# GeoWEPP for ArcGIS 10.x Version Overview Manual

By

Haoyi 'Finix' Xiong, M.S. Student, The University at Buffalo Jonathan Goergen, Ph.D. Student, The University of Iowa Misa Yasumiishi, M.S. Student, The University at Buffalo

and

Dr. Chris S. Renschler, Ph.D. Department of Geography The State University of New York at Buffalo

A research project at the

Landscape-based Environmental System Analysis & Modeling (LESAM) Laboratory at the Department of Geography / National Center for Geographic Information and Analysis (NCGIA) University at Buffalo - The State University of New York (SUNY), Buffalo, New York Copyright (C) 2014 LESAM Research Group, University at Buffalo. All rights reserved.

Revision Date: 01/31/2014.

Please ALWAYS review the GeoWEPP derived model input before running the WEPP model. All information, computer software, and database containing this GeoWEPP release are believed to be accurate and reliable. The Landscape-based Environmental System Analysis Modeling (LESAM) Laboratory of Department of Geography at the University at Buffalo, The State University of New York, accepts no liability or responsibility of any kind to any user, other person, or entity as a result of installation or operation of this software. GeoWEPP is provided 'AS IS', and you, the user, who assumes all risks, when using GeoWEPP.

If you have any questions, suggestions, or comments regarding GeoWEPP, visit the following web site: http://geowepp.geog.buffalo.edu/contact/ and fill out the inquiry form, or send email to: support@geowepp.org.

The GeoWEPP ArcGIS 10.1 Development Team

Haoyi 'Finix' Xiong, University at Buffalo Jonathan Goergen, University of Iowa Misa Yasumiishi, University at Buffalo Dr. Chris S. Renschler, University at Buffalo

For questions and suggestions for this manual, please contact: support@geowepp.org

# **Table of Contents**

1. System Requirements	. 4
2. GeoWEPP Installation	. 4
3. GeoWEPP Input Data Requirements	. 4
4. Launching GeoWEPP	. 6
5. GeoWEPP Basics	10
Folder Structure	10
Core Functions	10
Toolbar	11
6. GeoWEPP Steps	12
7. Product Note and Known Issues	20
Reference	22

# **1. System Requirements**

- Windows Operation System
- ArcGIS 10.1 Desktop. ArcGIS 10.1 doesn't work with ArcGIS's previous versions or ArcGIS 10.2 or higher.
- ArcGIS Spatial Analysis Extension
- Spatial Analysis Extension
- Most Recent version of WEPP (for application information and download go to <a href="http://www.ars.usda.gov/Research/docs.htm?docid=10621">http://www.ars.usda.gov/Research/docs.htm?docid=10621</a>)
- .NET Framework
- 250 MB hard disk space. A larger disk space will be required if example sets are used (approximately 50MB for each set).

# 2. GeoWEPP Installation

GeoWEPP applications can be downloaded at <u>https://geowepp.geog.buffalo.edu/versions/</u>. Please fill out the password request form of the version you wish to install.

Once you have downloaded an application zip file, unzip the zip file. The zip file can then be downloaded and installed to the local hard drive or external drive such as the flash drive.

**Important Note:** The location you provide should not contain any spaces in the folder names. For Example, you shouldn't use "C:\My GeoWEPP", but you should use "C:\MyGeoWEPP" or "C:\My\_GeoWEPP". This also means you can not save the GeoWEPP folder on to your desktop, since its location is actually "C:\Documents and Settings\All Users\Desktop". It is also recommended that you limit the folder name to no more than 13 characters. Both of these have to do with the way pathways were used and created in older operating systems and in older versions of ArcGIS.

# 3. GeoWEPP Input Data Requirements

### **Minimum Requirement Files**

• Elevation data file in ASCII format (.asc) of the area.

• Soil data files and landcover data files can be added for precise modeling. For details about how to create the data sets, please refer to GeoWEPP for ArcGIS 9.x Full Version Manual (http://geowepp.geog.buffalo.edu/training/arcgis-9-x/documentation/)

### **Important Note:**

.

- 1. Raster files of DEM, soil and landcover have to be ASCII format (.asc). You can convert raster files to ASCII format using the ArcGIS [Raster to ASCII] tool.
- 2. <u>For a DEM ASCII file</u>: All the elevation values in the DEM should be between 1.0 to 9999.0 meters
- 3. There must be NO scientific expression in the ASCII files.
- 4. There should be NO holes in ASCII files, which means that NoData values can be allowed inside the boundary of study area.
- 5. Values having a comma are not allowed. For example, "1,234" is not allowed but "1234" is permitted.
- 6. UTM easting of DEM (xllcorner) should be positive value no more than 1,000,000 meters. UTM northing of DEM (yllcorner) should be no more than 10,000,000 meters.

