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# Water Erosion Prediction Project (WEPP) Forest Applications

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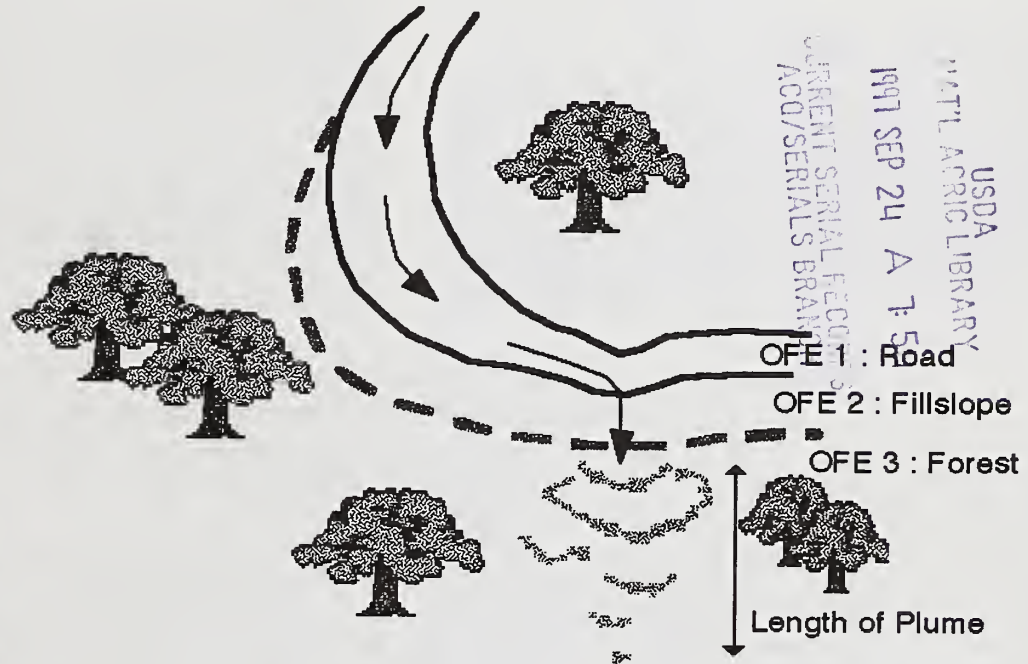
Forest Service  
Intermountain Research Station

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## Research Summary

Water Erosion Prediction Project (WEPP) soil erosion model is a process-based computer model to predict runoff, soil erosion, and sediment delivery. From our field research in forest soil erosion and literature reviews on forest physiology, input files have been developed for WEPP to predict soil erosion from forest roads, harvest areas, and burned areas. This report describes input files

to run the hillslope version of WEPP for these disturbed forest conditions.

## Acknowledgments

The authors wish to acknowledge Patty Liu, a seasonal employee from the Biological Engineering Department at the University of California, Davis, for her assistance in developing the forest growth files and in writing first draft of this document. We would also like to acknowledge Dr. Randy Foltz, Pete Robichaud, and Charles Luce, scientists within our Research Work Unit for providing research results to determine forest soil erosion processes and soil erodibility.

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### Obtaining a Copy of the WEPP Forest Files

The WEPP forest files can be obtained on a 3.5 inch diskette from the authors at:

Forestry Sciences Laboratory  
1221 South Main Street  
Moscow, ID 83843  
Telephone (208) 882-3557

DG WEPP:S22L04A or Internet [wepp@forest.moscowsl.wsu.edu](mailto:wepp@forest.moscowsl.wsu.edu)

The files forest.exe, forestap.dat and forestap.txt can also be obtained by anonymous ftp in directory /water/wepp at:

[forest.moscowsl.wsu.edu](ftp://forest.moscowsl.wsu.edu)

or point your browser to:

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# Water Erosion Prediction Project (WEPP) Forest Applications

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## Introduction

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The Water Erosion Prediction Project (WEPP) model consists of a physically based soil erosion model with a number of output options, numerous typical cropland and rangeland input files, a climate generator, and a user-friendly shell with complementary file builders. The WEPP model is a public domain model developed by Federal agencies that includes an MS DOS computer program and user documentation. The sidebar on this page provides instructions for obtaining the WEPP model and documentation. This publication describes input files that have been developed by Forest Service scientists and engineers to model some typical forest conditions. These files are part of a growing database of information to assist in running WEPP for forest conditions.

### Obtaining the WEPP Model

The WEPP model, data for over 1,000 soils and climate files for over 1,300 stations across the United States are on the WEPP CD ROM available by contacting:

laflen@ecn.purdue.edu

The same information can be obtained from the Internet from the USDA-ARS National Soil Erosion Research Laboratory (NSERL), located at Purdue University, West Lafayette, IN. Instructions for downloading the WEPP model and any of the desired databases by anonymous FTP can be obtained from:

ftp://soils.ecn.purdue.edu/pub/wepp

The readme.txt file in this directory provides instructions for downloading and installing the model.

The information is also available through the World Wide Web at:

http://soils.ecn.purdue.edu:20002/~wepp/nserl.html

This address will place the user on the NSERL home page, and from there, the user can access the required information for downloading either databases, documentation, or the WEPP model.

