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DFS–MAP – A SIMPLIFIED MAPPING TOOL FOR PRESENTATION OF ANIMAL OCCURRENCE IN SLOVAKIA

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Abstract

DFS–MAP is a simple mapping tool for plotting data on the occurrence od animals in Slovakia based on widely used software Microsoft Excel, which allows users to analyze and plot two sets distribution data. The software application draws raster maps with standard data points as well as map squares of the Databank of Slovak Fauna based on recorded geographic coordinates.

Key words

Mapping tool, animal distribution, Databank of Slovak Fauna.

INTRODUCTION

General availability of GPS receivers capable recirding precize position of sampling sites and record place of animal occurrence led to .

Recording of the position is widely used in diverse branches of wildlife research, nature protection, vegetation management require accurate information on the space array of different animal plant communities (Hulpert & French 2011)

The potential use of GPS is still increasing – from simple recording of spot sites to surveying of remote featureless landscapes to the tracking of crepuscular or far-ranging and mirating animals.

Hand in hand with growing usage of GPS in wildlife and biodiversity research, boom of diverse GIS (geoinformation system) coincided. However, in spite of wide application of georeferenced distribution data, there is still lack of free tools for presentation of recorded data especially for smaler regional data sets.

There are dozens of examples of efficient use of GPS receivers and diverse monitoring techniques in remote monitoring of animal occurrence in urban areas (e.g. Blake & Brown 2011) and agriculture (Turner et al. 2000).

According to Vaughan & Ormerod (2005) Species distribution models could bring manifold benefits across ecology, but require careful testing to prove their reliability and guide users.

There are several tools drawing maps based on data on global scale or producing low resolution maps which are not suitable for publication in scientific papers (e.g. Schneider 2011). Most GIS or map plotting software packages are either expensive, do require trained staff and/or are demanding additional resources like map layers, datae set etc. Among the most similar free maping services, the GPS Visualiser (Schneider 2011) must be mentioned, which is a versatile, flexible online mapping utility.

The DFS–MAP tool is a complement to the database system on taxonomy and biodiversity od animals and plats beeing compiled in the KRABIO project.

Citation

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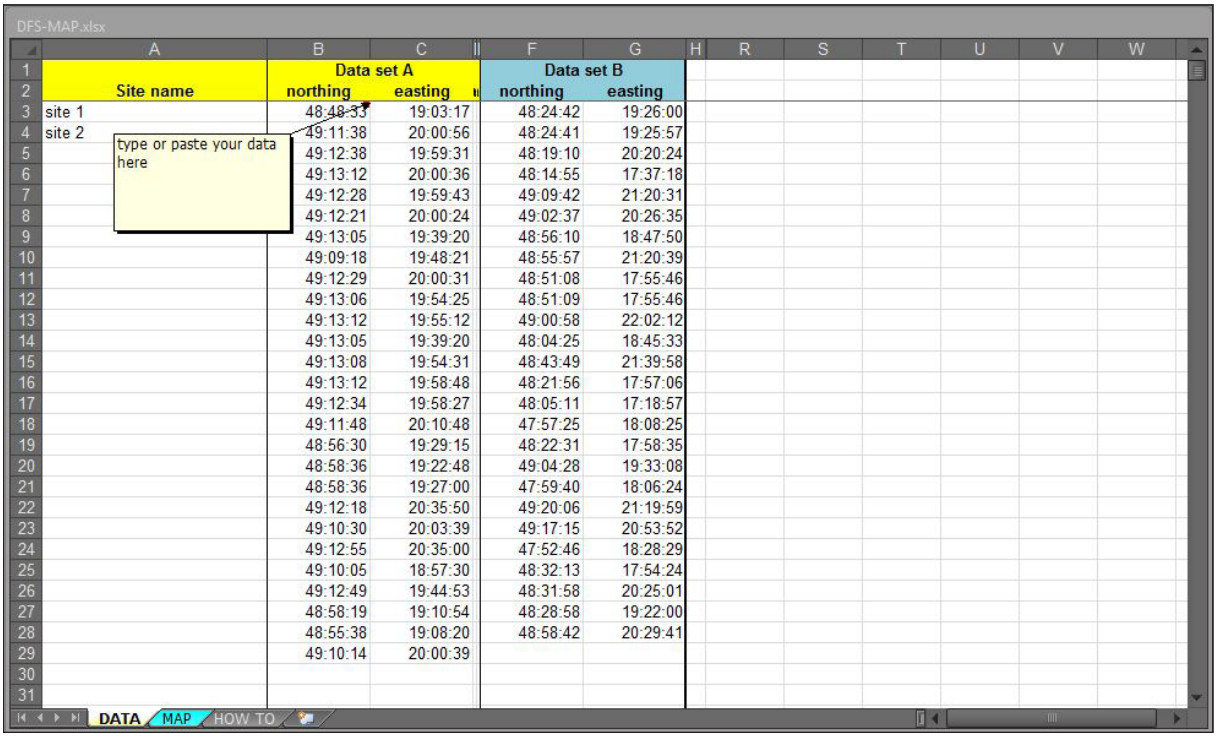

