A Simple Tool for Creating TxtInOut files for Simulating Land Use Change with SWAT
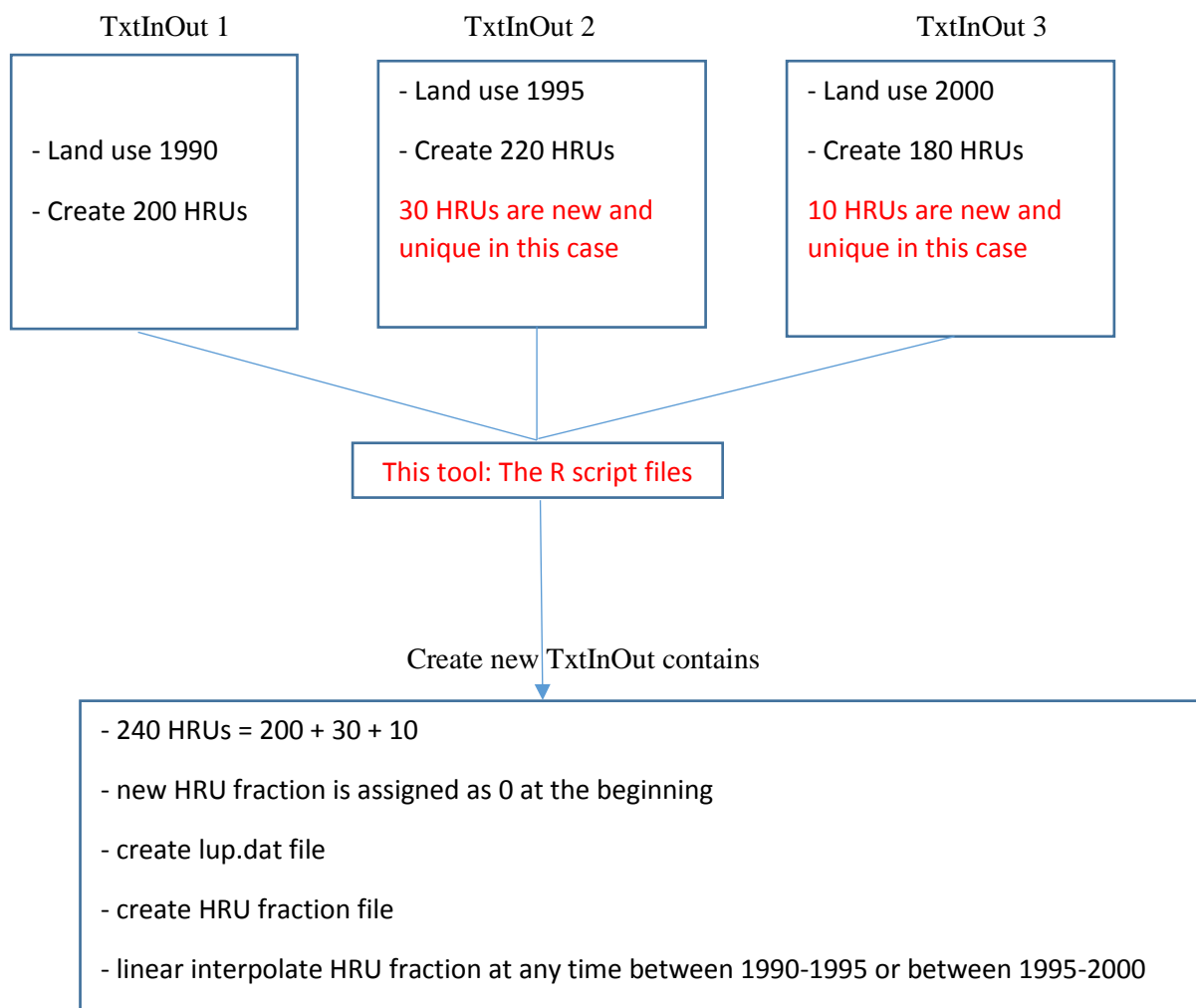
(new HRUs due to land use change, linear interpolation of HRU fraction also possible)

Description: This in an R script (https://www.r-project.org/)