In an undisturbed forest, soil erosion is generally negligible. Disturbances such as roads, harvesting activities, or fires will lead to soil erosion. We have provided seven forest profiles that describe both roads and harvest areas in the forest. The road files are for insloped roads, outsloped roads, insloped roads with a sediment plume, and rutted roads. The harvest area scenarios are for a 100 year forest regeneration sequence, a forest with a burn in year 2, and a forest skid trail with a skid operation in year 2. This document supplements the *WEPP User Summary* (Flanagan and Livingston 1995).

All of the management files are in the cropland format. Although cropland is an "agricultural" format, this format was used instead of the rangeland format because cropland allows for "tillage" operations which are necessary to describe blading or traffic on roads, skidding in forests, and other operations that mechanically disturb the soil.

## Running the WEPP Model

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Instructions for running the WEPP model are given in the *WEPP User Summary* (Flanagan and Livingston 1995). To run the hillslope version of the model, management (\*.man), slope (\*.slp), soil (\*.sol), and climate (\*.cli) files are required (*WEPP User Summary* page 8). File builders are provided with the model to assist the user in building and running WEPP files (pages 90-115). When using forest files, we recommend that the user run the WEPP program for 30 years, once he/she has confirmed that the files will run a single year. If additional years are required, then the management and climate file builders may be used to build longer files.

The WEPP interface directly accesses a file editor, DOS EDIT by default, or the file can be edited with any word processor or text editor and saved as a text file.

The WEPP model can be run through either the Hillslope interface or the Watershed interface. The files described in this document are all for the Hillslope file builder. Once a hillslope has been successfully built and run, it can be incorporated into a watershed along with other hillslope and channel elements.

## WEPP Forest Files Installation

The WEPP Forest Files can be obtained on a 3.5 inch diskette from the authors for installation on a computer capable of running the WEPP program. WEPP version 95.7 or 97.3 must be installed on your computer before you can install the WEPP Forest Files. Refer to page ii of the *WEPP User Summary Quick Start Guide* to install WEPP.

Place the diskette labeled WEPP Forest Files into your floppy drive, move to the floppy drive, and type **forest Z:** (where "Z" is the letter of the drive on which WEPP is installed). **Forest** will look for WEPP on the drive you have specified. If it cannot find WEPP there, it will look for WEPP on drive C and then on drive D. When **forest** has found WEPP, it will ask you to confirm installation to that WEPP directory. Press **Q** to quit the forest files installation, or any other key to continue.

## Reviewing WEPP Forest Files

The WEPP input files are ASCII format and can be viewed or edited with any word processor or file editor, or the text editor specified in the WEPP interface. The files described in this document are summarized in table 1. The management file builder will not show the

correct input values for the *trees100.man* file, because the 100 year simulation period is too long for the current file builder and it will truncate the file. The file is not too long for the WEPP model, however. The WEPP program will generally run if the input files are correctly modified in the DOS editor, even though they may be beyond the file builder's capability. If viewing the input files with an editor refer to pages 10 to 13 in the *WEPP User Summary* for a line by line description of the slope and soil input parameters. A description of the management input parameters is found on pages 30 to 54 of the *User Summary*.

## Running WEPP

Complete instructions to run WEPP are presented in the *User Summary*. To run the model, the user must change to the WEPP directory (**cd\WEPP**). From the WEPP directory, enter **HILL**, and the WEPP hillslope interface will be started. Once the hillslope interface is running, the user may begin to select or modify files, or may load all of the forest files described in this document by loading the **FOREST** table using the **LOAD** command under the **FILE** menu in the interface menu bar. The menu bar can be accessed with the mouse, or by hitting the **<Alt>** key.

**Table 1**—Files provided with this document.

Condition	Soil file	Slope file	Management file
Inslope bladed road	<i>inslope.sol</i>	<i>inslope.slp</i>	<i>inslope.man</i>
Outslope bladed road	<i>outslop3.sol</i>	<i>outslop3.slp</i>	<i>outslop3.man</i>
Inslope road leading to cross-drain, a fillslope, and a forest hillside on which a deposition plume forms	<i>plume3.sol</i>	<i>plume3.slp</i>	<i>plume3.man</i>
Rutted road with a rut and a road shoulder	<i>rut2.sol</i>	<i>rut2.slp</i>	<i>rut2.man</i>
Vegetation regenerating for 100 years after a complete removal of a forest	<i>forest.sol</i>	<i>tree.slp</i>	<i>trees 100.man</i>
Forest vegetation at <i>N</i> years of age	<i>forest.sol</i>	<i>tree.slp</i>	<i>treeN.man</i>
Forest with fire in the second year, followed by regeneration for 28 years	<i>fire.sol</i>	<i>fire.slp</i>	<i>fire.man</i>
Forest skid trail formed in year 2, followed by 28 years of regeneration	<i>skid.sol</i>	<i>skid.slp</i>	<i>skid.man</i>

## Modifying the WEPP Forest Files

The files in the Forest WEPP database can be modified to describe many situations. Most new users will prefer to use the file builders until they become comfortable with the WEPP program. Experienced users, particularly when carrying out sensitivity analyses, or studies looking at a range of options, may find it faster and more convenient to modify a single value with the text editor.