DFS-MAP.xlsx

	A	B	C	F	G
1		Data set A		Data set B	
2	Site name	northing	easting	northing	easting
3	site 1	48:48:33	19:03:17	48:24:42	19:26:00
4	site 2	49:11:38	20:00:56	48:24:41	19:25:57
5		49:12:38	19:59:31	48:19:10	20:20:24
6		49:13:12	20:00:36	48:14:55	17:37:18
7		49:12:28	19:59:43	49:09:42	21:20:31
8		49:12:21	20:00:24	49:02:37	20:26:35
9		49:13:05	19:39:20	48:56:10	18:47:50
10		49:09:18	19:48:21	48:55:57	21:20:39
11		49:12:29	20:00:31	48:51:08	17:55:46
12		49:13:06	19:54:25	48:51:09	17:55:46
13		49:13:12	19:55:12	49:00:58	22:02:12
14		49:13:05	19:39:20	48:04:25	18:45:33
15		49:13:08	19:54:31	48:43:49	21:39:58
16		49:13:12	19:58:48	48:21:56	17:57:06
17		49:12:34	19:58:27	48:05:11	17:18:57
18		49:11:48	20:10:48	47:57:25	18:08:25
19		48:56:30	19:29:15	48:22:31	17:58:35
20		48:58:36	19:22:48	49:04:28	19:33:08
21		48:58:36	19:27:00	47:59:40	18:06:24
22		49:12:18	20:35:50	49:20:06	21:19:59
23		49:10:30	20:03:39	49:17:15	20:53:52
24		49:12:55	20:35:00	47:52:46	18:28:29
25		49:10:05	18:57:30	48:32:13	17:54:24
26		49:12:49	19:44:53	48:31:58	20:25:01
27		48:58:19	19:10:54	48:28:58	19:22:00
28		48:55:38	19:08:20	48:58:42	20:29:41
29		49:10:14	20:00:39		
30					
31					

Figure 1. Input spreadsheet for coordinates in form DD:MM:SS.

The input spreadsheet allows user to enter two independent sets of data. Data set A is dwawn in the map in form of diamonds and mapping squares (DFS grid square), the data set B is drawn as white circles (see Figure 2). Additional modifications of symbols and colours is determined by MS Excel software.