# 4. Launching GeoWEPP

### **Before launching:**

- Please make sure that the Spatial Analysis extension is enabled on ArcGIS.
- Please check the UTM zone of the area. You will be prompted to enter the number later.
- We recommend that you read the "Product Notes and Known Issues" section in this document before starting GeoWEPP.
- 1. Go to the folder you unzipped GeoWEPP zip file.
- 2. Double click 'GeoWEPP.esriAddIn' **BEFORE** opening GeoWEPP application. This will add the GeoWEPP toolbar to ArcGIS.

**Note:** If you don't see the GeoWEPP tool bar when ArcGIS is opened later, go to the top menu > Customize> Toolsbars and turn on [GeoWEPP].

- 3. Double click 'Launch GeoWEPP.exe' to launch GeoWEPP.
- 4. Start up screen will now appear.



Figure 1: Start up screen

### [Use Example GIS Data button]

GeoWEPP contains four example data sets. To familiarize yourself with GeoWEPP, you can choose among the examples and run the processes.

### [Use your own GIS ASCII Data]

This screen allows you to upload your own data files. To upload files, click on each file path box. Windows Explorer will appear.

<Input file locations and samples>



2 - DEM ASCII file



3 - Soil ASCII file

4 - Landcover ASCII file





5 - Soil description text file

\*Please refer to GeoWEPP for ArcGIS 9.x Full Version Manual about how to create these text files

6 - Soil database text file

7 - Landcover description text file

8 - Landcover database text file



#### [Load Previously Saved Project]

Once a project is created on GeoWEPP, the project is saved as .mxd file. The next time you can click this button and select the .mxd file in the project folder. You won't need to upload the source data files again.

#### [Exit GeoWEPP]

Closes GeoWEPP.

# 5. GeoWEPP Basics

#### **Folder Structure**

Please review the folder structure to be familiarized with GeoWEPP.

GeoWEPP_10_1_0_1	Example_data folder contains example project data sets.
📔 Example_data	<b>PRISM_Files</b> folder contains PRISM climate data files.
PRISM_Files	Projects folder contains projects you created.
📗 Projects	
RequiredFiles	- Generated raster files are stored in Projects > RasterDataset
WEPP	
👸 GeoWEPP.esriAddIn	- WEPP reports are stored in Projects > Reports subfolder.
GeoWEPPDirInfo.txt	
GWMest dll	<b>RequiredFiles</b> folder contains necessary files to run GeoWPP.
Swivieat.dii	
📧 Launch GeoWEPP.exe	<b>WEPP</b> folder contains soil and land management data, climate data generated by cligen, slope data, etc. in <b>Data</b> sub folder.

#### **Core Functions**

GeoWEPP combines three different functions to calculate soil erosion.

1. TOPAZ (Topographic Parameterization) for topographic evaluation, drainage identification, watershed identification, watershed segmentation, and subcatchment parameterization

- 2. PRISM (Parameter-elevation Regressions on Independent Slopes Model) for editing *existing* climate data.
- 3. WEPP (Water Erosion Prediction Project) for soil erosion calculation

### Toolbar



#### Figure 2: GeoWEPP 10.1 toolbar

### <TOPAZ part>

1 - Defines CSA (Critical Source Area) and MSCL (Minimum Source Channel Length) to delineate streams

2 - Specifies the outlet point of watershed

<PRISM part>

3 - Opens PRISM to select/edit existing climate data

<WEPP part>

- 4 Obtains the erosion pattern in the watershed
- 5 Displays reports
- 6 Saves GeoWEPP project
- 7 Changes tolerable value of erosion
- 8 Shows the information of hillslope in the watershed area (click on hillslope)
- 9 Changes the associated landuse and soil type
- 10 Returns WEPP after changing hillslope parameter

- 11 Loads a single hillslope on WEPP
- 12 Goes to WEPP
- 13 Saves project and exit

# 6. GeoWEPP Steps

1. Enter Critical Source Area (CSA) and Minimum Source Channel Length (MSCL).

Critical Source Area (CSA) Minimum Source Channel Length (MSCL) 100 Meters Cancel	Channel Network Delineation		
Minimum Source Channel Length (MSCL) 100 Meters Cancel	Critical Source Area (CSA)	E Hectares	ОК
	Minimum Source Channel Length (MSCL)	100 Meters	Cancel

Figure 3: CSA, MSCL setting window. Default values are CSA - 5, MSCL - 100.