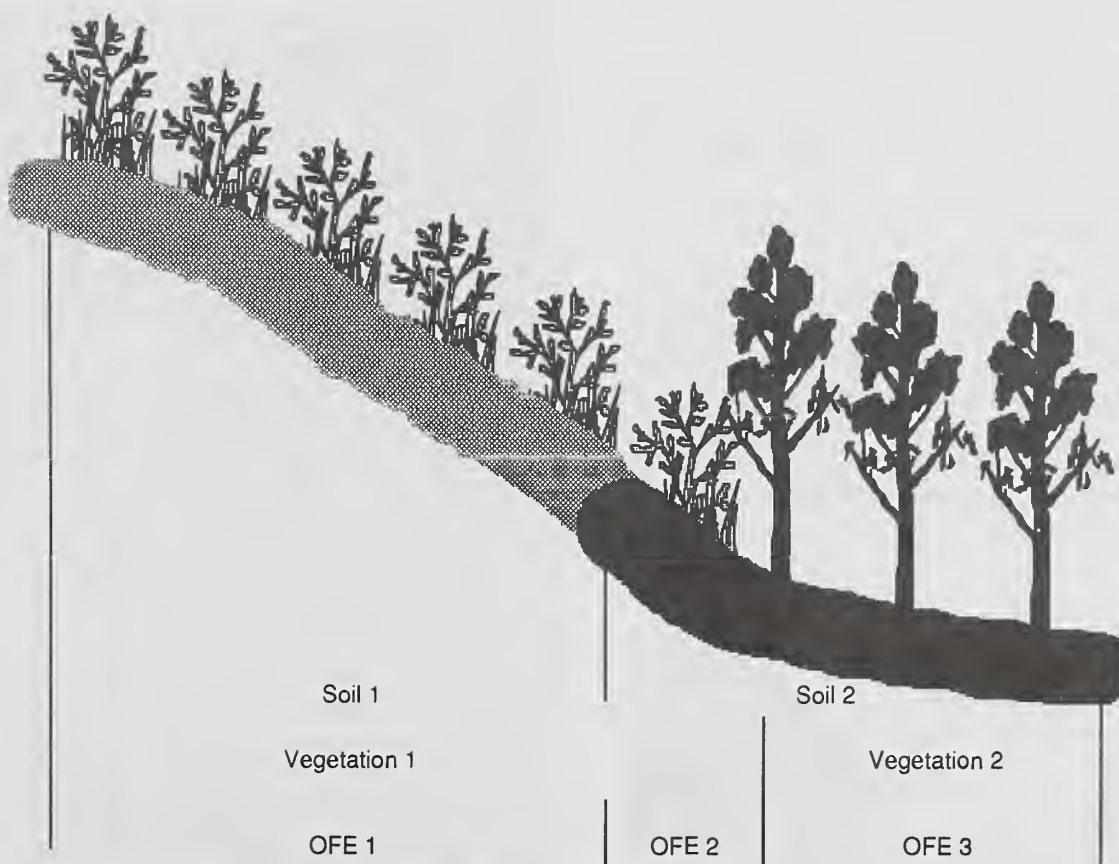
The management file includes a description of the vegetation, and the timing and effects of “tillage” operations on soil erodibility properties.

One of the features of the WEPP model is the ability to describe up to 10 combinations of soil and vegetation along a given hillslope (fig. 1). Each unique combination of soil and vegetation is called an overland flow element (OFE). Users must select soil and slope files with the same number of overland flow elements as the management file or WEPP will not run. The hillslope interface shows the user the number of OFE's in the selected file in the lower left corner of the screen.

When building new files, it is generally recommended that the user first run a scenario that approximates the specific problem site for a single year. Only a few input values should be altered in one file before making another run. Certain values or combinations of values for some inputs may cause the model to fail to run. A step by step approach to altering input values will make it easier to pinpoint any problem values, as well as determine the sensitivity of the model to altered values.

## Input File Descriptions

The following figures and narrative describe road and harvest area conditions provided with the WEPP Forest Files. For more details on the research behind these files, refer to Elliot and others (1994, 1995a,b). Complementary management, soil, and slope files have been prepared for each forest scenario. It is recommended that the complementary file set be selected at the beginning of any study, and then be modified to suit site specific conditions, rather than build a file from scratch.



**Figure 1**—Example of three overland flow elements describing three combinations of soil and vegetation along a hillslope.

## Roads

The suggested soil erodibility values in the input soil files are summarized in appendix A, table A1. If the road is gravelled, or the road ditch rocked, then the soil file should be altered as suggested in the bottom of table A1. Recommendations for minor adjustments of erodibility values from site-specific work can be found in Elliot and others (1995a).

**INSLOPE**—The *inslope.man* file models an insloped road with one overland flow element. The road is modeled as a large ridge and the ditch as a furrow system with a blading operation on the surface (fig. 2). The *inslope.sol* file describes the rill erodibility of the ditch and interrill erodibility of the road. The *inslope.slp* file describes the length and slope relationships of the road ditch gradient ( $S_g$ ). If there is significant runoff or erosion from the cutslope, the user can increase the profile width to include the width of the cutslope, assuming the cutslope is behaving in a hydrologically similar manner to the road. If the cutslope is behaving hydrologically different from the road, then the user should model the system with the WEPP watershed version as a watershed with a road hillslope element and a cutslope element, both feeding a common channel, which is the ditch (Tysdal and others 1997).

