bindata\ prep_data\test1 150 50
```

The pre-processing utility creates the intermediate data and link files, which are then used to generate the map of stochastic dominance ranks. The intermediate data file has the suffix 'perc.txt' (the full name starts from the `OutputPrefix` specified in command line arguments and ends with the 'perc.txt'). The link file is used to store the locations of 'nodata' values in the input binary maps and is then used to generate the output maps of the SSD ranks. The file name starts from the `OutputPrefix` and ends with the 'permlink.txt' suffix. The program also generates basic statistics (mean and standard deviations) and stores the data in the 'OutputPrefix*stats.txt' file.

Stochastic dominance ranking utility – sdrank_.exe

The ranking utility uses the intermediate data and link files (generated with the pre-processing utility `ssd_.exe`) and creates the map of the SSD ranks. The outputs are stored as binary and text files. The binary file has the name 'OutputPrefix'rank' without extension. The output binary file has the 'nodata' values placed as they appear in the original GIS input maps and can be exported to GIS for mapping and post-processing (via Arc-Info `floatgrid` command or the 'Float to Raster' option in ArcGIS). In order to be imported back to GIS the binary file will need the projection and header files – these files can be copied from one of the input binary maps. The user will need to copy one of the projection and header files from the input binary maps into the files named 'OutputPrefix'rank'.prj and 'OutputPrefix'rank'.hdr and the binary file will be ready for export to GIS.

The program also produces the output text file with the name OutputPrefix'rank.txt', which lists the final ranks inclusive of the 'nodata' values (so the number of cases is equal to the number of map cells in the binary input maps). Another output text file OutputPrefix'ranked.txt' lists the rank values without the 'nodata' values.

The ranking utility has the following command line syntax:

```
Sdrank_.exe InputFile OutputPrefix LinkFile
```

where

InputFile is the intermediate file generated with the pre-processing utility (ssd_.exe).

OutputPrefix is the output file prefix (can include subfolders).

LinkFile is the link file generated with the pre-processing utility that is then used to build the final output map of the SSD ranks.

Example syntax that is using the outputs generated with the pre-processing utility is shown below:

```
sdrank_.exe prep_data\test1perc.txt output\_ prep_data\test1perclink.txt
```

An illustrative example (test_example.bat)

A series of pest risk maps has been generated with the spatial invasion model and needs to be ranked with the SSD rule. The maps are stored in the \bindata folder – binary files, w/o extensions (sample data included in the zip archive).

First, in a command prompt window generate the text file with the list of binary input files:

```
dir /b bindata\*. >bindata\_files.txt
```

The list file '_files.txt' needs to be stored in the same directory as the input binary files.

Next, run the pre-processing utility:

```
ssd_.exe bindata\_files.txt bindata\ prep_data\_ 150 150
```

In this example, we use 150 binary files and sample the distributions of the data values in binary files at 150 percentile points. Note that the number of percentile points could be fewer but cannot exceed the number of binary files used in the analysis.

The intermediate files are stored in the prep_data\ directory and will start from the underscore symbol (as specified in the command line argument):

Intermediate file – prep_data_perc.txt

Link file – prep_data\perclink.txt

Statistics file – prep_data\stats.txt

Next, create the output folder (in our example – output\) and run the SD ranking utility with the intermediate output and link files:

```
sdrank_.exe prep_data\_perc.txt output\test1 prep_data\_perclink.txt
```

The output files will be stored in the output/folder and will start from the 'test1' prefix:

test1rank – binary map with the rank values for export to GIS;

test1rank.txt – text file with the rank values including the 'nodata' values;

test1ranked.txt – text file with the rank values without the 'nodata' values.

Copy the projection and header files from one of the binary input maps, i.e. from one of input binary maps in the bindata\directory into test1rank.prj and test1rank.hdr:

```
copy bindata\tmp_nodata.prj output\test1rank.prj
```

```
copy bindata\tmp_nodata.hdr output\test1rank.hdr
```

Finally, export the binary float file test1rank to GIS via 'floatgrid' ArcInfo or 'Float to Raster' ArcGIS commands.