Pesticide Root Zone Model Field and Orchard Crop Scenario Metadata

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INTRODUCTION

A fundamental construct for using data in any number of electronic environments, whether they are databases, models, or the World Wide Web, is to have an understanding of the data or information that make up its essential parts. Metadata is literally the "data about data." Metadata is the information used by a variety of groups to design, create, describe, preserve, and use information resources and systems. The crucial, non pesticide specific elements of each Pesticide Root Zone Model (PRZM) field and orchard scenario is recorded as a means of preserving an authoritative and reproducible record of the design, construct, and source of each element of the scenario.

In general, the information assembled to created each scenario will have three basic features: content, context, and structure; all of which are reflected through metadata. The data content relates to what each scenario contains or is about and is intrinsic to the field or orchard being modeled. Content reflects the element by which the designer authenticates and completes the content of the field or orchard scenario. For example, content is the date of a crop's maturation, the organic content of a particular soil, or the rate at which snow melts in the location of the scenario. Contexts are those aspects associated with the scenario's creation, such as the how or from where the soil characteristics were selected, where the weather station is located, or what cropping practices were chosen and why. The structure relates to the associations within and among the individual parameters that make up the scenario. An example of the structure would be the relationship of the depth of the total soil profile to the individual soil horizons. All three aspects of metadata are essential components of a scenario and have been captured and described in following pages.

In short, in an environment where immediate access to underlying information used to govern the construct of a PRZM field or orchard scenario, metadata:

- certifies the authenticity and degree of completeness of the scenario's content;
- establishes and documents the context of the scenario's content;
- identifies the structural relationships that exist between and within a parameter of the scenario;
- provides an access point for a diverse range of users of the scenario; and
- assembles electronically the information the developer might have ordinarily provided in a physical reference.

The following descriptions of each PRZM field and orchard scenario used in the assessment of drinking water exposures derived from surface water sources reflect the basic principles of establishing administrative and descriptive "metadata." However, it remains vitally important to understand that metadata is the "data about the data" and acting as umbrellas to this information are the established Agency procedures for ensuring the quality of that information. This is accomplished through the basic tenants of Quality Assurance and Quality Control in the selection of parameters that constitutes the field and orchard scenario.

These descriptions represent PRZM scenarios which have been developed over time with a variety of objectives. Many of these scenarios were developed with the intention that they represent high end exposure scenarios for national scale assessments. These are typically referred to as "standard scenarios".

Meteorological stations for individual scenarios have been selected based on proximity to the area represented by each scenario. A list of available weather stations containing the required data for PRZM can be found at http://www.epa.gov/ceampubl/tools/metdata/index.htm). If a more geographically distant station was chosen to represent a scenario, the choice of the more distant station is documented in the metadata for each file.

Users should note that several existing scenarios incorporate irrigation into the scenario and as such have been parameterized for either over-canopy or under-canopy irrigation. A number of other scenarios indicate in the metadata file that a significant portion of the crop in the geographic area identified utilize irrigation. To date, EFED has not incorporated irrigation into these scenarios. EFED is currently evaluating a standardized approach for determining when a scenario should include irrigation and this will be reflected in future revisions to these scenarios.

There are a number of input parameters which are generally not documented in this metadata file. Many of these represent parameter flags which are default values and do not change from scenario to scenario. Others are captured in the scenario file and have not been transferred to the metadata file. Finally, there are others (such as parameters for furrow irrigation) which are not currently used. A listing of the parameters which are generally not captured in this metadata file are listed below in table 1. Future updates to the metadata will include these parameters when applicable.

Table 1. Input parameters not typically recorded in metadata.

Record #	Variable Name	Variable Full Name
1	TITLE	Title of Input File
2	HTITLE	File Description
3	DSN (x5)	DSN (x5)
3	IPEIND	Flag-Pan Factor
9	GDUSLEC	Day of month to start USLEC and Manning's N factor
9	GMUSLEC	Month to start USLEC and Manning's N factor
9	HTMAX	Max Canopy Ht
9	ICNCN	ICNCN-Crop Number
9	NUSLEC	Number of USLEC factors (up to 32)
11	IYREM	Integer year of crop emergence
11	IYRMAT	Integer year of crop maturation
11	IYRHAR	Integer year of crop harvest
20	BDFLAG	Flag-Bulk Density
20	BIOFLG	Flag-Biodegradation
20	HSWZT	Flag-Drainage
20	IDFLAG	Flag-ThermalCond/HeatCapacity
20	ITFLAG	Flag-Soil Temp Sim
20	KDFLAG	Flag-Soil Adsorption Coeff
20	MOC	Flag-Method of Characteristics

Table 1. Input parameters not typically recorded in metadata.		
Record #	**Variable Name**	**Variable Full Name**
20	THFLAG	Flag-FC and WP
28	BT	Bottom Width of Furrow
28	EN	Manning's N for Furrow
28	Q0	Flow Rate of Water Entering Furrow
28	SF	Slope of Furrow
28	X2	Length of Furrow
28	XFRAC	Location of the Furrow
28	ZRS	Side Slope of Furrows
29	HF	Infiltration Suction Parameter
29	KS	Sat Hyd Cond
34	AD	Soil Drainage param
34	ADL	Lateral Soil Drainage
34	DISP	Hydrodynamic Solute Disp Coeff
40	CFLAG	Flag-Conversion
40	ILP	Flag-Initial Pest.Level

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CALIFORNIA ALMOND/WALNUTS (Northern and Southern)

The field used to represent almond production in California is located in San Joaquin County in the Central Valley, although almonds production areas are well distributed throughout the Central and Sacramento Valleys. According to the 1997 Census of Agriculture, California is the major producer of almonds and walnuts in the U.S.. Almonds are generally grown on low terraces. All types of irrigation is used. The floor of almond groves are kept smooth and clear to facilitate collection of the nuts after harvesting which is accomplished by shaking the trees (USDA 1999). The soil selected to simulate the field is a Manteca fine sandy loam. Manteca fine sandy loam is a coarse-loamy, mixed, thermic Haplic Durixerolls. These soils are often used for a variety of crops including Almonds. Manteca fine sandy loam consists of moderately deep, moderately well drained, slow runoff, moderately permeable above the hardpan soil that formed in alluvium mainly from mixed rock sources. These soil are generally found on low terraces at elevations of 20 to 110 feet above mean sea level and have slopes of 0 to 2 percent. The soil is of small extent in MLRA17. Manteca fine sandy loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for San Joaquin County, California - Almonds

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Sacramento, CA (W23232)
Ending Date	December 31, 1990	Meteorological File - Sacramento, CA (W23232)
Pan Evaporation Factor (PFAC)	0.73	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0 cm C^{-1}	PRZM Guidance (July, 2004). Snow not expected to occur or accumulate and persist for more than a day in San Joaquin or Sacramento Counties. http://www.weather.gov/climate (NOWData)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for San Joaquin County, California - Almonds

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)

USLE K Factor (USLEK)	0.28 tons EI^{-1*}	NRI - Average value listed for the soil series Manteca
USLE LS Factor (USLELS)	0.30	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	NRI - Average value listed for the soil series Manteca
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	1	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	2 %	Paul Verdegaal, San Joaquin County Cooperative Extension 209-468-9494
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
Irrigation Flag (IRFLAG)	2 (cropping period only)	Based on recommendations from farm advisors for general flooding for crop irrigation
Irrigation Type (IRTYP)	4 (Under Canopy)	Based on recommendations from farm advisors for general flooding for crop irrigation, although all types are used. Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005).
Leaching Factor (FLEACH)	0.1	Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005).
Fraction of Water Capacity when Irrigation is Applied (PCDEPL)	0.55	Based on recommendations from farm advisors for general flooding for crop irrigation. Most farm advisors in CA said water is always applied to crops before 50% depletion.
Maximum Rate at which Irrigation is Applied (RATEAP)	0.121 cm hr^{-1}	Irrigation Guidance for developing PRZM Scenario, Table 1; (June 15, 2005). For CN = 79 and f = 0.1
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for San Joaquin County, California - Almonds

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops EPA, 2001)
Initial Surface Condition (ISCOND)	1	Orchard floor is kept clear to facilitate almond harvest (almonds are shaken from the tree and harvested from the floor). All material is removed after harvest. (USDA crop profile for CA almonds, 1999)

Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Bakersfield, CA (W23155) or Sacramento, CA (W23232)
Maximum rainfall interception storage of crop (CINTCP)	0.25	Default value for orchard crops (EPA 2004).
Maximum Active Root Depth (AMXDR)	120	Paul Verdegaal, San Joaquin County Cooperative Extension 209-468-9494
Maximum Canopy Coverage (COVMAX)	90	Paul Verdegaal, San Joaquin County Cooperative Extension 209-468-9494
Soil Surface Condition After Harvest (ICNAH)	2	Paul Verdegaal, San Joaquin County Cooperative Extension 209-468-9494
Date of Crop Emergence (EMD, EMM, IYREM)	16/01	Values complied by HED for Almonds
Date of Crop Maturity (MAD, MAM, IYRMAT)	02/08	Values complied by HED for Almonds
Date of Crop Harvest (HAD, HAM, IYRHAR)	13/09	Values complied by HED for Almonds
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4, Meadow
Manning’s N Value (MNGN)	0.023	RUSLE Project; C21OCOCM for orchards, cov alley in Sacramento (USDA, 2000)
USLE C Factor (USLEC)	0.034 - 0.221	RUSLE Project; C21OCOCM for orchards, cov alley in Sacramento (USDA, 2000)

Table 4. PRZM 3.12 Manteca Soil Parameters for San Joaquin County, California - Almonds		
Parameter	Value	Verification Source
Total Soil Depth (CORED)	317 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 7 cm (HORIZN = 2) 300 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/) Ed Russell (USDA-NRCS, Fresno) Glenn Stanisewski, NRCS, Davis, CA
Bulk Density (BD)	1.55 g $\cdot cm^{-3}$ (HORIZN = 1,2) 1.6 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content (THETO)	0.22 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.23 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 1 cm (HORIZN =2) 5 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.22 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.23 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.1 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.095 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	THEWP-- Table 5-25, PRZM Manual.
Organic Carbon Content (OC)	0.81% (HORIZN = 1,2) 0.18% (HORIZN = 3)	

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EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

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USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

CALIFORNIA CITRUS (Southern)

The field used to represent citrus production in California is located in Fresno County in the Central Valley, although citrus production areas are quite extensive (San Joaquin, Coastal-Intermediate Region, Imperial Valley, Coachella Valley, and the Southern Interior Region). According to the 1997 Census of Agriculture, California is the major producer of citrus (lemons and oranges) for the fresh market, and among the highest producers in other citrus (grapefruit, tangerines, tangelos, and mandarins). Citrus is generally grown on the foothills to avoid frost damage. Areas under and between rows of trees are generally non-cultivated/non-maintained. Row spacing is approximately 22 feet and between tree spacing is approximately 18 feet. Row canopies tend to be 100 percent, while the canopy between rows is less to permit the operation of maintenance and harvest equipment. Irrigation is mostly by low-volume drip or micro-sprinkler systems, although furrow and overhead sprinklers are also used. The soil selected to simulate the field is a benchmark soil, Exeter loam. Exeter loam, is a fine-loamy, mixed, superactive, thermic Typic Durixeralfs. These soils are often used for citrus production under irrigation. Exeter loam is a moderately deep, moderately well drained, very slow to medium runoff soil that formed in alluvium mainly from granite sources. The soil also consists of a duripan. The Exeter loam has moderately slow permeability above the duripan and very slow permeability within the duripan. These soil are generally found on alluvial fans and stream terraces at elevations of up to 700 feet above mean sea level and have slopes of 0 to 9 percent. The soil is extensive in MLRA 17. Exeter loam is a Hydrologic Group C soil.

The Bakersfield, California meteorological station located in southern San Joaquin Valley is selected for this scenario. The scenario is generally representative of Fresno County. Although Bakersfield is not the geographically closest station to Fresno County, it is most representative of the scenario since it lies in the middle of the citrus growing regions (San Joaquin, Coastal-Intermediate Region, Imperial Valley, Coachella Valley, and the Southern Interior Region). In addition, Bakersfield is located in southern San Joaquin Valley where over 50% citrus is grown (USDA 2003 crop profile for California citrus).

Table 1. PRZM 3.12 Climate and Time Parameters for Fresno County, California - Citrus

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Southern: Bakersfield, CA (W23155)
Ending Date	December 31, 1990	Meteorological File - Southern: Bakersfield, CA (W23155)
Pan Evaporation Factor (PFAC)	0.73	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0 cm C^{-1}	PRZM Guidance (July, 2004). Snow not expected to occur or accumulate and persist for more than a day in Fresno or Bakersfield Counties. http://www.weather.gov/climate (NOWData)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Fresno County, California - Citrus		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.28 tons EI^{-1*}	NRI - Average value listed for the soil series Exeter
USLE LS Factor (USLELS)	1.07	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	NRI - Average value listed for the soil series Exeter
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	1	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	5%	Mark Freeman, Fresno County Cooperative Extension Agent.
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
Irrigation Flag (IRFLAG)	2 (cropping period only)	Mark Freeman, Fresno County Cooperative Extension Agent.
Irrigation Type	4 (Drip	Mark Freeman, Fresno County Cooperative Extension Agent. Irrigation is mostly by low-volume drip or micro-sprinkler

(IRTYP)	Irrigation)	systems, although furrow and overhead sprinklers are also used. Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005).
Leaching Factor (FLEACH)	0	Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005). Default value for drip or micro-irrigation methods.
Fraction of Water Capacity when Irrigation is Applied (PCDEPL)	0.55	Mark Freeman, Fresno County Cooperative Extension Agent. Most farm advisors in CA said water is always applied to crops before 50% depletion.
Maximum Rate at which Irrigation is Applied (RATEAP)	0.056 cm hr^{-1}	Irrigation Guidance for developing PRZM Scenario, Table 1; (June 15, 2005). For CN = 79 and f = 0
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Fresno County, California - Citrus

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Mark Freeman, Fresno County Cooperative Extension Agent.
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Bakersfield, CA (W23155)
Maximum rainfall interception storage of crop (CINTCP)	0.25	Maximum recommended value for orchards (EPA, 2001)
Maximum Active Root Depth (AMXDR)	60 cm	Mark Freeman, Fresno County Cooperative Extension Agent. Parameter value may be different than other citrus scenario due to local expert knowledge.
Maximum Canopy Coverage (COVMAX)	80	Mark Freeman, Fresno County Cooperative Extension Agent.
Soil Surface Condition After Harvest (ICNAH)	3	Mark Freeman, Fresno County Cooperative Extension Agent.
Date of Crop Emergence (EMD, EMM, IYREM)	01/01	Value set to a default evergreen cycle with no specific crop growth milestone such as flowering of fruit set.
Date of Crop Maturity (MAD, MAM, IYRMAT)	02/01	Value set to a default evergreen cycle with no specific crop growth milestone such as flowering of fruit set.

Date of Crop Harvest (HAD, HAM, IYRHAR)	31/12	Value set to a default evergreen cycle with no specific crop growth milestone such as flowering of fruit set.
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4, Meadows, no fallow conditions (USDA, 1990)
Manning’s N Value (MNGN)	0.023	RUSLE Project; D26CCCCM for cover alley citrus (USDA, 2000)
USLE C Factor (USLEC)	0.096 - 0.150	RUSLE Project; Variable with date, D26CCCCM for cover alley citrus (USDA, 2000)

Table 4. PRZM 3.12 Exeter Soil Parameters for Fresno County, California - Citrus

Parameter	Value	Verification Source
Total Soil Depth (CORED)	183 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	2 (Base horizons)	
First and Second Soil Horizons (HORIZN = 1,2)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 173 cm (HORIZN = 2)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.59 g $\cdot cm^{-3}$ (HORIZN = 1) 1.76 g $\cdot cm^{-3}$ (HORIZN = 2)	
Initial Water Content (THETO)	0.16 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.2 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 1 cm (HORIZN = 2)	
Field Capacity (THEFC)	0.16 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.2 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2)	

Wilting Point (THEWP)	0.06 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.11 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2)	
Organic Carbon Content (OC)	0.46% (HORIZN = 1) 0.19% (HORIZN = 2)	

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

CALIFORNIA COTTON (Southern)

The field used to represent cotton production in California is located in Fresno County in the Central Valley, although cotton production occurs throughout the Central Valley. According to the 1997 Census of Agriculture, California is the major producer of cotton in the U.S. Cotton is generally grown on the alluvial fans and basin rims by both dry and wet seeded methods. Row spacing and planting depths are consistent with other cotton growing regions of the U.S. Both standard (30-inch) and ultra-narrow (20-inch) row spacing are used. Irrigation is mostly by flooding. The soil selected to simulate the field is a Twisselman clay. Twisselman clay is a fine, mixed, calcareous, thermic Typic Torriorthents. These soils are often used for cotton production under irrigation. Twisselman clay is a deep, well drained, slow to medium runoff, slowly permeable (very slow in saline-alkali phases) soil that formed in alluvium mainly from sedimentary rock sources. These soil are generally found on alluvial fans and basin rims at elevations of 200 to 1,000 feet above mean sea level and have slopes of 0 to 5 percent. The soil is of moderate extent. Twisselman clay is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Fresno County, California - Cotton

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Fresno, CA (W93193)
Ending Date	December 31, 1990	Meteorological File - Fresno, CA (W93193)
Pan Evaporation Factor (PFAC)	0.73	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0 cm C^{-1}	PRZM Guidance (July, 2004). Snow not expected to occur or accumulate and persist for more than a day in Fresno County. http://www.weather.gov/climate (NOWData)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Fresno County, California - Cotton

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor	0.21 tons EI^{-1*}	PRZM Input Collator (Burns, 1992) and FARM Manual (EPA,

(USLEK)		1985)
USLE LS Factor (USLELS)	0.37	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	Kerry Arroues, USDA-NRCS, indicates contour plowing not common. In accordance with PRZM Manual (EPA,1998), set to 1.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	1	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	2.5%	Mid-point of soil series range (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
Irrigation Flag (IRFLAG)	2 (cropping period only)	Based on recommendations from farm advisors for general flooding for crop irrigation
Irrigation Type (IRTYP)	4 (Flood)	Irrigation is mostly by flooding. Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005).
Leaching Factor (FLEACH)	0.1	Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005).
Fraction of Water Capacity when Irrigation is Applied (PCDEPL)	0.55	Based on recommendations from farm advisors for general flooding for crop irrigation. Most farm advisors in CA said water is always applied to crops before 50% depletion
Maximum Rate at which Irrigation is Applied (RATEAP)	0.074 cm hr^{-1}	Irrigation Guidance for developing PRZM Scenario, Table 1; (June 15, 2005). For CN = 86 and f = 0.1
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Fresno County, California - Cotton

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Kerry Arroues USDA-NRCS
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping	30	Set to weather data. Meteorological File - Fresno,

Periods (NCPDS)		CA (W93193)
Maximum rainfall interception storage of crop (CINTCP)	0.2	PRZM Manual, Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	65 cm	Kerry Arroues USDA-NRCS. Consistent with PRZM manual, table 5-9 (EPA 1998) which cites range of 30-90 cm.
Maximum Canopy Coverage (COVMAX)	100	Kerry Arroues USDA-NRCS
Soil Surface Condition After Harvest (ICNAH)	3	Kerry Arroues USDA-NRCS
Date of Crop Emergence (EMD, EMM, IYREM)	01/05	Usual Planting and Harvesting Dates for U.S. Field Crops (USDA, 1984)
Date of Crop Maturity (MAD, MAM, IYRMAT)	20/09	Usual Planting and Harvesting Dates for U.S. Field Crops (USDA, 1984)
Date of Crop Harvest (HAD, HAM, IYRHAR)	11/11	Usual Planting and Harvesting Dates for U.S. Field Crops (USDA, 1984)
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	89, 86, 87	Set to MS Cotton values. Field validated curve numbers.
Manning’s N Value (MNGN)	0.023	RUSLE Project; C23CTCTC; Cotton, conventional tillage, Fresno (USDA, 2000)
USLE C Factor (USLEC)	0.054 - 0.412	RUSLE Project; C23CTCTC; Cotton, conventional tillage, Fresno, Variable with date (USDA, 2000)

Table 4. PRZM 3.12 Twisselman Soil Parameters for Fresno County, California - Cotton

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		

Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 26 cm (HORIZN = 2) 64 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/) Ed Russell (USDA-NRCS, Fresno)
Bulk Density (BD)	1.45 g $\cdot cm^{-3}$ (HORIZN = 1) 1.5 g $\cdot cm^{-3}$ (HORIZN = 2) 1.6 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content (THETO)	0.36 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.317 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 2 cm (HORIZN =2) 4 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.36 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.317 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.22 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.197 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	0.29% (HORIZN = 1,2) 0.174% (HORIZN = 3)	

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CALIFORNIA FRUITS: NON-CITRUS (Northern and Southern)

The field used to represent non-citrus fruit production in California is located in Fresno County in the Central Valley, although non-citrus fruit production covers most of the central portion of the state, but mainly on Eastern slopes. According to the 1997 Census of Agriculture, California is the major producer of peaches, plums/prunes, and kiwi for the fresh market, and among the highest producers in other non-citrus fruit such as pears and apples. Areas under and between rows of trees may or may not be maintained depending on the location. Row spacing varies depending on the fruit tree (from approximately 15 to 25 feet) as does the tree spacing (approximately 12 to 20 or more feet). Row canopies tend to be very close to 100 percent, while the canopy between rows is much less to permit the operation of maintenance and harvest equipment. Irrigation is by furrow and flood for most crops, but low-volume drip or micro-sprinkler systems are growing in popularity. The soil selected to simulate the field is a benchmark soil, Exeter loam. Exeter loam, is a fine-loamy, mixed, superactive, thermic Typic Durixeralfs. These soils are often used for citrus production under irrigation. Exeter loam is a moderately deep, moderately well drained, very slow to medium runoff soil that formed in alluvium mainly from granite sources. The soil also consists of a duripan. The Exeter loam has moderately slow permeability above the duripan and very slow permeability within the duripan. These soil are generally found on alluvial fans and stream terraces at elevations of up to 700 feet above mean sea level and have slopes of 0 to 9 percent. The soil is extensive in MLRA 17. Exeter loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Fresno County, California - Fruit (non-Citrus)

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Default is Fresno, CA (W93193). Alternative Central Valley stations are - Southern: Bakersfield, CA (W23155) and Northern: Sacramento, CA (W23232)
Ending Date	December 31, 1990	
Pan Evaporation Factor (PFAC)	0.73	Kurt Hembree (559.456.7556), UC Cooperative Extension Office, Fresno County, indicated that fruit crops are grown on east side of Central Valley. (8/8/2001)
Snowmelt Factor (SFAC)	0 cm C^{-1}	Kurt Hembree (559.456.7556), UC Cooperative Extension Office, Fresno County, indicated that last snowfall was in 1970.
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Fresno County, California - Fruit (non-Citrus)		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.34 tons EI^{-1*}	FARM Manual Table 3.1 (EPA, 1985); OSD texture range for Exeter series. Textures range from sandy loam to loam; %OC in surface is 0.58; took loam value to split the difference.
USLE LS Factor (USLELS)	0.30	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Scenario Guidance (Rev., July 2004), default for orchards
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	1	PRZM Manual Figure 5.12 (EPA, 1998) Consultation (08/08/2001) with Kurt Hembree (559.456.7556), UC Cooperative Extension Office, Fresno County, indicated that fruit trees are grown on the eastern side of the Central Valley.
Slope (SLP)	2%	Harry Andris, Fresno County Extension Phone 559-456-7557, Date: 2-24-06 Plums, peaches and kiwi are grown on level areas. Fields are laser leveled.
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
Irrigation Flag (IRFLAG)	2 (cropping period only)	Based on recommendations from farm advisors for general flooding for crop irrigation
Irrigation Type (IRTYP)	4 (Furrow)	Majority of peaches, plums and kiwi are furrow irrigated according to extension agent, Harry Andris, Fresno County Extension, (559-456-7557), Feb 24, 2006. Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005).
Leaching Factor (FLEACH)	0.1	Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005).
Fraction of Water Capacity when Irrigation is Applied (PCDEPL)	0.55	Based on recommendations from farm advisors for general flooding for crop irrigation. Most farm advisors in CA said water is always applied to crops before 50% depletion
Maximum Rate at which Irrigation is Applied (RATEAP)	0.056 cm hr^{-1}	Irrigation Guidance for developing PRZM Scenario (June 15, 2005); Table 3 for furrow irrigation, and Table 1 for CN = 79 and f = 0.
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Fresno County, California - Fruit (non-Citrus)		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Kurt Hembree, Fresno County Cooperative Extension Agent indicated that 25-30% of orchards are kept clear of vegetation; the rest keep vegetated middles, with berms (where trees are) kept clean. (8/8/2001)
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Fresno, CA (W93193).
Maximum rainfall interception storage of crop (CINTCP)	0.25	Maximum recommended value for grass (EPA, 2001)
Maximum Active Root Depth (AMXDR)	30 cm	Kurt Hembree (559.456.7556) Consultation 08/08/2001 with Kurt Hembree, UC Cooperative Extension Office, Fresno County, indicated that majority of fruit tree roots are in top 1 foot of soil and can extract moisture throughout that depth.
Maximum Canopy Coverage (COVMAX)	90	Kurt Hembree (559.456.7556) Consultation 08/08/2001 with Kurt Hembree, UC Cooperative Extension Office, Fresno County, indicated that canopy varies with type of orchard: walnuts = 100%; almonds = 85%. Others vary with spacings; most tree crops in Central Valley are planted on 20-22-ft spacings.
Soil Surface Condition After Harvest (ICNAH)	3	Kurt Hembree (559.456.7556) Consultation 08/08/2001 with Kurt Hembree, UC Cooperative Extension Office, Fresno County, indicated that 25-30% of orchards are kept clear of vegetation; the rest keep vegetated middles, with berms (where trees are) kept clean.
Date of Crop Emergence (EMD, EMM, IYREM)	16/01	Value set to a dates for plums based on Health Effects Division information
Date of Crop Maturity (MAD, MAM, IYRMAT)	01/04	Harry Andris, Fresno County Extension Phone 559-456-7557, Date: 2-24-06 Date of maturity of leaves.
Date of Crop Harvest (HAD, HAM, IYRHAR)	01/08	Value set to a dates for plums based on Health Effects Division information
Maximum Dry Weight	0.0	Set to “0" Not used in simulation

(WFMAX)		
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4, used Meadow for Orchards, no fallow conditions (USDA, 1990)
Manning's N Value (MNGN)	0.023	RUSLE Project; C21OCOCM for orchards, covered alley in Sacramento (USDA, 2000)
USLE C Factor (USLEC)	0.034 - 0.221	RUSLE Project; Variable with date, C21OCOCM for orchards, covered alley in Sacramento (USDA, 2000)

Table 4. PRZM 3.12 Exeter Fine Sandy Loam - Soil Parameters for Fresno County, California - Fruit (non-Citrus)

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Base horizons)	
First and Second Soil Horizons (HORIZN = 1,2)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 16 cm (HORIZN = 2) 74 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.7 g $\cdot cm^{-3}$ (HORIZN = 1) 1.7 g $\cdot cm^{-3}$ (HORIZN = 2) 1.8 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content (THETO)	0.218 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.218 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2) 0.248 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4 cm (HORIZN = 2) 2 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.218 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1)	

	0.218 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 2) 0.248 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.078 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1) 0.078 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 2) 0.108 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Organic Carbon Content (OC)	0.58% (HORIZN = 1) 0.58% (HORIZN = 2) 0.174% (HORIZN = 3)	

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CALIFORNIA GRAPES (Northern and Southern)

The field used to represent grape production in California is located in Southern San Joaquin Valley. According to the 1997 Census of Agriculture, California is the major producer of table, wine, and raisin grapes with 85 percent of California's production in the San Joaquin Valley and the bulk of the remainder in the Coachella Valley. Grapes need at least 3 ft of well drained soil, and are typically grown on sandy or sandy loam soils. Vine rows are usually kept weed free, but there is some growth in the winter. Surface soil around the vine row is usually sealed, but some plants can grow between vine rows. The soil between rows is usually disked. Row spacing varies depending on the terrain. Canopies between rows tend to be much less than 100 percent, while the canopy along the rows is 100 percent. Irrigation is mainly by drip irrigation, but some vineyards continue to use sprinkler systems. The soil selected to simulate the field is a benchmark soil, San Joaquin loam. San Joaquin loam, is a fine, mixed, active, thermic Abruptic Durixeralfs. These soils are often used for vineyards, fruit and nut production under irrigation. San Joaquin loam is a moderately deep, well and moderately well drained, medium to very high runoff soil that formed in alluvium mainly from granite sources. The soil also consists of a duripan. The San Joaquin loam has very slow permeability above the duripan and very slow permeability within the duripan. Some areas are subject to flooding. These soil are generally found on undulating terraces at elevations from 50 to 500 feet above mean sea level and have slopes of 0 to 9 percent. The soil is extensive in MLRA 17 along the Eastern slopes of the Sacramento and San Joaquin Valleys. San Joaquin loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for San Joaquin Valley, California - Grapes

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Fresno, CA (W93193)
Ending Date	December 31, 1990	Meteorological File - Fresno, CA (W93193)
Pan Evaporation Factor (PFAC)	0.73	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0 cm C^{-1}	PRZM Guidance (July, 2004). Snow not expected to occur or accumulate and persist for more than a day in Fresno County. http://www.weather.gov/climate (NOWData)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for San Joaquin Valley, California - Grapes

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.28 tons EI^{-1*}	NRI - Average value listed for the soil series San Joaquin
USLE LS Factor (USLELS)	0.30	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	NRI - Average value listed for the soil series San Joaquin
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	1	PRZM Manual Figure 5.12 (EPA, 1998); based on crops grown on Eastern side of slopes.
Slope (SLP)	2%	Paul Verdegaal, San Joaquin County Cooperative Extension 209-468-9494
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
Irrigation Flag (IRFLAG)	2 (cropping period only)	Based on recommendations from farm advisors for general flooding for crop irrigation
Irrigation Type (IRTYP)	4 (Drip Irrigation)	Irrigation is mainly by drip irrigation. Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005).
Leaching Factor (FLEACH)	0	Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005). Default value for drip irrigation.
Fraction of Water Capacity when Irrigation is Applied (PCDEPL)	0.55	Almost all vineyards use drip irrigation, and irrigate when the soil reaches 35-50% depletion.
Maximum Rate at which Irrigation is Applied (RATEAP)	0.056 cm hr^{-1}	Irrigation Guidance for developing PRZM Scenario, Table 1; (June 15, 2005). For CN = 79 and f = 0
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for San Joaquin Valley, California - Grapes		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition		Paul Verdegaal, San Joaquin County Cooperative

(ISCOND)	3	Extension 209-468-9494
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Fresno, CA (W93193)
Maximum rainfall interception storage of crop (CINTCP)	0.25	Maximum recommended value for grass (EPA, 2001)
Maximum Active Root Depth (AMXDR)	100 cm	Paul Verdegaal, San Joaquin County Cooperative Extension 209-468-9494
Maximum Canopy Coverage (COVMAX)	70	Paul Verdegaal, San Joaquin County Cooperative Extension 209-468-9494 Parameter value may be different than other grape scenario due to different source.
Soil Surface Condition After Harvest (ICNAH)	3	Paul Verdegaal, San Joaquin County Cooperative Extension 209-468-9494
Date of Crop Emergence (EMD, EMM, IYREM)	01/02	Paul Verdegaal, San Joaquin County Cooperative Extension 209-468-9494
Date of Crop Maturity (MAD, MAM, IYRMAT)	01/03	Set to 1 month after leaf emergence to model mature plant transpiration.
Date of Crop Harvest (HAD, HAM, IYRHAR)	31/08	Paul Verdegaal, San Joaquin County Cooperative Extension 209-468-9494
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4, for Meadows, no fallow conditions, Hydrologic Group C (USDA, 1990)
Manning's N Value (MNGN)	0.023	RUSLE Project; C21GBGBC for grapes, Sacramento, bare ground (USDA, 2000)
USLE C Factor (USLEC)	0.274 - 0.517	RUSLE Project; Variable with date, C21GBGBC for grapes, Sacramento, bare ground (USDA, 2000)

Table 4. PRZM 3.12 San Joaquin Soil Parameters for San Joaquin Valley, California - Grapes

Parameter	Value	Verification Source
Total Soil Depth	340 cm	NRCS, National Soils

(CORED)		Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	2 (Base horizons)	
First and Second Soil Horizons (HORIZN = 1,2)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 330 cm (HORIZN = 2)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.84 $g \cdot cm^{-3}$ (HORIZN = 1) 1.6 $g \cdot cm^{-3}$ (HORIZN = 2)	
Initial Water Content (THETO)	0.21 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =1) 0.28 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =2)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN = 2)	
Field Capacity (THEFC)	0.21 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN = 1) 0.28 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN = 2)	
Wilting Point (THEWP)	0.1 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN = 1) 0.15 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN = 2)	
Organic Carbon Content (OC)	0.72% (HORIZN = 1) 0.16% (HORIZN = 2)	

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CALIFORNIA LETTUCE (Coastal Zone)

The field used to represent lettuce production in California is near Salinas in Monterey County. Of 306,849 acres of lettuce (including romaine) grown in the United States in 2002 (USDA, 2004), 291,723, or 95%, were grown in California and Arizona. Hence, a site located in one of these two states is appropriate even though limited rainfall in this area would make site in these regions less vulnerable than those on the central or eastern United States. As a general rule if less than 10% of a crop is grown in more vulnerable states than using a west coast state is appropriate. Coastal California represents a good scenario, as the coastal counties of Monterey, San Luis Obispo and Santa Barbara receive more rainfall than the lettuce production areas in the Central Valley and Arizona, and these are the top counties in terms of lettuce production as well.