**OUTSLOP3**—*Outslop3.man* models an outsloped road with three OFEs: road with a blading operation, fillslope, and forest (fig. 3). The *outslop3.sol* and *outslop3.slp* files complement this management input file. If there is significant overland flow runoff from above the outsloping road, then the user may want to add more overland flow elements for the cutslope and the forest above it. There is seldom any runoff or surface erosion from an undisturbed forest. If there has been a severe fire, or if the cutslope was recently disturbed, then they may contribute to the overland flow. As users become comfortable with the management file builder, they may wish to alter the vegetation

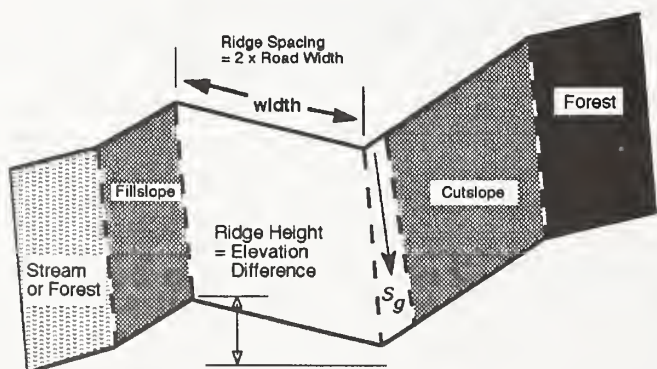
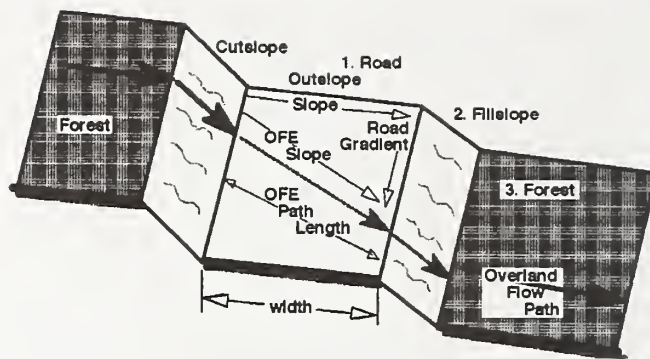


Figure 2—Inslope road detail.



$$\text{Road OFE Slope} = \sqrt{(\text{Outslope})^2 + (\text{Road Gradient})^2}$$

$$\text{Road OFE Path Length} = \text{Road Width} \times \frac{\text{OFE Slope}}{\text{Outslope Slope}}$$

$$\text{Effective width of hillslope} = \frac{\text{Road length} \times \text{Road width}}{\text{Road OFE Path length}}$$

Figure 3—Outslope road detail.

amount, spacing, and height on the cutslope and fillslope.

The effective width of an eroding outslope element must be determined from the equations shown in figure 3. Because the OFE path length is greater than the road width, the effective element width must be reduced to ensure that the total eroding surface area remains unchanged. On very steep road gradients (over about 15 percent), the road OFE path length may approach the distance between water bars, particularly if traffic has flattened the wheel tracks. In this situation, the PLUME3 scenario may be more appropriate to describe the flow paths.

**PLUME3**—The *plume3.man* file has three OFEs that model an insloped eroding road that drains to a buffer area where a plume of sediment is deposited (fig. 4). It is assumed that the width of flow is the same on the road as it is on the fillslope and buffer area. This file also has a blading operation on the road. *Plume3.sol* has three types of soil, one for each of the OFEs: road, fillslope, and forest soil. The road soil has a very low conductivity, the fillslope moderate, and the forest a high conductivity (appendix A). Suggested values for other soils are given in Morfin and others (1996). Users may wish to alter the conductivity of the fillslope and the forest to see the effects on the length of the sediment plume. *Plume3.slp* describes a 4 percent gradient on a 60 m road segment, a 50 percent gradient on a 4 m fillslope, and a 30 percent gradient on a 30 m forested hillside where the plume of deposited sediment forms. If there is a waterway near the road, then the WEPP model will predict the amount of sediment traversing the forest and entering the waterway. A detailed study of the sensitivity of the runoff and

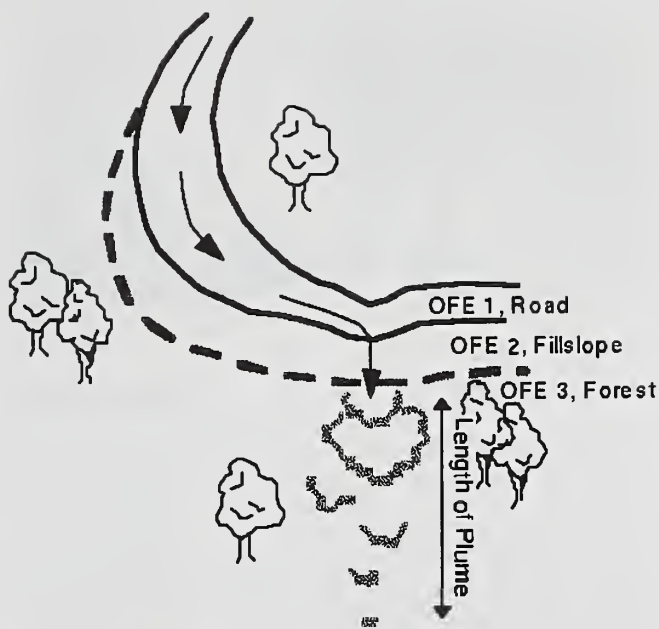


Figure 4—Details of modeling a sediment plume below a road.

sediment yield of this scenario was carried out and was summarized in Morfin and others (1996).