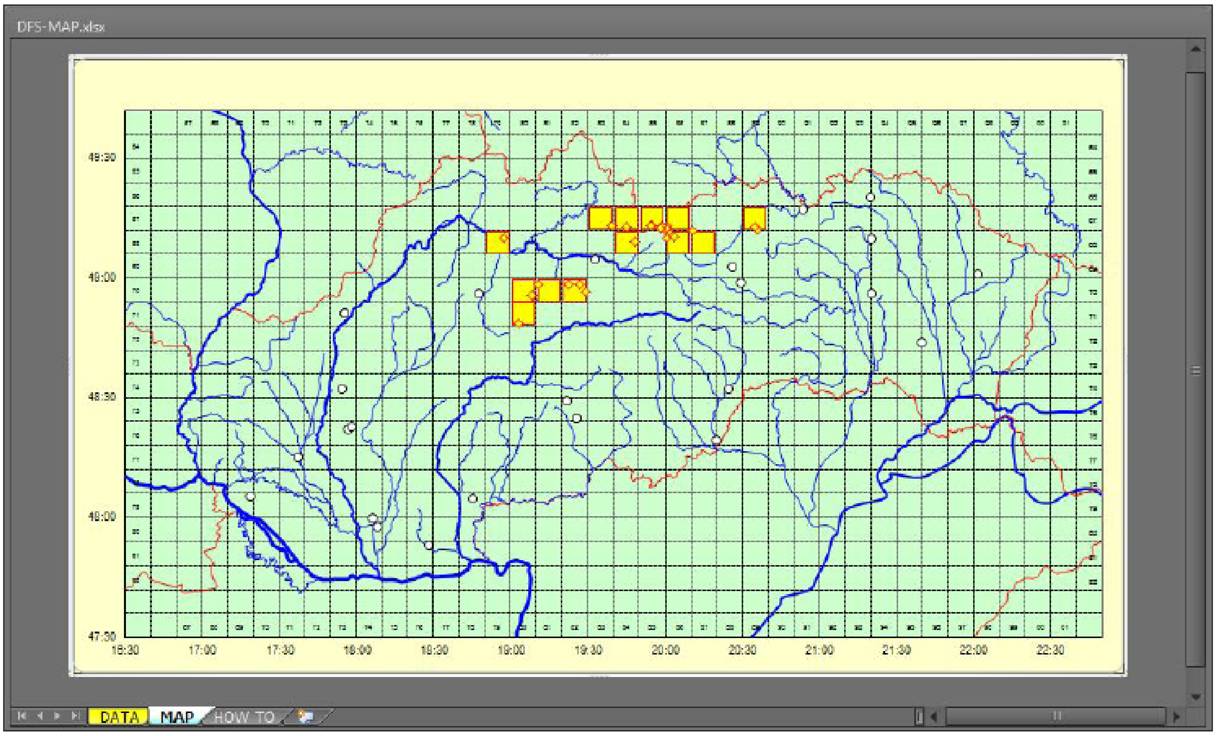

Figure 2. Output spreadsheet with the distribution map of taxons.

Our goal was to compile a simple mapping tool for both beginners and power users, which does not require special environment, software installation or additional resources and will allow plotting the distribution data on the occurrence of animals (and/or) plants in Slovakia. Such a tool is aimed to be freely distributable and accessible for wide group of experts as well as amateurs, who want to (1) present the data on distribution of organisms, (2) verify correctness of geographic coordinates