California itself is the top state for lettuce for lettuce production with 219701 acres (USDA NASS, 2004). Of that, over 57% is grown in Monterey County. Iceberg lettuce is considered a cool-season crop and is grown on a number of soil types. According the USDA crop for iceberg lettuce in California (Kurtz, 2001), planting and harvesting schedules are determined well in advance of planting to ensure a constant supply of lettuce throughout the year. Iceberg lettuce seed is planted by the grower at depths of approximately 1/8 to 1/4 inches primarily on 40-inch raised beds with 2 seedlines per bed. A small percentage of iceberg lettuce is produced on 80 inch beds with 5 seedlines per bed. Most lettuce seed is coated (i.e., pelletized) with a clay type mixture to provide a small pellet of uniform size and shape to facilitate precision planter use. Seed treatments (e.g., priming) are included with some coatings to assist in germination, especially during hot weather conditions. Most coated lettuce seed is planted in the range of 6 to 10 pounds per acre. Because an excess of seed is planted, thinning is required to establish the final stand which usually ranges between 31 (10 inch spacing between plants) to 26 (12 inch spacing between plants) thousand plants per acre. Under normal conditions, approximately 1 to 3% of the annual iceberg lettuce acreage in California is transplanted primarily using plants produced under greenhouse conditions. The percentage of transplanted acres is usually higher in wet years (e.g., 1995 and 1998). Practices used for leaf lettuce (romaine, red leaf, green leaf, and butterhead) are similar (Kurtz, 2001a).

Table 1. Benchmark soils in MLRA's 14 and 15 used to grow lettuce.

Soil series name	Hydrologic Group
Antioch	D
Brentwood	B
Chualar	B
Clear Lake	D
Gaviota	D
Lockwood	B
Lodo	D
Los Osos	D
Placentia	D
Pleasanton	B
Salinas	B
Santa Ynez	D
Sheridan	B

Our current guidance for soil selection indicates that a soil should be a bench mark soil used to grow the crop in hydrologic group C or D. There are 78 benchmark soils in California. Of these, fifteen can used to grow lettuce in MLRA's 14 or 15 (USDA, 1994). These fifteen soils are listed in Table 1. Of these, 8 are in Hydrologic Group C or D. (In fact, all are Hydrologic Group D.) Of these eight, two soils, the Gaviota and Lodo series, while capable of growing lettuce, are dominantly used for grazing and range (USDA Soil Survey Division, 2001) . Four others, the Antioch, Clear Lake, Santa Ynez, and Watsonville, are of only moderate or limited extent. The remaining two soils are the Placentia and the Salinas soils. The Placentia was chosen from these two soils as the soil used for the lettuce scenario.

The soil selected has a sandy loam surface texture. The Placentia sandy loam is a fine, smectitic, thermic Typic Natrixeralf (Soil Survey Division, 2001). These soils are used for citrus, truck crops, small grain, hay, and forage. They are found in the Salinas Valley and the coastal parts of Southern California in MLRA 14 and they are extensive. Placentia soils are nearly level to moderately sloping and are on alluvial fans and terraces at elevations of 50 to 2,500 feet.

The Santa Maria, California meteorological station is selected for this scenario. The scenario is located in the coastal county of Monterey. Although there are closer stations to Monterey County, the Santa Maria station is the closest coastal station and is therefore more relevant climatologically for this coastal scenario. In addition, the 2001 USDA crop profile for CA lettuce indicates that lettuce is planted in three primary production areas in California, with the principal production in the coastal areas of Salinas, Watsonville, and Santa Maria.

Table 1. PRZM 3.12 Climate and Time Parameters for lettuce grown in Monterey County, California

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Santa Maria, CA (W23273)
Ending Date	December 31, 1990	Meteorological File - Santa Maria, CA (W23273)
Pan Evaporation Factor (PFAC)	0.79	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0 cm C^{-1}	PRZM Guidance (July, 2004). Snow not expected to occur or accumulate and persist for more than a day in Monterey County or Santa Maria. http://www.weather.gov/climate (NOWData)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Multi Cropping. Multiple crops are grown each year on single field in coastal California. It was not clear how often lettuce would be double cropped or whether lettuce would more often rotated with other crops. Jim Manacero[1], a major grower of lettuce in the Salinas Valley indicates that lettuce is usually grown in rotation with other crops, particularly cole crops with slightly over two crops per field per season on average. Cole crops are favored for rotation because they help suppress *Sclerotinia*. Other crops that are rotated with lettuce are the alliums (*e.g.* onion, garlic, leeks), spinach, celery, and chili or bell peppers. These last two are predominantly grown toward the southern part of the Salinas Valley. There is at least some double cropping with lettuce, although disease concerns keep this lower than rotation to other crops. Mr. Manacero did not have an estimate on the amount of double cropping. On this basis we have chosen to simulate one crop of lettuce a year, as this will be the dominant practice, recognizing that there will be other crops grown on the field, and that there will be at least some double cropping.

Table 2. PRZM 3.12 Erosion and landscape parameters for lettuce grown in Monterey County, California.

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	Standard
USLE K Factor (USLEK)	0.37 tons EI^{-1*}	STATSGO
USLE LS Factor (USLELS)	1.34	Calculated according to Haan and Barfield (1978) equation: $LS = ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	0.5	represents row crop with slope between 3 and 8%, as per guidance
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	1	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Soil slope maximum >12% (range: 0-15%) (USDA 2006). For row crops, value should be 6% (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)

* EI = 100 ft-tons * in/ acre*hr

[1] personal communication with R. David Jones, July 8, 2004.

Irrigation. Mr. Manacero also indicated that pre-plant irrigation, and irrigation at germination is done with sprinkler. Subsequent irrigation varies from field to field, with sprinkler still dominating, but drip irrigation increasing. Ten or fifteen percent of fields use furrow irrigation. In most cases, furrow is used on flat fields, and irrigation is not applied to runoff. Mr Manacero also indicated that at least some furrow irrigated fields, there are catchments used to catch and recycle or recharge runoff off the field. Most fields are tile drained, with tile lines at five to six feet. Since irrigation is predominantly done using sprinkler and drip, which tend not produce runoff, irrigation was not simulated for this scenario.

Height of the crop. The height of the crop was developed from personal knowledge of the crop by the scenario developer

LS Factor. the LS factor was calculated according to guidance using the equation of Haan and Barfield (1978) using a slope length of 400 feet (the default) and a slope of 9%, which is the median slope for a Placentia soil in the SOILS5 data base.

Maximum areal canopy coverage and maximum rooting depth. Specific information for lettuce could not be identified. The values for cabbage in the Florida cabbage scenario were used as reasonable surrogates.

Soils Properties. The USLE K factor, slope, horizon boundaries, field capacities, wilting points, bulk densities, and organic carbon contents were taken from the STATSGO database rather than from PIC, as recommended in the guidance. PIC was developed from the SOILS5 database, which was a predecessor to STATSGO, and thus STATSGO contains a larger and more recent set of soils data from which to develop scenarios.

Table 3. PRZM 3.12 crop parameters for lettuce grown in Monterey County, California

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Field are fallow prior to planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Santa Maria, CA (W23273)
Maximum rainfall Interception storage of crop (CINTCP)	0.25	Table 5.4 from PRZM Manual (Burns, 1992 and EPA, 1985)
Maximum Active Root Depth (AMXDR)	12 cm	used value from FL cabbage scenario as a surrogate
Maximum Canopy		used value from Florida cabbage scenario as a

Coverage (COVMAX)	90	surrogate
Soil Surface Condition After Harvest (ICNAH)	3	Plant residues are left behind until later in the year when tilled for next series of crops.
Date of Crop Emergence (EMD, EMM)	16/02	California Head Lettuce Profile, (Kurtz, 2001)
Date of Crop Maturity (MAD, MAM)	05/05	California Head Lettuce Profile, (Kurtz,2001)
Date of Crop Harvest (HAD, HAM)	12/05	California Head Lettuce Profile, (Kurtz, 2001)
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
Maximum Crop Height (HTMAX)	30 cm	height of head lettuce
SCS Curve Number (CN)	94, 89, 94	Gleams Manual Table H-4, Fallow = SR poor, Cropping and Residue = Row Crop SR/poor (USDA, 1990)
Manning's N Value (MNGN)	0.011	RUSLE Project; C24LTLTC; Lettuce, conventional tillage; San Francisco, CA, Variable with date (USDA, 2000)
USLE C Factor (USLEC)	0.176 - 0.803	RUSLE Project; C24LTLTC; Lettuce, conventional tillage; San Francisco, CA, Variable with date (USDA, 2000)

Table 4. PRZM 3.12 Placentia sandy loam soil parameters for lettuce grown in Monterey County, California

Parameter	Value	Verification Source
Total Soil Depth (CORED)	171 cm	STATSGO Database
Number of Horizons (NHORIZ)	5 (Top horizon split in two)	
Soil Horizon Datas (HORIZN = 1,2,3, 4, 5)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 22 cm (HORIZN = 2) 40 cm (HORIZN = 3) 77 cm (HORIZN = 4) 22 cm (HORIZN = 5)	STATSGO Database

Bulk Density (BD)	1.575 g $\cdot cm^{-3}$ (HORIZN = 1, 2) 1.475 g $\cdot cm^{-3}$ (HORIZN = 3) 1.725 g $\cdot cm^{-3}$ (HORIZN = 4) 1.750 g $\cdot cm^{-3}$ (HORIZN = 5)	
Initial Water Content (THETO)	0.295 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.347 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3) 0224 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4) 0.214 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =5)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 2 cm (HORIZN =2) 5 cm (HORIZN =3) 1 cm (HORIZN =4) 2 cm (HORIZN =5)	
Field Capacity (THEFC)	0.295 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.347 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3) 0224 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4) 0.214 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =5)	
Wilting Point (THEWP)	0.170 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.242 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3) 0.139 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4) 0.089 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =5)	
Organic Carbon Content (OC)	0.725% (HORIZN = 1,2) 0.058% (HORIZN = 3, 4, 5)	

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CALIFORNIA ONION

The field used to represent onion production in California is located in Kern County in the San Joaquin Valley, although onion production areas are quite extensive (San Joaquin, Coastal-Intermediate Region, Imperial Valley, southern and central coastal regions, the high desert areas of Los Angeles County and the northern mountain valleys). According to the 1997 Census of Agriculture, California is the major producer of onions for the market. Bulb onions are planted from September through May and harvesting begins in April or May and completed by September. Onions are cools season, biennial plants that are commercially grown as an annual. Most onions are direct seeded, but transplants are used in some fall planted fields for an earlier harvest of short-day and intermediate-day varieties and to achieve uniform , jumbo-sized bulbs. Seeds are planted uniformly at 2 to 3 inches between plants in a row. Onions are most commonly grown in multiple rows on raised beds 40 to 42 inches wide, but some production areas use 36-inch wide beds or beds of 60 to 80 inches. Distribution of rows across beds varies depending on irrigation method and planter. With drip and sprinkler irrigation (most common types), rows are spaced equidistant across the bed at approximately 4-inch intervals. When furrow irrigation is used, the center of the bed is left vacant for salt accumulation with 2 or 3 rows planted on either side. Plant canopy can approach 100 percent in some narrow row fields grown under drip irrigation. Irrigation is required to avoid seed or plant dry out. Generally 24 to 36 inches of irrigated water per year is sufficient. Onions can grow on a wide range of soils. The soil selected to represent the field is Ciervo clay. Ciervo clay, is a fine, semetic, thermic Vertic Haplocambids. These soils are often used for onion and other truck crop production under irrigation. Ciervo clay is a very deep, moderately well drained, medium to high runoff soil on fan skirts that formed in alluvium mainly from sedimentary rocks at elevation of 170 to 735 feet above mean sea level. The Ciervo clay has very slow permeability. Slopes range from 0 to 2 percent. The soil is of large extent in MLRA 17. Ciervo clay is a Hydrologic Group D soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Kern County, California - Onions		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Southern: Bakersfield, CA (W23155)
Ending Date	December 31, 1990	Meteorological File - Southern: Bakersfield, CA (W23155)
Pan Evaporation Factor (PFAC)	0.7	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0 cm C^{-1}	PRZM Guidance (July, 2004). Snow not expected to occur or accumulate and persist for more than a day in Bakersfield or Kern Counties. http://www.weather.gov/climate (NOWData)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Kern County, California - Onions		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.21 tons EI^{-1*}	PRZM Input Collator (Burns, 1992) and FARM Manual (EPA, 1985)
USLE LS Factor (USLELS)	0.20	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	0.6	Based on slope and EPA guidance (EPA 2004). Onions typically grown in rows on raised beds. R.E. Voss UC Publication 7242
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	1	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1%	Mid-point of the Soil Series, Ciervo
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
Irrigation Flag (IRFLAG)	2 (cropping period only)	Voss, R.E. Fresh Market Bulb Onion Production in California. U. fo CA Publication 7242. 1999.
Irrigation Type	3 (Over	Voss, R.E. Fresh Market Bulb Onion Production in California.

(IRTYP)	Canopy)	U. fo CA Publication 7242. 1999.
Leaching Factor (FLEACH)	0.1	Irrigation Guidance for developing PRZM Scenario, Table 1; (June 15, 2005). Default value for over canopy irrigation.
Fraction of Water Capacity when Irrigation is Applied (PCDEPL)	0.75	Voss, R.E. Fresh Market Bulb Onion Production in California. U. fo CA Publication 7242. 1999. Voss states "irrigate when 25% of available moisture is depleted." Irrigation Guidance for developing PRZM Scenario, Table 1; (June 15, 2005).
Maximum Rate at which Irrigation is Applied (RATEAP)	0.08 cm hr^{-1}	Irrigation Guidance for developing PRZM Scenario, Table 1; (June 15, 2005). For CN = 85 and f = 0.1
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Kern County, California - Onions

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Default. R.E. Voss, UC Publication 7242 indicates that onions require a well prepared soil surface.
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Bakersfield, CA (W23155)
Maximum rainfall interception storage of crop (CINTCP)	0.05	PRZM Input Collator (Burns, 1992)
Maximum Active Root Depth (AMXDR)	35 cm	Voss, R.E. Fresh Market Bulb Onion Production in California. U. fo CA Publication 7242. 1999.
Maximum Canopy Coverage (COVMAX)	80	Estimated based on aerial photography
Soil Surface Condition After Harvest (ICNAH)	1	Voss, R.E. 1999. Fresh Market Bulb Onion Production in California. U. fo CA Publication 7242.
Date of Crop Emergence (EMD, EMM, IYREM)	16/01	PIC Recommended dates adjusted according to RUSLE Project planting dates.
Date of Crop Maturity (MAD, MAM, IYRMAT)	01/06	PIC Recommended dates adjusted according to RUSLE Project planting dates.
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/06	PIC Recommended dates adjusted according to RUSLE Project planting dates.

Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	92, 85, 86	Gleams Manual Table H-4, Meadows, no fallow conditions (USDA, 1990)
Manning's N Value (MNGN)	0.011	RUSLE Project; C23ONONC; Onions, Fresno CA Conventional Tillage (USDA, 2000)
USLE C Factor (USLEC)	0.521 - 0.732	RUSLE Project; C23ONONC; Onions, Fresno CA Conventional Tillage (USDA, 2000)

Table 4. PRZM 3.12 Ciervo Soil Parameters for Kern County, California - Onions

Parameter	Value	Verification Source
Total Soil Depth (CORED)	150 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Base horizons)	
First, Second and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	12 cm (HORIZN = 1) 50 cm (HORIZN = 2) 88 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.40 g $\cdot cm^{-3}$ (HORIZN = 1) 1.36 g $\cdot cm^{-3}$ (HORIZN = 2) 1.17 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content (THETO)	0.259 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.266 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2) 0.345 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5.0 cm (HORIZN = 2) 4.0 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.259 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1)	

	0.266 cm^3-H_2O ·cm^{-3}-soil (HORIZN =2) 0.345 cm^3-H_2O ·cm^{-3}-soil (HORIZN =3)	NRCS S85-019-004 Pedon 85P 988 (0 to 13 cm) NRCS S85-019-004 Pedon 85P 988 (weighted ave 13 to 63 cm) NRCS S85CA-019-004 Pedon 85P 988 (weighted ave. 63 to 150 cm)
Wilting Point (THEWP)	0.15 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1) 0.158 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 2) 0.202 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Organic Carbon Content (OC)	0.91% (HORIZN = 1) 0.43% (HORIZN = 2) 0.32% (HORIZN = 3)	

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CALIFORNIA TOMATOES (Northern and Southern)

The field used to represent tomato production in California is located in San Joaquin County in the Central Valley, although tomatoes are produced throughout the Central Valley and Imperial Valley. According to the 1997 Census of Agriculture, California is ranked 2nd in the U.S. in production; 45 percent of California's production is in Stanislaus and Merced Counties. Tomatoes are generally grown on raised beds 60-66 inches wide. Most tomato plants are from transplants grown in nurseries. Row spacing is approximately 30 to 45 inches and plants are grown close together within rows. Spaces between rows are generally kept clear, but plants often grow into these areas. Furrow irrigation is commonly used in California tomatoes, although drip irrigation is also common. The soil selected to simulate the field is a Stockton clay. Stockton clay is a fine, semectitic, thermic Xeric Epiaquerts. These soils are often used for tomato production under irrigation, but also for other row crops such as corn, beans, sugar beets, and grains. Stockton clay is a deep, somewhat poorly drained, slowly permeable, very slow to slow runoff soil that formed in alluvium of mixed igneous and sedimentary rock sources. These soil are generally found in basins and in swales of drainageways. They are located at elevation of 0 to 100 feet above mean sea level and have slopes of 0 to 2 percent. The soil is of moderate extent. Stockton clay is a Hydrologic Group D soil.

The Fresno, California meteorological station is selected for this scenario. The scenario represents San Joaquin County, and more broadly the Central Valley. Although the Fresno station is not the geographically closest meteorological station to San Joaquin County, The Fresno met station is located in the middle of Central Valley and is more representative climatologically for Central Valley tomato production. The 2000 USDA crop profile for tomatoes (fresh market) indicates that 45% of the state's fresh market tomatoes are produced in San Joaquin, Stanislaus and Merced counties. The 1999 USDA crop profile for processing tomatoes indicates the San Joaquin Valley south of Merced County produces 35 to 40%. Additionally, in 2004, Fresno produced the highest harvested acreage of tomatoes in the US based on the 2004 USDA NASS census of agriculture.

Table 1. PRZM 3.12 Climate and Time Parameters for Central Valley, California - Tomato		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File -Fresno, CA (W93193)
Ending Date	December 31, 1990	Meteorological File - Fresno, CA (W93193)
Pan Evaporation Factor (PFAC)	0.73	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Central Valley, California - Tomato		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.24 tons EI^{-1*}	NRI - Average value listed for the soil series Stockton
USLE LS Factor (USLELS)	0.13	Calculated according to Haan and Barfield (1978) equation: $LS = ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	NRI - Average value listed for the soil series Stockton
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	1	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	0.25%	Bob Mullen, San Joaquin County Cooperative Extension. 209-468-9489
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
Irrigation Flag (IRFLAG)	2 (cropping period only)	Based on recommendations from farm advisors for general flooding for crop irrigation

Flow rate of water entering furrow (Q0)	0.0025 m^3s^{-1}	PRZM Manual, Table 5.35 (EPA, 1998)
Bottom width of furrow (BT)	0.12m	Estimated based on 10-inch furrow width
Furrow side slope (ZRS)	2	PRZM Manual (EPA, 1998)
Furrow slope (SF)	0.005	Maximum field slope
Manning's N for furrow (EN)	0.02	PRZM Manual, Table 5.34 (EPA, 1998)
Furrow length (X2)	300m	PRZM Manual, Table 5.35 (EPA, 1998)
Irrigation Type (IRTYP)	4 (Furrow)	IPM Center Crop Profile
Leaching Factor (FLEACH)	0.1	Irrigation Guidance for developing PRZM Scenario, Table 3, (June 15, 2005)
Fraction of Water Capacity when Irrigation is Applied (PCDEPL)	0.55	Based on recommendations from farm advisors for general flooding for crop irrigation; and Irrigation Guidance for developing PRZM Scenario, Table 3, (June 15, 2005).
Maximum Rate at which Irrigation is Applied (RATEAP)	0.032 cm hr^{-1}	Irrigation Guidance for developing PRZM Scenario (June 15, 2005); Table 3 for furrow irrigation, and Table 1 for CN = 87 and f = 0.
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Central Valley, California - Tomato

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Bob Mullen, San Joaquin County Cooperative Extension. 209-468-9489
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Fresno, CA (W93193)
Maximum rainfall interception storage of crop (CINTCP)	0.1	PIC; confirmed using Table 5.4 from PRZM Manual (Burns, 1992 and EPA, 1985)
Maximum Active Root Depth (AMXDR)	90 cm	Bob Mullen, San Joaquin County Cooperative Extension. 209-468-9489 indicated that most roots are in top three feet. Parameter value may be inconsistent with different tomato scenarios due to different sources.
Maximum Canopy		Bob Mullen, San Joaquin County Cooperative

Coverage (COVMAX)	90	Extension. 209-468-9489 Based on 66" beds, 10" furrow and some intrusion of the crop on the furrow. Parameter value may be inconsistent with different tomato scenarios due to different sources.
Soil Surface Condition After Harvest (ICNAH)	1	Bob Mullen, San Joaquin County Cooperative Extension. 209-468-9489
Date of Crop Emergence (EMD, EMM, IYREM)	01/03	Bob Mullen, San Joaquin County Cooperative Extension. 209-468-9489
Date of Crop Maturity (MAD, MAM, IYRMAT)	01/07	Bob Mullen, San Joaquin County Cooperative Extension. 209-468-9489
Date of Crop Harvest (HAD, HAM, IYRHAR)	01/09	Bob Mullen, San Joaquin County Cooperative Extension. 209-468-9489
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	91, 87, 88	Gleams Manual Table H-4, Fallow = Fallow, SR/ poor; Cropping and Residue = Row Crops SR/poor condition
Manning's N Value (MNGN)	0.023	RUSLE Project; C23BDCGC for dry beans, 2000 lb, Fresno (USDA, 2000)
USLE C Factor (USLEC)	0.035- 0.255	RUSLE Project; C23BDCGC for dry beans, 2000 lb, Fresno Variable with date (USDA, 2000)

Table 4. PRZM 3.12 Stockton Soil Parameters for Central Valley, California - Tomato

Parameter	Value	Verification Source
Total Soil Depth (CORED)	180 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 8 cm (HORIZN = 2) 162 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.3 g $\cdot$cm^{-3} (HORIZN = 1,2) 1.4 g $\cdot$cm^{-3} (HORIZN = 3)	

Initial Water Content (THETO)	0.38 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.396 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	Edd Russell (USDA-NRCS, Fresno)
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4 cm (HORIZN =2) 3 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.38 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.396 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.25 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2,3)	
Organic Carbon Content (OC)	0.95% (HORIZN = 1,2) 0.4% (HORIZN = 3)	

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FLORIDA AVOCADO
(12/10/03)

The field used to represent avocado production in Florida is located in Miami-Dade County in Southeast Florida (MLRA 156A) and the weather station (BAN Number: 12839) representing the grove is in MLRA 156A and is located at Miami, FL. Florida is second only to California in avocado production (1999-2000) (Mossler and Nesheim, 2001). About 98 percent of the avocado acreage is located in Miami-Dade County. The remaining acreage, in Florida, is located in the following Counties: Brevard, Broward, Collier, Hillsborough, Palm Beach, and others (Mossler and Nesheim, 2001and Crane et al. (1998). **Note: This scenario represents the most likely site conditions that avocados will be grown on in southern Florida and therefore should only be used for avocado grown in southern Florida. This site is not highly vulnerable to runoff, because the soils are well drained (Hydrologic Group A) and site is relatively level (0 to 2 percent slope, but up to 5 percent).** As noted below avocado require soils that are well-drained, thus would be limited to soils of Hydrologic Group A and perhaps some soils in Hydrologic Group B.

The avocado tree is classified as an evergreen and is located in the Lauraceae family. The tree can grow to a height of 60 to 65 feet. Trees are generally maintained at 20 feet for ease of harvest and maintenance. Avocado trees are planted from 15 to 25 feet apart within rows and from 25 to 30 feet between rows. Thus, an eight- to twelve-year old grove would have about 75 trees per acre. Trees reach full-bearing potential by the seventh year, with a useful life of about 40 years. The fruit is a berry, consisting of a single large seed, surrounded by a buttery pulp. The fruit does not generally ripen until it falls or is picked from the tree. In Florida, the fruit is considered sufficiently mature for harvest when it reaches specific calender date or size. The specific dates, weights, and sizes used to determine maturity vary by variety. A number of cultivars, with different length periods (5- to 15-months) required for the fruit to reach maturity, are grown in Florida (Table 1). The early-maturing varieties ripen in June, others ripen in October or November. Commercial varieties in Florida mature from June to March. The greatest production in Florida is from August through December. Avocado trees are generally picked twice a season. Larger fruit are picked first, leaving smaller fruit to enlarge (Crane et al., 2001; Mossler and Mesheim, 2001).

Table 1. Avocado race and key development dates.

Characteristic[1]	Avocado Race (i.e., Varieties or Species) after Crane et al. 2001		
	West India	Guatemalan	Mexican
Blooming Season	February to March	March to April	January to February
Maturity Season	May to September	September to January	June to October
Development Period (fruit set to maturity)	5 to 8 months	10 to 15 months	6 to 8 months

[1] Crane et al. (2001) have more specific information for about 30 different varieties.

The avocado does not tolerate flooding or poorly drained soils, but is adapted to many types of well-drained soils. Thus, avocados should be planted in well-drained soil, such as the well-drained rockland and sandy soils present in south Florida. The avocado does have a high water requirement, thus, during dry periods irrigation water should be added (~1 inch per week) (Mossler and Nesheim, 2001), but the specific water requirements have not been determined (Crane et al., 2001). Irrigation water may also need to be applied to protect the trees against the cold. ***The irrigation routine in PRZM is undergoing revisions to correct routine deficiencies and was not incorporated into this scenario.***

The soil selected to simulate the field is a Krome very gravelly loam. The Krome soil is classified as Loamy-skeletal, carbonatic, hypothermic Lithic Udorthents. These soils are often used for avocado, tomato, and bean production. The Krome series consists of a very shallow, moderately well drained permeable soil over limestone. They formed by scarification of outcrops of oolitic limestone, and the loamy residuum that partially covers the limestone and fills the many cavities or solution holes. These soils are on broad areas of the Miami Ridge. Slopes are predominately 0 to 2 percent, but range to 5 percent. The series is only know to exist in Dade County and is of small extent. Krome very gravelly loam is a Hydrologic Group A soil. Limitations with the soil data used in the PRZM included that the depth only went to about 70 cm, rather than the usual 150 cm (5-ft). There is also limited data due the limited extent of this soil mapping unit (soil series). Several values for the surface layer (0 to 5 cm, Oi horizon had to be guess-timated - bulk density), were set value used in the underlying horizon (water contents)

The following information is presented concerning when an insecticide may be applied as part of a management control program for avocados (Pena and Johnson, 2003) (Table 2).

Table 2. Pest control and timing to apply pesticide.

Pest	**Timing: When to apply pesticide**
Control avocado red mites if needed	December, January, February
Control bloom infesting insects, mirids, and caterpillers if needed	January, February, March
Control scale insects, mealybugs or insect infestation on fruit if needed	May, June, July
Control greenhouse thrips if needed	August, September, October
Control fruit scarring insects if needed	August, September, October

Tables 3 through 6 summarize the parameters used in the PRZM Florida avocado scenario.

Table 3. PRZM 3.12 Climate and Time Parameters for Dade County, Florida - Avocado

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Miami, FL (w12839.dvf)
Ending Date	December 31, 1990	Meteorological File - Miami, FL (w12839.dvf)
Pan Evaporation Factor (PFAC)	0.78	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0 cm C^{-1}	PRZM Manual (EPA, 1998). Snow is generally not expected for southern Florida.
Minimum Depth of Evaporation (ANETD)	32.5 cm	PRZM Manual Figure 5.2 (EPA, 1998) The mid-point value of the range 30-35 cm.