**Rut2**—Wheel ruts in roads generally dominate the erosion processes. The factors that affect the rut development are traffic density, axle load, tire pressure, and aggregate quality (Whitcomb and others 1990). Low pressure tires, regular blading, or high quality aggregate on the roads often produce rut lengths of under 10 m. High pressure tires produce rut lengths up to 50 m or more. If dips or water bars are included in the road design, they will limit the maximum rut length. The *rut2.man* file describes two OFEs - rut and shoulder (fig. 5). The rut OFE has a fixed rill spacing and rill width in the initial conditions scenario of the management file. The rill spacing value is equal to the distance between ruts, which is 1.5 to 1.8 m. The rill width value is equal to the width of the rut, about 0.5 m. The management file specifies 10 traffic operations on the road that cause disturbance to a depth of 0.002 m with each pass. *Rut2.sol* models a rut with lower hydraulic conductivity and a shoulder with a higher conductivity. The shoulder steepness and length are calculated using the formulas in figure 3. Rut and shoulder lengths are critical in determining the amount of erosion and runoff. *Rut2.slp* describes the road gradient with the flow exiting over the shoulder at the end of the specified rut length.

To determine the fate of sediments eroded from roads, users may need to consider modeling the road in two halves. One half, the rutted outslope half, would follow the **Plume3** model, with a width equal to half

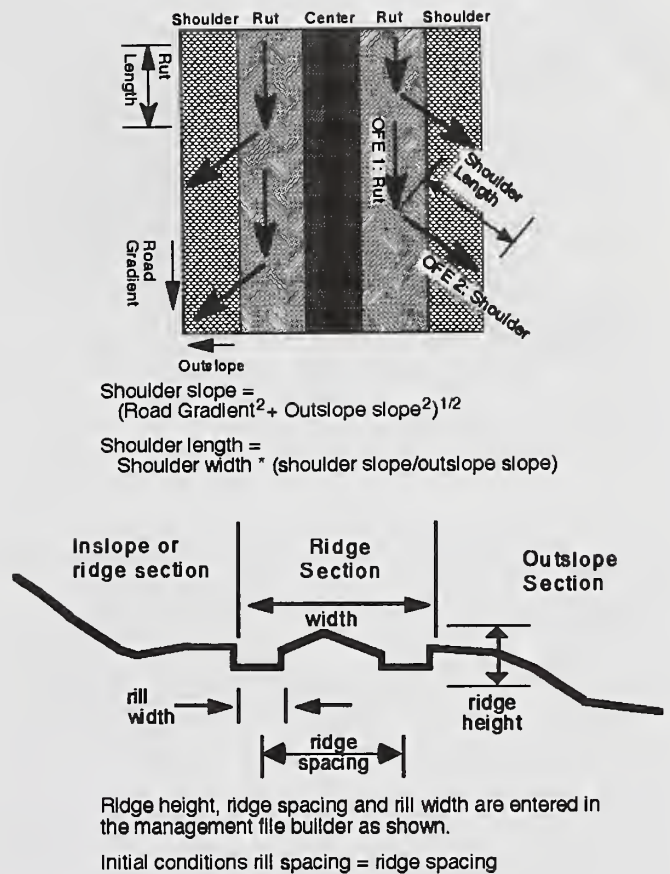


Figure 5—Plan and section of model for an eroding rutted road.

the width shown in figure 5. The inslope half could follow the **Inslope3** model if the inslope empties into a livewater crossing, or could be modelled in the **Plume3** model if the inslope empties into a culvert or cross-drain, delivering water to a hillslope. The resulting sediment yields are added for the two road halves, or the two hillslope elements incorporated into a watershed system. It is unlikely that there is any significant erosion from the outslope section of the road outside of the rut.

## Forests

**TREES100**—*Trees100.man* is a 100 year forest regeneration file with one OFE and 21 different plant and yearly scenarios. Each scenario represents 5 years of continuous growth, with the rate of growth and the generation of surface residue dependent on both the biomass conversion ratio for the given forest age and the precipitation amount and distribution (Arnold and others 1995) (fig. 6). The predicted amounts of above ground biomass and surface residue generated are similar to observed and reported values. This file

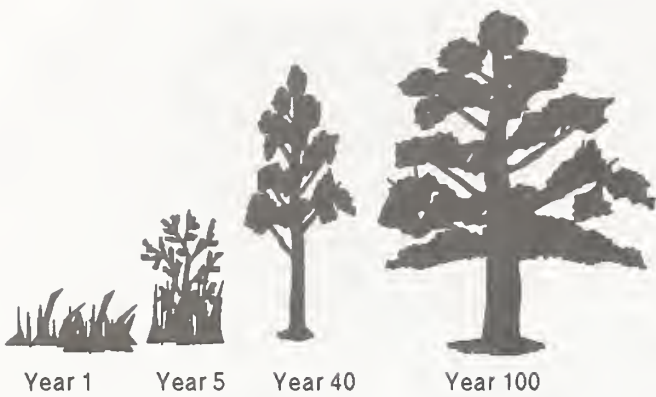


Figure 6—Model of forest regeneration.

cannot be altered by the WEPP management file builder, so with a text editor, users can alter vegetation spacing, canopy diameter, and growth rate (altered with the biomass conversion ratio) to suit specific conditions. The predicted distribution of biomass and surface residue during a growing season can be observed with the Graphics viewer by specifying “yes” in the Hillslope interface for Graphics. The output file generated for the graphics option is 0.32 Mb per year simulated, so be sure that there is adequate disk space to store this file before specifying “yes” or the run will crash with little explanation. *Tree.slp* and *forest.sol* input files are provided to run this management file. If you want to run this program for the full 100 years, be sure that you have plenty of disk space to store the climate input file and the output files.