Figure 4: Channels will be delineated

2. Click on a pixel of an outlet point.

Note: You are not able to select a source cell of a channel. It will return an error.



Figure 5: When you asked UTM Zone, enter UTM Zone number for the area



Figure 6: Subcatchments are delineated

3. **PRISM** Select and/or edit the existing climate data.

Climate Selecter	
Closest Climate Station to Oulet Point	
LAFAYETTE 5 S IN	Use
Or Select a Different Station Below	
State Name	
Station Name	Use
Or Use Your Own Climate Parameter File	Browse
Own File	Use
Exit	Help

#### Figure 7: Climate file selection window

limate Paramt	ers for	1	LAFAYET	TE 5		Iodified Climate	Name	Mod LAFAYE	TTE 5
40.35	•w	86.8	37 <b>°N</b>		Γ	40.35	W 86.87	*N	Y
600	feet	eleva	tion		Γ	600	feet elevati	m	PRISM
Mean Maximum Temperature (*F)	Mini Temp (*	erature F)	Mean Precipitation (in)	Number of Wet Days	Month	Mean Maximum Temperature (°F)	Mean Minimum Temperature (°F)	Mean Precipitation (in)	Number of Wet Days
31.56	17.	37	1.70	8.49	January	31.56	17.37	1,70	8.49
35.92	19.	33	1.65	7.49	February	35.92	19.33	1.65	7.49
47.34	28.	55	2.80	10.78	March	47.34	28.55	2.80	10.78
60.97	39.	67	3.50	10.94	April	60.97	39.67	3.50	10.94
72.07	49.	61	4.02	10.59	May	72.07	49.61	4.02	10.59
81.26	58.	65	3.80	9.26	June	81.26	58.65	3.80	9.26
84.59	62	58	<mark>4</mark> .16	8.86	July	84.59	62.58	4.16	8.86
82.68	60.	25	3.45	8.22	August	82.68	60.25	3.45	8.22
77.27	53.	20	2.74	7.41	September	77.27	53.20	2.74	7.41
64.96	41.	67	2.66	8.57	October	64.96	41.67	2.66	8.57
49.95	31.	96	3.03	9.47	November	49.95	31.96	3.03	9.47
36.83	22	03	2.52	9.69	December	36.83	22.03	2.52	9.69
Accept The	ese Valu	es	36.03	109.77	Annual	Clear All (	Changes	36.03	109.77
		1	Change e	entire column (e	nter 0 to reset) >>	0.00	0.00	0.0%	0.0%
ne	ib.			Exit		Adjust tem	perature for elev	ation by lapse ra	ste

Figure 8: PRISM screen. You can edit the existing climate parameters.

4. Enter parameters to obtain erosion patterns in the watershed.



Figure 9: WEPP will ask cligen climate station. Select one.

WEPP Climate S	election	X	
Latitude: 4 State Indiar Based on the waters CLIGEN data which	LAFAYETTE 5 S IN		
Distance to Closest Use Existing Clima	ОК	Cancel	

Figure 10: Successful message appears

Are	GIS Landuse	WEPP Management	
0.15	Emergent Herbaceous Wetlands	GeoWEPP¥grass.rot	
0.2%	Woody Wetlands	GeoWEPP¥Mountain Big Sagebrush.rot	-
0.2	Commercial/Industrial/Transportation	GeoWEPP¥grass.rot	-
16.3	% Pasture/Hay	GeoWEPP¥alfalfa with cuttings.rot	
4.2%	Low Intensity Residential	GeoWEPP¥grass.rot	
5.6	Deciduous Forest	GeoWEPP¥Tree-20 yr old forest.rot	-
1			F
To run a inputs. that ma (")	weep simulation the landuse and soils defined Double-click on any entry in the WEPP managem be used. Where no WEPP management or soil	in the GIS must be assoicated with equivalent W ient or soils columns to display a list of WEPP inpu is specified the default soil or management will be	EPP .ts used
	ОК	Cancel	

Figure 11: WEPP Mangement and Soil Lookup window over delineated watersheds. You can edit Landuse, Soils, Channels types by clicking on the line you want to change.