Table 4. PRZM 3.12 Erosion and Landscape Parameters for Dade County, Florida - Avocado

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.08 tons EI^{-1*}	Table 10 --Physical and Chemical Properties of the Soils http://soils.usda.gov/survey/online_surveys/florida/dade/table10.html
USLE LS Factor (USLELS)	0.37	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual, Table 5.6 (EPA, 1998)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	2.5%	Mid-point of soil series range (EPA, 2001) http://soils.usda.gov/survey/online_surveys/florida/dade/classify.html#Krome
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 5. PRZM 3.12 Crop Parameters for Dade County, Florida - Avocado

Parameter	Value	Source

Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Residues remain in field between tree rows, area under trees, approximately 3x3 feet, maintained residue free
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Miami, FL (w12839.dvf)
Maximum rainfall Interception storage of crop (CINTCP)	0.25	Maximum recommended value for orchards (EPA, 2001)
Maximum Active Root Depth (AMXDR)	70 cm	Set to soil horizon depth; roots may grow in excess of 70 cm. http://www.agweb.okstate.edu/pearl/hort/fruits/f6244.html
Maximum Canopy Coverage (COVMAX)	60	Based on estimates from aerial photography from Citrus scenario
Soil Surface Condition After Harvest (ICNAH)	3	Residues remain in field between tree rows, area under trees, approximately 3x3 feet, maintained residue free
Date of Crop Emergence (EMD, EMM, IYREM)	01/03	Emergence set to blooming season, Crane et. al., 2001, Cir. 1034 EDIS IAFS.UFL
Date of Crop Maturity (MAD, MAM, IYRMAT)	15/11	Maturity season Crane et. al., 2001, Cir. 1034 EDIS IAFS.UFL
Date of Crop Harvest (HAD, HAM, IYRHAR)	30/11	Harvest as fruit set to maturity Crane et. al., 2001, Cir. 1034 EDIS IAFS.UFL
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	66, 51, 59	Gleams Manual Table H-4,Meadow, conditions good for Hydrologic Soil A; Dade trees do not tolerate soils less than moderately drained. (USDA, 1990)
Manning’s N Value (MNGN)	0.014	RUSLE EPA Pesticide Project; UC0CCCCM; Tampa, FL; Citrus, Cover Code 3 (residues), Mowed (USDA, 2000)
USLE C Factor (USLEC)	0.178 - 0.273	RUSLE EPA Pesticide Project; UC0CCCCM; Tampa, FL; Citrus, Cover Code 3 (residues), Mowed (USDA, 2000)

Table 6. PRZM 3.12 Krome Soil Parameters for Dade County, Florida - Avocado

Parameter	Value	Verification Source
Total Soil Depth (CORED)	70 cm	NRCS, National Soils Characterization Database (NRCS, 2002)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	5 cm (HORIZN = 1) 35 cm (HORIZN = 2) 30 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2003) http://ssldata.nrcs.usda.gov/) Bulk density guesstimated from profile description; 0-4 cm is an Oi horizon, 4-36 is an Ap1 and 36 to 69 is Ap2 pedon # 97FL025001A and 97FL025001B. The three water content values for the Oi horizon are assumed to be the same a Ap1.
Bulk Density (BD)	1.00 g $\cdot cm^{-3}$ (HORIZN = 1)guessed 1.31 g $\cdot cm^{-3}$ (HORIZN = 2) 1.35 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content (THETO)	0.203 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.203 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2) 0.050 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN =2) 5 cm (HORIZN =3)	
Field Capacity (THEFC)	0.203 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.203 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2) 0.050 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.062 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.062 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.022 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	31.68% (HORIZN = 1) 1.57% (HORIZN = 2) 1.21% (HORIZN = 3)	

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FLORIDA CABBAGE (Vegetables)

The field used to represent cabbage (vegetable) production in Florida is located in Manatee County (accounting for approximately 18 percent of the states acreage). The principle production region is in Flagler and St. Johns Counties in the Northeastern region of the state, accounting for 50 percent of the acreage. Florida ranks fifth in the nation in fresh market cabbage production which is 100 percent of Florida's production. Approximately 7500 acres are harvested each year. Cabbage is a cool season crop best grown when temperatures do not exceed 25ºC. Cabbage and other truck crops are generally grown on "muck soils," but cabbage does as well on both mineral and sandy soils with pH around 6.5. Cabbage is planted by direct seeding and seedling transplant in Florida, with more than 90 percent by seedling transplant, especially on sandy soils. Typical planting distances are 20 to 40 (51 to 102 cm) inches between rows and 9 to 16 (23 to 41 cm) inches between plants in a row. Maximum density of plants is approximately 29,400 plants per acre. When crop is seeded in double rows in each bed, between row spacing is 15 to 24 inches (38 to 61 cm) and within row spacing is 10 to 12 inches (25 to 30 cm). Between bed spacing (double rows) is 40 to 60 inches (102 to 152 cm). Seeds are planted at a depth of 0.25 to 0.5 inches (0.6 to 1.3 cm). Maturity is reached in 85 to 110 days from seed planting and 70 to 90 days from transplant. Irrigation is used when necessary to maintain even moisture to prevent cracking of the cabbage heads. Seepage type irrigation is the most commonly used method. Harvest occurs between October 25 and June 15 with the most active period being January to mid-April. Fields are often laser-leveled and drainage controlled by a series of in-field laterals and perimeter canals. The soil selected to simulate the field is a Riviera sand. Riviera sand is a loamy, siliceous, active, hyperthermic Arenic Glossaqualfs. These soils are often used for truck crop and citrus production. Riviera sand is a deep, poorly drained, slow runoff, slowly to very slowly permeable soil that formed in stratified marine sandy and loamy sediments on the Lower Coastal Plain. These soil are generally found on broad, low flats and in depressions and have slopes generally less than 2 percent. The soil is of moderate extent. Riviera sand is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Manatee County, Florida - Cabbage

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Tampa, FL (W12842)
Ending Date	December 31, 1990	Meteorological File - Tampa, FL (W12842)
Pan Evaporation Factor (PFAC)	0.78	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.0 cm C^{-1}	No appreciable snow accumulation occurs in this part of Florida
Minimum Depth of Evaporation (ANETD)	25 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Manatee County, Florida - Cabbage		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.03 tons EI^{-1*}	PRZM Input Collator (Burns, 1992) and FARM Manual (EPA, 1985)
USLE LS Factor (USLELS)	0.20	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual Table 5.6 (EPA, 1998). FL vegetable crops are planted on level fields and on raised beds under plasticulture.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1%	Mid-point of soil series range (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Manatee County, Florida - Cabbage		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Fields are fallow prior to planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File -Tampa, FL (W12842)
Maximum rainfall Interception storage of crop (CINTCP)	0.25	PIC; confirmed using Table 5.4 from PRZM Manual (Burns, 1992 and EPA, 1985)
Maximum Active Root Depth (AMXDR)	12 cm	Florida Cucumber Crop Profile

Maximum Canopy Coverage (COVMAX)	80	Based on Aerial Photography; Field Visits as part of the Florida Fruit and Vegetable Tour
Soil Surface Condition After Harvest (ICNAH)	3	Plant residues are left behind until later in the year when tilled for next series of crops.
Date of Crop Emergence (EMD, EMM, IYREM)	16/10	Florida Cabbage Crop Profile, USDA
Date of Crop Maturity (MAD, MAM, IYRMAT)	08/02	Florida Cabbage Crop Profile, USDA
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/02	Florida Cabbage Crop Profile, USDA
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	91, 87, 88	Gleams Manual Table H-4, Fallow = SR poor, Cropping and Residue = Row Crop SR/poor (USDA, 1990)
Manning's N Value (MNGN)	0.011	RUSLE Project; UC0BGBGC; Green Beans, conventional tillage; Tampa, FL (USDA, 2000)
USLE C Factor (USLEC)	0.162 - 0.938	RUSLE Project; UC0BGBGC; Green Beans, conventional tillage; Tampa, FL, Variable with date (USDA, 2000)

Table 4. PRZM 3.12 Riviera Soil Parameters for Manatee County, Florida - Cabbage

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 62 cm (HORIZN = 2) 28 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.65 g $\cdot$cm^{-3} (HORIZN = 1,2) 1.7 g $\cdot$cm^{-3} (HORIZN = 3)	

Initial Water Content (THETO)	0.073 cm^3-H_2O ·cm^{-3}-soil (HORIZN =1,2) 0.211 cm^3-H_2O ·cm^{-3}-soil (HORIZN =3)	Ed Russell (USDA-NRCS, Fresno)
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 2 cm (HORIZN =2) 4 cm (HORIZN =3)	
Field Capacity (THEFC)	0.073 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.211 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.023 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.091 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.174% (HORIZN = 3)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. ***P**esticide and **I**ndustrial Chemical **R**isk Analysis and **H**azard **A**ssessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA. 1992.

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USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

FLORIDA CARROTS (Rooting and Tuberous Vegetables)

The field used to represent carrot (rooting and tuber vegetable) production in Florida is located in Palm Beach County in Southeast Florida near the Everglades Agricultural Area, although carrot production areas include other regions of Florida such as the central, northeast and north-central Florida. According to the 1997 Census of Agriculture, Florida ranks fourth nationally in the production of fresh market carrots; nearly all of Florida's production is for fresh market. Generally, around 7,000 acres are planted each year. Historically, carrot production occurred primarily on organic muck soils, but now occurs on inorganic, mineral-based soils. Mineral soils produce higher quality carrots. Winter and Spring crops are common. All carrots are planted by direct seeding in Florida. Typical planting occurs in rows of three groups at a distance of 1.5 inches (3.8 cm) between rows in the group and 12 inches (30 cm) between groups of 3 rows. In the southern part of the state, crops are planted in beds whereas in the northern part beds are seldom used. Seeds are planted at a depth of a quarter-inch. Approximately 2-4 pounds of seed are planted per acre and approximately 350,000 plants are produced per acre. Crops are planted between August 15 and February 15, with the most active planting season in August in central and north Florida and September in south Florida. Harvest occurs from November to mid-June with the most active between mid-December through May. Seventy percent of the crop is harvested from November to March. Between 90 and 165 days are required from seeding to maturation. All carrots in Florida are produced using irrigation to meet minimum growing requirement using several types of irrigation systems. Generally, 105 percent of ET is targeted during the most active growing season and will decrease to 75 percent of ET as harvest time approaches. Drip and overhead irrigation are mainly used. The soil selected to simulate the field is a Riviera sand. Riviera sand is a loamy, siliceous, active, hyperthermic Arenic Glossaqualfs. These soils are often used for truck crop and citrus production. Riviera sand is a deep, poorly drained, slow runoff, slowly to very slowly permeable soil that formed in stratified marine sandy and loamy sediments on the Lower Coastal Plain. These soil are generally found on broad, low flats and in depressions and have slopes generally less than 2 percent. The soil is of moderate extent. Riviera sand is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Palm Beach County, Florida - Carrots		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - West Palm Beach, Fl (W12844)
Ending Date	December 31, 1990	Meteorological File - West Palm Beach, Fl (W12844)
Pan Evaporation Factor (PFAC)	0.78	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.0 cm C^{-1}	No appreciable snow accumulation occurs in this part of Florida
Minimum Depth of Evaporation (ANETD)	32.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Palm Beach County, Florida - Carrots		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.03 tons EI^{-1*}	PRZM Input Collator (Burns, 1992) and FARM Manual (EPA, 1985)
USLE LS Factor (USLELS)	0.20	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual Table 5.6 (EPA, 1998). Much of FL vegetable crops are planted on level fields and on raised beds under plasticulture.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1%	Mid-point of soil series range (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Palm Beach County, Florida - Carrots		
Parameter	Value	Source

Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Field are fallow prior to planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - West Palm Beach, FL (W12844)
Maximum rainfall Interception storage of crop (CINTCP)	0.25	PIC; confirmed using Table 5.4 from PRZM Manual (Burns, 1992 and EPA, 1985)
Maximum Active Root Depth (AMXDR)	100 cm	Rooting depth of 4-4.8 feet is usual. Rooting depth set to max. soil profile depth http://www.soilandhealth.org/01aglibrary/010137veg.roots/010137ch22.html
Maximum Canopy Coverage (COVMAX)	30	Carrot canopy based on estimation from ground/aerial photography. http://edis.ifas.ufl.edu/BODY_CV120
Soil Surface Condition After Harvest (ICNAH)	3	Plant residues are left behind until later in the year when tilled for next series of crops.
Date of Crop Emergence (EMD, EMM, IYREM)	16/10	Florida Carrot Crop Profile, USDA - http://pestdata.ncsu.edu/cropprofiles/docs/Flcarrots.html or http://edis.ifas.ufl.edu/BODY_CV120
Date of Crop Maturity (MAD, MAM, IYRMAT)	15/01	Florida Carrot Crop Profile, USDA - http://pestdata.ncsu.edu/cropprofiles/docs/Flcarrots.html or http://edis.ifas.ufl.edu/BODY_CV120
Date of Crop Harvest (HAD, HAM, IYRHAR)	22/01	Florida Carrot Crop Profile, USDA - http://pestdata.ncsu.edu/cropprofiles/docs/Flcarrots.html or http://edis.ifas.ufl.edu/BODY_CV120
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	91, 87, 88	Gleams Manual Table H-4, Fallow = SR poor, Cropping and Residue = Row Crop SR/poor (USDA, 1990)
Manning’s N Value (MNGN)	0.011	RUSLE Project; UC0BGBGC; Green Beans, conventional tillage; Tampa, FL (USDA, 2000)
USLE C Factor (USLEC)	0.162 - 0.938	RUSLE Project; UC0BGBGC; Green Beans, conventional tillage; Tampa, FL, Variable with date (USDA, 2000)

Table 4. PRZM 3.12 Riviera Soil Parameters for Palm Beach County, Florida - Carrots

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 62 cm (HORIZN = 2) 28 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/) Ed Russell (USDA-NRCS, Fresno)
Bulk Density (BD)	1.65 g $\cdot cm^{-3}$ (HORIZN = 1,2) 1.7 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content (THETO)	0.073 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.211 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 2 cm (HORIZN =2) 4 cm (HORIZN =3)	
Field Capacity (THEFC)	0.073 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.211 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.023 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.091 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.174% (HORIZN = 3)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. *Pesticide and Industrial Chemical Risk Analysis and Hazard Assessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S.

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

FLORIDA CITRUS

The field used to represent citrus production in Florida is located in Collier or Hendry Counties in Southwest Florida, although citrus production areas cover a substantial portion of the state. Citrus production has been moving southward in an attempt to avoid frost damage that has occurred in recent years. According to the 1997 Census of Agriculture, Florida is the major producer of citrus (oranges) for the juice market and among the highest for the fresh market. Florida is also among the highest producers in other citrus (grapefruit, tangerines, tangelos, and mandarins). Citrus is generally grown in double rows of trees (beds) with swales between to move water off site. Areas under and between rows of trees are generally non-cultivated/non-maintained except for the occasional mowing. Row spacing (pairs or rows) is approximately 20 to 25 feet (paired beds may be less than 20 feet) and between tree spacing is approximately 12 to 15 feet. Row canopies tend to be 100 percent, while the canopy between rows is less to permit the operation of maintenance and harvest equipment. Irrigation is mostly by low-volume drip or micro-sprinkler systems. The soil selected to simulate the field is a Wabasso fine sand. Wabasso fine sand, is a sandy, siliceous, hyperthermic Alfic Alaquods. These soils are often used for citrus production and truck crops. Wabasso fine sand is a deep to very deep, poorly to very poorly drained, slow to ponded runoff, rapidly permeable in the top horizon and slow to very slowly permeable in the lower horizons soil that formed in sandy and loamy marine sediments. These soils are generally found on flatwoods, flood plains, and depressions and have slopes of 0 to 2 percent. The soil is extensive in Florida. Wabasso fine sand is a Hydrologic Group D soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Collier and Hendry Counties, Florida - Citrus

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - West Palm Beach, Fl (W12844)
Ending Date	December 31, 1990	Meteorological File - West Palm Beach, Fl (W12844)
Pan Evaporation Factor (PFAC)	0.78	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.0 cm C^{-1}	Does not snow in Southern Florida such that accumulation is expected
Minimum Depth of Evaporation (ANETD)	32.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Collier and Hendry Counties, Florida - Citrus		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.1 tons EI^{-1*}	GLEAMS Manual, table of Representative Soils (USDA, 1990)
USLE LS Factor (USLELS)	0.20	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	Assume no practice used under trees and between rows remain in vegetation and occasionally mowed.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1%	Mid-point of soil series range (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
Irrigation Flag (IRFLAG)	0	
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Collier and Hendry Counties, Florida - Citrus		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Set to represent fallow field. Citrus is an evergreen. Only areas between rows are vegetated. Conservative assumption is to set to fallow.
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Meteorological File - West Palm Beach, Fl (W12844)
Maximum rainfall interception storage of crop (CINTCP)	0.25	Maximum recommended value for orchards (EPA, 2001)
Maximum Active Root	100 cm	Set to maximum of soil profile. Trees may root from

Depth (AMXDR)		7-18 feet http://edis.ifas.ufl.edu Parameter value may be different than other citrus scenario due to different source.
Maximum Canopy Coverage (COVMAX)	60	http://edis.ifas.ufl.edu
Soil Surface Condition After Harvest (ICNAH)	3	Default, material under trees and between rows is generally left alone
Date of Crop Emergence (EMD, EMM, IYREM)	1/1	Value set to correspond to harvest date and allow for modeling of evergreen tree (i.e. continual maturity).
Date of Crop Maturity (MAD, MAM, IYRMAT)	2/1	Value set to correspond to harvest date and allow for modeling of evergreen tree (i.e. continual maturity).
Date of Crop Harvest (HAD, HAM, IYRHAR)	31/12	Date represents late season harvest http://edis.ifas.ufl.edu
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	87, 85, 86	Gleams Manual Table H-4, Meadows, no fallow conditions (USDA, 1990)
Manning’s N Value (MNGN)	0.014	RUSLE Project; UC0CBCBC; Citrus bare ground; conventional tillage; Tampa, FL (USDA, 2000)
USLE C Factor (USLEC)	0.324 - 0.488	RUSLE Project; Variable with date, UC0CBCBC; Citrus bare ground; conventional tillage; Tampa, FL (USDA, 2000)

Table 4. PRZM 3.12 Wabasso Soil Parameters for Collier and Hendry Counties, Florida - Citrus

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	2 (Base horizons)	
First and Second Soil Horizons (HORIZN = 1,2)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 90 cm (HORIZN = 2)	NRCS, National Soils Characterization Database (NRCS, 2001)
Bulk Density (BD)	1.45 g $\cdot$cm^{-3} (HORIZN = 1)	

	1.75 g $\cdot cm^{-3}$ (HORIZN = 2)	http://www.statlab.iastate.edu/soils/ssl/)
Initial Water Content (THETO)	0.066 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.178 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN = 2)	
Field Capacity (THEFC)	0.066 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.178 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2)	
Wilting Point (THEWP)	0.036 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.078 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2)	
Organic Carbon Content (OC)	2.32% (HORIZN = 1) 0.29% (HORIZN = 2)	

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1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

FLORIDA CUCUMBER (Vegetables)

The field used to represent cucumber (vegetable) production in Florida is located in Collier and Hendry Counties in Southwest Florida, although vegetable production areas include other regions of Florida such as the Everglades Agricultural Area, west-central and south-eastern regions. According to the 1997 Census of Agriculture, Florida is a major producer of truck crops and is the highest producer of cucumbers. Cucumbers and other truck crops are generally grown on “muck soils,” but cucumbers do as well on sandy soils which require less cleaning before marketing. All cucumbers are planted by direct seeding in Florida. Typical planting distances for slicing cucumbers are 48 to 60 inches between rows and 6 to 12 inches between plants. Pickling cucumbers are typically planted at 36 to 48 inches between rows and 2 to 4 inches between plants. When grown using plastic mulch, slicing cucumbers are planted in one or two rows per bed, with 10 to 18 inches between the rows on the bed, 48 to 72 inches between beds, and 8 to 12 inches between holes with one or two plants per hole. Pickling cucumbers are planted at a distance of 3 to 4 inches between plants. At the closest spacing, the plant population is 21,780 per acre. Seeds are planted at a depth of 0.5 to 0.75 inches. Between 35 and 65 days are required from seeding to
maturity (first pick). Cucumbers in Florida are produced using several types of irrigation systems. In mulched production, drip, overhead, and seepage irrigation are used. By raising the water table, seepage irrigation restricts root growth to the bed area. Water is maintained approximately 15 to 18 inches below the soil surface, allowing seepage into the root zone. The soil selected to simulate the field is a Riviera sand. Riviera sand is a loamy, siliceous, active, hyperthermic Arenic Glossaqualfs. These soils are often used for truck crop and citrus production. Riviera sand is a deep, poorly drained, slow runoff, slowly to very slowly permeable soil that formed in stratified marine sandy and loamy sediments on the Lower Coastal Plain. These soil are generally found on broad, low flats and in depressions and have slopes generally less than 2 percent. The soil is of moderate extent. Riviera sand is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Collier and Hendry Counties, Florida - Cucumber		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - West Palm Beach, Fl (W12844)
Ending Date	December 31, 1990	Meteorological File - West Palm Beach, Fl (W12844)
Pan Evaporation Factor (PFAC)	0.78	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.0 cm C^{-1}	No appreciable snow accumulation occurs in this part of Florida
Minimum Depth of Evaporation (ANETD)	32.5 cm	PRZM Manual Figure 5.2 (EPA, 1998); mid-point

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Collier and Hendry Counties, Florida - Cucumber		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.03 tons EI^{-1*}	PRZM Input Collator (Burns, 1992) and FARM Manual (EPA, 1985)
USLE LS Factor (USLELS)	0.20	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual Table 5.6 (EPA, 1998). FL vegetable crops are planted on level fields and on raised beds under plasticulture.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1%	Mid-point of soil series range (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)

* EI = 100 ft-tons * in/ acre*hr

Table 3. PRZM 3.12 Crop Parameters for Collier and Hendry Counties, Florida - Cucumber		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Field are fallow prior to planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data.
Maximum rainfall Interception storage of crop (CINTCP)	0.15	PIC; confirmed using Table 5.4 from PRZM Manual (Burns, 1992 and EPA, 1985)
Maximum Active Root Depth (AMXDR)	50 cm	Florida Cucumber Crop Profile, USDA
Maximum Canopy Coverage (COVMAX)	80	PIC (Burns, 1992), for cucumber.
Soil Surface Condition After Harvest (ICNAH)	3	Plant residues are left behind until later in the year when tilled for next series of crops; rarely cucumbers.
Date of Crop Emergence (EMD, EMM, IYREM)	16/10	Florida Cucumber Crop Profile, USDA http://pestdata.ncsu.edu/cropprofiles/cropprofiles.cfm
Date of Crop Maturity (MAD, MAM, IYRMAT)	05/12	Florida Cucumber Crop Profile, USDA http://pestdata.ncsu.edu/cropprofiles/cropprofiles.cfm
Date of Crop Harvest (HAD, HAM, IYRHAR)	10/12	Florida Cucumber Crop Profile, USDA http://pestdata.ncsu.edu/cropprofiles/cropprofiles.cfm
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	91, 87, 88	Gleams Manual Table H-4, Fallow = SR poor, Cropping and Residue = Row Crop SR/poor (USDA, 1990)
Manning’s N Value (MNGN)	0.011	RUSLE Project; UC0BGBGC; Green Beans, conventional tillage; Tampa, FL (USDA, 2000)
USLE C Factor (USLEC)	0.162 - 0.938	RUSLE Project; UC0BGBGC; Green Beans, conventional tillage; Tampa, FL, Variable with date (USDA, 2000)

Table 4. PRZM 3.12 Riviera Soil Parameters for Collier and Hendry Counties, Florida - Cucumber		
Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 62 cm (HORIZN = 2) 28 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/) Ed Russell (USDA-NRCS, Fresno)
Bulk Density (BD)	1.65 g $\cdot cm^{-3}$ (HORIZN = 1,2) 1.7 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content (THETO)	0.073 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.211 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 2 cm (HORIZN =2) 4 cm (HORIZN =3)	
Field Capacity (THEFC)	0.073 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.211 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.023 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.091 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.174% (HORIZN = 3)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. ***P**esticide and **I**ndustrial Chemical **R**isk Analysis and **H**azard **A**ssessment, Version 3.0.*

(PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA. 1992.

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

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EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

FLORIDA PEPPERS - BELL (Vegetables)

The field used to represent pepper (bell peppers) production in Florida is located in Collier and Hendry Counties in Southwest Florida, although vegetable production areas include other regions of Florida such as the Everglades Agricultural Area, west-central and south-eastern regions. According to the 1997 Census of Agriculture, Florida is a major producer of truck crops and is the highest producer of bell peppers. Peppers and other truck crops are generally grown on “muck soils,” but peppers do as well on sandy soils which require less cleaning before marketing. Peppers (bell peppers) are planted mainly by transplant, but some direct seeding in does occur in Florida. Typical planting distances for most peppers are 36 to 42 inches between rows and 12 to 16 inches between plants in a row. When grown using plastic mulch, which is a common practice in Florida, planting distances change very little. Peppers are generally harvested two or more times during the course of the growing season and in Southern Florida, where frost pressures are minimal, they are planted and harvested throughout the year. Peppers in Florida are produced using several types of irrigation systems. In mulched production, drip irrigation is highly recommended because of less water use, lower weed production, and some evidence of increased yields. Various forms of sprinkler irrigation may also be used. The soil selected to simulate the field is a Riviera sand. Riviera sand is a loamy, siliceous, active, hyperthermic Arenic Glossaqualfs. These soils are often used for truck crop and citrus production. Riviera sand is a deep, poorly drained, slow runoff, slowly to very slowly permeable soil that formed in stratified marine sandy and loamy sediments on the Lower Coastal Plain. These soil are generally found on broad, low flats and in depressions and have slopes generally less than 2 percent. The soil is of moderate extent. Riviera sand is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Collier and Hendry Counties, Florida - Bell Peppers

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - West Palm Beach, Fl (W12844)
Ending Date	December 31, 1990	Meteorological File - West Palm Beach, Fl (W12844)
Pan Evaporation Factor (PFAC)	0.78	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.0 cm C^{-1}	No appreciable snow accumulation occurs in this part of Florida
Minimum Depth of Evaporation (ANETD)	32.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Collier and Hendry Counties, Florida - Bell

Peppers		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.03 tons EI^{-1*}	PRZM Input Collator (Burns, 1992) and FARM Manual (EPA, 1985)
USLE LS Factor (USLELS)	0.20	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual Table 5.6 (EPA, 1998). FL vegetable crops are planted on level fields and on raised beds under plasticulture.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1%	Mid-point of soil series range (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Collier and Hendry Counties, Florida - Bell Peppers		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Field are fallow prior to planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - West Palm Beach, FL (W12844)
Maximum rainfall Interception storage of crop (CINTCP)	0.15	PIC; confirmed using Table 5.4 from PRZM Manual (Burns, 1992 and EPA, 1985)
Maximum Active Root Depth (AMXDR)	45 cm	http://www.ces.uga.edu/pubcd/b1027-w.html#Transplant
Maximum Canopy Coverage (COVMAX)	40	Based on estimates from aerial photography; specific to peppers, other vegetable crops will require a

		different value
Soil Surface Condition After Harvest (ICNAH)	3	Plant residues are left behind until later in the year when tilled for next series of crops
Date of Crop Emergence (EMD, EMM, IYREM)	01/09	Florida Peppers (Bell) Crop Profile, USDA, http://pestdata.ncsu.edu/cropprofiles/docs/FLpeppers-bell.html
Date of Crop Maturity (MAD, MAM, IYRMAT)	15/11	http://edis.ifas.ufl.edu/BODY_CV130#TABLE_2
Date of Crop Harvest (HAD, HAM, IYRHAR)	01/12	Florida Peppers (Bell) Crop Profile, USDA, http://pestdata.ncsu.edu/cropprofiles/docs/FLpeppers-bell.html
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	91, 87, 88	Gleams Manual Table H-4, Fallow = SR poor, Cropping and Residue = Row Crop SR/poor (USDA, 1990)
Manning’s N Value (MNGN)	0.011	RUSLE Project; UC0BGBGC; Green Beans, conventional tillage; Tampa, FL (USDA, 2000)
USLE C Factor (USLEC)	0.162 - 0.938	RUSLE Project; UC0BGBGC; Green Beans, conventional tillage; Tampa, FL, Variable with date (USDA, 2000)

Table 4. PRZM 3.12 Riviera Soil Parameters for Collier and Hendry Counties, Florida - Bell Peppers

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 62 cm (HORIZN = 2) 28 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.65 g $\cdot$cm^{-3} (HORIZN = 1,2) 1.7 g $\cdot$cm^{-3} (HORIZN = 3)	

Initial Water Content (THETO)	0.073 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.211 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	Ed Russell (USDA-NRCS, Fresno)
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 2 cm (HORIZN =2) 4 cm (HORIZN =3)	
Field Capacity (THEFC)	0.073 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.211 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.023 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.091 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.174% (HORIZN = 3)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. ***P**esticide and **I**ndustrial Chemical **R**isk Analysis and **H**azard **A**ssessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA. 1992.

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

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EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001;

Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

FLORIDA STRAWBERRIES

The field used to represent strawberry production in Florida is located in Hillsborough or Manatee Counties on the west coast of Central Florida near Tampa Bay where 95 percent of Florida's crop is produced and the weather station representing the field's weather is located in Tampa. The other major strawberry production area occurs in southeastern Florida. According to 2000 production statistics and the 1997 Census of Agriculture, Florida ranks second behind California in the production of strawberries; nearly all of Florida's production is for fresh market. Florida produces 100 percent of the domestically produced winter crop. Generally, around 6,300 acres are planted each year in Florida. Historically, strawberry production occurres primarily on inorganic, mineral-based soils. Mineral soils produce higher quality strawberries than organic muck soils. Nearly all strawberries are planted by transplant in Florida. Typical planting occurs on raised beds using full-bed plastic mulch with 2 to 4 rows of plants per bed; tow to three being most common. Plastic mulch is essential for successful maximization of production. The crop scenario does not take into account the impact plastic mulch systems may have on runoff from natural rainfall or sprinkler irrigation; plastic mulch will not impact runoff in drip irrigation systems. Ongoing research by the U.S. Department of Agriculture and pesticide registrants may result in modification to this scenario in the future. Distance between rows of plants range from 12 to 14 inches for 2-row beds to 10 to 12 inches for 3-row beds. Distance between plans in a row runs 8 to 14 inches. Distance between beds range from 48 to 60 inches between 2-row beds to 60 to 84 inches between 3-row beds. Between 15,000 and 25,000 plants are planted per acre in 2-row systems and 20,000 to 30,000 plants per acre in 3-row systems. Crops are planted between October 7 and November 1 in Central Florida and from October 1 to December 1 in South Florida. First crop appears 30 to 60 days following planting under optimal weather conditions. Up to four crops per plant each season is possible. Each subsequent crop takes approximately 30 days to set; flowers which eventually bear the next fruit appear continuously from shortly after planting until the end of harvest. First harvest occurs from November thru December with final harvest occurring sometime in late March or early April; depending on initial planting. All strawberries in Florida are produced using irrigation to meet minimum growing requirement by either overhead (for plant establishment and freeze protection) or drip irrigation systems (for watering and fertilizing). Generally, water requirements depends on the soil and the needs of the plants. Maintaining 100 percent of evapotranspiration (ET) needs is targeted during the most active growing season and irrigation will normally be triggered when available soil moisture is between 66 and 85 percent. The current scenario is set to add irrigation water at 66 percent which maximizes available runoff water. The soil selected to simulate the field is a Myakka sand. Myakka sand is a sandy, siliceous, hyperthermic Aeric Alaquods. These soils, with proper draining, are often used for truck crops and citrus production and are important soils in strawberry production. Myakka sands consists of deep to very deep, poorly to very poorly drained soils with slow internal drainage. These soils are known to have high water tables (i.e., 18 inches below surface for 1 to 4 months). Runoff is slow to ponded, internal permeability is rapid in the A and E horizon and moderate to moderately rapid in the Bh horizon. These soils formed in sandy marine deposits and are located on flatwoods, high tidal areas, flood plains, depressions, and gently sloping to sloping barrier islands with slopes ranging from 0 to 8 percent. The soil is of large extent as is classified as a benchmark soil. Myakka sand is a Hydrologic Group D soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Hillsborough County, Florida - Strawberries		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Tampa, Fl (W12842)
Ending Date	December 31, 1990	Meteorological File - Tampa, Fl (W12842)
Pan Evaporation Factor (PFAC)	0.77	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.0 cm C^{-1}	No appreciable snow accumulation occurs in this part of Florida
Minimum Depth of Evaporation (ANETD)	25.0 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Hillsborough County, Florida - Strawberries		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.1 tons EI^{-1*}	GLEAMS Manual; Table of Representative Soils (USDA, 1990)
USLE LS Factor (USLELS)	0.69	Calculated according to Haan and Barfield (1978) equation: $LS = ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.4 (EPA 2004).
USLE P Factor (USLEP)	0.5	PRZM Manual (EPA, 1998). Strawberries in Florida are grown in rows on raised beds lined with plastic mulch for best performance; http://pestdata.ncsu.edu/cropprofiles/docs/Flstrawberries.html
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	4%	Midpoint of soil series range (0-8%) (EPA 2004)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
Irrigation Flag (IRFLAG)	2 (cropping period only)	AE 260, Irrigation Management, Table 2. Irrigation demands during mid-season to final growth will range 70-85% ET0
Irrigation Type (IRTYP)	4 (Drip Irrigation)	Alicia Whidden, County Extension Agent, University of Florida, Institute of Food and Agricultural Sciences, Extension Service Hillsborough County, 813-744-5519 (ext.134). Email: ajwhidden@mail.ifas.ufl.edu
Leaching Factor	0	Irrigation Guidance for developing PRZM Scenario, Table 3

(FLEACH)		(June 15, 2005); for Drip Irrigation
Fraction of Water Capacity when Irrigation is Applied (PCDEPL)	0.66	http://edis.ifas.ufl.edu/BODY_AE075
Maximum Rate at which Irrigation is Applied (RATEAP)	0.026 cm hr^{-1}	Irrigation Guidance for developing PRZM Scenario, Table 1 (June 15, 2005). For CN = 89 and f = 0
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Hillsborough County, Florida - Strawberries

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Fields are prepared each growing season into raised beds following laser-leveling. http://pestdata.ncsu.edu/cropprofiles/docs/Flstrawberries.html
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Tampa, FL (W12842)
Maximum rainfall Interception storage of crop (CINTCP)	0.1	PIC; confirmed using Table 5.4 from PRZM Manual (Burns, 1992 and EPA, 1985)
Maximum Active Root Depth (AMXDR)	30 cm	http://edis.ifas.ufl.edu
Maximum Canopy Coverage (COVMAX)	40	Canopy based on estimation from ground/aerial photography. http://edis.ifas.ufl.edu/
Soil Surface Condition After Harvest (ICNAH)	3	Plant residues are left behind until later in the year when tilled for next series of crops.
Date of Crop Emergence (EMD, EMM, IYREM)	01/10	First crop. Florida Strawberry Profile, USDA - http://pestdata.ncsu.edu/cropprofiles/docs/Flstrawberries.html or http://edis.ifas.ufl.edu/ Dates set for first crop. Florida strawberry fields may set 3-4 crops per growing season at approximately 30 day intervals following first set, which occurs approximately 4-6 weeks following transplant. Nearly all Florida strawberries are grown from transplant.
Date of Crop Maturity (MAD, MAM, IYRMAT)	10/11	First crop. Florida Strawberry Profile, USDA - http://pestdata.ncsu.edu/cropprofiles/docs/Flstrawberries.html or http://edis.ifas.ufl.edu/
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/02	Last crop. Florida Strawberry Profile, USDA - http://pestdata.ncsu.edu/cropprofiles/docs/Flstrawberries.html or http://edis.ifas.ufl.edu/ Date set to final crop assuming 4 crops to allow irrigation water to be applied during all 4 crops in a growing season.

Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	92, 89, 90	GLEAMS Manual Table H-4; Fallow = SR Conservation Tillage/poor, Cropping and Residue = Row Crop SR Conservation tillage/poor; Curve number do not compensate for plastic mulch.(USDA, 1990)
Manning's N Value (MNGN)	0.023	RUSLE EPA Pesticide Project: Uc0STSTN Strawberry, Tampa, Fl. No-till. Cover Code 5: light cover, residues over soil surface during critical period
USLE C Factor (USLEC)	0.017 - 0.326	RUSLE EPA Pesticide Project: Uc0STSTN Strawberry, Tampa, Fl. No-till. Cover Code 5: light cover, residues over soil surface during critical period

Table 4. PRZM 3.12 Myakka Soil Parameters for Hillsborough County, Florida - Strawberries

Parameter	Value	Verification Source
Total Soil Depth (CORED)	150 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	15 cm (HORIZN = 1) 75 cm (HORIZN = 2) 60 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) [http://www.statlab.iastate.edu/soils/ssl/)](http://www.statlab.iastate.edu/soils/ssl/) Ed Russell (USDA-NRCS, Fresno)
Bulk Density (BD)	1.25 g $\cdot cm^{-3}$ (HORIZN = 1) 1.45 g $\cdot cm^{-3}$ (HORIZN = 2) 1.48 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content (THETO)	0.251 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.267 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2) 0.133 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN =2,3)	
Field Capacity (THEFC)	0.251 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.267 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2) 0.133 cm^3-H_2O $\cdot cm^{-3}$-soil	

	(HORIZN = 3)	
Wilting Point (THEWP)	0.101 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.067 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2) 0.033 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1) 0.116% (HORIZN = 2) 0.058% (HORIZN = 3)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. ***P**esticide and **I**ndustrial Chemical **R**isk Analysis and **H**azard **A**ssessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA. 1992.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

EPA. 2001. Abel, S.A. Procedure for Conducting Quality Assurance and Quality Control of Existing and New PRZM Field and Orchard Crop Standard Scenarios. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

FLORIDA SUGARCANE

The field used to represent sugarcane production in Florida is located in Hendry County in Southwest Florida, although sugarcane production areas cover an area extending east to the Everglades Agricultural Area. According to the 1997 Census of Agriculture, Florida is the major producer (yield) of sugarcane. Most sugarcane is grown on high organic “muck” soils; approximately 10 percent is grown on mineral soils. Sugarcane is grown on laser-leveled fields by placing short seed “stalks” horizontally in the prepared field. Sugarcane is produced in a three to four year cycle with the first year planting referred to as the “plant cane” crop and successive years referred to as “stubble” or “ratoon” crops which are harvested from regrowth. Yields diminish with each successive crop. At the end of the third or fourth year, sugarcane is rotated to another crop before replanting. Row spacing is approximately 60 inches. Irrigation, when needed, may be accomplished by raising the ground water level through the use of “lateral” drainage systems controlled by locks and spaced from 100 feet to 300 feet apart. The soil selected to simulate the field is a Wabasso fine sand. Wabasso fine sand, is a sandy, siliceous, hyperthermic Alfic Alaquods. These soils are used for sugarcane production, but mainly citrus production and truck crops. Wabasso fine sand is a deep to very deep, poorly to very poorly drained, slow to ponded runoff, rapidly permeable in the top horizon and slow to very slowly permeable in the lower horizons soil that formed in sandy and loamy marine sediments. These soil are generally found on flatwoods, flood plains, and depressions and have slopes of 0 to 2 percent. The soil is extensive in Florida. Wabasso fine sand is a Hydrologic Group D soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Hendry County, Florida - Sugarcane

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - West Palm Beach, FL (W12844)
Ending Date	December 31, 1990	Meteorological File - West Palm Beach, FL (W12844)
Pan Evaporation Factor (PFAC)	0.78	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.0 cm C^{-1}	Does not snow in Southern Florida such that accumulation is expected
Minimum Depth of Evaporation (ANETD)	32.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Hendry County, Florida - Sugarcane

Parameter	Value	Source
Method to Calculate		

Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.1 tons EI^{-1*}	GLEAMS Manual, table of Representative Soils (USDA, 1990)
USLE LS Factor (USLELS)	0.20	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	Assume no conservation practice used; fields are laser leveled.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1%	Mid-point of soil series range (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Hendry County, Florida - Sugarcane

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Set to represent fallow field
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - West Palm Beach, FL (W12844)
Maximum rainfall interception storage of crop (CINTCP)	0.1	Set similar to LA Sugarcane; PIC (Burns, 1998). Sugarcane is a grass. No PIC value for FL Sugarcane.
Maximum Active Root Depth (AMXDR)	100 cm	Set similar to LA Sugarcane; PIC (Burns, 1998). No PIC value for FL Sugarcane.
Maximum Canopy Coverage (COVMAX)	100	Set to default for row crops (EPA, 2001)
Soil Surface Condition After Harvest (ICNAH)	3	Default for sugarcane while under 3-4 yr cycle. After cycle, rotate to new crop..
Date of Crop Emergence	01/01	typically planted August thru January, See Sugarcane

(EMD, EMM, IYREM)		Handbook http://edis.ifas.ufl.edu/
Date of Crop Maturity (MAD, MAM, IYRMAT)	02/01	typically harvested October thru March, See Sugarcane Handbook http://edis.ifas.ufl.edu/
Date of Crop Harvest (HAD, HAM, IYRHAR)	31/12	dates were chosen such that cycle would remain in a single calendar year and still remain within the typical range. See Sugarcane Handbook http://edis.ifas.ufl.edu/
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	94, 91, 92	Gleams Manual Table H-4, Fallow = SR/poor; Cropping and Residue = Row Crop, SR/poor condition (USDA, 1990)
Manning's N Value (MNGN)	0.014	RUSLE Project; UC0SCSCC; Sugarcane, conventional tillage, Tampa (USDA, 2000)
USLE C Factor (USLEC)	0.194 - 0.717	RUSLE Project; Variable with date, UC0SCSCC; Sugarcane, conventional tillage, Tampa (USDA, 2000)

Table 4. PRZM 3.12 Wabasso Soil Parameters for Hendry County, Florida - Sugarcane

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	2 (Base horizons)	
First and Second Soil Horizons (HORIZN = 1,2)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 90 cm (HORIZN = 2)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.45 g $\cdot cm^{-3}$ (HORIZN = 1) 1.75 g $\cdot cm^{-3}$ (HORIZN = 2)	
Initial Water Content (THETO)	0.066 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.178 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN = 2)	

Field Capacity (THEFC)	0.066 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.178 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2)	
Wilting Point (THEWP)	0.036 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.078 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2)	
Organic Carbon Content (OC)	2.32% (HORIZN = 1) 0.29% (HORIZN = 2)	

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

EPA. 2001. Abel, S.A. Procedure for Conducting Quality Assurance and Quality Control of Existing and New PRZM Field and Orchard Crop Standard Scenarios. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

FLORIDA TOMATO (Vegetables)

The field used to represent tomato (vegetable) production in Florida is located in Manatee (#1 producing Florida county), Collier and Lee Counties in Southwest Florida (MLRA 156A), although tomato production areas include other regions of Florida such as the Everglades Agricultural Area and west-central and south-eastern regions. According to the 1997 Census of Agriculture, Florida is the major producer of truck crops and is the highest producer of fresh market tomatoes in the U.S. Tomatoes and other truck crops are generally grown on “muck soils,” but tomatoes do as well on sandy soils. Tomatoes are planted by direct seeding and seedling transplant in Florida, with more than half by seedling transplant. Typical planting distances are 48 to 72 inches between rows (72 inches being the most common) and 12 to 24 inches between plants in a row (18 inches being the most common). Maximum density of plants is approximately 4840 plants per acre. Fields are often laser-leveled and drainage controlled by a series of in-field laterals and perimeter canals. Stakes, approximately 4 feet in length, are place between two plants, 2-3 weeks after transplanting. Tomato plants are pruned during the growing season to optimize fruit production. Nearly all of the State’s tomato crop is grown on plastic mulched, raised beds, using stake culture and drip or seep irrigation. Nearly all tomatoes grown in Florida receive supplemental irrigation during the growing season. The most active harvest period is from November through June. The soil selected to simulate the field is a Riviera sand. Riviera sand is a loamy, siliceous, active, hyperthermic Arenic Glossaqualfs. These soils are often used for truck crop and citrus production. Riviera sand is a deep, poorly drained, slow runoff, slowly to very slowly permeable soil that formed in stratified marine sandy and loamy sediments on the Lower Coastal Plain. These soil are generally found on broad, low flats and in depressions and have slopes generally less than 2 percent. The soil is of moderate extent. Riviera sand is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Manatee, Collier and Lee Counties, Florida - Tomato

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - West Palm Beach, FL (W12844)
Ending Date	December 31, 1990	Meteorological File - West Palm Beach, FL (W12844)
Pan Evaporation Factor (PFAC)	0.78	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.0 cm C^{-1}	No appreciable snow accumulation occurs in this part of Florida
Minimum Depth of Evaporation (ANETD)	32.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Manatee, Collier and Lee Counties, Florida - Tomato		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.03 tons EI^{-1*}	PRZM Input Collator (Burns, 1992) and FARM Manual (EPA, 1985)
USLE LS Factor (USLELS)	0.20	Calculated according to Haan and Barfield (1978) equation: $LS = ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual Table 5.6 (EPA, 1998). FL vegetable crops are planted on level fields and on raised beds under plasticulture.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1%	Mid-point of soil series range (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Manatee, Collier and Lee Counties, Florida - Tomato		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Field are fallow prior to planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - West Palm Beach, FL (W12844)
Maximum rainfall Interception storage of crop (CINTCP)	0.1	PIC; confirmed using Table 5.4 from PRZM Manual (Burns, 1992 and EPA, 1985)
Maximum Active Root Depth (AMXDR)	30 cm	Phillis Gilreath, Manatee County Extension Agent Phone: 941-722-4524, Date: 2/3/2006 Roots grow in top 10-12" of soil. Parameter value may be inconsistent with different tomato scenarios due to different sources.

Maximum Canopy Coverage (COVMAX)	40	Phillis Gilreath, Manatee County Extension Agent Phone: 941-722-4524, Date: 2/3/2006 This varies based on row spacing. Parameter value may be inconsistent with different tomato scenarios due to different sources.
Soil Surface Condition After Harvest (ICNAH)	3	Phillis Gilreath, Manatee County Extension Agent Phone: 941-722-4524, Date: 2/3/2006 After harvest, plants are disced into soil.
Date of Crop Emergence (EMD, EMM, IYREM)	01/02	Phillis Gilreath, Manatee County Extension Agent Phone: 941-722-4524, Date: 2/3/2006 There are two crops: spring and fall. They are grown on different fields due to overlap. This models the spring crop. Emergence is from end of January to the 1st week in March. The peak occurs early February. Harvest is from late April to early June.
Date of Crop Maturity (MAD, MAM, IYRMAT)	21/04	
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/05	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	91, 87, 88	Gleams Manual Table H-4, Fallow = SR poor, Cropping and Residue = Row Crop SR/poor (USDA, 1990)
Manning's N Value (MNGN)	0.011	RUSLE Project; UC0BGBGC; Green Beans, conventional tillage; Tampa, FL (USDA, 2000)
USLE C Factor (USLEC)	0.162 - 0.938	RUSLE Project; UC0BGBGC; Green Beans, conventional tillage; Tampa, FL, Variable with date (USDA, 2000)

Table 4. PRZM 3.12 Riviera Soil Parameters for Manatee, Collier and Lee Counties, Florida - Tomato

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 62 cm (HORIZN = 2) 28 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001)

Bulk Density (BD)	1.65 g $\cdot cm^{-3}$ (HORIZN = 1,2) 1.7 g $\cdot cm^{-3}$ (HORIZN = 3)	http://www.statlab.iastate.edu/soils/ssl/) Ed Russell (USDA-NRCS, Fresno)
Initial Water Content (THETO)	0.073 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.211 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 2 cm (HORIZN =2) 4 cm (HORIZN =3)	
Field Capacity (THEFC)	0.073 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.211 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.023 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.091 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.174% (HORIZN = 3)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. ***P**esticide and **I**ndustrial Chemical **R**isk Analysis and **H**azard **A**ssessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA. 1992.

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Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

FLORIDA TURF

The field used to represent turf grass in Florida is located in Osceola County within MLRA 155, although turf grasses (golf courses, sod farms, etc.) are located throughout the state. This turf scenario is considered to be essentially generic, with no distinction made between sod farms, golf course fairways, greens and tees, or residential lawns. For pesticides applied to golf courses, the fraction of the total area composed of greens, tees, and fairways may, however be used to modify the results of a modeling run, somewhat in the fashion of a percent cropped area (PCA) adjustment. The approximate average percent areas (confirmed by Mike Kenna, USGA, personal communication) are as follows: fairways, 23%; greens, 2%; tees, 2%. Thus if a pesticide is only used on greens and tees, for example, the modeling results would be multiplied by a factor of 0.04. It is possible that current PCA development efforts may produce PCAs for golf courses, turf farms, and/or residential lawns that may also be used to refine the results of modeling runs.

To develop a turf scenario the soil was modified by adding a 2 cm thick layer of Athatch@ on top of the soil profile. The thatch layer has the following properties: bulk density = 0.37; field capacity = 0.47; wilting point = 0.27; organic carbon = 7.5%. Curve numbers were selected based on Agood condition@ open space areas as specified in TR-55, that is for hydrologic soil groups C. A 2 cm layer of thatch is typical for golf course fairways, but is probably thicker than average for golf course greens.

Sod Production. Sod may be grown on most soil types in Florida, however, soils with drainage problems must be mechanically altered to breakup hardpans or provide subsurface drainage to prevent prolonged periods of saturation. Soils with very high sand content and very rapid drainage such as sand-dune-type sands are not recommended due to their poor water holding capacity and difficulty maintaining adequate nutrient levels. Where necessary, irrigation systems are installed before operation of a sod farm begins. Fields are generally laser-leveled before planting to allow for uniform harvesting of sod by the “cutter blade.” Small hills and valleys can be accommodated by the cutter blade, but irregularities in the field left by poor maintenance will reduce yield. Irrigation is generally necessary for successful production. Nearly all forms of irrigation are used in sod production except “flood” irrigation. Many turfgrass species are grown in Florida. Among these are *bahiagrass*, *St. Augustinegrass, bermudagrass, zoysiagrass,* and *centipedegrass,* Depending on the type of grass, seed, sprigs, plugs or sod are used to establish the field. Specific information on each cultivar can be found at http://edis.ifas.ufl.edu/BODY_LH066 . Harvesting occurs year round. The soil selected to simulate turf grass is an Adamsville sand, a hyperthermic, uncoated Aquic Quartzipsamment. The Adamsville sand is a somewhat poorly drained, rapidly permeable soil that formed in thick sandy marine sediments occurring in Central and Southern Florida on slopes of 0-5 percent. Adamsville sand ranges from a Hydrologic Group A soil to a Hydrologic Group C soil, depending on the water table. For the purpose of this modeling, EFED used the curve number~~s~~ from the PIC of the Adamsville sand as a Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Osceola County, Florida - Turf		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Daytona Beach, FL (W12834)
Ending Date	December 31, 1990	Meteorological File -Daytona Beach, FL (W12834)
Pan Evaporation Factor (PFAC)	0.78	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.0 cm C^{-1}	Does not snow in Southern Florida such that accumulation is expected
Minimum Depth of Evaporation (ANETD)	25.0 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Osceola County, Florida - Turf		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.04 tons EI^{-1*}	PRZM Input Collator (Burns, 1992) and FARM Manual Table 3.1 (EPA, 1985). Soil has low OM content. Set to mid-value between <0.0 and 1.2%
USLE LS Factor (USLELS)	0.30	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	No practice used on turf other than regular mowing
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	2%	Official Soil Description Database. Mid-point of soil series range
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Osceola County, Florida - Turf		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Turf in continuous cultivation
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Daytona Beach, FL (W12834)
Maximum rainfall interception storage of crop (CINTCP)	0.1	For water management and protection of fungal diseases, value set to less than the minimum value for small grains
Maximum Active Root Depth (AMXDR)	10 cm	Recommendation on consultation with Mike Davy, Plant Biologist, OPP/EFED (2001)
Maximum Canopy Coverage (COVMAX)	100	http://edis.ifas.ufl.edu
Soil Surface Condition After Harvest (ICNAH)	3	Default
Date of Crop Emergence (EMD, EMM, IYREM)	01/02	Arbitrarily set to date when grass is likely to green after overwintering. Note: does not indicate grass will not grow during period from harvest to emergence the following year.
Date of Crop Maturity (MAD, MAM, IYRMAT)	15/02	Set to date when first cutting likely
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/12	Set arbitrarily to date when grass begins to overwinter. Note: does not indicate further cuttings will not occur between harvest and emergence the following year.
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
Maximum Height of Crop (HTMAX)	5.0 cm	Based on average height of grass over sod farms, golf courses and residential lawns. Greens and tees may be lower.
SCS Curve Number (CN)	74, 74, 74	Gleams Manual Table H-4, Hydrologic group C good condition, open space (USDA, 1990). Runoff curve numbers selected in accordance w. draft EFED turf group proposal; same number year round, since no cropping season
Manning’s N Value (MNGN)	0.023	RUSLE Project; UC0STSCN; Strawberry, no tillage; Tampa, FL (USDA, 2000). Use because ground coverage code is most representative of surface roughness and cover for turf.

USLE C Factor (USLEC)	0.017 - 0.326	RUSLE Project; UC0STSCN; Strawberry, no tillage; Tampa, FL (USDA, 2000). Use because ground coverage code is most representative of surface roughness and cover for turf.

Table 4. PRZM 3.12 Adamsville Soil Parameters for Osceola County, Florida - Turf

Parameter	Value	Verification Source
Total Soil Depth (CORED)	102 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4 (Top horizon split in two and thatch layer added)	
First, Second, Third, and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	2 cm (HORIZN = 1) 10 cm (HORIZN = 2,3) 80 cm (HORIZN = 4)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/) To develop a turf scenario the soil was modified by adding a 2 cm thick layer of thatch on top of the soil profile.
Bulk Density (BD)	0.37 g $\cdot cm^{-3}$ (HORIZN = 1) 1.44 g $\cdot cm^{-3}$ (HORIZN = 2,3) 1.58 g $\cdot cm^{-3}$ (HORIZN = 4)	
Initial Water Content (THETO)	0.47 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.086 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2,3) 0.03 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN =2) 5 cm (HORIZN =3) 5 cm (HORIZN = 4)	
Field Capacity (THEFC)	0.47 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.086 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2,3) 0.03 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4)	
Wilting Point (THEWP)	0.27 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1)	

	0.036 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 2,3) 0.023 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Organic Carbon Content (OC)	7.5% (HORIZN = 1) 0.58% (HORIZN =2,3) 0.116% (HORIZN =4)	

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GEORGIA ONION

The field used to represent Vidalia or Sweet Onion production in Georgia is located in Toombs County in Southeastern Georgia. Vidalia Onion can only be legally grown in Southeastern Georgia, in the counties of: Appling, Bacon, Jeff Davis, Montgomery, Tattnall, Telfair,Toombs, Truetlen and Wheeler, and in parts of Dodge, Jenkins, Laurens, Long, Pierce, Screven, and Wayne Counties (Federal Market Order 955) .

Toombs County, Georgia is representative of the Vidalia onion growing region of Southeastern Georgia. Toombs County is located in the Southern Coastal Plain (MLRA 133A) as are many of the Vidalia Onion growing counties. However some of these counties (i.e., Bacon, Wayne) also extend into Atlantic Coastal Flatwoods (MLRA 153A).

According to the 1999-2001 (NASS, http://www.usda.gov/nass/pubs/agr02/02_ch4.pdf) Georgia is a major producer of onions. Vidalia onions are typically planted from mid-September (Sept. 20) through mid-October (Oct. 20) and harvesting begins in mid-June (June 15). Onions are cool season, biennial plants that are commercially grown as an annual. Most onions are direct seeded, but transplants are used in some fall planted fields for an earlier harvest of short-day and intermediate-day varieties and to achieve uniform , jumbo-sized bulbs. Seeds are planted into 6 foot wide raised beds, with a 4- to 6-inch within row spacing and 10- to 18-inch spacing between rows (Granberry and Kelly, 2000). Distribution of rows across beds varies depending on irrigation method and planter. All commercial grown onions in Georgia are irrigated (Harrison, 2001). Irrigation should be light and frequent until the onion plants are established. The onion has a shallow root system, with most of the roots in the top 12 inches of soil. Onions continue to grow new roots (3 to 4 per week) throughout the entire growing season. Maintaining proper soil moisture in the upper 3 to 4 inches of the soil is critical for continuous root growth and for supplying the needs of the foliage and bulb. Depending upon soil type, temperature, wind velocity and rainfall, 0.10 to 0.25 inches of irrigation may be required daily. Boyhan et al. (1999) and Granberry and Kelley (2000) provide more specific information concerning the irrigation of onions in Georgia). Between 10 and 12 inches of irrigation water were reportedly applied vegetable crops in Georgia, during the year 2000 (Harrison, 2001). Almost all onions in Georgia are sprinkler-irrigated. The over-canopy irrigation routine (IRTYP 3) is used in this PRZM scenario. The ideal range for soil moisture is between 5 and 30 centibars. Readings above 30 centibars indicates the soil is becoming dry and irrigation should be applied (Harrison, 2001).

Onions can be grown on a wide range of soils. The soil selected to represent the field is Clarendon. Clarendon loamy sand is a fine-loamy, siliceous, semiactive, thermic Plinthaquic Paleudults. These soils are often used for growing tobacco, cotton, corn, soybeans, small grain, and pasture grasses. Forested areas are mostly pine with scattered hardwoods. The Clarendon series consists of very deep, moderately well drained, slow runoff, loamy soils that formed in marine sediments. The Clarendon loamy sand has moderately slow permeability. Slopes range from 0 to 6 percent. The soil extends along the Coastal Plain of Alabama, Florida, Georgia, and South Carolina. The series is of large extent in MLRA 133A and 153A. Clarendon loamy sand is a Hydrologic Group C soil. The Clarendon soil was selected, because it is geographically associated with the competing soil Tifton loamy sand (Hydrologic Group B) which is also a suitable onion soil. Granberry and Kelley, (2000) indicated that Tifton soils are found in the Vidalia onion growing area and is well suited for onion production. The use and vegetation between the two series are similar.

Metfile: W03822.dvf (Savannah, GA)

Table 1. PRZM 3.12 Climate and Time Parameters for Southeastern Georgia - Onions

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Savannah, GA (W03822)
Ending Date	December 31, 1990	Meteorological File - Savannah, GA (W03822)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	25 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Southeastern Georgia - Onions

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.1 tons EI^{-1*}	PRZM Manual Table 5.3 (EPA, 1998); FARM Manual (EPA, 1985)
USLE LS Factor (USLELS)	0.43	Calculated according to Haan and Barfield (1978) equation: $LS = ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	0.5	PRZM Manual (EPA, 1998)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	3%	Mid-point of the Soil Series, Clarendon Loamy Sand
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)

Irrigation Flag (IRFLAG)	2	Irrigate during cropping period (Harrison 2001) Harrison, 2001. Irrigating Sweet Onions in Georgia. In: (ed.) G. Boyhan et al. Onion Production Guide Bulletin 1198 University of Georgia. Granberry and Kelley, 2000. Dry Bulb Onions, Circular 801 Coop. Exten. Service, University of Georgia
Irrigation Type (IRTYP)	3	Over canopy Harrison, 2001. Irrigating Sweet Onions in Georgia. In: (ED.) G. Boyhan et al. Onion Production Guide. Bulletin 1198 University of Georgia. Granberry and Kelley, 2000. Dry Bulb Onions, Circular 801 Coop. Exten. Service, University of Georgia
Leaching Factor (FLEACH)	0.1	Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005).
Fraction of water capacity to apply irrigation (PCDEPL)	0.55	Harrison, 2001. Irrigating Sweet Onions in Georgia. In: (ED.) G. Boyhan et al. Onion Production Guide. Bulletin 1198 University of Georgia. Irrigate at 30 centibars soil moisture.
Maximum rate at which irrigation is applied (RATEAP)	0.074 cm hr^{-1}	Irrigation Guidance for developing PRZM Scenario, Table1; (June 15, 2005), for CN = 86 and f = 0.1
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Southeastern Georgia - Onions		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Boyhan, Granberry, and Kelley, University of Georgia Circular 821 (5/99). Indicates practice is to turn under residues, rototill just before planting, soil surface smooth and firm.
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Savannah, GA (W03822)
Maximum rainfall interception storage of crop (CINTCP)	0.05 cm	Estimated from PRZM3 Manual Table 5-4, assuming light density, and consistent with other onion scenarios
Maximum Active Root Depth (AMXDR)	35 cm	Estimated based on Onion Production Guide, University of Georgia Bulletin 1198; July, 2001
Maximum Canopy Coverage (COVMAX)	80	Estimated

Table 3. PRZM 3.12 Crop Parameters for Southeastern Georgia - Onions		
Parameter	Value	Source
Soil Surface Condition After Harvest (ICNAH)	1	University of Georgia Bulletin 1198, July, 2001; "Harrison, 2001. Bulletin 1198 University of Georgia July 2001 Irrigating Sweet Onions in GA", Granberry and Kelley, 2000 Circular 801 University of Georgia; and RUSLE information
Date of Crop Emergence (EMD, EMM, IYREM)	15/09	RUSLE Project planting dates and Circulars 801 and 821 and Bulletin 1198.
Date of Crop Maturity (MAD, MAM, IYRMAT)	01/06	RUSLE Project planting dates and Circulars 801 and 821 and Bulletin 1198..
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/06	RUSLE Project planting dates and Circulars 801 and 821 and Bulletin 1198..
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	91, 86, 87	Gleams Manual Table H-4, Meadows, no fallow conditions (USDA, 1990) 91"GLEAMS Manual Table H-4; Fallow = SR - middle or average value 86"GLEAMS Manual Table H-4; Row Crop = SR poor, Cropping and Residue = Row Crop poor" 87"GLEAMS Manual Table H-4; Row Crop = SR/ poor, Cropping and Residue = Row Crop SR/poor"
Manning's N Value (MNGN)	0.011	RUSLE Project; Pb9ONONC, Onions, Augusta, GA Conventional Tillage (USDA, 2000)
USLE C Factor (USLEC)	0.564 - 0.902	RUSLE EPA Pesticide Project: Pb9ONONC; Onions, Augusta, GA Conventional Tillage"

Table 4. PRZM 3.12 Clarendon Loamy Sand Soil Parameters for Southeastern Georgia - Onions		
Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Base horizons)	
First, Second and Third Soil Horizons (HORIZN = 1,2,3)		

Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 30 cm (HORIZN = 2) 60 cm (HORIZN = 3)	PIRANHA Version 3.0 PRZM Input Collator PIC Version 2.0
Bulk Density (BD)	1.6 g $\cdot cm^{-3}$ (HORIZN = 1) 1.6 g $\cdot cm^{-3}$ (HORIZN = 2) 1.7 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content (THETO)	0.115 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.115 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2) 0.173 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5.0 cm (HORIZN = 2) 5.0 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.115 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.115 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2) 0.173 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Wilting Point (THEWP)	0.035 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.035 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2) 0.093 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	1.74% (HORIZN = 1) 1.74% (HORIZN = 2) 0.174% (HORIZN = 3)	

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Research Service (ARS).

GEORGIA PEACHES

The field used to represent peach production in Georgia is located in Peach County in Southwest Georgia (MLRA133) and the weather station representing the orchard is in MLRA 137 and located in Macon, GA. Peaches are grown throughout the state, Peach County represents the highest producing county in Georgia and the 7th highest producing county in the U.S. Tree row spacing is generally 15 to 20 feet and within row spacing varies with the variety and maintenance size of the tree from as little as 8 feet to 20 feet. Tree heights are maintained from 8 feet to as much as 20 or more feet. Tree size and density is carefully maintained to optimize fruit production and pesticide and growth regulator applications. Flower buds begin to swell in late Winter to early Spring in the South as heat accumulates followed closely by bud bloom. At the time of flowering the fruiting stage commences and continues through harvest. For high yields of quality fruit, proper soil and site management, among other factors are necessary. Soil characteristics have a significant influences on tree development, fruit bearing capacity, and tree life. Of these, soil texture and drainage are among the most important for peach tree health. Peach trees do best in moderately to well drained soils of a sandy to silt loam texture. Trees do not tolerate wet soils for prolonged periods of time (days to weeks) during the growing period. The soil selected to simulate the field is a Greenville fine sandy loam in the Greenville-Faceville-Orangeburg Association. Greenville fine sandy loam is a fine, kaolinitic, thermic Rhodic Kandiudults. These soils are often used for peach, truck crop and grain production. Greenville fine sandy loam is a very deep, well drained, medium runoff, moderately permeable soil that formed in clayey marine sediments on the Coastal Plain. These soil are generally found on uplands and have slopes generally less than 8 percent, but may range up to 18 percent. The soil is extensive in the Coastal Plains of the South. Greenville fine sandy loam is a Hydrologic Group B soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Peach County, Georgia - Peach

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Macon, GA (W03813)
Ending Date	December 31, 1990	Meteorological File - Macon, GA (W03813)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.16 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	25.0 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Peach County, Georgia - Peach		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.35 tons EI^{-1*}	FARM Manual Table 3.1 (EPA, 1985)
USLE LS Factor (USLELS)	3.63	Calculated according to Haan and Barfield (1978) equation: $LS = ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual, Table 5.6 (EPA, 1998)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	12%	Since max of soil slope range (<8-18%) is >12%, SLP of orchard scenarios is set to 12% (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Peach County, Georgia - Peach		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Residues remain in field between tree rows, area under trees, approximately 3x3 feet, maintained residue free
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Macon, GA (W03813)
Maximum rainfall Interception storage of crop (CINTCP)	0.25	Default value for orchards (EPA 2004).
Maximum Active Root Depth (AMXDR)	150 cm	Set to soil horizon depth; roots may grow in excess of 5 feet deep. http://www.agweb.okstate.edu/pearl/hort/fruits/f6244.h

		tml
Maximum Canopy Coverage (COVMAX)	60	Based on estimates from aerial photography
Soil Surface Condition After Harvest (ICNAH)	3	Residues remain in field between tree rows, area under trees, approximately 3x3 feet, maintained residue free
Date of Crop Emergence (EMD, EMM, IYREM)	01/03	Emergence set to flower bud, Mark Collier, Extension Agent, Peach County, GA
Date of Crop Maturity (MAD, MAM, IYRMAT)	15/05	Maturation set to beginning of harvest, Mark Collier, Extension Agent, Peach County, GA
Date of Crop Harvest (HAD, HAM, IYRHAR)	31/08	Harvest set to last days of harvest, Mark Collier, Extension Agent, Peach County, GA
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	78, 67, 74	Gleams Manual Table H-4,Meadow, conditions good for Hydrologic Soil B; Peach trees do not tolerate soils less than moderately drained. (USDA, 1990)
Manning's N Value (MNGN)	0.07	RUSLE EPA Pesticide Project; Tb7WWSBC; Savannah, GA; Winter Wheat, Cover Code 3 (residues), Conventional Tillage (USDA, 2000)
USLE C Factor (USLEC)	0.021 - 0.259	RUSLE EPA Pesticide Project; Tb7WWSBC; Savannah, GA; Winter Wheat, Cover Code 3 (residues), Conventional Tillage (USDA, 2000)

Table 4. PRZM 3.12 Greenville Soil Parameters for Peach County, Georgia - Peach

Parameter	Value	Verification Source
Total Soil Depth (CORED)	150 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 15 cm (HORIZN = 2) 125 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.3 g $\cdot cm^{-3}$ (HORIZN = 1,2) 1.35 g $\cdot cm^{-3}$ (HORIZN = 3)	

Initial Water Content (THETO)	0.284 cm^3-H_2O ·cm^{-3}-soil (HORIZN =1,2) 0.48 cm^3-H_2O ·cm^{-3}-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN =2) 5 cm (HORIZN =3)	
Field Capacity (THEFC)	0.284 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.48 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.144 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.3 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Organic Carbon Content (OC)	0.29% (HORIZN = 1,2) 0.116% (HORIZN = 3)	