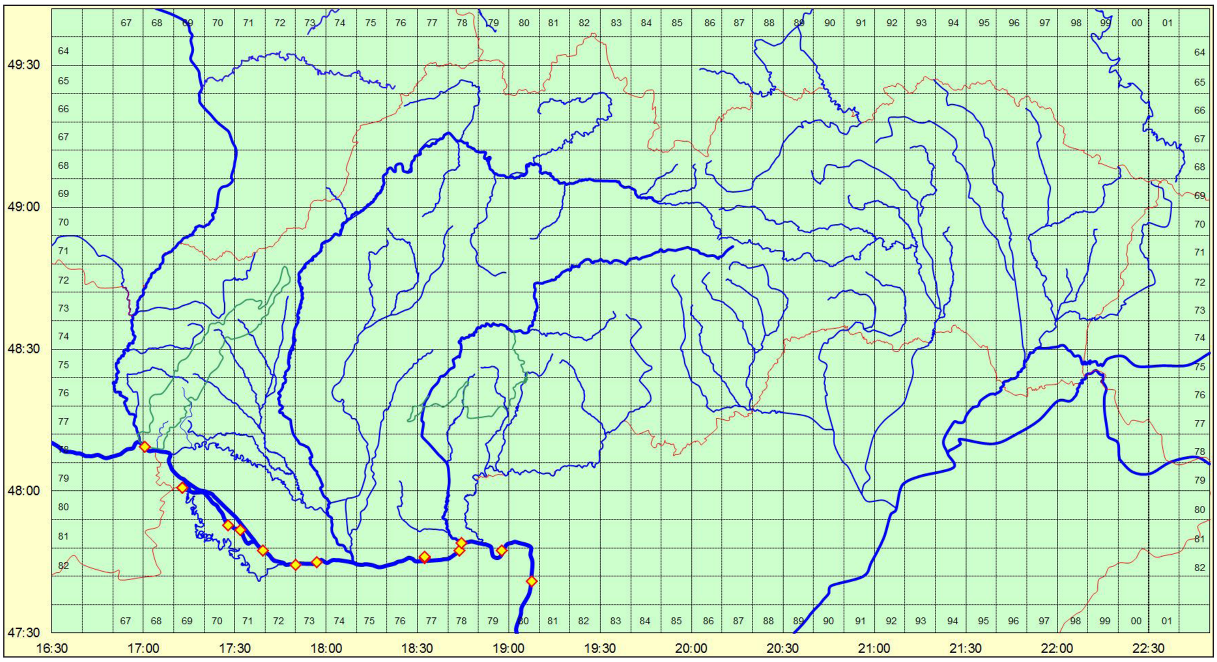

Figure 3. The occurence map of invasive amphipod *Corophium robustum* Sars, 1895 in Danube river between Slovakia and Hungary drawn by the DFS-MAP mapping tool (yellow diamonds – known occurrence of species; red line – national borders; green line – borders of adjacent large scale protected areas).