sw Help					_
Watershed Settings	Name	Management	Sol	% of Area	1
Channe Sel Jamerinteen Channel Jamerinteen	H#_141	GeoWEPPVcom.soybean-fail mulch till rot	in//CROSBY(SIL) add	2.8%	-
Charge Charge Charge Charge Charge	H# 142	GeoWEPPVcom.sovbean/fall mulch till rot	InVCROSBY(SIL) sol	5.1%	
	Hill 22	GeoWEPPVcom.soybean-fail muich til rot	in/#BILLETT(SL).ad	5.3%	
ange Management Associations	HØ 143	GeoWEPPVcom sovbean fail mulch til rot	InVCROSBY(SIL) sol	1.2%	
	Hil 152	GeoWEPPVcom.soybean.fall mulch til rot	InWCROSBY(SIL) and	4.4%	
rshed has 47 Hilslopes and 19 Channels.	H# 23	GeoWEPPVallalla with outlings rol.	WBILLETT(SL) sol	3.6%	
	Hill 151	GeoWEPPVcom soybean fail mulch til rot	InVCROS8Y(SIL) and	1.9%	
Indena%LAFAYETTE 5 5 IN di	H# 32	GeoWEPPVcom sovbean fail mulch til rot	in/BILLETT(SL) and	0.6%	
10	Hil 42	GeoWEPPVcom.soybean-fall mulch till rot	in//BILLETT(St) sol	1.0%	
Dance Orrate	Hil 132	GeoWEPPVcon soybean fail mulch til rot	in#CROS8Y(SIL) sol	1.6%	
	Hill 43	GeoWEPPVcom soybean-fall mulch till rot	INVBELIETT(SL) sol	0.6%	
lation Method Watershed and Rowpaths	Hil 122	GeoWEPPVcom soybean fail mulch til rot	inWMUAMI(SIL) and	4.1%	
	HI 33	GeoWEPPVcom sovbean fall mulch sil rot	INVELLETT(SL) sol	2.6%	
	H# 53	GeoWEPPVcom zoybean-fail mulch til rot	in//TROVEL(SIL) and	0.0%	
Hun WEPP	H8 41	GeoWEPPVcom soybean fall mulch sil rot	INVMIAMI(SIL) sol	3.2%	
	Hil 153	GeoWEPPValiatia with outlings rot	INVCROSBY(SIL) and	6.4%	
	110 81	CasWEPDVocan are base. fall on deb til out	add MODIFICITY and	2.0%	

Figure 12: Review the setting. Change setting, including Number of Years, and check Return Periods if necessary.



Figure 13: WEPP onsite and offsite output

5. Displays reports.

Select Reports to Displ	ay	
Available Reports		Reports to be Displayed
Offsite 1_0thy_events Offsite 1_0thy_retum_period: Offsite 1_0thy_summary Onsite 1p_thy_summary	S	
Add >>>		<< <remove< td=""></remove<>
Show Reports	Previous Reports	Exit

Figure 14: Select reports you want to display

ATERSHED OL Results lis	TPUT: DISC ted for Run	HARGE FROM WA hoff Volume >	TERSHED OUTL 0.005m^3)	ET	
Month Year	Precip. Depth (mm)	Runoff Volume (m^3)	Peak Runoff (m^3/s)	Sediment Yield (kg)	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 1 & 0.0 \\ 1 & 9.0 \\ 1 & 0.0 \\ 1 & 0.0 \\ 1 & 16.7 \\ 1 & 25.05 \\ 1 & 26.05 \\ 1 & 26.05 \\ 1 & 26.08 \\ 1 & 28.4 \\ 2 & 0.00 \\ 2 & 0.55 \\ 2 & 0.7 \\ 2 & 0.18 \\ 2 & 34.63 \\ 2 & 34.63 \\ 2 & 37.43 \\ 2 & 37.43 \\ 2 & 25.33 \\ 2 & 25.53 \\ 2 & 27.53 \\ 1 & 16.25 \\ 2 & 27.53 \\ 2 & 16.25 \\ 3 & 0.08 \\ 2 & 26.33 \\ 2 & 26.33 \\ 3 & 226.33 \\ \end{array} $	$\begin{array}{c} 1923.62\\ 7183.94\\ 1995.22\\ 422.91\\ 2255.82\\ 1970.42\\ 0.02\\ 11070.42\\ 0.0492.70\\ 0.26\\ 38.50\\ 0.08\\ 0.14\\ 0.04\\ 55175.40\\ 3630.81\\ 2493.70\\ 763.07\\ 863.30\\ 4301.96\\ 2312.05\\ 60407.86\\ 2312.05\\ 60407.86\\ 7330.89\\ 8322.18\\ 0.01\\ 9372.74\\ 26912.69\\ 7330.89\\ 754.36\\ 0.01\\ 38180.95\\ 16365.52\\ 16365.52\\ 16365.52\\ 76094.03\\ 0.01\\ 0.03\\ \end{array}$	$\begin{array}{c} 0.2941\\ 1.0549\\ 0.3216\\ 0.758\\ 0.3605\\ 0.3605\\ 0.3050\\ 0.0000\\ 0.0007\\ 0.0000\\ 0.0000\\ 0.0000\\ 0.0000\\ 0.0000\\ 0.0000\\ 0.0000\\ 0.0000\\ 0.0000\\ 0.0000\\ 0.0000\\ 0.3744\\ 0.1335\\ 0.1335\\ 0.1336\\ 0.0082\\ 0.3744\\ 0.1335\\ 0.3788\\ 0.0082\\ 0.0082\\ 0.0082\\ 0.0082\\ 0.0082\\ 0.0000\\ 0.0000\\ 0.000\\ 0.000\\ 0.000\\ 0.$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	