Also included with the WEPP Forest Files are files for each age of trees, with the generic file name *tree\*\*.man*. The most sensitive forest vegetation parameter values are presented in appendix A. Sensitivity studies have shown that neither the biomass production nor the subsequent erosion rates are particularly sensitive to any of these values except the biomass conversion ratio. Users are encouraged to use the graphics output viewer to compare the vegetation growth predicted by WEPP with forest conditions in their own areas to see how the conditions compare and to see whether adjusting the input values has any effect on the predicted erosion rates for their sites.

**FIRE**—*Fire.man* is a 30 year forest file with one OFE. This file models an undisturbed forest in year 1, with a fire in year 2, and vegetation regenerating for the remainder of the years (fig. 7). *Fire.sol* and *fire.slp* describe typical forest conditions for use with this file. The hydraulic conductivity in the soil file has been reduced from 15 to 10 mm/h reflect hydrophobicity which has been observed on some soils (Robichaud 1996). Users may wish to study the sensitivity of erosion rates to the fraction of standing and flat



Figure 7—Model of forest fire.

residue burned as entered in the management file builder in the “Yearly Cropland Management Annual Burning” window.

**Skid**—*Skid.man* is a 30 year file with one OFE. This file describes an undisturbed forest in the first year with a skid operation of one pass of 0.2 m depth in year 2, and regeneration on the skid trail for the remainder of the years (fig. 8). *Skid.sol* and *skid.slp* should be used with this management file. Users may wish to incorporate the skid yearly scenarios in the management file builder into multiple OFE files combining skid trails, harvest areas, and undisturbed riparian zones, to better describe a harvested hillslope. The tillage intensity (*User Summary page 35* and *Technical Documentation pages 9.8* and *9.9*) describes the percent of surface residue buried on the skid trail.

The model is sensitive to the buried residue value, just as skid trails can become highly erodible if the majority of surface residue is removed or incorporated into the soil. Users may wish to alter this value in the surface effects operation window to see the impact of degree of surface disturbance on soil erosion. Skidding



Figure 8—Highly disturbed skid trail in forest.



also reduces the hydraulic conductivity from 15 mm/h in undisturbed forest to 10 mm/h or less, the amount of reduction depending on the soil (Elliot and others 1995b).

The **Skid** tillage effects can be modified to model the effects of other tillage activities, like tillage as a site preparation treatment in forest management. The timing of tillage, depth, and amount of incorporated residue can be altered with the management file builder.

## References

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- Arnold, J.G., M.A. Weltz, E.E. Alberts, and D.C. Flanagan. 1995. Chapter 8. Plant growth component *IN*: Flanagan, D.C., and M.A. Nearing (eds.). *USDA-Water Erosion Prediction Project Hillslope Profile and Watershed Model Documentation*. NSERL Report No. 10. W. Lafayette IN: USDA-ARS National Soil Erosion Research Laboratory.
- Elliot, W.J., R.B. Foltz, and C.H. Luce. 1995a. Validation of the Water Erosion Prediction Project (WEPP) Model for Low-Volume forest roads. Sixth International Conference on Low-Volume Roads, Washington, DC: Transport and Road Research Board and Natural Research Council. pp 178-186.
- Elliot, W.J., R.B. Foltz, and M.D. Remboldt. 1994. Predicting sedimentation from roads at stream crossings with the WEPP model. Presented at the 1994 International Winter Meeting of the ASAE, Paper No. 947511, St. Joseph MI: ASAE. 10 p.
- Elliot, W.J., P.R. Robichaud, and C.H. Luce. 1995b. Applying the WEPP erosion model to timber harvest areas. Proceedings of the ASCE Watershed Management Symposium. New York: ASCE: 83-93.
- Flanagan, D.C., and S.J. Livingston (eds.). 1995. *WEPP User Summary*. NSERL Report No. 11, W. Lafayette IN: National Soil Erosion Research Laboratory. 131 p.
- Flanagan, D.C., and M. A. Nearing (eds.). 1995. *WEPP Hillslope Profile and Watershed Model Documentation*. NSERL Report No. 10, W. Lafayette IN: National Soil Erosion Research Laboratory.
- Morfin, S., B. Elliot, R. Foltz, and S. Miller. 1996. Predicting effects of climate, soil and topography on road erosion with WEPP. Presented at the 1996 International Meeting of the American Society of Agricultural Engineers, Paper No. 965016, ASAE, St. Joseph, MI 49085-9659.
- Robichaud, P. R. 1996. Spatially-varied erosion potential from harvested hillslopes after prescribed fire in the interior northwest. Moscow ID: University of Idaho Library, PhD dissertation.
- Tysdal, L. M., W. J. Elliot, C. H. Luce, and T. Black. 1997. Modeling insloped road erosion processes with the WEPP Watershed Model. Submitted to ASAE for presentation at the 1997 International Meeting. Manuscript available from second author.
- Whitcomb, W.G., M.T. Yapp, and M. Myers. 1990. Aggregate surfacing design guide. Final Report, Contract 53-04H1-8-6230. Portland, OR: USDA Forest Service.

