Final Report (March 2007), JFSP AFP 2004-4, Task 1

Project Title/Number: Geo-Spatial Wildland Management Tool/ 04-4-1-12

Principal Investigators: Chris S. Renschler (PI), NCGIA University at Buffalo, Buffalo, NY
William J. Elliot, Rocky Mountain Research Station, Moscow, ID

PI Contact Information: (716) 645-2722 x 23; rensch@buffalo.edu

Project Duration: 30 months (August 1, 2004 - March 31 2007)

This final report details findings and deliverables of this Joint Fire Science Project. More details on the background, methods, and tools are presented on our continuously updated project web page (http://www.geog.buffalo.edu/~rensch/geowepp/):

Objectives

1. Develop a database for soils and vegetation information based on the existing nationwide WEPP climate, soils and management specifically to support fuel management activities.
2. Transfer the GeoWEPP tool from ArcView (widely distributed earlier version of a simple desktop GIS) to ArcGIS (widely used state-of-the-art GIS).
3. Develop custom interfaces and menus within the latest version of ArcGIS accessing the databases and targeting specific management options related to fuel management.
4. Assist users in defining critical watershed topographic parameters relating to stream density.
5. Assist with at least four wildland erosion workshops to present the most current version of our GIS tool for field use, while receiving feedback about areas to improve, or new features to incorporate into the tool.
6. Hold an information session at the 2005 BAER training to identify user needs and wishes and organize a workshop associated with the 2006 BAER training to release the new tool for public use.

A brief Synopsis and Summary of Findings

Prior to this activity, we had developed a geo-spatial soil erosion analysis tool that could be applied to forests, rangelands, or agricultural watersheds, using ArcView software to display results. The outcome of the JFSP-funded Geo-Spatial Wildland Management Tool project is an improved and customized watershed analysis tool to support wildfire rehabilitation and fuel management activities using ArcGIS 9.x as the display and data handling platform. The ArcGIS version of the Geospatial Interface for the Water Erosion Prediction Project (ArcGeoWEPP) was first presented at a BLM workshop on March 16, 2006, and has been presented at 9 more workshops prior to the completion of this project.

We have expanded the capabilities of GeoWEPP to allow watershed managers to assess the impact of wildfire and fuel or post-fire management activities on runoff, soil loss and sediment delivery at a small watershed scale. ArcGeoWEPP is a “standalone” Windows application, which can be obtained from the GeoWEPP web site. Managers can now use either the ArcView version, or the ArcGIS version of GeoWEPP for their analysis. The Forest Service and BLM have an agency-wide license agreement with the producers of ArcView and ArcGIS (ESRI) and most agency computers have ArcGIS or still have ArcView 3.x installed on system computers. The latest ArcGeoWEPP version is now fully integrated in the Geographic Information System ArcGIS 9.x.
Compared to the ArcView version, the ArcGIS version has enhanced capabilities for post-fire analysis for Burned Area Emergency Rehabilitation (BAER) teams, and for cumulative watershed effects (CWE) analysis of fuel management treatments, including thinning and prescribed fire, for watershed managers. One new feature in the modeling technology is direct access to the PRISM precipitation database with monthly values for every cell in a 4-km grid covering the lower 48 states. ArcGeoWEPP now provides return period analysis of precipitation, runoff, erosion and sediment delivery events, the first step in incorporating risk into watershed erosion prediction. Other enhancements are within the WEPP model that serves as the GeoWEPP erosion engine. Perennial vegetation algorithms have been improved to better model forest and rangeland vegetation. Shallow lateral subsurface flow of runoff has been improved, greatly improving WEPP’s and subsequently GeoWEPP’s hydrologic performance in steep forest and rangeland conditions.

In ten BLM, Forest Service and NRCS workshops over the project period, the GeoWEPP tool has been presented, and users have given and continue to give feedback to further develop and refine this tool for fire and fuel management applications. We have prepared analysis worksheets and model documentation. All products are available online from the public ftp sites at the University at Buffalo. GeoWEPP was used in 2004 to aid the BLM with analysis of the Andrews Fire, in the Reno Nevada wildland urban interface. The results of that analysis highlighted to main risk as runoff, not erosion. This finding was proved to be correct on December 31, 2004, when there was a major flood event causing significant property damage on one of the burned watershed outlets. In 2005, GeoWEPP was used for the BAER assessment of the largest fire in the lower 48 states for that year (the School Fire on the Umatilla National Forest). That analysis resulted in considerable mitigation investment on the areas that were most susceptible to soil erosion. Using other JFSP funding, our colleagues have installed a monitoring program on both treated and untreated areas, and hope to use the findings to validate our new tool. We expect to see increasing use for this new spatial analysis tool in the coming years as increased incidences of wildfires are coincident with increased fuel management activities. During the short 30-month duration of this proposal we presented the GeoWEPP technology at 10 workshops and 14 professional meetings. We have had dozens of consultations on applying the new technology to a wide variety of forest conditions, and have listed the seven most significant ones in this report. We have published six peer-reviewed papers, two PhD dissertations, and two master’s theses directly related to this activity.