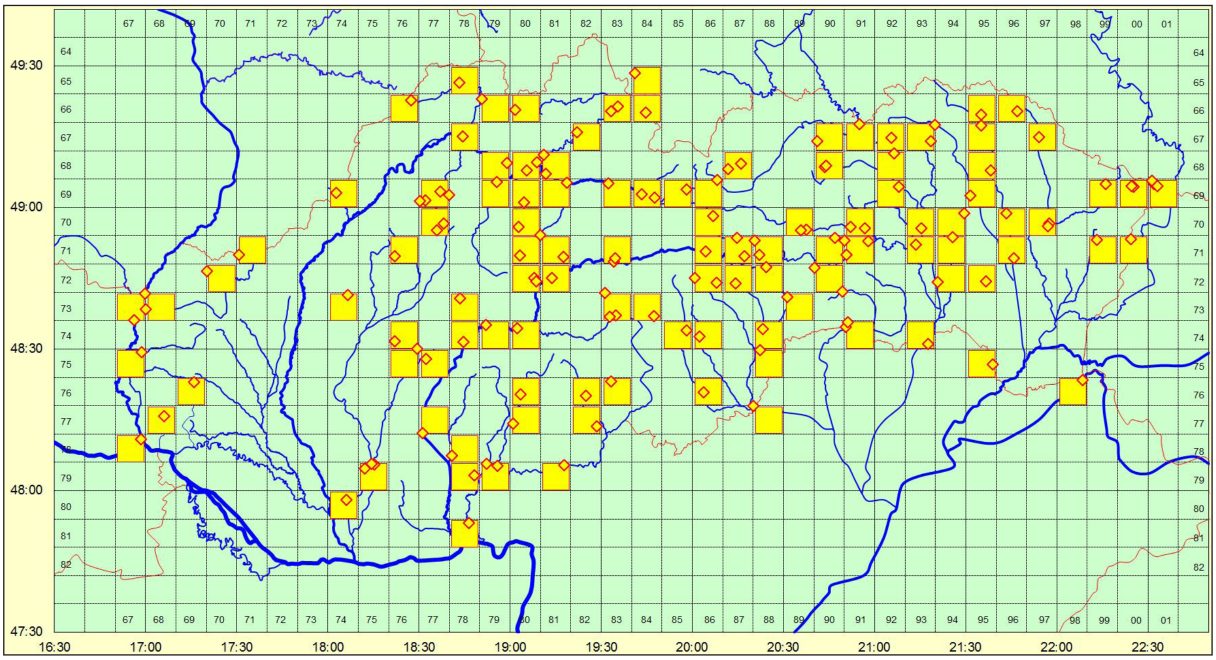

Figure 4. Example of the mapping tool application – localities of occurrence of the family Athericidae as reported by Bulánková 2011 with exact occurrence sites and mapping squares of DFS based on coordinates.

(e.g. check for transcription errors), and (3) compare differend sets of data on occurrence (based on the different taxons, time period).

MATERIAL AND METHODS

Definition of GPS

The Global Positioning System (GPS) refers to the group of 24 geosynchronous satellites operated by the U.S. Department of Defense. Equipped with atomic clocks, each satellite emits a unique radio signal that is received by a GPS receivers. The GPS receiver is calibrated to a satellite's atomic clock via information imbedded in the GPS signal. Because each GPS receiver generates the same unique code at the same time as each satellite, it is able to measure the time lag between radio signals sent and received. Because radio signals travel at a standard speed (299,460 km/s), a precise Earth location is thus a trigonometric equation solving for the intersection of four spheres with known radii (the radius being the measured distance between a receiver and satellite). Therefore, a minimum of four accurate distance measurements is theoretically

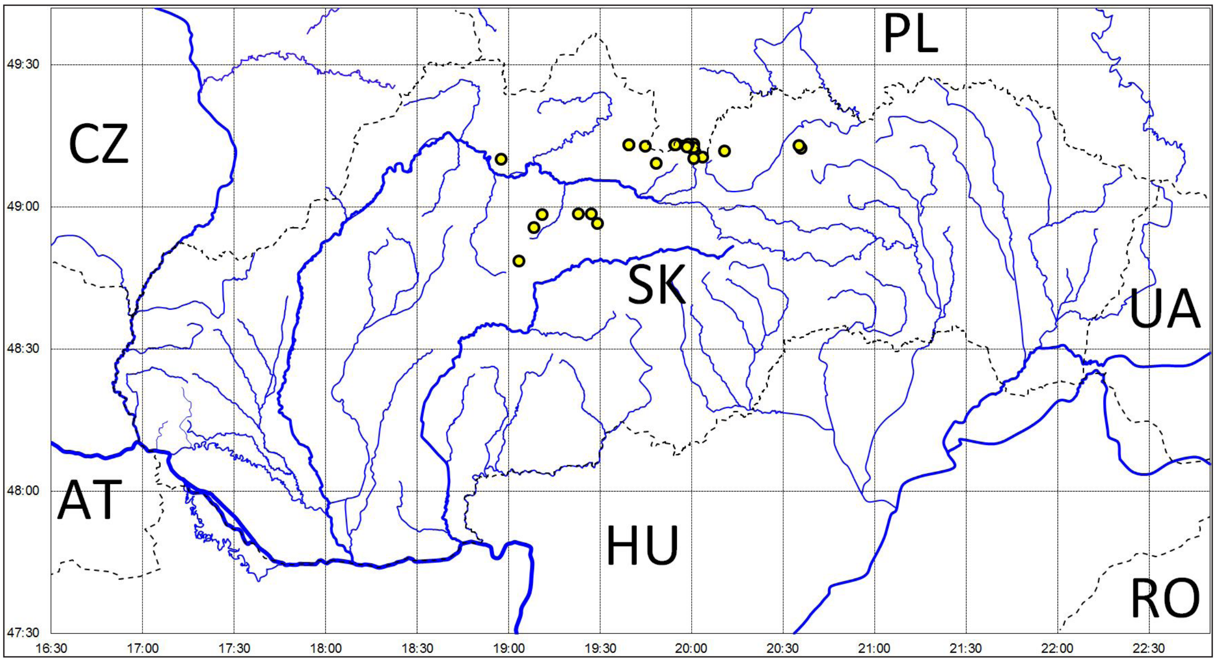

Figure 5. Modification of the map display plotted in the enhanced version of the DFS-MAP mapping tool used to plot the distribution data of *Prosimulim latimucro* (Enderlein, 1925) from publication Jedlička et al. (in press).

required to determine a precise three-dimensional location on the surface of the Earth (Dominy & Duncan 2001).