# Appendix A: Forest Parameter Values

## Values for Soil File Parameters

General Relationships for all forest soil files:

Soil Albedo 20 percent

Saturation on Jan. 1 75 percent

$CEC$  (meq/100g)  $\cong 0.8 * \text{clay content (percent)}$

(Users should consult local soil scientists for better estimates)

Sand, silt, and clay contents are the percentage of the soil fraction below 2 mm diameter.

$Kr$  and  $TAUc$  can be predicted with Rangeland erodibility equations in the *User Summary* pp 18, 27.

$Ki$  for an unbladed road can be predicted with Rangeland erodibility equations in the *User Summary* p 27, and  $Ki$  for a bladed road can be predicted with Cropland equations in the *User Summary* p 26.

**Table A1**—Suggested values for forest soil files if no other soils information.

File name	OFE	Location	$Ki$ (kg s/m <sup>4</sup> )	$Kr$ s/m	$TAUc$ (N/m <sup>2</sup> )	Conductivity (mm/h)
<i>Inslope</i>	1	Bladed Road	3e+006	0.0003	1	0.4 <sup>a</sup>
<i>Outslop3</i>	1	Bladed Road	3e+006	0.0003	1	0.4 <sup>a</sup>
	2	Fillslope	4e+006	0.0003	1	6
	3	Forest	2e+006	0.003	2	15
<i>Plume3</i>	1	Bladed Road	3e+006	0.0003	1	0.4
	2	Fillslope	4e+006	0.0003	1	6
	3	Forest	2e+006	0.003	2	15
<i>Rut2</i>	1	Rut	3e+006	0.0003	1	0.4 <sup>a</sup>
	2	Shoulder	3e+006	0.0003	1	3
<i>Tree</i>	1	Forest	2e+006	0.003	2	15
<i>Fire</i>	1	Forest	2e+006	0.003	2	10
<i>Skid</i>	1	Forest	2e+006	0.003	2	10

### Mitigation Effects

Gravelling Road Surface

Change Road Surface Rock content to 90 percent  
Change road surface conductivity to 3 mm/hr<sup>a</sup>

Rocking Ditches on *Inslope*

Change  $TAUc$  to 10

<sup>a</sup>On coarse-textured granitic roads, conductivity  $\cong$  3 mm/hr (6 mm/hr if gravelled).

## Management File Parameter Values

**Table A2**—Suggested initial conditions for forest situations.

Parameters	Road	Fillslope	Forest
Bulk Density (g/cc)	1.8	1.40	1.20
Canopy Cover (percent)	0	0	90
Days since last tillage	100	300	500
Days since last harvest	400	300	500
Interrill Cover (percent)	0	10	100
Residue Type	Road	Cutfill	Tree
Residue Cropping System	Fallow	Perennial	Perennial
Total rainfall since last tillage (mm)	250	1000	1000
Ridge height after last tillage (m)	0.006	0.1	0.1
Rill cover (percent)	0	10	100
Random Roughness after tillage (m)	0.006	0.05	0.1
Rill spacing (use 0 for autocalc.) (m)	2.0	0	0
Rill width (use 0 for autocalc.) (m)	0.5	0	0
Total dead root mass (kg/m <sup>2</sup> )	0	0.001	0.5
Total submerged residue mass (kg/m <sup>2</sup> )	0	0.003	0.5

**Table A3**—Cropland plant scenario parameter values for road conditions.

Parameters	Inslope	Outslop3			Plume3			Rut2	
OFE		1	2	3	1	2	3	1	2
Biomass energy ratio	2	2	15	150	2	15	150	2	4
Canopy cover (percent)	0.1	0.1	50	80	0.1	50	80	0.1	0.1
Plant stem diameter (mm)	1	1	6	80	1	6	80	1	1
Biomass after senescence (percent)	1	1	90	70	1	90	70	1	1
Maximum canopy height (m)	0.15	0.15	0.6	3	0.15	0.6	3	0.15	0.15
In-row plant spacing (m)	5	5	0.06	0.73	5	0.06	0.73	5	1
Maximum perennial root mass (kg/m <sup>2</sup> )	0.001	0.001	0.15	0.5	0.001	0.15	0.5	0.001	0.001
Maximum leaf area index	1	1	2	4.6	1	2	4.6	1	1

**Table A4**—Cropland plant scenario parameter values for *Fire.man*.

Parameter	Year1	Year2 <sup>a</sup>	Year3	Year4	Year5	Year6
Biomass energy ratio	90	90	10	20	30	40
Canopy cover (percent)	45	45	80	100	100	100
Plant stem diameter (m)	0.25	0.25	0.006	0.006	0.012	0.02
Biomass after senescence (percent)	20	20	20	20	20	20
Maximum canopy height (m)	20	20	0.8	1.5	2	2.5
In-row plant spacing (m)	3	3	0.08	0.04	0.08	0.1
Maximum perennial root mass (kg/m <sup>2</sup> )	0.5	0.5	0.05	0.05	0.1	0.7
Maximum leaf area index	10	10	1	1.2	1.4	1.6

<sup>a</sup>Fire burned on August 10 with 40 percent standing residue burned and 40 percent flat residue burned.

**Table A5**—Cropland plant scenario parameter values for *Skid.man* file.

Parameter	Year1	Year2 <sup>a</sup>	Year3	Year4	Year5
Biomass energy ratio	90	10	20	30	40
Canopy cover (percent)	45	50	100	100	100
Plant stem diameter (m)	0.25	0.006	0.008	0.01	0.012
Biomass after senescence (percent)	20	90	80	70	60
Maximum canopy height (m)	20	0.4	0.8	1.5	2
In-row plant spacing (m)	3	0.1	0.08	0.04	0.08
Maximum perennial plant root mass (kg/m <sup>2</sup> )	0.5	0.2	0.05	0.1	0.5
Maximum leaf area index	10	1	1.2	1.4	1.6

<sup>a</sup>Skidder operation on July 1, burying 50 percent of surface residue.