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GEORGIA PECANS

The field used to represent peach production in Georgia is located in Mitchell or Dougherty County in Southwest Georgia (MLRA133) and the weather station representing the orchard's weather is located in Tallahassee, FL. Pecans are grown throughout the southwestern part of the state. Georgia and Texas generally compete from year to tear for status as the top U.S. producer. As such, production varies significantly from year to year. Trees are very large, growing up to 100 feet tall and living 80 or more years, although production declines as the trees reach the end of its life span. Tree are initially planted at a rate of 27 trees per acre and thinned to 8 trees per acre over an 18-20 year period; approximately 60 feet by 60 feet spacing. Pollinizers are generally planted every 9^{th} or 11^{th} row to facilitate adequate pollination and increases profitability of the stand. Pecan trees require approximately 50 percent foliar canopy for optimal light penetration and crop yield. Proper tree density also allows for better pesticide application. Pecan trees typically produce nuts for 40 or more years. Most (approximately 65 percent) Georgia pecans are irrigated via drip irrigation systems. Soil characteristics have a significant influences on tree development, fruit bearing capacity, and tree life. Pecan trees prefer light to medium textured soils, pH 5.5-6.0, but can grow on higher clay content and slightly higher pH soils. Soil depth should be several feet or more and water table below the primary root zone. Pecans are native to floodplains and river-bottoms having inherently high water requirements. Maturity is reached when the shuck loosens or splits from the shell - harvest then begins. Pecans are harvested with trunk or limb shakers depending on tree age. The soil selected to simulate the field is a Williston loamy fine sand. Williston loamy fine sand is a fine, mixed, superactive, hyperthermic Typic Hapludalfs. Williston loamy fine sand is a moderately deep, well drained, moderately rapid runoff, moderately slowly permeable soil that formed in moderately thick beds of clayey marine sediments overlying soft limestone. These soil are generally found on nearly level to sloping landscapes in the Coastal Plain. Slopes is dominantly less than 5 percent but ranges up to 8 percent on hillsides. The soil is of small extent in the Coastal Plains of the South. Williston loamy fine sand is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Mitchell County, Georgia - Pecan		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Tallahassee, FL (W93805)
Ending Date	December 31, 1990	Meteorological File - Tallahassee, FL (W93805)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.16 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	25.0 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Mitchell County, Georgia - Pecan		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.35 tons EI^{-1*}	FARM Manual Table 3.1 (EPA, 1985)
USLE LS Factor (USLELS)	0.85	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.4 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual, Table 5.6 (EPA, 1998)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	4.75%	The slope range is <5-8% (USDA 2002). The midpoint slope is selected (EPA 2004). The midpoint would range from 4-6.5%. The midpoint of that range was selected.
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Mitchell County, Georgia - Pecans		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Residues remain in field between tree rows, area under trees
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Tallahassee, FL (W93805)
Maximum rainfall Interception storage of crop (CINTCP)	0.25	Default value for orchards (EPA 2004).
Maximum Active Root Depth (AMXDR)	100 cm	Set to soil horizon depth; Set to soil horizon depth; main root cluster may grow in excess of 2 meters deep. Tap root will grow to first confining layer. http://www.uga.edu/fruit/pecan.htm
Maximum Canopy Coverage (COVMAX)	50	Based or optimal light penetration and yield. http://www.uga.edu/fruit/pecan.htm
Soil Surface Condition After Harvest (ICNAH)	3	Residues remain in field between tree rows, area under trees.
Date of Crop Emergence (EMD, EMM, IYREM)	16/04	Estimated date of canopy leaf-out; http://www.uga.edu/fruit/pecan.htm
Date of Crop Maturity (MAD, MAM, IYRMAT)	21/09	Estimated date (based on 180-220 day required growing season) for fruit maturity; http://www.uga.edu/fruit/pecan.htm
Date of Crop Harvest (HAD, HAM, IYRHAR)	01/10	Estimated date of harvesting; http://www.uga.edu/fruit/pecan.htm
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4,Meadow, conditions good for Hydrologic Soil C;
Manning’s N Value (MNGN)	0.07	RUSLE EPA Pesticide Project; Tb7WWSBC; Savannah, GA; Winter Wheat, Cover Code 3 (residues), Conventional Tillage (USDA, 2000)
USLE C Factor (USLEC)	0.021 - 0.259	RUSLE EPA Pesticide Project; Tb7WWSBC; Savannah, GA; Winter Wheat, Cover Code 3 (residues), Conventional Tillage (USDA, 2000)

Table 4. PRZM 3.12 Williston Soil Parameters for Mitchell County, Georgia - Pecans

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4 (Top horizon split in two)	
First, Second, Third and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 20 cm (HORIZN = 2) 16 cm (HORIZN = 3) 54 cm (HORIZN = 4)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.45 g $\cdot cm^{-3}$ (HORIZN = 1,2) 1.7 g $\cdot cm^{-3}$ (HORIZN = 3,4)	
Initial Water Content (THETO)	0.149 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.245 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3) 0.332 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN =2) 4 cm (HORIZN =3) 3 cm (HORIZN =4)	
Field Capacity (THEFC)	0.149 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.245 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.332 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Wilting Point (THEWP)	0.069 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.125 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.192 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Organic Carbon	1.16% (HORIZN = 1,2)	

Content (OC)	0.174% (HORIZN = 3) 0.116% (HORIZN = 4)	

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IDAHO POTATOES

The field used to represent potato production in Idaho is located in Bingham County (#1 producing Idaho county) in Southeast Idaho (MLRA13), although potato production areas include other regions of Idaho such as the southwest and south-central regions. According to the 2002 Census of Agriculture, Idaho is the major producer of potatoes in the U.S. producing 29 percent of the crop. Potatoes are generally grown on a range of soils from sandy to clay loam of volcanic origin along the Snake River Plain of southern Idaho. Potatoes are in rotation with crops such as hay and various grains. Potatoes are generally grown once ever three years on the same field to limit disease pressures (Willem Schrage, Minnesota Sept. of Agriculture). Potato seed pieces are planted "eyes" facing upward about 10-12 cm deep and between 12 to 14 inches apart. Rows are generally 36-40 inches on center, but may be less or greater depending on equipment. Sprinkler irrigation is used on about 99 percent of the crop and furrow and rill irrigation is used on the remainder. Planting begins April and runs through Mid-June depending on region. Harvest also depends on regions, beginning in mid-July and running through November 15.

The soil selected to simulate the field is an Malm fine sandy loam. Malm soil is classified as a Coarse-loamy, mixed, superactive, frigid Xeric Haplocalcids. These soils are mainly used for irrigated pasture, potatoes, and small grains, but some are used as rangeland. The Malm series consists of moderately deep, well drained soils formed mainly in eolian deposits. Malm soils are on lava plains and have slopes of 0 to 20 percent at elevations of 4500 to 5200 feet above mean sea level. Potatoes were planted in soils with 0 to 8 percent slopes. The soil is well drained with slow to medium runoff and moderately rapid permeability. The soil is moderately extensive in southeastern Idaho. The Malm soil is a Hydrologic Group C soil.

The Malm series is not a benchmark soil, but was selected because it is of moderate extent and because it belonged Hydrologic Soil Group C. The majority of the soils in the STATSGO database used for potatoes belong to Hydrologic Group B. The STATSGO data (bulk density, available water content, clay content) used for the estimation of soil properties (field capacity and wilting point) are included below. Because STATSGO does not contain field capacity and wilting point values, they had to estimated. The method proposed by Saxton et al. (1986) was used to estimate soil-water characteristics from soil texture (Table 5). An executable program (SOILWATR.exe), was used to estimate field capacity and wilting point values.

Planting and harvest dates (May 1 and September 15), respectively were obtained from the RUSLE database (USDA, 2000) (Pocatello, ID) (Epat3.xls) in order conform with the USLEC factors. King and Bradley (no date) report that planting to emergence ranges from 20 to 35 days. Emergence was extrapolated from the May 1 planting date.

NOTE: Include in the exposure/risk characterization discussion. For the Index Reservoir Scenario, Idaho potato are planted once every three years on the same field (3 year rotation: one year potatoes, 2 years fallow or other crops). Therefore, discuss the implications that perhaps only 33 percent of the fields within the watershed are planted to potatoes in any given year. For ecological exposure assessments, discuss that a single field may be planted to potatoes once every three years.

Table 1. PRZM 3.12 Climate and Time Parameters for Bingham County, Idaho, Potato

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Pocatello, ID (w24156.dvf)
Ending Date	December 31, 1990	Meteorological File - Pocatello, ID (w24156.dvf)
Pan Evaporation Factor (PFAC)	0.72	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	12.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Bingham County, Idaho, Potato

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.14 tons EI^{-1*}	Mid-value Kffact for layer 1 for Malm fine sandy loam from STATSGO Database (1995)
USLE LS Factor (USLELS)	0.69	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.4 (EPA 2004).
USLE P Factor (USLEP)	0.5	PRZM Manual (EPA, 1998)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	4%	Mid value of slope for soil series range 0 to 8 % - STATSGO Database (1995) - Malm Series with potatoes (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)

* EI = 100 ft-tons * in/ acre*hr

Table 3. PRZM 3.12 Crop Parameters for Bingham County, Idaho, Potato		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Field are fallow prior to planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Pocatello, ID (w24156.dvf)
Maximum rainfall Interception storage of crop (CINTCP)	0.1	PRZM Manual, Table 5.4 (EPA 2004).
Maximum Active Root Depth (AMXDR)	60 cm	Roots may reach 24 inches (King and Stark). Parameter value may be inconsistent with other potato scenarios due to different sources.
Maximum Canopy Coverage (COVMAX)	40	Based on visual estimates from aerial photography; http://www.css.orst.edu/Classes/CSS322/Growing.htm
Soil Surface Condition After Harvest (ICNAH)	3	Material is burned in place using propane burners and left behind
Date of Crop Emergence (EMD, EMM, IYREM)	01/06	http://info.ag.uidaho.edu/resources/PDFs/BUL0789.pdf Planting date from RUSLE data Epat3.xls
Date of Crop Maturity (MAD, MAM, IYRMAT)	15/08	http://info.ag.uidaho.edu/resources/PDFs/BUL0789.pdf Estimated from Bul 789 and planting date
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/09	http://info.ag.uidaho.edu/resources/PDFs/BUL0789.pdf Harvest date from Rusle data Epat3.xls
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN) Hydrologic Soil Group C	89, 86, 87	Gleams Manual Table H-4, Fallow = SR/CT/poor, Cropping and Residue = Row Crop SR/CT/poor
Manning's N Value (MNGN)	0.014	RUSLE Project; B33PIWWC; Potatoes, Irish Conventional tillage; Idaho Falls, ID (USDA, 2000)
USLE C Factor (USLEC)	0.037 - 0.603	RUSLE Project; B33PIWWC; Potatoes, Irish Conventional tillage; Idaho Falls, ID (USDA, 2000)
Irrigation Flag (IRFLAG)	2	cropping period only
Irrigation Type (IRTYP)	3	Overhead sprinkler most common King and Stark
Leaching Factor (FLEACH)	0.1	Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005).

Table 3. PRZM 3.12 Crop Parameters for Bingham County, Idaho, Potato		
Fraction of Water Capacity when Irrigation is Applied (PCDEPL)	.65	Typical value from King and Stark; Trimmer et al.
Maximum Rate at which Irrigation is Applied (RATEAP)	0.074	Irrigation Guidance for developing PRZM Scenario, Table 1; (June 15, 2005). CN = 86 runoff fraction is 0.10

Table 4. PRZM 3.12 Malm Soil Parameters for Bingham County, Idaho, Potato		
Parameter	Value	Verification Source
Total Soil Depth (CORED)	90 cm	NRCS, STATSGO Database (NRCS, 1995) http://ortho.ftw.nrcs.usda.gov/osd/dat/M/MALM.html
Number of Horizons (NHORIZ)	4 (Middle horizon split in two)	
First, Second, Third, and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	8 cm (HORIZN = 1) 52 cm (HORIZN = 2) 22 cm (HORIZN = 3) 8 cm (HORIZN = 4)	NRCS, STATSGO Database (NRCS, 1995) Mid-Point Values http://ortho.ftw.nrcs.usda.gov/osd/dat/M/MALM.html BD, Available water content, clay content obtained from STATSGO Database. to estimate Initial Water Content (THETO), Field Capacity (THEFC), and Wilting Point (THEWP) estimated by THETO is assumed to be equal to THEFC K.E. Saxton et.al. 1986. Soil Science Society of America Journal,50: 1031-1036. See Table 5
Bulk Density (BD)	1.55 g $\cdot cm^{-3}$ (HORIZN = 1,2,3) 1.58 g $\cdot cm^{-3}$ (HORIZN = 4)	
Initial Water Content (THETO)	0.20 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.22 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2,3) 0.18 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4 cm (HORIZN =2, 4) 2 cm (HORIZN =3)	
Field Capacity (THEFC)	0.20 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.22 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2,3) 0.18 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4)	

Wilting Point (THEWP)	0.09 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1) 0.10 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 2,3) 0.09 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Organic Carbon Content (OC)	0.87% (HORIZN = 1) 0.44% (HORIZN =2, 3) 0.15% (HORIZN = 4)	

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Table 5. Selected properties from STATSGO (Malm series) used to estimate Field Capacity and Wilting Point for PRZM input.

STATSGO Database - Malm series					Soil Water Estimates (Saxton et al. 1986)				
Soil[1] Layer	AWC[2]	BD[3]	Saturation[4]	Clay[5]	Field[6] Capacity	Wilting[7] Point	Saturation[8]	AWC[9]	BD[10]
1	0.11	1.55	0.415	9	0.20	0.09	0.41	0.11	1.55
2	0.12	1.55	0.415	13.5	0.22	0.10	0.44	0.12	1.50
3	0.09	1.58	0.404	12.5	0.18	0.09	0.41	0.09	1.57

[1] Soil layer number in STATSGO
[2] Mid-point available water holding capacity (AWC) from STATSGO
[3] Mid-point bulk density from STATSGO
[4] Saturation = (1 - (bulk density/2.65)
[5] Mid point Percent clay from STATSGO
[6] Field capacity (THETFC) estimated with Soil Water Program using STATSGO input values.
[7] Wilting point (THETWP) estimated with Soil Water Program using STATSGO input values.
[8] Saturation estimated with Soil Water Program using STATSGO input values.
[9] AWC estimated with Soil Water Program using STATSGO input values.
[10] Bulk density values estimated with Soil Water Program using STATSGO input values.

ILLINOIS CORN

The field used to represent corn production in Illinois is located in McLean County, although the crop is grown extensively throughout the state. According to the 1997 Census of Agriculture, Illinois is ranked 2nd among the major corn producing states in the U.S. The crop is generally planted the early Spring (April) in the south, early May in the north and harvested beginning in August. Continuous corn is practice is much of the region (approximately 30 percent is continuous), however, rotation with other crops such as soybean, wheat, sorghum, and alfalfa is the dominant practice. Most of the corn is planted for feed grain, but may also be planted for oil, sweetener, and for export. Planting depth and row spacing (generally 30 inches) follows general practices for the U.S. Conservation tillage practices are regularly used for field corn with no-till practiced on about 20 percent of the corn acreage annually. About 50 percent of the acreage is cultivated with a row cultivator and an estimated 40 percent is rotary hoed annually. The crop is rarely grown under irrigation. The soil selected to simulate the field is an Adair clay loam. Adair clay loam is a fine, smectitic, mesic Aquertic Argiudolls. More than 50 percent of the soil is used for the production of grains with the balance in meadow and pasture. Adair clay loam is a deep, somewhat poorly drained, medium to rapid runoff, slowly permeable soil formed on uplands in a thin mantle of loess or loess and pedisediments and a paleosol formed in glacial till. They are on convex summits of narrow interfluves and on convex side slopes at slightly lower elevations. Slopes are generally between 2 to 18 percent, but may range to 30 percent. The soils are extensive in MLRA 108 and found in many MLRA in the region. Adair clay loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for McLean County, Illinois - Corn

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Peoria, IL (W14842)
Ending Date	December 31, 1990	Meteorological File - Peoria, IL (W14842)
Pan Evaporation Factor (PFAC)	0.77	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for McLean County, Illinois - Corn

Parameter	Value	Source
Method to Calculate	4 (MUSS)	PRZM Manual (EPA, 1998)

Erosion (ERFLAG)		
USLE K Factor (USLEK)	0.32 tons EI^{-1*}	GLEAMS Table of Representative Soils (USDA, 1990)
USLE LS Factor (USLELS)	1.34	Calculated according to Haan and Barfield (1978) equation: LS $= ((\lambda/72.6)^{m})((430x^{2} + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual (EPA, 1998); Lyle Paul of U of Illinois indicates that contour plowing is not typical
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Range: 2-30%. Maximum of the range is >12, the SLP for a row crop should be set to 6% (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for McLean County, Illinois - Corn

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Lyle Paul of U of Illinois indicates residues are typically chiseled in
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Moline, IL (W14923)
Maximum rainfall interception storage of crop (CINTCP)	0.25	PRZM Manual, Table 5.4 (EPA 1998).
Maximum Active Root Depth (AMXDR)	90 cm	Median value (60-120 cm); PRZM Manual Table 5-9. (EPA 1998).
Maximum Canopy Coverage (COVMAX)	100	Lyle Paul of U of Illinois. Also consistent with default value cited in guidance (EPA 2004).
Soil Surface Condition After Harvest (ICNAH)	3	Lyle Paul of U of Illinois indicates residues are typically chiseled in
Date of Crop Emergence		Usual Planting and Harvest Dates for US Field Crops

(EMD, EMM, IYREM)	01/05	(USDA, 1984) & Updated Crop Stage Information from HED (Bernard Schneider)
Date of Crop Maturity (MAD, MAM, IYRMAT)	21/09	
Date of Crop Harvest (HAD, HAM, IYRHAR)	20/10	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	91, 87, 88	Gleams Manual Table H-4, Fallow = SR/poor; Cropping and Residue = Row Crop, SR/poor condition (USDA, 1990)
Manning's N Value (MNGN)	0.014	RUSLE Project, MA3CGSBC; Corn, grain, Conventional tillage, Springfield, IL (USDA, 2000)
USLE C Factor (USLEC)	0.017 - 0.638	RUSLE Project; MA3CGSBC; Corn, grain, Conventional tillage, Springfield, IL, variable with date (USDA, 2000)

Table 4. PRZM 3.12 Adair Soil Parameters for McLean County, Illinois - Corn

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4 (Top horizon split in two)	
First, Second, Third and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 34 cm (HORIZN = 2) 44 cm (HORIZN = 3) 12 cm (HORIZN = 4)	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/) Doug Oelmann (IA State-USDA)
Bulk Density (BD)	1.45 g $\cdot cm^{-3}$ (HORIZN = 1, 2) 1.6 g $\cdot cm^{-3}$ (HORIZN = 3) 1.7 g $\cdot cm^{-3}$ (HORIZN = 4)	
Initial Water Content (THETO)	0.355 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1, 2) 0.338 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	

	0.307 cm^3-H_2O ·cm^{-3}-soil (HORIZN =4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 2 cm (HORIZN = 2) 4 cm (HORIZN = 3) 4 cm (HORIZN = 4)	
Field Capacity (THEFC)	0.355 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1, 2) 0.338 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3) 0.307 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Wilting Point (THEWP)	0.185 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.208 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3) 0.167 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Organic Carbon Content (OC)	2.32% (HORIZN = 1,2) 0.174% (HORIZN = 3) 0.116% (HORIZN = 4)	

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USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

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KANSAS SORGHUM

The field used to represent sorghum production in Kansas is located in Osage County in the east central potion of the state although the crop is grown throughout Kansas. The leading production counties are Marshall in the northeastern Kansas, Washington and Mitchell in north central Kansas. According to the 1997 Census of Agriculture, Kansas is ranked 1st in both grain and silage production. Sorghum is planted early in May when soil temperature reaches 70^{o} F to a depth of approximately 2 inches. Row spacing is approximately 10 inches (narrow-spacing) to 30 inches (traditional spacing). A greater percentage of farm are moving towards the narrower row spacing due to increased grain yields. Seeding rates vary from 24,000 to 100,000 seeds per acre depending on water availability, soil type, and natural rainfall or irrigation. Much of Kansas sorghum is irrigated, especially moving west. Root systems rarely exceed 4 feet and depend on the available moisture and soil texture. Productions practices vary throughout the state, however, with increasing emphasis on soil loss prevention, conservation tillage is the dominant practice. The soil selected to simulate the field is a benchmark soil, Dennis silt loam, loacated in MLRA112. Dennis silt loam, is a fine, mixed, active, thermic Aquic Argiudolls. These soils are extensively used growing small grain, sorghums and soybeans. Dennis silt loam is a very deep, somewhat poorly drained, slowly, permeable soils with low to high runoff. There soils may have epipsaturation (perched water table) at a depth of 2 to 3 feet for short periods of time during the months of December to April. These soils are on nearly level to sloping uplands of the Cherokee Prairies. They formed in material weathered from shale of Pennsylvania age. These soils are extensive in southeastern Kansas and eastern Oklahoma. Dennis silt loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Osage County, Kansas - Sorghum

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Topeka, Kansas (W13996)
Ending Date	December 31, 1990	Meteorological File - Topeka, Kansas (W13996)
Pan Evaporation Factor (PFAC)	0.73	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Osage County, Kansas - Sorghum		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.43 tons EI^{-1*}	GLEAMS Table of Representative Soils (USDA, 1990)
USLE LS Factor (USLELS)	0.69	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.4 (EPA 2004).
USLE P Factor (USLEP)	1.0	GLEAMS Table of Representative Soils (USDA, 1990) No practice assumed.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	4%	Official Soils Description Database; Slope 0-8%; mid-point selected
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Osage County, Kansas - Sorghum		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA. 2001)
Initial Surface Condition (ISCOND)	3	Focus is on conservation tillage to reduce runoff: http://www.ianr.unl.edu/pubs/soil/g831.htm
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Topeka, Kansas (W13996)
Maximum rainfall interception storage of crop (CINTCP)	0.1	Table 5.4 PRZM Manual (EPA 1998).
Maximum Active Root Depth (AMXDR)	23 cm	Table 5.9 PRZM Manual (EPA 1998).
Maximum Canopy	100	Based on visual estimates from aerial photography;

Coverage (COVMAX)		http://www.ianr.unl.edu/pubs/soil/g831.htm and similarity to corn
Soil Surface Condition After Harvest (ICNAH)	3	http://www.ianr.unl.edu/pubs/soil/g831.htm
Date of Crop Emergence (EMD, EMM, IYREM)	20/05	Crop Planting and harvest Dates, RUSLE "C" and "N" Factors, File epat3.xls, 1/5/00
Date of Crop Maturity (MAD, MAM, IYRMAT)	20/09	Crop Planting and harvest Dates, RUSLE "C" and "N" Factors, File epat3.xls, 1/5/00
Date of Crop Harvest (HAD, HAM, IYRHAR)	01/10	Crop Planting and harvest Dates, RUSLE "C" and "N" Factors, File epat3.xls, 1/5/00
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	89, 86, 87	Gleams Manual Table H-4, Pasture/Range, Non-CNT, Poor (USDA, 1990)
Manning’s N Value (MNGN)	0.023 (all dates)	RUSLE Project, H88SGWWM; Grain Sorghum, Conventional Tillage, Salina, KS (USDA, 2000)
USLE C Factor (USLEC)	0.076 - 0.449	RUSLE Project, H88SGWWM; Grain Sorghum, Conventional Tillage, Salina, KS (USDA, 2000)

Table 4. PRZM 3.12 Dennis Soil Parameters for Osage County, Kansas - Sorghum

Parameter	Value	Verification Source
Total Soil Depth (CORED)	120 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4 (Top horizon split in two)	
First, Second, Third and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 24 cm (HORIZN = 2) 10 cm (HORIZN = 3) 76 cm (HORIZN = 4)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.55 g $\cdot cm^{-3}$ (HORIZN = 1, 2) 1.6 g $\cdot cm^{-3}$ (HORIZN = 3) 1.6 g $\cdot cm^{-3}$ (HORIZN = 4)	

Initial Water Content (THETO)	0.247 cm^3-H_2O ·cm^{-3}-soil (HORIZN =1, 2) 0.316 cm^3-H_2O ·cm^{-3}-soil (HORIZN =3) 0.348cm^3-H_2O ·cm^{-3}-soil (HORIZN =4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4.0 cm (HORIZN = 2) 5.0 cm (HORIZN = 3) 4.0 cm (HORIZN = 4)	
Field Capacity (THEFC)	0.247 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1, 2) 0.316 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3) 0.348 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Wilting Point (THEWP)	0.097 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.166 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3) 0.198 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Organic Carbon Content (OC)	1.74% (HORIZN = 1,2) 0.174% (HORIZN = 3) 0.116% (HORIZN =)	

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

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Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

LOUISIANA SUGARCANE

The field used to represent sugarcane production in Louisiana is located in Terrebonne Parish in South-central Louisiana, although sugarcane production areas cover 21 parishes in the south central part of the state. According to the 1997 Census of Agriculture, Louisiana ranks 2nd in both sugarcane acreage and production. Most sugarcane is grown on well drained soils. Sugarcane is grown on fields with 15- to 18-inch flat bottom furrows or a furrow with a slight ridge of loose soil down the center. The elevated rows or beds are opened and the seed cane planted to a depth at least 3- to 4-inches above the final furrow water level, poorly drained soils will require higher planting. The seed cane is covered with no more than 2 inches of packed soil. Sugarcane is produced in a three to four year cycle with the first year planting referred to as the "plant cane" crop and successive years referred to as "stubble" or "ratoon" crops which are harvested from regrowth. Yields diminish with each successive crop. At the end of the third or fourth year, sugarcane is rotated to another crop or left fallow before replanting. Row spacing is approximately 60 inches. Irrigation is rarely used except in very dry years. The soil selected to simulate the field is a benchmark soil, Commerce silt loam. Commerce silt loam, is a fine-silty, mixed, superactive, nonacid, thermic, Aeric Fluvaquents. These soils are extensively used for sugarcane production. Commerce silt loam is a deep, somewhat poorly drained, medium to slow runoff, slowly permeable soil that formed in loamy alluvial sediments. These soil are generally found on level or undulating alluvial plains and have slopes generally less than 1 percent, but may range up to 5 percent. Agricultural areas are protected by levees; unprotected areas are subject to occasional to frequent flooding. The soil is extensive in Louisiana and throughout the lower Mississippi drainage basin. Commerce silt loam is a Hydrologic Group C soil.

The meteorological station associated with this scenario is located in Baton Rouge, Louisiana (W13970). Although the Baton Rouge station is not the geographically closest met station, it is more representative of the geographic areas where sugarcane is grown in Louisiana. The 1999 USDA crop profile for LA sugarcane indicates that it is grown in at least 21 parishes in the south central part of the state, extending from Rapides Parish near the center of the state, south to Lafourche Parish south of New Orleans and west to near Lake Charles in Calcasieu Parish. In addition, Baton Rouge is approximately in the center of LA sugarcane production based on the 2004 Census of Agriculture.

Table 1. PRZM 3.12 Climate and Time Parameters for Terrebonne Parish, Louisiana - Sugarcane		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Baton Rouge, LA (W13970)
Ending Date	December 31, 1990	Meteorological File - Baton Rouge, LA (W13970)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.0 cm C^{-1}	Does not snow in Southern Louisiana such that accumulation is expected
Minimum Depth of Evaporation (ANETD)	25.0 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Terrebonne Parish, Louisiana - Sugarcane		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.43 tons EI^{-1*}	FARM Manual Table 3.1 (EPA, 1985)
USLE LS Factor (USLELS)	0.40	Calculated according to Haan and Barfield (1978) equation: $LS = ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	Assume no practice supported
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	2.75%	The slope range is <1-5% (USDA 2004). The midpoint slope is selected (EPA 2004). The midpoint would range from 2.5-3%. The midpoint of that range was selected.
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)

* EI = 100 ft-tons * in/ acre*hr

Table 3. PRZM 3.12 Crop Parameters for Terrebonne Parish, Louisiana - Sugarcane

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Set to represent fallow field
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Baton Rouge, LA (W13970)
Maximum rainfall interception storage of crop (CINTCP)	0.1	Set to maximum recommended value for grass; sugarcane is in the grass family. PIC (Burns, 1998)
Maximum Active Root Depth (AMXDR)	100 cm	Set to maximum of soil profile (EPA, 2001)
Maximum Canopy Coverage (COVMAX)	100	Set to default for row crops (EPA, 2001)
Soil Surface Condition After Harvest (ICNAH)	3	Default for sugarcane while under 3-4 yr cycle. After cycle, rotate to new crop or fallow.
Date of Crop Emergence (EMD, EMM, IYREM)	01/1	USDA Agricultural Handbook No. 417 Culture of Sugarcane
Date of Crop Maturity (MAD, MAM, IYRMAT)	02/01	USDA Agricultural Handbook No. 417 Culture of Sugarcane
Date of Crop Harvest (HAD, HAM, IYRHAR)	31/12	USDA Agricultural Handbook No. 417 Culture of Sugarcane
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	91, 87, 88	Gleams Manual Table H-4, Fallow = SR/poor, Cropping and Residue = Row Crops, SR/poor condition (USDA, 1990)
Manning’s N Value (MNGN)	0.014	RUSLE Project; TA6SCSCC; Sugarcane, conventional tillage, Lake Charles, LA: actually outside MLRA (USDA, 2000)
USLE C Factor (USLEC)	0.251 - 0.736	RUSLE Project; Variable with date, TA6SCSCC; Sugarcane, conventional tillage, Lake Charles, LA: actually outside MLRA (USDA, 2000)

Table 4. PRZM 3.12 Commerce Soil Parameters for Terrebonne Parish, Louisiana - Sugarcane

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (2 Base horizons, top horizon split in two)	
First, Second and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 16 cm (HORIZN = 2) 74 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.65 g $\cdot cm^{-3}$ (HORIZN = 1,2,3)	
Initial Water Content (THETO)	0.323 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.313 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4 cm (HORIZN = 2) 2 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.323 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.313 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.113 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2,3)	
Organic Carbon Content (OC)	2.32% (HORIZN = 1,2) 0.174% (HORIZN = 3)	

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MAINE POTATOES

The field used to represent potato production in Maine is located in Aroostook County (#1 producing county in Maine) in Northeastern Maine (MLRA143/146), although potato production areas include other regions of Maine. Aroostook County produces approximately 90 percent of Maine's potatoes. A wide variety of potatoes are grown in Aroostook County, and are generally classified as early-, mid-, and late-season. According to the 1997 Census of Agriculture, Maine is the 3rd largest producer of potatoes in the U.S. behind Idaho and Pennsylvania. Potatoes are generally grown on a range of soils from sandy to clay loam, though deep, well drained sandy loam is ideal because they tend to dry out and warm up earlier facilitating early planting. Poorly drained soils should be avoided. Potato seed pieces, 3.5 to 5 cm in size, are planted "eyes" facing upward about 10-15 cm deep and between 12 to 14 inches apart. Rows are generally 32-36 inches on center, but may be less or greater depending on equipment. Planting is not recommended until soil temperatures reach 45-50^{o}F. In Maine, potatoes should not be planted more than once in a three year period on the same field to avoid soilborne diseases. Rotations with strawberries, tomatoes or legumes should be avoided because these crops can be infected with the same diseases. Rotation with crops such as hay, alfalfa and small grains is common. Planting begins in May and harvest begins in late September through October. The soil selected to simulate the field is an Conant silt loam. Conant silt loam is a fine loamy, isotic, frigid Aquic Haplorthods These soils are extensively used for potatoes, oats and peas. Conant silt loam is a very deep, moderately well drained and somewhat poor drained, slow runoff, moderately permeable soils located on till plains and lower slopes of till ridges derived mainly from metamorphosed limestone and calcareous sandstone and shale. Slopes are 0 to 15 percent at elevations of 350 to 800 feet above mean sea level. The soil is of moderate extent in the MLRA. Conant silt loam is a Benchmark soil in Hydrologic Group C.

NOTE: For the Index Reservoir Scenario, assume that at least 33 percent of the fields within the watershed are planted to potatoes in any given year. For ecological exposure assessments, assume the field is planted to potatoes once every three years. Assess exposures for each scenario accordingly.