**Deliverables**

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<th>Proposed</th>
<th>Delivered</th>
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<td>Develop a database for soils and vegetation information based on the existing nationwide WEPP climate, soils and management specifically to support fuel management activities.</td>
<td>A complete database to support both WEPP and GeoWEPP applications has been developed and is included with the download of the WEPP software that accompanies GeoWEPP. Files to describe the vegetation have also been developed, with a worksheet to describe how to modify those files to match the soil surface conditions following wildfire or fuel management activities. Vegetation and hydrologic algorithms have been improved, and databases developed to support those algorithms are incorporated into the WEPP software. This enhance version of WEPP can be downloaded at: <a href="http://topsoil.nserl.purdue.edu/~jrf/weppdev.htm">http://topsoil.nserl.purdue.edu/~jrf/weppdev.htm</a></td>
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Transfer the GeoWEPP tool | We currently provide a version of GeoWEPP for ArcView and an
from ArcView (widely distributed earlier version of a simple desktop GIS) to ArcGIS (widely used state-of-the-art GIS).

Develop custom interfaces and menus within the latest version of ArcGIS accessing the databases and targeting specific management options related to fuel management.

Assist users in defining critical watershed topographic parameters relating to stream density.

Assist with at least four wildland erosion workshops to present the most current version of our GIS tool for field use, while receiving feedback about areas to improve, or new features to incorporate into the tool.

Enhanced version for ArcGIS 9.x. These programs can be accessed at: http://www.geog.buffalo.edu/~rensch/geowepp/

The presentations of GeoWEPP at a series of workshops allowed us to collect detailed feedback to develop the design specifications for the new databases and interfaces. At this time we successfully achieved developing the following two scenarios:

1. Wildfire erosion and effectiveness of mulching, and seeding.
2. Cumulative watershed effects analysis of fuel management treatments including prescribed fire and mechanical thinning.

The ARS Topographic Parameterization (TOPAZ) software has been incorporated into the GeoWEPP Technology. It allows the user to define watersheds of interest by clicking on an outlet point of a delineated drainage network. If the delineated drainage pattern or the watershed is unsatisfactory, the user has two simple parameters to modify the channel delineation of a watershed: a) critical source area: where does a channel start; and b) minimum source channel length: how long is the smallest contributing channel in the specified stream network. Hillslopes developed from GeoWEPP runs can be accessed directly from the WEPP Windows interface for more detailed analysis. With the help of a scripting tool, hillslope details can be summarized in a file and entered into the post wildfire Erosion Risk Management Tool (ERMiT) interface developed with JFSP funding.

Workshops including GeoWEPP

3. March 8-11, 2005. BLM Workshop, Phoenix, AZ.
7. Mar 14-16, 2006. BLM Workshop, Phoenix, AZ. Attendance,
Hold an information session at the 2005 BAER training to identify user needs and wishes and organize a workshop associated with the 2006 BEAR training to release the new tool for public use.

Presentations on GeoWEPP Technologies


York October 7-9 2005.


17. Elliot, W. J. 2006. Predicting runoff and erosion after wildfire with WEPP technology. Invited Presentation at the NFS Regions 1, 4 and 6 BAER Refereeser Training Workshop. 6-8 June, 2006. La Grande, OR.


Assist users in applying GeoWEPP technology

Consultations on applying GeoWEPP to forest conditions (most significant BAER and CWE analysis requests only)

1. September, 2004. Consultation about applications of GeoWEPP to BAER analysis with Alan Gallegos, Sierra NF, USDA FS, Region 5.


western U.S. to carry out erosion prediction runs for the entire area to complement the LANDFIRE Project wildfire databases. CSU was supported by an EPA grant to complete this study.

4. January, 2005. Assist specialists from Idaho Panhandle National Forest, USDA Forest Service Region 1, in developing a fuel management plan for the Myrtle Creek Drainage, the source of water for the town of Bonner’s Ferry, ID. GeoWEPP was used to delineate the watershed and provide topographic information to assist in project scale analysis.

5. May, 2005. Assist graduate student at Colorado State University to address channel concerns in current GeoWEPP model.

6. August, 2005. Carry out BAER analysis for School Fire, Umatilla NF, WA. This was the largest fire in the lower 48 states in 2005. The results from three days of analysis with three members of the work unit were the basis for targeting mitigation. Completed analysis on about 40% of 50,000 acre fire in the time available.


**Support and Training of Graduate Students**

One MA/PhD and one PhD student were supported (the MA graduated in Jan 2006; he and another student are currently in the Geography PhD program at the University at Buffalo). Completed MA thesis in 2006.

On graduate committee for one PhD Student in Geography using GeoWEPP technology at the University of Idaho, Moscow. Completed dissertation in 2005.

One MS student using GeoWEPP technology in Ag & Biosystems Engineering at Washington State University. Completed MS thesis in 2006.

**Continued Technology Transfer: Webpage and Workshops**

The current ArcGIS version is now available for all users by request. The GeoWEPP webpage will continue to provide the GeoWEPP community with the latest information about GeoWEPP:

http://www.geog.buffalo.edu/~rensch/geowepp/

Future workshops will be held as requested subject to the availability of resources.

**Peer-reviewed Publications and Dissertations**

**Publications using GeoWEPP Technology**