The source code is available at   https://github.com/tamnva/SWAT_LUC

Usage: please see next page

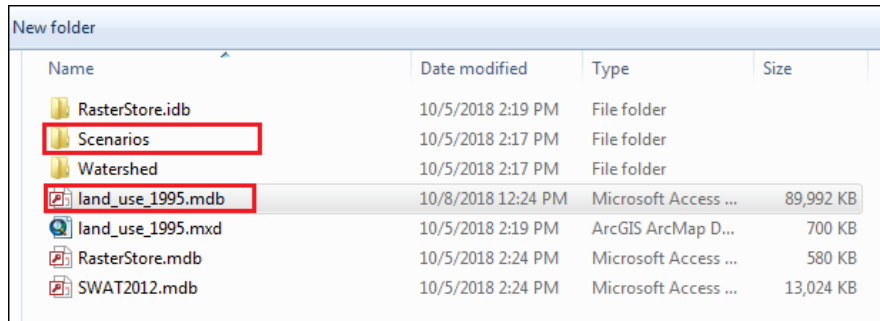Function of this tool (please see the graphical description below)

TxtInOut 1	TxtInOut 2	TxtInOut 3

TxtInOut 1
- Land use 1990
- Create 200 HRUs

TxtInOut 2
- Land use 1995
- Create 220 HRUs

30 HRUs are new and unique in this case

TxtInOut 3
- Land use 2000
- Create 180 HRUs

10 HRUs are new and unique in this case

This tool: The R script files

Create new TxtInOut contains

- 240 HRUs = 200 + 30 + 10

- new HRU fraction is assigned as 0 at the beginning

- create lup.dat file

- create HRU fraction file

- linear interpolate HRU fraction at any time between 1990-1995 or between 1995-2000

I hope you find this tool is useful

If you have any question, suggestion, please contact me via nguyen@iww.uni-hannover.de

Step 1: Setup your ArcSWAT project with different land use scenarios.

To use this R script, the "TxtInOut" and the ".mdb" files must be created beforehand (with ArcSWAT) for each land used scenarios (I have not tested with QSWAT output files)

Example: A project was created with ArcSWAT for land use scenario in 1995. So all the files in the folder "TxtInOut"have been created and the hru information can be found in the file "land_use_1995.mdb"→ table with the name "hru", which is needed for step 2.
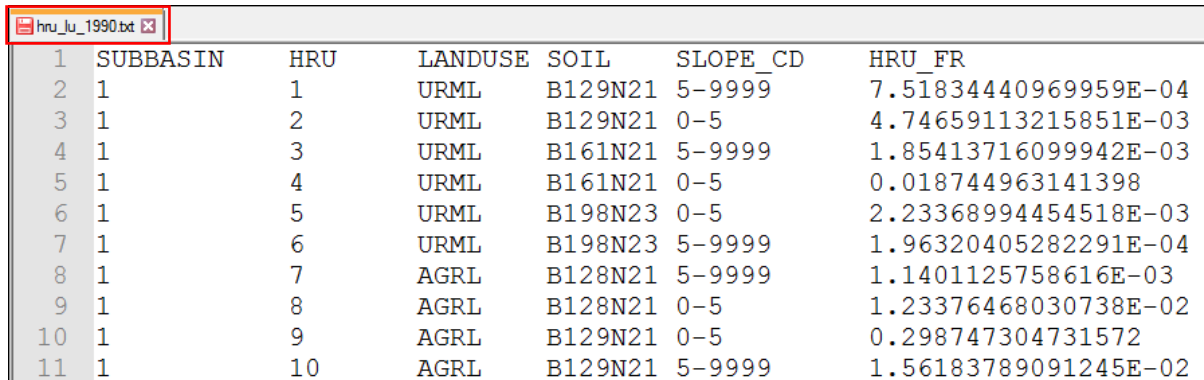