Table 1. PRZM 3.12 Climate and Time Parameters for Aroostook County, Maine, Potato		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Caribou, ME (W14607)
Ending Date	December 31, 1990	Meteorological File - Caribou, ME (W14607)
Pan Evaporation Factor (PFAC)	0.8	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	12.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Aroostook County, Maine, Potato		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.28 tons EI^{-1*}	Soil Data Mart Database for Aroostook County, ME. Data for Conant silt loam, 2-8% slopes.
USLE LS Factor (USLELS)	1.34	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual (EPA, 1998). Non-contour plowing.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Range: 0-15%. Maximum of the range is >12, the SLP for a row crop should be set to 6% (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Aroostook County, Maine, Potato		
Parameter	Value	Source

Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Field residues prior to planting(post-harvest cover crop generally planted; residues likely)
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Caribou, ME (W14607)
Maximum rainfall Interception storage of crop (CINTCP)	0.1	PRZM Manual, Table 5.4 (EPA, 1998).
Maximum Active Root Depth (AMXDR)	60 cm	Based on ID potato scenario. Parameter values may be inconsistent due to different sources.
Maximum Canopy Coverage (COVMAX)	40	Based on visual estimates from aerial photography; http://www.css.orst.edu/Classes/CSS322/Growing.htm
Soil Surface Condition After Harvest (ICNAH)	3	Material is burned in place using propane burners and left behind
Date of Crop Emergence (EMD, EMM, IYREM)	01/06	http://ipmwww.ncsu.edu/opmppiap/subcrp.htm http://www.css.orst.edu/Classes/CSS322/select.htm
Date of Crop Maturity (MAD, MAM, IYRMAT)	01/10	http://ipmwww.ncsu.edu/opmppiap/subcrp.htm http://www.css.orst.edu/Classes/CSS322/select.htm
Date of Crop Harvest (HAD, HAM, IYRHAR)	05/10	RUSLE Crop Planting and Harvest Dates, Table 3. File: epat3.xls
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	89, 86, 87	Gleams Manual Table H-4, Fallow = SR/CT/poor, Cropping and Residue = Row Crop SR/CT/poor (USDA, 1990)
Manning’s N Value (MNGN)	0.014	RUSLE "C" and "N" Factors; Rb3PIPIC Potato, Iris, Conventional tillage, Monpelier, VT
USLE C Factor (USLEC)	0.053 - 0.801	RUSLE "C" and "N" Factors; Rb3PIPIC Potato, Iris, Conventional tillage, Monpelier, VT

Table 4. PRZM 3.12 Conant Silt Loam Soil Parameters for Aroostook County, Maine, Potato

Parameter	Value	Verification Source

Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4 (Top horizon split in two)	
First, Second, Third, and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1,4) 16 cm (HORIZN = 2) 64 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) [http://www.statlab.iastate.edu/soils/ssl/)](http://www.statlab.iastate.edu/soils/ssl/) Ed Russell (USDA-NRCS, Fresno)
Bulk Density (BD)	1.25 $g \cdot cm^{-3}$ (HORIZN = 1,2) 1.4 $g \cdot cm^{-3}$ (HORIZN = 3) 1.6 $g \cdot cm^{-3}$ (HORIZN = 4)	
Initial Water Content (THETO)	0.341 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =1,2) 0.266 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =3) 0.261 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4 cm (HORIZN =2) 4 cm (HORIZN =3) 5 cm (HORIZN =4)	
Field Capacity (THEFC)	0.341 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =1,2) 0.266 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =3) 0.261 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =4)	
Wilting Point (THEWP)	0.121 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN = 1,2) 0.116 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN = 3) 0.111 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	4.64% (HORIZN = 1,2) 0.174% (HORIZN = 3) 0.116% (HORIZN = 4)	

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MICHIGAN ASPARAGUS

(03/17/04)

Asparagus, a member of the lily family, is a perennial crop which produces a commercial harvest for 15 years or more before field renewal. Pesticides are not generally applied to asparagus spears, which are completely removed from the field when harvested at 1 to 2 days after emergence onto a bare ground plot. Harvest continues until the diameter of spears is reduced to about the size of a pencil. In Michigan, asparagus spears are harvested for 6-7 weeks from late April or early May to mid to late June. The asparagus ferns, remain on the field until early spring, gathering energy for growth the following season, protecting the crowns from frost damage and the soil from erosion. For the purpose of this scenario, the ferns are considered the crop. Therefore, emergence date for asparagus is the date harvest normally ends in mid to late June. Asparagus ferns can grow to a height of 4 to 10 feet tall. Ferns reach maximum height, analogous to crop maturation, by late August. In colder climates, such as Michigan, the dormant ferns are allowed to remain on the field over winter in order to protect the asparagus crowns from cold damage and soil erosion. The dried ferns are removed a few weeks before spear production so that the field can receive a shallow plowing and treatment with herbicide to remove weeds. The removal of the brown, residual ferns in mid March is analogous to the crop harvest.

Table 1: Asparagus Phenology.

Bare Ground		**Fern Growth**	**Mature Fern (green or dormant)**
shallow plowing and herbicide applied	**spears harvested** from bare field as emergence	fern emergence date June 21 to crop maturation date August 25	crop maturation date (for ferns) August 25 to crop harvest date (dried ferns removed) March 15

Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
		^ end dormancy		^ fern emergence		^ fern maturation						^ fern residue removed

The field used to represent asparagus production in Michigan is located in Oceana County on the East Central and South East Coast of Lake Michigan, on the lower peninsula of the State (MLRA 96). The weather station representing the modeled asparagus field in MLRA 96, is located at Muskegon, MI (Metfile: w14840.dvf). Michigan ranks third in total U.S. asparagus production, both fresh market and processing, with 13 percent of the national total in 2002. California and Washington State were the leading producers. Oceana County produces about 70 percent of the states asparagus, with acreage also located in Manistee, St. Joseph, Ottawa and Mecosta counties (http://www.cns.jrn.msu.edu/articles/2003_0221/ASPARAGUS.html). **Note: This scenario**

represents a "likely" non-West Coast site conditions where asparagus will be grown. This site is not highly vulnerable to runoff, because the soils are well drained (Hydrologic Group A) and site is relatively level (the typical pedon and soil characterization data is based on a cultivated field with a 2 percent slope). Asparagus require soils that are well-drained, preferably either sandy loams or loamy sands, and therefore would be limited to soils of Hydrologic Group A, and perhaps some soils in Hydrologic Group B. Heavy textured soils damage the emerging spears, and shallow soils limit root growth. Both soils are unlikely to be used for commercial asparagus production.

The soil selected to simulate the asparagus field is a Spinks loamy sand soil. The series, which is classified as a benchmark soil, is of large extent in MRLA 96. The Spinks Series soil is classified as sandy, mixed, mesic Lamellic Hapludalfs. These glacial outwash soils are deep, well drained, sand, that are ideal for asparagus production. Spinks soils can be found in southern Michigan, northwestern Ohio, northern Indiana, southern Wisconsin, and southern Minnesota. **Slope gradients may range from 0 to 70 percent, but typically range between 2 to 18 percent. The STATSGO database (1994) gives the minimum (slopeL) and maximum (slopeH) value for slope a soil component within a mapping unit as 2 and 6 percent, respectively.** Spinks loamy sand is a Hydrologic Group A soil. Permeability is moderately rapid, leading to a negligible to moderate potential for surface runoff. Scenario includes limitations resulting from the soil data used in PRZM. Tables 2 through 6 summarize the parameters used in the PRZM Michigan asparagus scenario.

Table 2. PRZM 3.12 Climate and Time Parameters for Dade County, Florida - Avocado

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Muskegon MI (w14840.dvf)
Ending Date	December 31, 1990	Meteorological File - Muskegon MI (w14840.dvf)
Pan Evaporation Factor (PFAC)	0.77	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	12.5 cm	PRZM Manual Figure 5.2 (EPA, 1998) and PRZM Guidance July 2004 revision. County is on a boundary in the figure. Midpoint value of lowest range of values selected.

Table 3. PRZM 3.12 Erosion and Landscape Parameters for Oceana County, Michigan - Asparagus

Parameter	Value	Source

Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.18	PRZM Manual, Table 5.3 (EPA, 1998) Average value from 2% and 4% soil organic matter content tabulated for Loamy Fine Sand; soil type supplied by Mark Kelly. USDA Natural Resources Conservation Services, Shelby MI, (mark.kelly@mi.usda.gov); % organic matter content not determined
USLE LS Factor (USLELS)	1.34	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	0.5	Based on slope and EPA guidance (EPA 2004)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Range: 0-70%(USDA 2006). Maximum of the range is >12, the SLP for a row crop should be set to 6% (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)

Table 4. PRZM 3.12 Crop Parameters for Oceana County, Michigan - Asparagus		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	2	previous season's vegetation destroyed through mowing and/or tillage and herbicides http://pestdata.ncsu.edu/cropprofiles/docs/Miasparagus.html
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Muskegon MI (w14840.dvf)
Maximum rainfall Interception storage of crop (CINTCP)	0.15	PRZM Manual Table 5-4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	170 cm	Set to soil horizon depth; roots may grow to 610 cm http://www.dole5aday.com/ReferenceCenter/Encyclopedia/Asparagus/asparagus_harvested.jsp

Maximum Canopy Coverage (COVMAX)	85	visual estimate from photographs of mature ferns http://www.uga.edu/vegetable/asparagus.html
Soil Surface Condition After Harvest (ICNAH)	2	Plot can be shallow plowed and/or burned down with herbicides after ferns residues are removed in preparation for spear harvesting.
Date of Crop Emergence (EMD, EMM, IYREM)	16/06	Emergence set to end of spear harvesting, when ferns are allowed to develop. (This scenario is only for use with pesticides used on the fern stage of asparagus phenology; therefore, the emergence date for the ferns is the same as the date when spear harvesting ceases)
Date of Crop Maturity (MAD, MAM, IYRMAT)	25/08	Maturity set to date average maximum fern development. (This scenario is only for use with pesticides used on the fern stage of asparagus phenology; therefore, the crop maturation date for the ferns is the same as the date when the ferns reach their maximum size)
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/03	Harvest set to average date when fern residue is removed from field (This scenario is only for use with pesticides used on the fern stage of asparagus phenology; therefore, the crop harvest date for the ferns is the same as the date when the dried, over wintered vegetation is removed from the field)
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	71, 61, 66	GLEAMS Manual Table H-4. Hydrologic Soil Group A, Landuse selected: Close seeded legumes or rotation meadows. Treatment: SR; condition: poor.
Manning’s N Value (MNGN)	0.014	RUSLE EPA Pesticide Project; Grapes, bare ground, Grand Rapids, MI (USDA, 2000)
USLE C Factor (USLEC)	0.311 - 0.587	ERFLAG equal to zero

Table 5. PRZM 3.12 Spinks Loamy Sand Soil Parameters for Oceana County, Michigan - Asparagus

Parameter	Value	Verification Source
Total Soil Depth (CORED)	170 cm	NCSS http://ortho.ftw.nrcs.usda.gov/osd/dat/S/SPINKS.html
Number of Horizons (NHORIZ)	5 (Top horizon split in two)	
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 10 cm (HORIZN = 2) 20 cm (HORIZN = 3) 50 cm (HORIZN = 4) 80 cm (HORIZN = 5)	NCSS. http://ortho.ftw.nrcs.usda.gov/osd/dat/S/SPINKS.html NRCS http://ssldata.nrcs.usda.gov/
Bulk Density (BD)	1.66 g $\cdot cm^{-3}$ (HORIZN = 1) 1.66 g $\cdot cm^{-3}$ (HORIZN = 2) 1.63 g $\cdot cm^{-3}$ (HORIZN = 3) 1.67 g $\cdot cm^{-3}$ (HORIZN = 4) 1.66 g $\cdot cm^{-3}$ (HORIZN = 5)	NRCS http://ssldata.nrcs.usda.gov/ average for 40A1914 and 40A1916 pedons (Horz 1-4). average for 40A1914, 40A1915, and 40A1916 pedons (Horz 5)
Initial Water Content (THETO)	0.181 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.181 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2) 0.171 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.153 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4) 0.138 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 5)	Initial water content values defaulted to the field capacity values. PRZM Manual (EPA, 1998)
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN =2) 5 cm (HORIZN =3) 5 cm (HORIZN =4) 5 cm (HORIZN =5)	NRCS http://ssldata.nrcs.usda.gov/ average for 40A1914 and 40A1916 pedons (Horz 1-4). average for 40A1914, 40A1915, and 40A1916 pedons (Horz 5)
Field Capacity (THEFC)	0.181 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.181 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2)	

	0.171 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.153 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4) 0.138 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 5)	NRCS http://ssldata.nrcs.usda.gov/ average for 40A1914 and 40A1916 pedons
Wilting Point (THEWP)	0.0442 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.0442 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2) 0.03 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.0498 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4) 0.0652 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 5)	NRCS http://ssldata.nrcs.usda.gov/ average for 40A1914 and 40A1916 pedons (Horz 1-4). average for 40A1914, 40A1915, and 40A1916 pedons (Horz 5)
Organic Carbon Content (OC)	0.655% (HORIZN = 1) 0.655% (HORIZN = 2) 0.105% (HORIZN = 3) 0.060% (HORIZN = 4) 0.0733% (HORIZN = 5)	

EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

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USDA. NRCS. 2006. Soil Classification. Information taken from the website: http://soils.usda.gov/technical/classification/.

MICHIGAN BEANS

A variety of beans are grown in Michigan, among these are dry, pole, kidney, and black. The Bay-Thumb region of Michigan, which includes Huron County, has the highest production acreage in the U.S. Among all states producing beans, Michigan ranks in the top; 2nd in overall dry bean production, 3rd in snap beans for fresh market, and highest in black bean production. Beans are planted in May and June. Plants reach full height at approximately 12 to 14 weeks after planing. Small flowers appear on the plants at maturity and pods form in August. Harvest begins in late August and extends until early October or when the first killing frost occurs. Weeds are generally controlled by cultivation, minimizing the need for herbicides. Most herbicides are applied before planting. Irrigation is almost never used, in fact on many farms, too much water is often a problem. Seeds are generally planted to 0.75 to 1.0 inch deep at the beginning of the frost-free period. Planting architecture is generally 2 to 3 inches between plants in a row and 18 to 36 inches between rows. Plant heights vary up to about 4 to 5 feet on average, root systems likewise vary with some species sending tap roots to more that 5.5 feet. The field used to represent bean production in Michigan is located in Huron County on the thumb of the East Central Coast of Lake Michigan in MLRA 99. The weather station representing the modeled bean field in MLRA 99, is located at Flint Michigan (Metfile: w14826.dvf). **Note: This scenario represents a "likely" high-end regional bean scenario, as such, it has not been established that this scenario represents a high-end "national" bean scenario.**

The soil selected to simulate the bean field is a Toledo silty clay soil. The series, which is classified as a benchmark soil, is of large extent in MRLA 99. The Toledo Series soil is classified as fine, illitic, nonacid, mesic Mollic Endoaquepts. Toledo silty clay is a very deep, very poorly drained soil formed in clayey glaciolacustrine sediments. These soils are located on lake plains. Permeability is generally slow and runoff negligible to medium. There is an apparent water table one foot above to one foot below surface from November to May of most years. Slope ranges from 0 to 2 percent, hence the negligible runoff classification on some fields. These soils form at elevations from 500 to 800 feet above mean sea level. The Toledo soil series is commonly used for special crop production including beans'. Annual precipitation ranges from 27 to 36 inches. Toledo silty clay is a Hydrologic Group D soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Huron County, Michigan - Beans		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Flint, MI (w14826.dvf)
Ending Date	December 31, 1990	Meteorological File - Flint, MI (w14826.dvf)
Pan Evaporation Factor (PFAC)	0.76	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Tablee 5.1 (EPA, 1998). Maximum value of minimum range for open areas.
Minimum Depth of Evaporation (ANETD)	12.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Huron County, Michigan - Beans		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.2	Table 3.1 FARM Manual, 3.48% organic matter
USLE LS Factor (USLELS)	0.20	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual, Table 5.6 (EPA, 1998). No support practices.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1%	Median slope range (0-2%) (USDA 2006) (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)

Table 3. PRZM 3.12 Crop Parameters for Huron County, Michigan - Beans		

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	http://pestdata.ncsu.edu/cropprofiles/docs/mibeans-snap.html
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Flint, MI (w14826.dvf); closest met file
Maximum rainfall Interception storage of crop (CINTCP)	0.1	PRZM Manual Table 5-4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	38 cm	Taken from OR Snapbeans scenario
Maximum Canopy Coverage (COVMAX)	100	Taken from OR Snapbeans scenario
Soil Surface Condition After Harvest (ICNAH)	3	http://pestdata.ncsu.edu/cropprofiles/docs/mibeans-snap.html
Date of Crop Emergence (EMD, EMM, IYREM)	01/06	http://www.colostate.edu/programs/wvrc/annrpt/00/Pearsons_Beans.html
Date of Crop Maturity (MAD, MAM, IYRMAT)	27/07	http://www.colostate.edu/programs/wvrc/annrpt/00/Pearsons_Beans.html
Date of Crop Harvest (HAD, HAM, IYRHAR)	4/09	http://www.colostate.edu/programs/wvrc/annrpt/00/Pearsons_Beans.html
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	92,89,90	GLEAMS Manual Table H-4, Hydrologic group D soil, Fallow = straight row, conventional tillage; cropping and residue = close-seeded legumes; all are poor row conditions
Manning’s N Value (MNGN)	0.014	File LA2BDCGC.dat; Beans, Dry; Conventional Tillage; no cover; Grand Rapids, MI; rotate with corn
USLE C Factor (USLEC)	0.078 - 0.476	File LA2BDCGC.dat; Beans, Dry; Conventional Tillage; no cover; Grand Rapids, MI; rotate with corn

Table 4. PRZM 3.12 Toledo Soil Parameters for Huron County, Michigan - Beans

Parameter	Value	Verification Source

<table>
<tr><td>Total Soil Depth (CORED)</td><td>100 cm</td><td rowspan="2">NCSS
http://pestdata.ncsu.edu/croppro files/docs/mibeans-snap.html
and
http://ssldata.nrcs.usda.gov/
http://ssldata.nrcs.usda.gov/</td></tr>
<tr><td>Number of Horizons (NHORIZ)</td><td>3 (Top horizon split in two)</td></tr>
<tr><td colspan="3">First, Second, and Third Soil Horizons (HORIZN = 1,2,3)</td></tr>
<tr><td>Horizon Thickness (THKNS)</td><td>10 cm (HORIZN = 1)
12 cm (HORIZN = 2)
78 cm (HORIZN = 3)</td><td rowspan="7">NRCS
http://ssldata.nrcs.usda.gov/

NRCS
http://ssldata.nrcs.usda.gov/

PRZM Manual (EPA, 1998)

NRCS
http://ssldata.nrcs.usda.gov/

NRCS
http://ssldata.nrcs.usda.gov/

NRCS
http://ssldata.nrcs.usda.gov/</td></tr>
<tr><td>Bulk Density (BD)</td><td>1.1 g $\cdot cm^{-3}$ (HORIZN = 1)
1.1 g $\cdot cm^{-3}$ (HORIZN = 2)
1.8 g $\cdot cm^{-3}$ (HORIZN = 3)</td></tr>
<tr><td>Initial Water Content (THETO)</td><td>0.377 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1)
0.377 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2)
0.314 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)</td></tr>
<tr><td>Compartment Thickness (DPN)</td><td>0.1 cm (HORIZN = 1)
4 cm (HORIZN =2)
3 cm (HORIZN =3)</td></tr>
<tr><td>Field Capacity (THEFC)</td><td>0.377 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1)
0.377 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2)
0.314 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)</td></tr>
<tr><td>Wilting Point (THEWP)</td><td>0.257 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1)
0.257 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2)
0.254 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)</td></tr>
<tr><td>Organic Carbon Content (OC)</td><td>3.48% (HORIZN = 1)
3.48% (HORIZN = 2)
0.29% (HORIZN = 3)</td></tr>
</table>

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EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

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Soil and Health Library; *Root Development of Vegetable Crops*: Chapter VI; http://www.soilandhealth.org/01aglibrary/010137veg.roots/010137ch6.html

STATSGO, 1994. State Soil Geographic (STATSGO) data base for Michigan Publication Information. (Source data 1991) U.S. Department of Agriculture, Soil Conservation Service, Fort Worth, Texas.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

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USDA. NRCS. 2006. Soil Classification. Information taken from the website: http://soils.usda.gov/technical/classification/.

MICHIGAN CHERRIES (Sweet and Tart)

The field used to represent cherry production in Michigan is located in Leelanau County, but may be similarly located in Grand Traverse County in the Northwest region of the state along Lake Michigan (MLRA96) and the weather station representing the orchard's weather is located in Traverse City, MI. Cherries are grown throughout the western portion of the state bordering Lake Michigan. A number of varieties are produced, but, Montmorency is the main tart variety and Emperor, Francis, Napoleon, and Schmidt the main sweet varieties. Michigan is the top acreage and production state in the U.S. for combined sweet and tart cherries followed by Washington State which is only 10 percent of Michigan production and is mainly sweet cherries. Michigan produces more than 75 percent of the annual tart crop and about 20 percent of the annual sweet crop. Nearly the entire crop is produced for processing. Trees are carefully maintained at a height from 12 to 18 feet tall, 14 feet is common. Width of trees is generally 18 feet. Planting averages about 110 trees per acres. Ground between trees and rows are well maintained to minimize disease and insect pressures. The life span of an orchard averages 30 to 35 years. The size and density of trees make pruning, spraying and harvesting difficult, therefore, most pesticide applications are via air-blast. Cherry trees are dependent on honey bees for pollination for fruit set; about one tree in nine is a pollen source within an orchard. Most varieties of cherries require about 42 inches rain each year, with much being necessary during the mid-summer growth period. Irrigation may be used to supplement natural rainfall during this period. The crop scenario does not include irrigation. Cherry trees can grow under almost any condition, but do best along the Lake Michigan shoreline where the lake tempers the Arctic winds in winter and coos the orchards in summer. Orchards do best on sandy soils along rolling hills. Harvest peaks in mid July. The soil selected to simulate the field is a Kewaunee silt loam. Kewaunee silt loam is a fine, mixed, mesic Typic Hapludalfs. Kewaunee silt loam consists of deep, well drained or moderately well drained soils with runoff determined by slope and may pond on level slopes after heavy rainfall. Internal drainage is restricted by the massive substratum; permeability is moderately slow or slow. These soils formed in reddish-colored calcareous, moderately fine and fine textured glacial till of late Wisconsinan age, typically with a thin mantle of loess. They are found on ground, end and recessional moraines. Slopes range from 0 to 45 percent and are typically 2 to 12 percent. Kewaunee silt loam is a Hydrologic Group C soil of large extent and classified as a benchmark soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Leelanau County, Michigan - Cherries		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Traverse City, MI (W14850)
Ending Date	December 31, 1990	Meteorological File - Traverse City, MI (W14850)
Pan Evaporation Factor (PFAC)	0.78	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.16 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	12.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Leelanau County, Michigan - Cherries		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.37 tons EI^{-1*}	GLEAMS Manual, Table of Representative Soils. (USDA, 1990)
USLE LS Factor (USLELS)	3.63	Calculated according to Haan and Barfield (1978) equation: $LS = ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual, Table 5.6 (EPA, 1998)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	12%	Range: 0-45%. Maximum of the range is >12, the SLP for an orchard crop should be set to12% (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Leelanau County, Michigan - Cherries

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Residues remain in field between tree rows, area under trees
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Traverse City, MI (W14850)
Maximum rainfall Interception storage of crop (CINTCP)	0.25	Default value for orchards (EPA 2004).
Maximum Active Root Depth (AMXDR)	100 cm	Set to soil horizon depth; main root cluster may grow in excess of 1 meters deep. Some single large branch roots will grow to first confining layer. http://www.leelanau.com/cherry/industry.html
Maximum Canopy Coverage (COVMAX)	75	Based on estimates from aerial photography; http://www.Leelanau.com/cherry/industry.html
Soil Surface Condition After Harvest (ICNAH)	3	Residues remain in field between tree rows, area under trees during critical periods.
Date of Crop Emergence (EMD, EMM, IYREM)	01/05	Estimated date of full flower bloom. Other critical stages described in metadata file. http://www.Leelanau.com/cherry/industry.html
Date of Crop Maturity (MAD, MAM, IYRMAT)	07/07	Estimated date of maturity; http://www.Leelanau.com/cherry/industry.html
Date of Crop Harvest (HAD, HAM, IYRHAR)	21/07	Peak harvest time in Michigan; http://www.Leelanau.com/cherry/industry.html
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4, Meadow, conditions good for Hydrologic Soil C.
Manning’s N Value (MNGN)	0.023	RUSLE EPA Pesticide Project; La2OCOCM; Grand Rapids MI; Orchard; Cover Alley; Till System: Mulch Tillage (MT); Cover Code 5 (Light Cover - residue cover on soil during critical periods, common with mulch tillage); (USDA, 2000)
USLE C Factor (USLEC)	0.052 - 0.235	RUSLE EPA Pesticide Project; La2OCOCM; Grand Rapids MI; Orchard; Cover Alley; Till System: Mulch Tillage (MT); Cover Code 5 (Light Cover - residue cover on soil during critical periods, common with mulch tillage); (USDA, 2000)

Table 4. PRZM 3.12 Kewaunee Soil Parameters for Leelanau County, Michigan - Cherries		
Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4 (Top horizon split in two)	
First, Second, Third and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 16 cm (HORIZN = 2) 48 cm (HORIZN = 3) 26 cm (HORIZN = 4)	NRCS, National Soils Characterization Database (NRCS, 2001) [http://www.statlab.iastate.edu/soils/ssl/)](http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.6 g $\cdot cm^{-3}$ (HORIZN = 1,2) 1.8 g $\cdot cm^{-3}$ (HORIZN = 3,4)	
Initial Water Content (THETO)	0.291 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.263 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.252 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4 cm (HORIZN = 2,3) 2 cm (HORIZN = 4)	
Field Capacity (THEFC)	0.291 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.263 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.252 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Wilting Point (THEWP)	0.101 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.193 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.192 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Organic Carbon Content (OC)	1.74% (HORIZN = 1,2) 0.174% (HORIZN = 3)	

	0.116% (HORIZN = 4)	

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EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

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EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

MINNESOTA SUGAR BEETS

The field used to represent sugar beet production in Minnesota is located in Polk County, in the Red River Valley of the North (MLRA 56). According to the 1997 Census of Agriculture, Minnesota ranked 1st in production and acreage of sugar beets in the U.S. The crop is generally planted the late Spring and harvested beginning in October. Row spacing is generally 30-inches. Row canopies tend to be very close to 100 percent, while the canopy between rows is much less. The crop may be grown under irrigation by furrow, canal, or center pivot systems. However, sugar beets grown in the Red River Valley, do not need to be irrigated. The soil selected to simulate the field is a benchmark soil, Bearden silty clay loam. Bearden silty clay loam, is a fine-silty, mixed, superactive, frigid Aeric Calciaquolls. These soils are nearly all under cultivation to small grains, especially alfalfa, and row crops (i.e., sugar beets). Bearden silty clay loam is a very deep, somewhat poorly drained, slowly permeable soil with negligible to high runoff. A seasonal high water table is at depths of 1.5 to 3.5 feet as some time during the period of April to June. These soils formed in calcareous silt loam and silty clay loam lacustrine sediments. They are generally found on glacial lake plains at elevations from 650 to 2000 feet above mean sea level on slopes of 0 to 3 percent. Bearden silty clay loam is a Hydrologic Group C soil. The series is of large extent in Minnesota, North Dakota, and South Dakota.

Table 1. PRZM 3.12 Climate and Time Parameters for Polk County, Minnesota - Sugar Beets

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Fargo, ND (W14914)
Ending Date	December 31, 1990	Meteorological File - Fargo, ND (W14914)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm $^{\circ}C^{-1}$	PRZM Manual Table 5.1 (EPA, 1998).
Minimum Depth of Evaporation (ANETD)	12.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Polk County, Minnesota - Sugar Beets

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)

USLE K Factor (USLEK)	0.28 tons EI^{-1*}	GLEAMS Table of Representative Soils (USDA, 1990)
USLE LS Factor (USLELS)	0.25	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	0.6	Based on slope and guidance (EPA 2004)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1.5%	Set to median value (range 0-3%) (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Polk County, Minnesota - Sugar Beets

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Default value (EPA 2004).
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Fargo, ND (W14914.dvf)
Maximum rainfall interception storage of crop (CINTCP)	0.2	PRZM Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	100 cm	Set to soil profile depth. Roots can be as much as 8 feet deep. Dr. Mohamed Kahn; NDSU (701) 231-8596; Larry Smith U of MN (218) 281-8602. Value may be inconsistent with different sugar beet scenarios due to different sources.
Maximum Canopy Coverage (COVMAX)	100	Dr. Mohamed Kahn; NDSU (701) 231-8596; Larry Smith U of MN (218) 281-8602.
Soil Surface Condition After Harvest (ICNAH)	3	Default value (EPA 2004).
Date of Crop Emergence	16/05	Usual Planting and Harvest Dates for US Field Crops

(EMD, EMM, IYREM)		(USDA, 1984) & Updated Crop Stage Information from HED (Bernard Schneider)
Date of Crop Maturity (MAD, MAM, IYRMAT)	01/10	
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/10	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	91, 85, 87	Gleams Manual Table H-4, Fallow = SR/poor; Cropping and Residue = Row Crop, SR/poor condition (USDA, 1990)
Manning's N Value (MNGN)	0.014	RUSLE Project, F86SUSUC); Sugar beets, Conventional tillage, Fargo, ND (USDA, 2000)
USLE C Factor (USLEC)	0.017 - 0.638	RUSLE Project; F86SUSUC); Sugar beets, Conventional tillage, Fargo, ND (USDA, 2000)

Table 4. PRZM 3.12 Bearden Soil Parameters for Polk County, Minnesota - Sugar Beets

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4 (3 Base, Top horizon split in two)	
First, Second, Third and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 8 cm (HORIZN = 2) 54 cm (HORIZN = 3) 28 cm (HORIZN = 4)	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.4 $g \cdot cm^{-3}$ (HORIZN = 1, 2) 1.5 $g \cdot cm^{-3}$ (HORIZN = 3) 1.8 $g \cdot cm^{-3}$ (HORIZN = 4)	
Initial Water Content (THETO)	0.377 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =1, 2) 0.292 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =3) 0.285 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =4)	

Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4.0 cm (HORIZN =2) 3.0 cm (HORIZN = 3) 4.0 cm (HORIZN = 4)	
Field Capacity (THEFC)	0.377 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1, 2) 0.292 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3) 0.285 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Wilting Point (THEWP)	0.207 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.132 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3) 0.125 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Organic Carbon Content (OC)	4.06% (HORIZN = 1,2) 0.174% (HORIZN = 3) 0.116% (HORIZN = 4)	

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MISSISSIPPI CORN

The field used to represent corn production in Mississippi is located in the Southern Mississippi Valley Uplands. According to the 1997 Census of Agriculture, Mississippi is not a major corn producing state in the U.S. (not among the top 20 states) with approximately 600,000 acres in production. The crop is generally planted in the early Spring (April) and harvested beginning in August. Continuous corn is practice is much of the region, however, rotation with other crops such as soybean is the practiced as well. Most of the corn is planted for feed grain. Planting depth and row spacing (generally 30 inches) follows general practices for the U.S. Conventional tillage dominates with more than 50 percent of the practice, followed by conservation tillage, no-tillage, and ridge tillage. The crop is rarely grown under irrigation. The soil selected to simulate the field is a benchmark soil, Grenada silt loam. Grenada silt loam is a fine-silty, mixed, active, thermic Oxyaquic Fraglossudalfs. Most of the soil is used for the production of row crops such as corn, cotton, and soybeans, the principal crops. Grenada silt loam is a very deep, moderately well drained, medium to slow runoff, moderately permeable above a fragipan and slow in the fragipan soil. The fragipan is at a depth of about two feet. The soils formed in loess. They are located on uplands and stream terraces of low relief in the Southern Mississippi Valley Silty Uplands. Slopes are generally between 0 to 8 percent, but may range to 12 percent. The soils are extensive throughout the region. Grenada silt loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Southern Mississippi Valley Uplands, Mississippi - Corn

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Jackson, MS (W03940)
Ending Date	December 31, 1990	Meteorological File - Jackson, MS (W03940)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	25.0 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Southern Mississippi Valley Uplands, Mississippi - Corn

Parameter	Value	Source

Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.43 tons EI^{-1*}	GLEAMS Table of Representative Soils (USDA, 1990)
USLE LS Factor (USLELS)	1.34	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual (EPA, 1998) Non-contour plowing, no practice assumed
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Mid-point of series range. Selected according to QA/QC Guidance (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Southern Mississippi Valley Uplands, Mississippi - Corn

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Default value (EPA 2004).
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Jackson, MS (W03940)
Maximum rainfall interception storage of crop (CINTCP)	0.25	PRZM Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	90 cm	Median value (60-120 cm) (Table 5-9. EPA 1998).
Maximum Canopy Coverage (COVMAX)	100	Taken from IL corn. Also consistent with default value cited in guidance (EPA 2004).
Soil Surface Condition After Harvest (ICNAH)	3	Default value (EPA 2004).