GPS data are mostly expressed as latitudes and longitudes relative to a mathematical model called the World Geodetic System 1984 datum (or WGS-84). Before 1.5.2000, satelites generates a GPS error called Selective Availability (S/A) induced by the U.S. Department of Defense. This generated the GPS inaccuracy of 10–30 m, but practically combined with some other (atmospheric) sources of error resulted in 95% of all civilian GPS positions being somewhere within 100 m of truth (Trimble Navigation 2011). The presidential decision to remove S/A improved civilian GPS accuracy to 10–30 m.

The DFS–MAP mapping tool is compiled in the most frequently used spreadsheet software Microsoft Excel 2010 (file format xlsx). As a beckgroud layers, it contains (1) the river network covering all streams of lenght above 20 km, (2) a gazetter of all settlements in Slovakia, (3) national borders of Slovakia and adjacent countries), (4) borders of large scale protected areas (national parks and protected lanscape areas), and (5) borders of orographic units.

Background line and spot layers of maps were georeferenced from Google Earth programme as well as OziExplorer v. 3.95.5g (Newman 2011).

Computer requirements are identical to requirement for computers running the Microsoft Windows operating system and Microsoft Office-software package.

For more details on the distribution data proccessing for map plotting, see Hijmans & Elith (2011) and Hengl (2009).

RESULTS AND DISCUSSION

The DFS–MAP is more then simple proportioned scatterplot chart in an Excel spreadsheet, because it contains a background layers of georeferenced features (settlements, rivers, borders etc).

Advanted of the DFS-MAP mapping utility is that it works offline in any personal computer operating Windows 7 with installed Microsoft Office package. It allows user to apply all formating features included in the MS Excel and save or export maps in standard file formats for future use.

The DFS–MAP is do-it-yourself mapping utility, for both beginners and power users, simple in terms of input as well as the output. When user copies GPS data into spreadsheet, the DFS–MAP will automatically produce a map in separate sheet. The output contains not only scatter plot poits of coordinates, but also the DFS mapping squares, widely used by botanists and zoologists in Slovakia for decades to present the distribution of organisms.

DFS–MAP data imput

Coordinate conversion

The three common formats of geographic coordinates:
DDD° MM‘ SS.s“ Degrees, Minutes and Seconds
DDD° MM.mmm‘ Degrees and Decimal Minutes
DDD.ddddd° Decimal Degrees
Degrees, Minutes and Seconds DDD° MM‘ SS.s“

Beacuse the DFS–MAP tool uses geographic coordinated in the form DD:MM:SS, users can convert their coordinates easily from decimal degrees to degrees, minutes, and seconds by the formula:

Decimal Degree [D.ddd] = 46.17444°

Deg. [D] = D.ddd – .ddd = 46.17444° – 0.17444° = 46°

Decimal Min. (M.mmm) = .ddd * 60 = 0.17444° * 60 = 10.4664´

Min. (M) = M.mmm – .mmm = 10.4664´ – 0.4664´ = 10´

Sec. (S) = .mmm * 60 = 0.4664´ * 60 = 27.984"

D/M/S = D and M and S = 46° 10´ 27.984"

Difference between the DFS–MAP and other mapping services

Maps produced in the DFS-MAP do not show conical projection, which is not too significant at size of Slovakia.

Download link:
www.ffs.sk/16-2011/34-stloukal/dfs-map.xlsx

ACKNOWLEDGEMENTS

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