Step 2: Write report file about HRUs in all land use change scenario
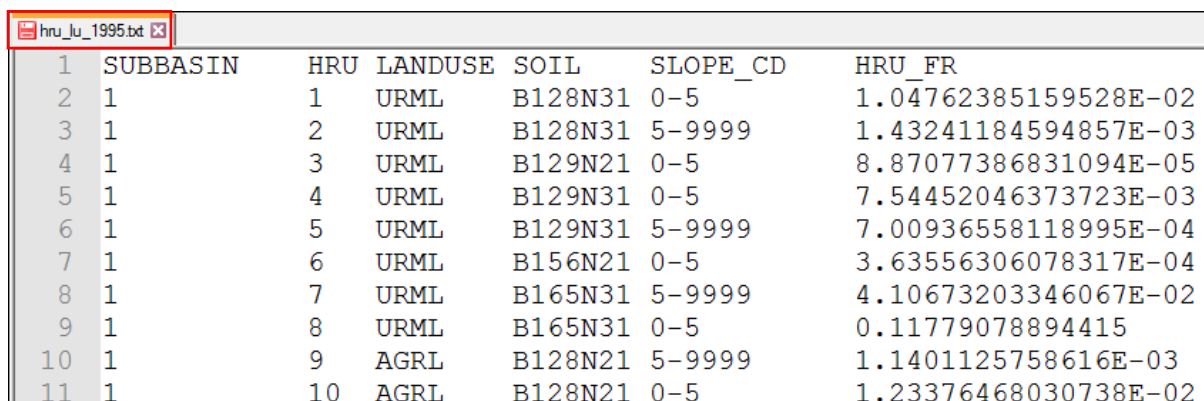
1. Prepare Input files format (files with information about HRUs in each land use scenario)

How to get this information: Please see the example in step 2, this information is in the file "land_use_1995.mdp" → Table with the name "hru"

For example: I copied this information from the database and paste it to the text files with the name "hru_lu_1990.txt" and "hru_lu_1995.txt"

hru_lu_1990.txt

	SUBBASIN	HRU	LANDUSE	SOIL	SLOPE_CD	HRU_FR
1	SUBBASIN	HRU	LANDUSE	SOIL	SLOPE_CD	HRU_FR
2	1	1	URML	B129N21	5-9999	7.51834440969959E-04
3	1	2	URML	B129N21	0-5	4.74659113215851E-03
4	1	3	URML	B161N21	5-9999	1.85413716099942E-03
5	1	4	URML	B161N21	0-5	0.018744963141398
6	1	5	URML	B198N23	0-5	2.23368994454518E-03
7	1	6	URML	B198N23	5-9999	1.96320405282291E-04
8	1	7	AGRL	B128N21	5-9999	1.1401125758616E-03
9	1	8	AGRL	B128N21	0-5	1.23376468030738E-02
10	1	9	AGRL	B129N21	0-5	0.298747304731572
11	1	10	AGRL	B129N21	5-9999	1.56183789091245E-02

hru_lu_1995.txt

	SUBBASIN	HRU	LANDUSE	SOIL	SLOPE_CD	HRU_FR
1	SUBBASIN	HRU	LANDUSE	SOIL	SLOPE_CD	HRU_FR
2	1	1	URML	B128N31	0-5	1.04762385159528E-02
3	1	2	URML	B128N31	5-9999	1.43241184594857E-03
4	1	3	URML	B129N21	0-5	8.87077386831094E-05
5	1	4	URML	B129N31	0-5	7.54452046373723E-03
6	1	5	URML	B129N31	5-9999	7.00936558118995E-04
7	1	6	URML	B156N21	0-5	3.63556306078317E-04
8	1	7	URML	B165N31	5-9999	4.10673203346067E-02
9	1	8	URML	B165N31	0-5	0.11779078894415
10	1	9	AGRL	B128N21	5-9999	1.1401125758616E-03
11	1	10	AGRL	B128N21	0-5	1.23376468030738E-02

- File format: text file and free format

Column 1: SUBBASIN number

Column 2-5: HRU number, LANDUSE type, SOIL type, SLOPE_CD, HRU_FR

- Line 1: is the title (must be the same name and capitalized as indicated in these file)

- Line 2 to Line number of HRUs: data (free format)

2. Create output file using the R script named "hru_all_landuse_reprort.R"

Please modify some lines (between the user defined parameter, see figure below) in this file if necessary. For example, if you have 2 (or 4) land use scenarios please delete the line starts with hru_landuse[3] (or added another line starts with hru_landuse[4]) and so on.