Date of Crop Emergence (EMD, EMM, IYREM)	10/04	Usual Planting and Harvest Dates for US Field Crops (USDA, 1984)
Date of Crop Maturity (MAD, MAM, IYRMAT)	22/08	
Date of Crop Harvest (HAD, HAM, IYRHAR)	02/09	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	91, 87, 88	Gleams Manual Table H-4, Fallow = SR/poor, Cropping and Residue = Row Crop, SR/Poor condition (USDA, 1990)
Manning's N Value (MNGN)	0.014	RUSLE Project, OA6CGSBC; Corn, grain, conventional tillage, Natchez, MS (USDA, 2000)
USLE C Factor (USLEC)	0.024 - 0.848	RUSLE Project; OA6CGSBC; Corn, grain, conventional tillage, Natchez, MS (USDA, 2000)

Table 4. PRZM 3.12 Grenada Soil Parameters for Southern Mississippi Valley Uplands, Mississippi - Corn

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4 (3 Base, Top horizon split in two)	
First, Second, Third and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 44 cm (HORIZN = 2) 8 cm (HORIZN = 3) 38 cm (HORIZN = 4)	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.7 g $\cdot$cm^{-3} (HORIZN = 1, 2) 1.8 g $\cdot$cm^{-3} (HORIZN = 3,4)	
Initial Water Content (THETO)	0.309 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =1, 2) 0.304 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =3)	

	0.216 cm^3-H_2O ·cm^{-3}-soil (HORIZN =4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4 cm (HORIZN = 2) 4 cm (HORIZN = 3) 2 cm (HORIZN = 4)	
Field Capacity (THEFC)	0.309 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1, 2) 0.304 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3) 0.216 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Wilting Point (THEWP)	0.109 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.104 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3) 0.116 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.174% (HORIZN = 3) 0.116% (HORIZN = 4)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. ***P****esticide and* ***I****ndustrial Chemical* ***R****isk Analysis and* ***H****azard* ***A****ssessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA. 1992.

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

MISSISSIPPI COTTON

The field used to represent cotton production in Mississippi is located in Yazoo County. According to the 1997 Census of Agriculture, Mississippi is ranked 4th in production and acreage of cotton in the U.S. The crop is generally planted in Spring (late April) and harvested beginning in September. Row spacing is generally 38-inches with 3-4 plants per foot row. Row canopies tend to be very close to 100 percent, while the canopy between rows is much less. The crop may be grown under irrigation by furrow or canal systems. Most crops are planted by stale seedbed, no-till, or conventional methods. The soil selected to simulate the field is a Loring silt loam. Loring silt loam is a fine-silty, mixed, active, thermic, Qxyaquic Fragiudalfs. Nearly all soils are cleared and used to grow cotton, small grains, soybeans, hay and pasture. Loring silt loam is a moderately well drained with a fragipan, medium to rapid runoff, moderate permeability above the fragipan and moderately slowly permeable in the fragipan soils formed in loess. They are located on level to strongly sloping uplands and stream terraces. Slopes are generally between 0 to 20 percent. The soils are extensive in the lower Mississippi drainage basin. Loring silt loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Yazoo County, Mississippi - Cotton

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Jackson, MS (W03940)
Ending Date	December 31, 1990	Meteorological File - Jackson, MS (W03940)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Pan Factor Flag (IPEIND)	0	PAN Evaporation data read from file
Minimum Depth of Evaporation (ANETD)	25 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Yazoo County, Mississippi - Cotton

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.49 tons EI^{-1*}	EXPRES; PRZM Manual Table 5.3 (EPA, 1998)
USLE LS Factor	1.34	Calculated according to Haan and Barfield (1978) equation: LS

(USLELS)		$= ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	0.5	Based on slope range and EPA guidance (EPA 2004) for row crops.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Range: 0-20%. Since maximum value >12%, value is set to 6% for row crops (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Yazoo County, Mississippi - Cotton

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Default value (EPA 2004).
Number of Different Crops (NDC)	1	Set to 1, PRZM Guidance (2004)
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Jackson, MS (W03940)
Maximum rainfall interception storage of crop (CINTCP)	0.2	EXPRES; PRZM manual Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	65 cm	Value from CA cotton. Consistent with PRZM manual, table 5-9 (EPA 1998) which cites range of 30-90 cm.
Maximum Canopy Coverage (COVMAX)	100	Consistent with advice of Kerry Arroues USDA-NRCS for development of CA cotton scenario. Also, consistent with EPA 2004 guidance of default value of 100 of row crops.
Soil Surface Condition After Harvest (ICNAH)	3	Default value (EPA 2004).
Date of Crop Emergence (EMD, EMM, IYREM)	01/05	EXPRES and verified with Usual Planting and Harvest Dates for US Field Crops (USDA, 1984)
Date of Crop Maturity (MAD, MAM, IYRMAT)	07/09	

Date of Crop Harvest (HAD, HAM, IYRHAR)	22/09	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	89, 86, 87	GLEAMS manual, Table H-4 Hydrologic group C soils, Fallow SR/CT/poor, cropping and residue Row Crop SR/CT/poor condition
Manning's N Value (MNGN)	0.014	RUSLE Project, PA6CTCTC: Cotton, conventional tillage, Holly Springs, MS (USDA, 2000)
USLE C Factor (USLEC)	0.223 - 0.718	RUSLE Project; PA6CTCTC: Cotton, conventional tillage, Holly Springs, MS (USDA, 2000)

Table 4. PRZM 3.12 Loring Soil Parameters for Yazoo County, Mississippi - Cotton

Parameter	Value	Verification Source
Total Soil Depth (CORED)	155 cm	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	6	
First, Second, Third, Fourth, Fifth, and Sixth Soil Horizons (HORIZN = 1,2,3,4,5,6)		
Horizon Thickness (THKNS)	13 cm (HORIZN = 1) 23 cm (HORIZN = 2) 33 cm (HORIZN = 3) 30 cm (HORIZN = 4) 23 cm (HORIZN = 5) 33 cm (HORIZN = 6)	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.4 $g \cdot cm^{-3}$ (HORIZN = 1,2,3) 1.45 $g \cdot cm^{-3}$ (HORIZN = 4) 1.49 $g \cdot cm^{-3}$ (HORIZN = 5) 1.51 $g \cdot cm^{-3}$ (HORIZN = 6)	
Initial Water Content (THETO)	0.385 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =1) 0.370 cm^3-$H_2O \cdot cm^{-3}$-soil (HORIZN =2,3) 0.340 cm^3-$H_2O \cdot cm^{-3}$-soil	

	(HORIZN =4) 0.335 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =5) 0.343 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =6)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 1 cm (HORIZN = 2) 3 cm (HORIZN = 3) 5 cm (HORIZN = 4) 1 cm (HORIZN = 5) 3 cm (HORIZN = 6)	
Field Capacity (THEFC)	0.385 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.370 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2,3) 0.340 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4) 0.335 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =5) 0.343 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =6)	
Wilting Point (THEWP)	0.151 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.146 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2,3) 0.125 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4) 0.137 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 5) 0.147 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 6)	
Organic Carbon Content (OC)	1.28% (HORIZN = 1) 0.49% (HORIZN = 2) 0.16% (HORIZN = 3) 0.12% (HORIZN = 4) 0.07% (HORIZN = 5) 0.06% (HORIZN = 6)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. ***P**esticide and **I**ndustrial Chemical **R**isk Analysis and **H**azard **A**ssessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S.

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Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

MISSISSIPPI SOYBEANS

The field used to represent soybean production in Mississippi is located in Yazoo County. According to the 1997 Census of Agriculture, Mississippi harvested more than 2 million acres of soybeans and ranks 12th in production in the U.S. The crop is generally planted in Spring (late April) and harvested beginning in September. Row spacing is generally 30 to 38-inches, but spacing could be a little as 7 inches. Field canopies tend to be very close to 100 percent early in the season and less as harvest nears. The crop may be grown under irrigation by furrow or canal systems. Most crops are planted by conventional tillage, but, no-till, or conservation methods are employed as well. The soil selected to simulate the field is a Loring silt loam. Loring silt loam is a fine-silty, mixed, active, thermic, Qxyaquic Fragiudalfs. Nearly all soils are cleared and used to grow cotton, small grains, soybeans, hay and pasture. Loring silt loam is a moderately well drained with a fragipan, medium to rapid runoff, moderate permeability above the fragipan and moderately slowly permeable in the fragipan soils formed in loess. They are located on level to strongly sloping uplands and stream terraces. Slopes are generally between 0 to 20 percent. The soils are extensive in the lower Mississippi drainage basin. Loring silt loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Yazoo County, Mississippi - Soybeans

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Jackson, MS (W03940)
Ending Date	December 31, 1990	Meteorological File - Jackson, MS (W03940)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	25 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Yazoo County, Mississippi - Soybeans

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.42 tons EI^{-1*}	FARM Manual, Table 3.1 (EPA, 1985)
USLE LS Factor (USLELS)	0.30	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope

		length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1	Tim Pepper, Yazoo Co. Ag Extension Agent (622-746-2453). Contour plowing not common, slope generally <2%.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	2%	Tim Pepper, Yazoo Co. Ag Extension Agent (622-746-2453). Typical maximum slope.
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Yazoo County, Mississippi - Soybeans

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Tim Pepper, Yazoo Co. Ag Extension Agent (622-746-2453)
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Jackson, MS (W03940)
Maximum rainfall interception storage of crop (CINTCP)	0.2	PRZM Manual, Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	30 cm	PRZM Manual, Table 5.9 (EPA, 1998), Soybean Rooting depth: 30-60 cm. PIC returned 22.
Maximum Canopy Coverage (COVMAX)	100	Default for row crops (EPA, 2001)
Soil Surface Condition After Harvest (ICNAH)	3	Tim Pepper, Yazoo Co. Ag Extension Agent (622-746-2453)
Date of Crop Emergence (EMD, EMM, IYREM)	16/04	Tim Pepper, Yazoo Co. Ag Extension Agent (622-746-2453): For emergence date, date of planting used. For maturation date, harvest beginning date used. Harvest occurs 9/1-10/25.
Date of Crop Maturity (MAD, MAM, IYRMAT)	01/09	

Date of Crop Harvest (HAD, HAM, IYRHAR)	10/10	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	87, 84, 86	Gleams Manual Table H-4; Fallow = SR/poor, Cropping and Residue = Row Crop, SR/poor
Manning's N Value (MNGN)	0.014	RUSLE Project, OA6SBCGC; Soybean, conventional tillage, Natchez, MS. Using boarding LRR (O) (USDA, 2000)
USLE C Factor (USLEC)	0.040 - 0.654	RUSLE Project; OA6SBCGC; Soybean, conventional tillage, Natchez, MS. Using boarding LRR (O) (USDA, 2000)

Table 4. PRZM 3.12 Loring Soil Parameters for Yazoo County, Mississippi - Soybeans

Parameter	Value	Verification Source
Total Soil Depth (CORED)	155 cm	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	6	
First, Second, Third, Fourth, Fifth, and Sixth Soil Horizons (HORIZN = 1,2,3,4,5,6)		
Horizon Thickness (THKNS)	13 cm (HORIZN = 1) 23 cm (HORIZN = 2) 33 cm (HORIZN = 3) 30 cm (HORIZN = 4) 23 cm (HORIZN = 5) 33 cm (HORIZN = 6)	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.4 g $\cdot cm^{-3}$ (HORIZN = 1,2,3) 1.45 g $\cdot cm^{-3}$ (HORIZN = 4) 1.49 g $\cdot cm^{-3}$ (HORIZN = 5) 1.51 g $\cdot cm^{-3}$ (HORIZN = 6)	
Initial Water Content (THETO)	0.385 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.370 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2,3) 0.340 cm^3-H_2O $\cdot cm^{-3}$-soil	

	(HORIZN =4) 0.335 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =5) 0.343 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =6)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 1 cm (HORIZN = 2) 3 cm (HORIZN = 3) 5 cm (HORIZN = 4) 1 cm (HORIZN = 5) 3 cm (HORIZN = 6)	
Field Capacity (THEFC)	0.385 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.370 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2,3) 0.340 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4) 0.335 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =5) 0.343 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =6)	
Wilting Point (THEWP)	0.151 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.146 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2,3) 0.125 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4) 0.137 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 5) 0.147 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 6)	
Organic Carbon Content (OC)	1.28% (HORIZN = 1) 0.49% (HORIZN = 2) 0.16% (HORIZN = 3) 0.12% (HORIZN = 4) 0.07% (HORIZN = 5) 0.06% (HORIZN = 6)	

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NORTH CAROLINA APPLES (Western)

The field used to represent apple production in North Carolina is located in Henderson County, in Western North Carolina. According to the 1997 Census of Agriculture, North Carolina is among the major producers of apples (7th to 8th overall) in the U.S., and is one of the southern most production areas. There are four primary apple production areas in western North Carolina, all long-term perennial regions, grown on a variety of soils, in different climate regions. Henderson County produces between 60 to 70 percent of the apple crop. Within row tree spacing depends on the root stock and cultivation method. Spacing ranges from as little as 5 feet to 25 feet. Row spacing may be as much as twice the within row spacing to allow for maintenance and harvesting equipment. The soil selected to simulate the field is a benchmark soil, Hayesville loam. Hayesville loam, is a fine, kaolinitic, mesic, Typic Kanhapludults. About one-half of these soils are under cultivation in corn, small grains, pasture, hayland, tobacco, vegetables, and Christmas trees. Hayesville loam is a very deep, well drained, moderately rapid permeable soil with slow to high runoff depending on slope. These soils formed in residuum weathered from igneous and high-grade metamorphic rocks. They are found on gently sloping to very steep ridges and side slopes of the Southern Appalachian Mountains. They are located at elevations from 100 to 4000 feet above mean sea level on slopes of 2 to 60. The series is of large extent in the mountain areas of lower South. Hayesville loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Henderson County North Carolina - Apples

Parameter	Value	Source
Starting Date	January 1, 1965	Meteorological File - Asheville, NC (W03812)
Ending Date	December 31, 1990	Meteorological File - Asheville, NC (W03812)
Pan Evaporation Factor (PFAC)	0.76	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.16 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Henderson County North Carolina - Apples

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)

USLE K Factor (USLEK)	0.2 tons EI^{-1*}	GLEAMS Table of Representative Soils (USDA, 1990)
USLE LS Factor (USLELS)	3.63	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	Set according to guidance (EPA, 2001). PRZM Table 5.6 - no supporting practice.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	12%	Range 2-60%. Since maximum value is >12%, value is set to 12% for orchard crops (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Henderson County North Carolina - Apples

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Set to reside prior to new crop planting; forest floor or meadow. Material is largely left in place in the orchard.
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	26	Set to weather data. Asheville, NC (W03812)
Maximum rainfall interception storage of crop (CINTCP)	0.25	Set to default for orchards (EPA, 2001)
Maximum Active Root Depth (AMXDR)	150 cm	Depends or soil (hardpan, consolidated material, etc). Set to profile's presence of rock structure.
Maximum Canopy Coverage (COVMAX)	90	Ross Byers, Horticultural Specialist VPI - canopy somewhat open between rows; 90% reasonable upper end estimate. Parameter value may be inconsistent with different apple scenarios due to different sources.
Soil Surface Condition After Harvest (ICNAH)	3	Orchards floor maintained similar to a meadow
Date of Crop Emergence	01/04	Personal communication w/ Ross Byers, VA Tech

(EMD, EMM, IYREM)		Fruit Horticulturalist (540) 869-2560 x19"Emergence based on leaf emergence, Maturation based on canopy maturity, Harvest based on average leaf fall. Dates based on central VA and modified by: 1 day added for every 100 miles north or 100 feet higher elevation or 1day subtracted for every 100 miles south or 100 feet lower elevation.
Date of Crop Maturity (MAD, MAM, IYRMAT)	03/05	
Date of Crop Harvest (HAD, HAM, IYRHAR)	25/10	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4, meadow; condition good (USDA, 1990)
Manning's N Value (MNGN)	0.023	RUSLE Project, NB0OFOFN; Orchard; no tillage Asheville, NC (USDA, 2000)
USLE C Factor (USLEC)	0.008 - 0.057	RUSLE Project, NB0OFOFN; Orchard; no tillage Asheville, NC (USDA, 2000)

Table 4. PRZM 3.12 Hayesville Soil Parameters for Henderson County North Carolina - Apples

Parameter	Value	Verification Source
Total Soil Depth (CORED)	150 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4 (3 Base, Top horizon split in two)	
First, Second, Third, and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 6 cm (HORIZN = 2) 84 cm (HORIZN = 3) 50 cm (HORIZN = 4)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.30 g $\cdot$cm^{-3} (HORIZN = 1,2,3,4)	
Initial Water Content (THETO)	0.392 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =1,2) 0.475 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =3) 0.259 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =4)	
Compartment Thickness	0.1 cm (HORIZN = 1)	

(DPN)	3.0 cm (HORIZN = 2) 4.0 cm (HORIZN = 3) 5.0 cm (HORIZN = 4)	
Field Capacity (THEFC)	0.392 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.475cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.259 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Wilting Point (THEWP)	0.192 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.275 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.109 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Organic Carbon Content (OC)	0.58% (HORIZN = 1,2) 0.116 (HORIZN = 3) 0.058% (HORIZN = 4)	

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NORTH CAROLINA CORN (Eastern)

The field used to represent corn production in Eastern North Carolina is located in Pitt County in the Piedmont. According to the 1997 Census of Agriculture, North Carolina is ranked 9^{th} among major corn producing states in the U.S. Corn is produced throughout the state with the largest production located in the coastal plain and tidewater regions. Sweet corn is produced mainly on the coastal plain (MLRA 153 A and B). The crop is generally planted the early Spring (April) and harvested beginning in August. Continuous corn is practice is much of the region, especially the Piedmont. However, rotation with other crops such as soybean is practiced on the coastal plain. Most of the corn is planted for feed grain. Planting depth and row spacing (generally 30 inches) follows general practices for the U.S. Conventional tillage dominates management practices, followed by no-tillage. However, conservation tillage is continuing to grow. The crop is rarely grown under irrigation, except for sweet corn. The soil selected to simulate the field is a Craven silt loam. Craven silt loam is a fine, mixed, subactive, thermic Aquic Hapludults. Approximately one-half of the series is used for the production of row crops such as corn, tobacco, cotton, small grain, peanuts and pasture. Craven silt loam is a deep, moderately well drained, medium to rapid runoff, slowly permeable soil formed in clayey Pleistocene sediments. They are located on nearly level to sloping Coastal Plain Uplands. Slopes are generally between 0 to 12 percent. The soils are extensive throughout the Coastal Plain region. Craven silt loam is a benchmark soil and a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Pitt County North Carolina - Eastern Corn

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Raleigh, NC (W13722)
Ending Date	December 31, 1990	Meteorological File - Raleigh, NC (W13722)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Pitt County North Carolina - Eastern Corn

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)

USLE K Factor (USLEK)	0.24 tons EI^{-1*}	FARM Manual, Table 3.1 (EPA, 1985)
USLE LS Factor (USLELS)	1.34	Calculated according to Haan and Barfield (1978) equation: LS $= ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual (EPA, 1998). No contour plowingaccording to Sam Uzzell, Pitt County Extension
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Mid-point of series range. Selected according to QA/QC Guidance (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Pitt County North Carolina - Eastern Corn

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Sam Uzzell, Pitt County Extension
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Raleigh, NC (W13722)
Maximum rainfall interception storage of crop (CINTCP)	0.25	PRZM Table 5.4 (EPA, 1998); maximum value.
Maximum Active Root Depth (AMXDR)	90 cm	Median value (60-120 cm) (Table 5-9. EPA 1998).
Maximum Canopy Coverage (COVMAX)	100	Taken from IL corn. Also consistent with default value cited in guidance (EPA 2004).
Soil Surface Condition After Harvest (ICNAH)	3	Sam Uzzell, Pitt County Extension
Date of Crop Emergence (EMD, EMM, IYREM)	15/04	Usual Planting and Harvest Dates for US Field Crops (USDA, 1984)

Date of Crop Maturity (MAD, MAM, IYRMAT)	28/08	
Date of Crop Harvest (HAD, HAM, IYRHAR)	12/09	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	89, 86, 87	Gleams Manual Table H-4,Fallow SR/CT/poor, Cropping and Residue = Row Crop SR/CT/poor (USDA, 1990)
Manning's N Value (MNGN)	0.014	RUSLE Project, PB6CGWWC Field corn, conventional tillage, Greensboro (USDA, 2000)
USLE C Factor (USLEC)	0.105 - 0.471	RUSLE Project; PB6CGWWC Field corn, conventional tillage, Greensboro (USDA, 2000)

Table 4. PRZM 3.12 Craven Soil Parameters for Pitt County North Carolina - Eastern Corn

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	PIC (Burns, 1992). Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 12 cm (HORIZN = 2) 78 cm (HORIZN = 3)	PIC (Burns, 1992). Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.45 g $\cdot$cm^{-3} (HORIZN = 1,2,3)	
Initial Water Content (THETO)	0.194 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =1, 2) 0.321 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4 cm (HORIZN = 2) 3 cm (HORIZN = 3)	
Field Capacity	0.194 cm^3-H_2O $\cdot$cm^{-3}-soil	

(THEFC)	(HORIZN = 1, 2) 0.321 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.074 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.201 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.174% (HORIZN = 3)	

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

NORTH CAROLINA COTTON

The field used to represent cotton production in North Carolina is located in the Piedmont/Coastal Plain. According to the 1997 Census of Agriculture, North Carolina is ranked 5th among the major cotton producing states in the U.S. Most cotton is grown in the coastal plain region and approximately 3 percent in the Piedmont. Cotton is planted in the early Spring (mid-April) and harvested beginning in October. Continuous cotton is practice is much of the region and cotton is gradually replacing land once cultivated in tobacco. Row spacing is generally 38-inches with 3-4 plants per foot row. Row canopies tend to be very close to 100 percent, while the canopy between rows is much less. All cotton is defoliated in North Carolina prior to harvesting. Conventional tillage is the dominant practice, but, conservation tillage, no-till and strip-till practices are gaining in popularity in the region. The crop is rarely grown under irrigation, approximately 5 percent. The soil selected to simulate the field is a Boswell fine sandy loam. Boswell fine sandy loam is a fine, mixed, active, thermic Vertic Paleudalfs. Very little of the soil is in cotton and most remains in woodland or pasture. Boswell fine sandy loam is a deep, moderately well drained, moderate to rapid runoff, very slowly permeable soils formed in marine fluviatile deposits of acid clayey sediments. These soils have a high shrink-swell potential. They are located on nearly level to steep uplands of the Southern Coastal Plain. Slopes are generally between 1 to 17 percent. The soils are of large extent in the Southern Coastal Plain region. Boswell fine sandy loam is a Hydrologic Group D soil.

Table 1. PRZM 3.12 Climate and Time Parameters for the Piedmont/Coastal Plain of North Carolina - Cotton

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Raleigh, NC (W13722)
Ending Date	December 31, 1990	Meteorological File - Raleigh, NC (W13722)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for the Piedmont/Coastal Plain of North Carolina - Cotton

Parameter	Value	Source
Method to Calculate	4 (MUSS)	PRZM Manual (EPA, 1998)

Erosion (ERFLAG)		
USLE K Factor (USLEK)	0.34 tons EI^{-1*}	FARM Manual, Table 3.1 (EPA, 1985)
USLE LS Factor (USLELS)	1.34	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual (EPA, 1998). No practice assumed
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Range: 1-17%. Since maximum of range is >12%, value is set to 6% for row crop (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for the Piedmont/Coastal Plain of North Carolina - Cotton

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Set to default for fallow surface prior to planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Raleigh, NC (W13722)
Maximum rainfall interception storage of crop (CINTCP)	0.2	PRZM Table 5.4 (EPA, 1998), minimum value.
Maximum Active Root Depth (AMXDR)	65 cm	Value from CA cotton. Consistent with PRZM manual, table 5-9 (EPA 1998) which cites range of 30-90 cm.
Maximum Canopy Coverage (COVMAX)	100	Consistent with advice of Kerry Arroues USDA-NRCS for development of CA cotton scenario. Also, consistent with EPA 2004 guidance of default value of 100 of row crops.
Soil Surface Condition After Harvest (ICNAH)	3	Residues left on field until following year or cover crop is planted.

Date of Crop Emergence (EMD, EMM, IYREM)	01/06	Usual Planting and Harvest Dates for US Field Crops (USDA, 1984)
Date of Crop Maturity (MAD, MAM, IYRMAT)	01/08	
Date of Crop Harvest (HAD, HAM, IYRHAR)	01/11	
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	92, 89, 90	Gleams Manual Table H-4; Fallow SR/CT/poor, Cropping and Residue = Row Crop SR/CT/poor condition (USDA, 1990)
Manning’s N Value (MNGN)	0.014	RUSLE Project, PB8CTCTC, actually for Columbia, SC cotton, conv till (USDA, 2000)
USLE C Factor (USLEC)	0.228 - 0.748	RUSLE Project; PB8CTCTC, actually for Columbia, SC cotton, conv till (USDA, 2000)

Table 4. PRZM 3.12 Boswell Soil Parameters for the Piedmont/Coastal Plain of North Carolina - Cotton

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 2 cm (HORIZN = 2) 88 cm (HORIZN = 3)	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.8 g $\cdot cm^{-3}$ (HORIZN = 1,2) 1.7 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content (THETO)	0.213 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1, 2) 0.354 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	

Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 2 cm (HORIZN = 2) 4 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.213 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1, 2) 0.354 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.063 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.213 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	2.32% (HORIZN = 1,2) 0.29% (HORIZN = 3)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. ***P**esticide and **I**ndustrial Chemical **R**isk Analysis and **H**azard **A**ssessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA. 1992.

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

EPA. 2001. Abel, S.A. Procedure for Conducting Quality Assurance and Quality Control of Existing and New PRZM Field and Orchard Crop Standard Scenarios. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky,

Lexington, Kentucky 40506. pp. 286.

USDA. 1984. Usual Planting and Harvesting Dates for U.S. Field Crops, Statistical Reporting Service, U.S. Department of Agriculture, Agriculture Handbook #628, pp.78.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

NORTH CAROLINA PEANUTS

The field used to represent peanut production in North Carolina is located in Eastern Pitt County in the Coastal Plain. According to the 1997 Census of Agriculture, North Carolina is ranked 3rd among the major peanut producing states in the U.S., accounting for approximately 10 percent of the total U.S. crop. Peanuts are produced mainly on the northeastern coastal plain and a small amount is produced in the southeastern region. The crop is generally planted in the Spring (mid-April to early May) and harvested beginning in September. Crop rotation is the most important cultural practice, with a long rotation (3 years) followed by two years of a grass-type crop being among the most effective management practices for nematode, diseases, and weed control. Most plantings occurs on raised beds. Row spacing is generally 30 to 48 inches. Conventional tillage is practiced in the region, but strip-tillage and no-tillage practices are becoming more popular. The crop is rarely grown under irrigation, approximately 10 percent. The soil selected to simulate the field is a Craven silt loam. Craven silt loam is a fine, mixed, subactive, thermic Aquic Hapludults. Approximately one-half of the series is used for the production of row crops such as corn, tobacco, cotton, small grain, peanuts and pasture. Craven silt loam is a deep, moderately well drained, medium to rapid runoff, slowly permeable soils formed in clayey Pleistocene sediments. They are located on nearly level to sloping Coastal Plain Uplands. Slopes are generally between 0 to 12 percent. The soils are extensive throughout the Coastal Plain region. Craven silt loam is a benchmark soil and a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Pitt County North Carolina - Peanuts

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Raleigh, NC (W13722)
Ending Date	December 31, 1990	Meteorological File - Raleigh, NC (W13722)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Pitt County North Carolina - Peanuts

Parameter	Value	Source
Method to Calculate	4 (MUSS)	PRZM Manual (EPA, 1998).

Erosion (ERFLAG)		
USLE K Factor (USLEK)	0.24 tons EI^{-1*}	FARM Manual, Table 3.1 (EPA, 1985)
USLE LS Factor (USLELS)	1.34	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual (EPA, 1998). No practice assumed.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Mid-point of series range. Selected according to QA/QC Guidance (EPA, 2001). Max of row crop guidance.
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Pitt County North Carolina - Peanuts

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	American Peanut Council http://peanutsusa.com/what/growing.html tillage before planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Raleigh, NC (W13722)
Maximum rainfall interception storage of crop (CINTCP)	0.1	PRZM Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	45 cm	PRZM Table 5.9 (EPA, 1998)
Maximum Canopy Coverage (COVMAX)	100	Sam Uzzell, Pitt County Extension Agent. Phone: 252-902-1704, Date: 2/7/06
Soil Surface Condition After Harvest (ICNAH)	1	American Peanut Council http://peanutsusa.com/what/growing.html - assuming plants used for hay (can also be left in field)

Date of Crop Emergence (EMD, EMM, IYREM)	16/05	Usual Planting and Harvest Dates for US Field Crops (USDA, 1984). Made consistent with crop profile using midpoints of planting and harvest periods.
Date of Crop Maturity (MAD, MAM, IYRMAT)	01/10	
Date of Crop Harvest (HAD, HAM, IYRHAR)	10/10	
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	89, 84, 86	Gleams Manual Table H-4; close seeded legume, C soil, fallow = fallow SR/CT poor; cropping and residue = legumes SR poor condition (USDA, 1990)
Manning’s N Value (MNGN)	0.014	RUSLE Project, PB9PRPRC- runner peanuts, Augusta GA (nearest peanut) (USDA, 2000)
USLE C Factor (USLEC)	0.047 - 0.668	RUSLE Project; PB9PRPRC- runner peanuts, Augusta GA (nearest peanut) (USDA, 2000)

Table 4. PRZM 3.12 Craven Soil Parameters for Pitt County North Carolina - Peanuts

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 12 cm (HORIZN = 2) 78 cm (HORIZN = 3)	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.45 g $\cdot cm^{-3}$ (HORIZN = 1,2,3)	
Initial Water Content (THETO)	0.194 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1, 2) 0.321 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4 cm (HORIZN = 2)	

	3 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.194 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1, 2) 0.321 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.074 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.201 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.174% (HORIZN = 3)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. ***P**esticide and **I**ndustrial Chemical **R**isk Analysis and **H**azard **A**ssessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA. 1992.