Figure 15: Reports are displayed in text format

- 6. Save your GeoWEPP project.
- 7. Change tolerable value of erosion, if necessary.
- 8. Shows the information of hillslope in the watershed area (click on hillslope).
- 9. Change the associated landuse and soil type, if necessary.
- 10. Returns to WEPP after changing hillslope parameter
- 11. Click on a hillslope to run WEPP on a single hill slope. Click [OK] on message pop-ups. WEPP window appears.



### Right click on each layer to display options

- 12. Click this button when you want to open a new blank WEPP project.
- 13. Save the project and exit.

# 7. Product Note and Known Issues

### Note:

1) Common errors are associated with an original raster file. It is recommended that you eliminate NoData cells.

2) A standard area for GeoWEPP is about 5 hectors. When you process a large area, please consider decreasing the DEM resolution such as from 10m to 30m, 30m to 50m, etc.

3) If a user does not upload soil or landover ASCII files, a default file (uniform) will be generated.

4) If a user does not upload soil or landcover ASCII files, a description file will be created with an entry for each unique value. All landcover and soil values will be set to a default value if the user doesn't offer a database file. Users may change these settings when modeling a subcatchment area.

5) If users are familiar with how to create a description and database file for GeoWEPP ArcGIS 9.x version, they may create them by referring to the ArcGIS 9.x manual.

6) Please use the [Load Previous Saved Project] button to open your .mxd file if you move your whole GeoWEPP folder to a different place to make sure some directory files inside are correct.

7) Please do not use any scientific notations to represent pixel elevation values in a raster file. All values in scientific notation will be treated as NoData Value.

## **Known Issues:**

1) Occasionally an ArcMap error occurs when GeoWEPP tries to delete a layer. When this occurs, save and exit the project and then re-open.

2) PRISM may report an error the first time you attempt to use it during a project. Re-running PRISM often fixes the problem.

3) A large DEM files (over 200,000 cells) may fail to process. If GeoWEPP freezes while running DEDNM.exe, try resampling your input raster.

4) Occasionally when a project opens on ArcMap for the first time the layers don't appear although the layer names appear in the left Table of Contents pane. When this happens, please save the project, close ArcMap, and re-open the project. The layers should appear.

# 8. Support

Email: <a href="mailto:support@geowepp.org">support@geowepp.org</a>

For detailed instructions about GeoWEPP functions and how to set up data sets: <a href="http://geowepp.geog.buffalo.edu/training/arcgis-9-x/documentation/">http://geowepp.geog.buffalo.edu/training/arcgis-9-x/documentation/</a>

For general inquires: <u>http://geowepp.geog.buffalo.edu/contact/</u>

For bug report: <u>http://geowepp.geog.buffalo.edu/contact/bug-report/</u>

For suggestions: http://geowepp.geog.buffalo.edu/contact/suggestions/

# Reference

Cligen

http://hydrolab.arsusda.gov/nicks/nicks.htm

Glossary of Hydrologic Terms

http://www.nws.noaa.gov/om/hod/SHManual/SHMan014\_glossary.htm

PRISM

http://oldprism.nacse.org/

PRISM Generator

http://prism.oregonstate.edu/

http://forest.moscowfsl.wsu.edu/cgi-bin/fswepp/rc/rockclim.pl

Soil Series Description

https://soilseries.sc.egov.usda.gov/osdquery.aspx

TOPAZ

http://homepage.usask.ca/~lwm885/topaz/overview.html

Web Soil Survey

http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

WEPP

http://www.ars.usda.gov/Research/docs.htm?docid=10621