(Screen shoot of this R script is shown below)

```
#**************************************************************************#
# USER DEFINE PARAMETER - PLEASE CHANGE ONLY WITHIN THIS PART             #

    hru_landuse    <- c()                            # don't change this line
    hru_landuse[1] <- "D:/landuse/hru_lu_1990.txt"   # e.g. HRU info with land use in 1990
    hru_landuse[2] <- "D:/landuse/hru_lu_1995.txt"   # e.g. HRU info with land use in 1995
    hru_landuse[3] <- "D:/landuse/hru_lu_2000.txt"   # e.g. HRU info with land use in 2000

    ouput_file <- "D:/landuse/hru_lu_all.txt"        # output file name

# END USER DEFINE PARAMETER                                               #
#**************************************************************************#



# Number of land use change scenario
    nluc <- length(Lu)
```

After running this code, the output file (for example, please see the above figure, the output file is named "hru_lu_all.txt" as below. Note: HRU number and HRU fraction are assign as 0 if it does not exist in that land used scenario.

SUBBASIN	HRU	LANDUSE	SOIL	SLOPE_CD	HRU_FR	V7	V8	V9	V10
1	1	URML	B129N21	5-9999	0.000751	0	0	1	0.00075183444096996
1	2	URML	B129N21	0-5	0.004746	3	8.8707e-05	2	0.00474659113215851
1	3	URML	B161N21	5-9999	0.001854	0	0	3	0.00185413716099942
1	4	URML	B161N21	0-5	0.018744	0	0	4	0.018744963141398
1	5	URML	B198N23	0-5	0.002233	0	0	5	0.00223368994454518
1	6	URML	B198N23	5-9999	0.000196	0	0	6	0.000196320405282291
1	7	AGRL	B128N21	5-9999	0.001140	9	0.001140	0	0
1	8	AGRL	B128N21	0-5	0.012337	10	0.012337	0	0
1	9	AGRL	B129N21	0-5	0.298747	11	0.298747	9	8.87077386831094e-05
1	10	AGRL	B129N21	5-9999	0.015618	12	0.015618	0	0

....

...

1	0	FRSE	B165N21	5-9999	0	0	0	35	0.027880406000534
1	0	FRSE	B198N21	0-5	0	0	0	36	0.0545799811189256
1	0	FRSE	B198N21	5-9999	0	0	0	37	0.00257252442181017
2	1	AGRL	B129N21	5-9999	0.00266	8	0.002665	0	0
2	2	AGRL	B129N21	0-5	0.053428	9	0.053428	0	0
2	3	AGRL	B129N31	0-5	0.000411	10	0.000411	2	0.00946027035637853
2	4	AGRL	B129N31	5-9999	0.000179	11	0.000179	1	0.00290185441914833

This info is as in the file "hru_lu_1990.txt"

HRU number in the second land use scenario "hru_lu_1995.txt"

HRU fraction in the second land use scenario "hru_lu_1995.txt"

HRU number in the third land used scenario

HRU fraction in the third land used scenario

Step 3: Create "TxtInOuts" files for all land use scenario and necessary files for ~~simulating land use change~~ – use the R script name "writeTxtInOuts.R"

(Screen shoot of this R script is shown below)

Please modify the code within the user define only.

How to modify it?

- Line starts with: Lu[1]
  - Lu[1] is the TxtInOut folder for when the SWAT project is created with the first land use land use in 1990 and so on for Lu[2] and Lu[3]. *Please remove or add Lu[i] if necessary.*
- Line starts with date
  - Assign date as a vector contains the date (format ddmmyyyy) of three land use scenarios (see example in the above figure). *Remove or add more date to this vector if necessary*
- Line starts with inter_date[[i]]:
  - In this example, I have the land use map in 01011990 and 01012005, I want to interpolate land use between these dates (linear interpolation), for example, for the beginning of 1991, 1992, and 1993, the inter_date[[1]] should be assign as the above figure.
  - The same is done with inter_date[[2]]. *If you don't want to interpolate for the date in between, please assign inter_date[[i]] as c("NA")*

- outfolder is the ouput folder, where the generated text files will be placed in this folder
- hru_lu_all is the directory of the files created in step 2.
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If there is no problem, all of the TxtInOut files will be find in the outfolder (please see examples of the files created related to land use change in the below figure)

Now you can run SWAT in this folder (outfolder), or use SWAT_CUP to calibrate the model