General parameters for plant scenarios in the *Trees100.man* file:

Canopy Cover after senescence	50. percent
Biomass after senescence	70. percent
Maximum perennial plant root mass	2.7 kg/m <sup>2</sup>
Decomposition Constants	0.0074

**Table A6**—Vegetation growth parameter values in *Trees100.man* plant scenarios.

Year	Biomass energy ratio	Stem diameter (m)	Canopy height (m)	Plant spacing (m)	Length of senescence (days)	Leaf area index
0	5	0.01	0	0.03	30	0.1
1	10	0.01	0.1	0.03	35	1.4
5	50	0.02	1	0.2	40	2.2
10	80	0.04	1.5	0.4	45	3
15	120	0.06	2	0.6	50	3.8
20	150	0.08	4	0.8	60	4.6
30	470	0.12	11	1.0	90	6.2
40	600	0.16	15	1.4	130	7.8
50	700	0.20	18	1.8	170	8.5
60	800	0.24	21	2.2	210	8.7
70	850	0.28	23	2.6	250	8.9
80	890	0.32	25	2.9	270	9.1
90	910	0.36	27	3	290	9.3
100	930	0.4	29	3	300	9.5

## Appendix B: Deleting Unwanted Files

Generally users will only be interested in a small subset of the files available to run WEPP, and will quickly generate new files to meet their specific needs. In order to reduce the hard disk space storage necessary, increase speed of interface response, and to simplify file selection, we recommend that unneeded files be deleted. There are many agricultural management and soil files that the user will not need. Generally, all the files referring to corn and soybeans including rotations beginning with *C\*.man* or *B\*.man* should be deleted. Wheat files are also generally not needed unless the user is modeling wheat as a mitigation measure. Files of grasses, alfalfa, and fallow may be useful for initially describing some forest regeneration conditions where forbs or grasses dominate, so users may wish to keep these files. If the user wishes to recover deleted files, the WEPP program can be installed again, and all files previously installed and deleted will be reinstalled, while leaving any new files undisturbed.

There are three common ways you may delete unwanted agriculture, rangeland, or forest files: in DOS (**del filename.xxx**), a file manager utility in Windows, or with the WEPP interface.

To delete files with the WEPP interface, select the **File Action Bar**. Under the **File list** select **File Utilities (Print/Delete)** and a “Do what?” screen will appear. Under that screen, select the **Print/Delete Selected Input files**. A list of all the hill, climate, soil, slope, management, channel, impoundment, and scenario input files will be shown in a pop-up screen. Press the **del** key when you have highlighted the file you want to delete. For information about Action Bars refer to page 96, and for a description of some agriculture files provided with the WEPP program see pages 118-129 of the *WEPP User Summary*.

Output files can be deleted with the same methods. Output files are named by the run name entered in the first box of the WEPP hillslope interface. To conserve disk space, it is a good practice to delete unwanted output files when they are no longer needed. The graphics files (\*.*ugr*) are particularly large, and can soon fill-up many hard disks.

## Appendix C: Source of WEPP Hard Copy

WEPP program disks, a hard copy of the WEPP user summary and user guide, and the CD-ROM disk containing both the soils and the climate databases were released at the WEPP/WEPS Symposium in August 1995. These materials can be obtained from the Soil and Water Conservation Society of America at 7515 NE Ankeny Road, Ankeny, IA 50021. The cost is \$150 (\$125 for SWCSA members). The society can be reached at 1-800-THE-SOIL or 515-289-2331.

## Appendix D: Useful Conversions

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<b>Multiply WEPP/SI Units</b>	<b>By</b>	<b>To get customary U.S. Units</b>
mm (millimeters)	0.0394	in. (inches)
m (meters)	39.4	in. (inches)
m (meters)	3.28	ft (feet)
m <sup>2</sup> (square meters)	10.8	ft <sup>2</sup> (square feet)
m <sup>3</sup> (cubic meters)	35.3	ft <sup>3</sup> (cubic feet)
ha (hectares)	10,000	m <sup>2</sup> (square meters)
ha (hectares)	2.47	acres
kg (kilograms)	2.2	lbs (pounds)
t (metric tonnes)	1,000	kg
t (metric tonnes)	1.1	short tons
kg/m <sup>2</sup> (kilograms per sq m)	10	t/ha (metric tonnes per ha)
kg/m <sup>2</sup> (kilograms per sq m)	4.45	tons/a (short tons per acre)
kg/m <sup>2</sup> (kilograms per sq m)	0.204	lbs/ft <sup>2</sup> (pounds per ft square)





Elliot, William J.; Hall, David E. 1997. Water Erosion Prediction Project (WEPP) forest applications. Gen. Tech. Rep. INT-GTR-365. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 11 p.

The Water Erosion Prediction Project (WEPP) soil erosion model is a process-based model to predict runoff, soil erosion, and sediment delivery. WEPP input files, described in this publication, predict soil erosion from forest roads, harvest areas, and burned areas. These files are part of a growing database.

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Keywords: hydrology, soil erosion, water quality

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