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

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EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

EPA. 2001. Abel, S.A. Procedure for Conducting Quality Assurance and Quality Control of Existing and New PRZM Field and Orchard Crop Standard Scenarios. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1984. Usual Planting and Harvesting Dates for U.S. Field Crops, Statistical Reporting Service, U.S. Department of Agriculture, Agriculture Handbook #628, pp.78.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

NORTH CAROLINA SWEET POTATOES

The field used to represent sweet potato production in North Carolina is located in the Southern Coastal Plains in Johnston County. Johnston and Nash Counties have the largest acres in production, approximately 6,000-7,500, and North Carolina is ranked 1st among major sweet potato producing states in the U.S. with more than 37,000 acres planted in 1999 (http://www.ncsweetpotatoes.com/stats.htm). Sweet potatoes are produced throughout the coastal and tidewater region of North Carolina and in portions of the Piedmont. These areas are well suited for sweet potato production because of the sandy soils and temperate climate. The crop (seed sprouts) is generally transplanted the early Spring (April thru May) and harvested beginning in late August and extending thru October depending on planting date. Sprouts are started in March in greenhouse or temperature controlled enclosures from the previous year's crop. Maturity takes about 120 days from transplanting cuttings before they are ready for harvest. Planting depth is uniform at about 2 inches (5 cm) and cuttings are covered loosely with soil. Beds are generally covered with ventilated black plastic mulch to warm the soil and speed plant emergence until emergence. Row spacing is generally 3.5 to 4 feet and plants are spaced 12-15 inches apart in a row, yielding approximately 14,520 plants per acre. The crop is grown under frequent light irrigation depending on local weather conditions, proper water management is essential for sweet potato yields. Sweet potatoes are grown on soils in a four year cycle, one year of production and three years off production. The soil selected to simulate the field is a Craven silt loam. Craven silt loam is a fine, mixed, subactive, thermic Aquic Hapludults. Approximately one-half of the series is used for the production of row crops such as corn, tobacco, cotton, small grain, peanuts and pasture. Craven silt loam is a deep, moderately well drained, medium to rapid runoff, slowly permeable soil formed in clayey Pleistocene sediments. They are located on nearly level to sloping Coastal Plain Uplands. Slopes are generally between 0 to 12 percent. The soils are extensive throughout the Coastal Plain region. Craven silt loam is a benchmark soil and a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Johnston County North Carolina - Sweet Potatoes

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Raleigh, NC (W13722)
Ending Date	December 31, 1990	Meteorological File - Raleigh, NC (W13722)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Johnston County North Carolina - Sweet Potatoes		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.42 tons EI^{-1*}	FARM Manual, Table 3.1 (EPA, 1985), for OC 1.2%.
USLE LS Factor (USLELS)	1.34	Calculated according to Haan and Barfield (1978) equation: $LS = ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.00	PRZM Manual (EPA, 1998)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Mid-point of series range. Selected according to QA/QC Guidance (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Johnston County North Carolina - Sweet Potatoes		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Black plastic mulch or row covers are used in many areas requiring clear and smooth soil surface. http://oregonstate.edu/Dept/NWREC/swpotato.html
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Raleigh, NC (W13722)
Maximum rainfall interception storage of crop (CINTCP)	0.25	PRZM Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	100 cm	Set to maximum depth of soil profile. Main root cluster may be as deep as 120 cm with tap roots extending to first confining layer. http://agriculture.kzntl.gov.za/production_guidelines/vegetable_production/crop_rotation.pdf
Maximum Canopy Coverage	80	Estimated based on aerial photography;

(COVMAX)		http://www.ncsweetpotatoes.com/index2.html
Soil Surface Condition After Harvest (ICNAH)	3	residues remain on field until winter cover crop is planted.
Date of Crop Emergence (EMD, EMM, IYREM)	15/05	Seed potato sprouts are transplanted into fields throughout April, May and June. Mid-May selected taking into account approximately 4 weeks before spouts appear above soil surface (I.e., sprouts planted 4 weeks before may 15. http://www.ncagr.com
Date of Crop Maturity (MAD, MAM, IYRMAT)	15/09	Approximately 120 days from transplanting cuttings and maturation/harvest. http://www.ncagr.com
Date of Crop Harvest (HAD, HAM, IYRHAR)	22/09	Assume harvest occurs one week later.
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	89, 86, 87	Gleams Manual Table H-4, Fallow SR/CT/poor, Cropping and Residue = Row Crop SR/CT/poor (USDA, 1990)
Manning's N Value (MNGN)	0.011	Pb6BGBGC Green Beans, conventional tillage, Cover Code 7 (clean tilled, smooth or fallow), Greensboro, N.C.
USLE C Factor (USLEC)	0.160 - 0.923	Pb6BGBGC Green Beans, conventional tillage, Cover Code 7 (clean tilled, smooth or fallow), Greensboro, N.C.

Table 4. PRZM 3.12 Craven Soil Parameters for Johnston County North Carolina - Sweet Potatoes

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 12 cm (HORIZN = 2) 78 cm (HORIZN = 3)	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.45 g $\cdot cm^{-3}$ (HORIZN = 1,2,3)	
Initial Water Content (THETO)	0.194 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1, 2)	

	0.321 cm^3-H_2O ·cm^{-3}-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4 cm (HORIZN = 2) 3 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.194 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1, 2) 0.321 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.074 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.201 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.174% (HORIZN = 3)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. ***P**esticide and **I**ndustrial Chemical **R**isk Analysis and **H**azard **A**ssessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA. 1992.

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

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NORTH CAROLINA TOBACCO

The field used to represent tobacco (flue-cured) production in North Carolina is located in Pitt and Johnston Counties, in Eastern North Carolina. According to the 1997 Census of Agriculture, North Carolina is the major producer of tobacco (1st overall) in the U.S. Tobacco is grown on a wide variety of soils, however, maximum yields are typically seen on sandy loam soils with low organic matter content. In addition, tobacco roots do not tolerate “wet” soils for prolong periods of time. Approximately 90 percent of the crop is grown in two-year rotation. Row spacing is generally from 40 to 48 inches. Tobacco is transplanted from greenhouse or plastic-covered outdoor plant beds in early spring after frost pressures (mid-April). Flower heads are removed to induce growth of lateral shoots. Harvesting is done in stages from lowest to highest leaves on the plant as the leaves ripen. Nearly all (99 percent) of tobacco is grown with conventional tillage. No-till production is used mostly for burley tobacco grown in western North Carolina. The soil selected to simulate the field is a benchmark soil, Norfolk loamy sand. Norfolk loamy sand is a fine-loamy, kaolinitic, thermic, Typic Kandiudults. Most of these soils are under cultivation in corn, cotton, peanuts, tobacco and soybeans. Norfolk loamy sand is a very deep, well drained, moderately permeable soil with slow to medium runoff. These soils formed in loamy marine sediments of the Coastal Plain.. They are found on level to gently sloping uplands of the Coastal Plain. Slopes range from 0 to 10 percent. The series is of large extent throughout the Coastal Plan. Norfolk loamy sand is a Hydrologic Group B soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Pitt and Johnston Counties, North Carolina - Tobacco

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Raleigh, NC (W13722)
Ending Date	December 31, 1990	Meteorological File - Raleigh, NC (W13722)
Pan Evaporation Factor (PFAC)	0.77	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Pitt and Johnston Counties, North Carolina - Tobacco

Parameter	Value	Source
Method to Calculate	4 (MUSS)	PRZM Manual (EPA, 1998)

Erosion (ERFLAG)		
USLE K Factor (USLEK)	0.17 tons EI^{-1*}	GLEAMS Table of Representative Soils (USDA, 1990)
USLE LS Factor (USLELS)	1.07	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	0.5	PRZM Table 5.6 value for contour plowing on 5% slope (EPA, 1998)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	2	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	5%	Value set to mid-point of range (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Pitt and Johnston Counties, North Carolina - Tobacco

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Set to fallow ground prior to years planting (bed preparation)
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Raleigh, NC (W13722)
Maximum rainfall interception storage of crop (CINTCP)	0.2	PRZM Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	60 cm	PRZM Table 5.9 (EPA, 1998), max depth of range.
Maximum Canopy Coverage (COVMAX)	80	NCSU Crop Profile http://ipmwww.ncsu.edu/ncpmip/
Soil Surface Condition After Harvest (ICNAH)	3	Residue left until following year
Date of Crop Emergence (EMD, EMM, IYREM)	16/04	PRZM Table 5.9 and NCSU Crop Profile http://ipmwww.ncsu.edu/ncpmip/

Date of Crop Maturity (MAD, MAM, IYRMAT)	07/07	
Date of Crop Harvest (HAD, HAM, IYRHAR)	16/07	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	84, 79, 83	Gleams Manual Table H-4, Fallow SR/CT/poor, Cropping and Residue = Row Crop SR/CT/poor; B soil (USDA, 1990)
Manning's N Value (MNGN)	0.014	RUSLE Project, PB6TBHGC; Tobacco, conventional tillage; Greensboro, NC (USDA, 2000)
USLE C Factor (USLEC)	0.071 - 0.500	RUSLE Project; PB6TBHGC; Tobacco, conventional tillage; Greensboro, NC (USDA, 2000)

Table 4. PRZM 3.12 Norfolk Soil Parameters for Pitt and Johnston Counties, North Carolina - Tobacco

Parameter	Value	Verification Source
Total Soil Depth (CORED)	150 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4 (Top horizon split in two)	
First, Second, Third, and Fourth and Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 35 cm (HORIZN = 2) 55 cm (HORIZN = 3) 50 cm (HORIZN = 4)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.55 g $\cdot$cm^{-3} (HORIZN = 1,2) 1.3 g $\cdot$cm^{-3} (HORIZN = 3) 1.1 g $\cdot$cm^{-3} (HORIZN = 4)	
Initial Water Content (THETO)	0.199 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =1,2) 0.406 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =3) 0.396 cm^3-H_2O $\cdot$cm^{-3}-soil	

	(HORIZN =4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5.0 cm (HORIZN = 2,3,4)	
Field Capacity (THEFC)	0.199 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.406cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.396 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Wilting Point (THEWP)	0.089 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.206 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.246 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Organic Carbon Content (OC)	0.29% (HORIZN = 1,2) 0.116 (HORIZN = 3) 0.058% (HORIZN = 4)	

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EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

NORTH DAKOTA CANOLA

The field used to represent canola production in North Dakota is located in Cavalier County in north east North Dakota on the Canadian border and the weather station representing the field's weather is located in Minot in Ward County. According the 2002 Census of Agriculture, Cavalier county ranks 1st in the domestic production of canola with 177,000 acres harvested and 258 million pounds produced in 2002. Canola (*Brassica napus L.*) varieties have been developed as both spring and winter annuals. The spring type is best adapted to North Dakota conditions. Canola can be grown on most soil types. It is best suited to clay-loam soils that do not crust. If grown on soil with poor internal drainage, good surface drainage is essential, as it cannot tolerate standing water or water logged soils. Canola can be planted with a variety of seeding equipment. The optimum depth to seed canola is between a ½ to 1 inch. Seeding depth should not exceed 1 inch. Canola is typically seeded in 6 or 7 inch rows with a grain drill or air seeder if uniform depth control can be obtained. Typical planting dates range from late April through early May, and the seed is harvested in August and September. The soil selected to simulate the field is a Hamerly loam. Hamerly loam is a fine-loamy, frigid Aeric Calciaquoll. The Hamerly is a deep, somewhat poorly drained, moderately slowly permeable, calcareous soil found typically on nearly level sites with slope of about 1%. These soils were developed on glacial drift. The soil is of large extent as is classified as a benchmark soil. Hamerly is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Cavalier County, North Dakota - Canola

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Minot, ND (W24013)
Ending Date	December 31, 1988	Meteorological File - Minot, ND (W24013)
Pan Evaporation Factor (PFAC)	0.76	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	12.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Cavalier County, North Dakota - Canola

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.28 tons EI^{-1*}	FARM Manual Table 3.1 (EPA, 1985) for Loam textured soils containing >2.3 %OC.

USLE LS Factor (USLELS)	0.25	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1	Low slope not on contour
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1.5%	Value mid-point of series slope range (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Cavalier County, North Dakota - Canola

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Field are fallow prior to planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	28	Set to weather data. Meteorological File - Minot, ND (W24013)
Maximum rainfall Interception storage of crop (CINTCP)	0.1	PIC; confirmed using Table 5.4 from PRZM Manual (Burns, 1992 and EPA, 1985) value for wheat.
Maximum Active Root Depth (AMXDR)	120 cm	NDSU Extension Service http://www.ag.ndsu.nodak.edu/aginfo/procrop/rps/wateru05.htm Canola Council of Canada http://www.canola-council.org/production/soilmois.html Water use data suggests that the majority of water extraction occurs from 0-120 cm with a max. depth of 160 cm for Brassica napus L.;
Maximum Canopy Coverage (COVMAX)	100	Terry Gregoire, NDSU Extension Service, (701) 662-1364, tgregoir@ndsuext.nodak.edu
Soil Surface Condition After Harvest (ICNAH)	3	Plant residues are left behind.
Date of Crop Emergence (EMD, EMM, IYREM)	16/5	NDSU Extension Service http://www.ag.ndsu.nodak.edu/aginfo/procrop/rps/wateru05.htm; Canola Council of Canada http://www.canola-council.org/production/soilmois.html

Date of Crop Maturity (MAD, MAM, IYRMAT)	15/8	NDSU Extension Service http://www.ag.ndsu.nodak.edu/aginfo/procrop/rps/wateru05.htm; Canola Council of Canada http://www.canola-council.org/production/soilmois.html
Date of Crop Harvest (HAD, HAM, IYRHAR)	25/8	NDSU Extension Service http://www.ag.ndsu.nodak.edu/aginfo/procrop/rps/wateru05.htm; Canola Council of Canada http://www.canola-council.org/production/soilmois.html
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	87, 82, 83	GLEAMS Manual Table H-4; Fallow = SR Conservation Tillage/good, Cropping and Residue = SR Conservation tillage/good (USDA, 1990). Based on personal communication from Terry Gregoire of NDSU, "minimum till is normal practice, minimum 10% cover remains after seeding and up to 35% cover prior to planting suggest soil conditions should be set to good."
Manning's N Value (MNGN)	0.014	RUSLE EPA Pesticide Project: Fargo, ND spring wheat, fallow, conventional tillage F86WSFAC.DAT
USLE C Factor (USLEC)	0.036 - 0.617	RUSLE EPA Pesticide Project: Fargo, ND spring wheat, fallow, conventional tillage F86WSFAC.DAT

Table 4. PRZM 3.12 Hamerly Loam Soil Parameters for Cavalier County, North Dakota - Canola

Parameter	Value	Verification Source
Total Soil Depth (CORED)	150 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4	
First, Second, Third, and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 15 cm (HORIZN = 2) 25 cm (HORIZN = 3) 100 cm (HORIZN = 4)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/s

Bulk Density (BD)	1.48 g $\cdot cm^{-3}$ (HORIZN = 1) 1.48 g $\cdot cm^{-3}$ (HORIZN = 2) 1.48 g $\cdot cm^{-3}$ (HORIZN = 3) 1.48 g $\cdot cm^{-3}$ (HORIZN = 4)	oils/ssl/)
Initial Water Content (THETO)	0.135 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.135 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2) 0.111 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.136 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN =2, 3, 4)	
Field Capacity (THEFC)	0.224 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.224 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2) 0.224 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.228 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Wilting Point (THEWP)	0.108 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.108 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2) 0.108 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.110 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Organic Carbon Content (OC)	2.36% (HORIZN = 1) 2.36% (HORIZN = 2) 0.82% (HORIZN = 3) 0.25% (HORIZN = 4)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. *__P__esticide and __I__ndustrial Chemical __R__isk Analysis and __H__azard __A__ssessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA. 1992.

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PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

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EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

NORTH DAKOTA WHEAT

The field used to represent wheat production in North Dakota is located in Cass County in the Red River Valley. According to the 1997 Census of Agriculture, North Dakota is ranked 1st in the production of both durum and spring wheat in the U.S. The crop is generally planted in the Spring (late April to the end of May) and harvested beginning in August. Continuous wheat is practice is much of the region. Conventional tillage is used but requires greater seedbed preparation. No-till and reduced tillage systems are designed for use in high residue conditions. Row spacing ranges from 6 to 9 inches with seeds planted at a depth of 2 inches or less. The soil selected to simulate the field is a benchmark soil, Bearden silty clay loam. Bearden silty clay loam, is a fine-silty, mixed, superactive, frigid Aeric Calciaquolls. These soils are nearly all under cultivation to small grains, especially alfalfa, and row crops. Bearden silty clay loam is a very deep, somewhat poorly drained, slowly permeable soil with negligible to high runoff. These soils formed in calcareous silt loam and silty clay loam lacustrine sediments. They are generally found on glacial lake plains at elevations from 650 to 2000 feet above mean sea level on slopes of 0 to 3 percent. Bearden silty clay loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Cass County, North Dakota Wheat

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Fargo, ND (W14914)
Ending Date	December 31, 1990	Meteorological File - Fargo, ND (W14914)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 m C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	12.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Cass County, North Dakota Wheat

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.28 tons EI^{-1*}	GLEAMS Manual, table of Representative Soils (USDA, 1990)

USLE LS Factor (USLELS)	0.25	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	Set according to guidance (EPA, 2001). Low slopes not on contour.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1.5%	Value mid-point of series slope range (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Cass County, North Dakota Wheat

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Set to fallow prior to new crop planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Fargo, ND (W14914)
Maximum rainfall interception storage of crop (CINTCP)	0.1	PRZM, Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	23 cm	PRZM Manual, Table 5.9 (EPA, 1998). May be inconsistent with different wheat scenarios due to different sources.
Maximum Canopy Coverage (COVMAX)	99	Consistent with information from Tom Gerik used for derivation of COVMAX of TX wheat scenario.
Soil Surface Condition After Harvest (ICNAH)	1	Fallow conditions after harvest in preparation for winter crop
Date of Crop Emergence (EMD, EMM, IYREM)	16/05	Planting and Harvesting dates for spring wheat adjusted for "C" value planting and harvesting date (USDA, 1984)
Date of Crop Maturity	25/07	Planting and Harvesting dates for spring wheat

(MAD, MAM, IYRMAT)		adjusted for "C" value planting and harvesting date (USDA, 1984)
Date of Crop Harvest (HAD, HAM, IYRHAR)	05/08	Planting and Harvesting dates for spring wheat adjusted for "C" value planting and harvesting date (USDA, 1984)
Maximum Dry Weight (WFMAX)	0.0	Set to 0. Not used in simulation
SCS Curve Number (CN)	91, 85, 87	Gleams Manual Table H-4, Fallow = SR/CT poor; Cropping = Row Crop SR/CT poor (second number; Fallow = row crop SR/CT poor (3rd number) (USDA, 1990)
Manning's N Value (MNGN)	0.014	RUSLE Project, F86WSFA Fargo, ND spring wheat, fallow, conventional tillage (USDA, 2000)
USLE C Factor (USLEC)	0.036 - 0.617	RUSLE Project; F86WSFA Fargo, ND spring wheat, fallow, conventional tillage (USDA, 2000)

Table 4. PRZM 3.12 Bearden Soil Parameters for Cass County, North Dakota Wheat

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4	
First, Second, Third and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 8 cm (HORIZN = 2) 54 cm (HORIZN = 3) 28 cm (HORIZN = 4)	NRCS, National Soils Characterization Database (NRCS, 2001) [http://www.statlab.iastate.edu/soils/ssl/)](http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.4 g $\cdot cm^{-3}$ (HORIZN = 1,2) 1.5 g $\cdot cm^{-3}$ (HORIZN = 3) 1.8 g $\cdot cm^{-3}$ (HORIZN = 4)	
Initial Water Content (THETO)	0.377 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.292 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3) 0.285 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4)	
Compartment Thickness	0.1 cm (HORIZN = 1)	

(DPN)	4.0 cm (HORIZN = 2) 3.0 cm (HORIZN = 3) 4.0 cm (HORIZN = 4)	
Field Capacity (THEFC)	0.377 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.292cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3) 0.285 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Wilting Point (THEWP)	0.207 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.132 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3) 0.125 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Organic Carbon Content (OC)	4.06% (HORIZN = 1,2) 0.174% (HORIZN = 3) 0.116% (HORIZN = 4)	

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

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USDA. 1984. Usual Planting and Harvesting Dates for U.S. Field Crops, Statistical Reporting Service, U.S. Department of Agriculture, Agriculture Handbook #628, pp.78.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

NEW YORK GRAPES

The field used to represent grape production in New York is located in Chautauqua County in Southwest New York along Lake Erie (MLRA100/101) and the weather station representing the vineyard's weather is located in Erie, PA. Grapes are grown throughout the state, but are concentrated in the western part of the state where the macroclimate is best suited for grape production. New York is among the leading Eastern U.S. state in both wine and table grape production, however, the Appalachian region further south (i.e., Pennsylvania, maryland, Virginia and North Carolina) is rapidly growing. Chautauqua County has the highest acreage in the state and New York remains the 3rd or 4th highest production state in the U.S. Vines are well manicured, growing up to 6 feet tall and living for many years, although production and disease resistence declines and as the vines reach the end of their life span. Vines are initially planted at a rate of 545 plants per acre or an North-South orientation in straight rows. Straight rows are preferred for trellis stability. Plant are generally spaced about 8 feet apart in a row and rows spaced approximately 10 feet apart, deviations will occur according to variety planted and site conditions. Wider row spacing reduces yield because more sunlight is hitting the soil rather than the plants and narrower spacing will impede equipment movement and air flow through the vineyard increasing the chance of disease. Soil characteristics have a significant influences on the vineyard development, fruit bearing capacity, and life. Grape vines can grow on a wide range of soil types, but prefer well drained soils that support root growth through adequate aeration and loose texture and good internal and surface drainage. Grape vines do not like to get their "feet wet." Key growth stages for grapes, based on more than 15 years of data, include early bloom which generally occurs in early- to mid- March (average March 10th), veraison (early ripening) which occurs in mid- to late-August (average August 22nd), and ripening (bunch closing) which generally occurs in early- to late October (average October 15th). The soil selected to simulate the vineyard is a Lordstown channery silt loam. Lordstown channey silt loam is a coarse-loamy, mixed, active, mesic Typic Dystrudepts. Lordstown channery silt loam is a moderately deep, well drained, with low to very high potential for runoff, and moderate permeability throughout the profile. These soils formed in till and cryoturbated material derived from siltstone and sandstone on bedrock controlled landforms of glaciated plateaus. They are nearly level to very steep soils with slopes ranging from 0 to 90 percent at elevations of 800 to 1800 feet above mean sea level. The soil is extensive throughout the glaciated Allegheny Plateau. Lordstown channery silt loam is a benchmark soil and a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Chautauqua County, New York - Grapes		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Erie, PA (W14860)
Ending Date	December 31, 1990	Meteorological File - Erie, PA (W14860)
Pan Evaporation Factor (PFAC)	0.76	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.16 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Chautauqua County, New York - Grapes		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.42 tons EI^{-1*}	FARM Manual (EPA, 1985)
USLE LS Factor (USLELS)	3.63	Calculated according to Haan and Barfield (1978) equation: $LS = ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual, Table 5.6 (EPA, 1998)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	12%	Set to maximum slope according to guidance (EPA, 2001). Slope ranges from 0 to 90 percent
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Chautauqua County, New York - Grapes		

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Residues remain in field between vine rows. Common practice is maintain material in rows, but keep areas under vines relatively clear. http://www.nysaes.cornell.edu/hort
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Erie, PA (W14860)
Maximum rainfall Interception storage of crop (CINTCP)	0.25	PIC; confirmed using Table 5.4 from PRZM Manual (Burns, 1992 and EPA, 1985)
Maximum Active Root Depth (AMXDR)	100 cm	Set to soil horizon depth; Set to soil horizon depth; main root cluster may grow in excess of 40 inches deep. Tap root will grow to first confining layer. http://www.nysaes/cornell.edu/hort/
Maximum Canopy Coverage (COVMAX)	50	Based or optimal light penetration and yield and aerial photography. http://www.nysaes/cornell.edu/hort/ Parameter value may be different than other grape scenario due to different source.
Soil Surface Condition After Harvest (ICNAH)	3	Residues remain in field between vine rows
Date of Crop Emergence (EMD, EMM, IYREM)	1/06	Set to early-mid bloom; Phillip Throop (viticulture specialist), Cornell University and Fredonia Regional Extension; pthroop@cce.cornell.edu (716) 672-2191. Information based on average of 15 years of data collection for concord grapes.
Date of Crop Maturity (MAD, MAM, IYRMAT)	1/07	Set to 1 month after leaf emergence to model mature plant transpiration.
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/10	Set to harvest, bunch closing; Phillip Throop (viticulture specialist), Cornell University and Fredonia Regional Extension; pthroop@cce.cornell.edu (716) 672-2191.
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4, Meadow, conditions good for Hydrologic Soil C;
Manning's N Value (MNGN)	0.014	RUSLE EPA Pesticide Project; Rb2GBGBM; Syracuse, NY; Grapes; Cover in Alley; Cover Code 6 (no cover); Mulch tillage
USLE C Factor (USLEC)	0.309 - 0.559	RUSLE EPA Pesticide Project; Rb2GBGBM; Syracuse, NY; Grapes; Cover in Alley; Cover Code 6 (no cover); Mulch tillage

Table 4. PRZM 3.12 Lordstown Soil Parameters for Chautauqua County, New York - Grapes		
Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4 (Top horizon split in two)	
First, Second, Third and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 2 cm (HORIZN = 2) 54 cm (HORIZN = 3) 34 cm (HORIZN = 4)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.4 g $\cdot cm^{-3}$ (HORIZN = 1,2) 1.5 g $\cdot cm^{-3}$ (HORIZN = 3,4)	
Initial Water Content (THETO)	0.206 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.172 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.098 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 2 cm (HORIZN = 2) 3 cm (HORIZN = 3) 2 cm (HORIZN = 4)	
Field Capacity (THEFC)	0.206 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.172 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.098 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Wilting Point (THEWP)	0.096 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.072 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.048 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	

Organic Carbon Content (OC)	3.48% (HORIZN = 1,2) 0.174% (HORIZN = 3) 0.116% (HORIZN = 4)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. ***P**esticide and **I**ndustrial Chemical **R**isk Analysis and **H**azard **A**ssessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA. 1992.

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EPA. 2001. Abel, S.A. Procedure for Conducting Quality Assurance and Quality Control of Existing and New PRZM Field and Orchard Crop Standard Scenarios. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

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Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

OHIO CORN

The field used to represent corn production in Ohio is located in Darke and/or Pickaway Counties, although the crop is grown extensively throughout the state. According to the 1997 Census of Agriculture, Ohio is ranked 6th among the major corn producing states in the U.S. and Darke and Pickaway are ranked among the highest in Ohio. The crop is generally planted in early Spring (April 15 to May 10) in the north and from April 10 to May 10 in the south. Corn is harvested beginning in September depending on kernel moisture and may extend into late November. Continuous corn is practice in the region (approximately 30 percent is continuous), however, rotation with mainly soybean is the most common. Rotation promotes weed control and has been shown to increase yields as much as 10 percent over continuous corn operations. Most of the corn is planted for feed grain, but may also be planted for oil, sweetener, and for export. Planting depth (1 - 1.5 inches) and row spacing (generally 30 inches, but may be as narrow as 15 to 22 inches) follows general practices for the U.S. Seeding rates in Ohio range from 20,000 to 30,000 plants/acre for corn grown for grain and 22,000 to 34,000 plants/acre for corn grown for silage. Conservation tillage practices are regularly used for field corn with no-till practiced on a small percentage of the corn acreage annually. Corn is generally cultivated with a row cultivator or rotary hoed. The crop is rarely grown under irrigation. The soil selected to simulate the field is a Cardington silt loam. Cardington silt loam is a fine, illitic, mesic Aquic Haplaudalfs. Most of the area is planted in row crops including production of grains with the balance in pasture and woodland. Cardington silt loam is a very deep, moderately well drained, negligible to very high runoff, slowly permeable soil with an intermittent perched water table at 1-2 feet between November and April. These soils formed in loamy till of medium calcium carbonate content. These soils are on summits, shoulders, and backslopes on Wisconsin Age ground moraines and end moraines. Slopes are generally between 0 to 25 percent. The soils are extensive in MLRA 111 and 139. Cardington silt loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Darke and Pickaway Counties, Ohio - Corn

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Vandalia, OH (W93815)
Ending Date	December 31, 1990	Meteorological File - Vandalia, OH (W93815)
Pan Evaporation Factor (PFAC)	0.77	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Darke and Pickaway Counties, Ohio - Corn		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.37 tons EI^{-1*}	PIC; verified w/ FARM Manual Table 3.1
USLE LS Factor (USLELS)	1.34	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Manual (EPA, 1998). Contour support practices are rarely used in corn agriculture in this region.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Set to maximum according to guidance. Series range: up 25%; http://www.statlab.iastate.edu/soils/osd/
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Darke and Pickaway Counties, Ohio - Corn		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Lyle Paul of U of Illinois indicates residues are typically chiseled in
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Meteorological File - Vandalia, OH (W93815)
Maximum rainfall interception storage of crop (CINTCP)	0.25	PRZM manual, table 5.4 (EPA 1998).
Maximum Active Root Depth (AMXDR)	90 cm	Median value (60-120 cm) (Table 5-9. EPA 1998).
Maximum Canopy		Taken from IL corn. Also consistent with default value

Coverage (COVMAX)	100	cited in guidance (EPA 2004).
Soil Surface Condition After Harvest (ICNAH)	3	Lyle Paul of U of Illinois indicates residues are typically chiseled in, practice similar in Ohio
Date of Crop Emergence (EMD, EMM, IYREM)	01/05	Usual Planting and Harvest Dates for US Field Crops (USDA, 1984)
Date of Crop Maturity (MAD, MAM, IYRMAT)	26/09	
Date of Crop Harvest (HAD, HAM, IYRHAR)	25/10	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	91, 87, 88	Gleams Manual Table H-4, Fallow = SR/poor; Cropping and Residue = Row Crop, SR/poor condition (USDA, 1990)
Manning's N Value (MNGN)	0.014	RUSLE Project, MA3CGSBC; Corn, grain, Conventional tillage, Springfield, IL (USDA, 2000)
USLE C Factor (USLEC)	0.017 - 0.638	RUSLE Project; MA3CGSBC; Corn, grain, Conventional tillage, Springfield, IL, variable with date (USDA, 2000)

Table 4. PRZM 3.12 Cardington Soil Parameters for Darke and Pickaway Counties, Ohio - Corn

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 12 cm (HORIZN = 2) 78 cm (HORIZN = 3)	PIC (Burns, 1992) Confirmed with: NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.6 g $\cdot cm^{-3}$ (HORIZN = 1, 2) 1.65 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content	0.294 cm^3-H_2O $\cdot cm^{-3}$-soil	

(THETO)	(HORIZN =1, 2) 0.147 cm^3-H_2O ·cm^{-3}-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4 cm (HORIZN = 2) 3 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.294 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1, 2) 0.147 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.086 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.087 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.174% (HORIZN = 3)	

Burns. 1992. Burns, L.A., (Coordinator), B.W. Allen, Jr., M.C. Barber, S.L. Bird, J.M. Cheplick, M.J. Fendley, D.R. Hartel, C.A. Kittner, F.L. Mayer, Jr., L.A. Suarez, and S.E. Wooten. ***P**esticide and **I**ndustrial Chemical **R**isk Analysis and **H**azard **A**ssessment, Version 3.0.* (PIRANHA) Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA. 1992.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

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Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky,

Lexington, Kentucky 40506. pp. 286.

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

OREGON APPLES

The field used to represent apple production in Oregon is located in Marion County, in the Willamette Valley. According to the 1997 Census of Agriculture, Oregon is among the major producers (7^{th} to 8^{th} overall) of apples for the fresh market in the U.S. Within row tree spacing depends on the root stock and cultivation method. Spacing ranges from as little as 5 feet to 25 feet. Row spacing may be as much as twice the within row spacing to allow for maintenance and harvesting equipment. The soil selected to simulate the field is a Cornelius silt loam. Cornelius silt loam, is a fine-silty, mixed, superactive, mesic Mollic Fragixeralfs. The series is used to produce berries, orchards, small grain and seed crop, hay and pasture. Cornelius silt loam is a moderately deep, moderately well drained, moderately slowly permeable soil with slow to medium runoff. The soil has a fragipan at about 2 feet. These soils formed in silt loess-like materials over mixed, fine-silty old alluvium of mixed origin. They are found on gently sloping to rolling low hills ans steep hill slopes with convex, long slopes and ridgetops at elevation of 350 to 800 feet above mean sea level. Slopes range from 2 to 60 percent. The series is not very extensive. Cornelius silt loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Marion County Oregon - Apples

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Salem, OR (W24232)
Ending Date	December 31, 1990	Meteorological File - Salem, OR (W24232)
Pan Evaporation Factor (PFAC)	0.74	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.16 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Marion County Oregon - Apples

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.33 tons EI^{-1*}	Farm Manual, Table 3.1 (EPA, 1985). OM=4%

USLE LS Factor (USLELS)	3.63	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	Set according to guidance (EPA, 2001). Set to 1 for orchards.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	2	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	12%	Value set to maximum for crop (EPA, 2001) Slopes range: 2 to 60 %
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Marion County Oregon - Apples

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Set to reside prior to new crop planting; forest floor or meadow.
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data to Salem, OR (W24232)
Maximum rainfall interception storage of crop (CINTCP)	0.25	Set to default for orchards (EPA, 2001). Heavy foliar density simulated for orchards.
Maximum Active Root Depth (AMXDR)	148 cm	Jeff Olsen, Marion County Extension Agent Phone: 503-434-8915, Date: 2/2/2006 Roots will grow up to impenetrateable soil layers. This value depends upon the soil depth. Value set to maximum soil depth.
Maximum Canopy Coverage (COVMAX)	75	Jeff Olsen, Marion County Extension Agent Phone: 503-434-8915, Date: 2/2/2006 Free standing mature trees will have a maximum of 75% cover. Trees are no longer left standing, they are trellised. This involves tapering trees at top of canopy. Parameter value may be inconsistent with different apple scenarios due to different sources.
Soil Surface Condition After	3	Jeff Olsen, Marion County Extension Agent Phone: 503-434-8915, Date: 2/2/2006

Harvest (ICNAH)		Orchard floors generally have a cover crop or grass, with a vegetation free strip under the trees.
Date of Crop Emergence (EMD, EMM, IYREM)	01/04	Jeff Olsen, Marion County Extension Agent Phone: 503-434-8915, Date: 2/2/2006 The trees form leaves in early April. Their fruit matures soon before harvest. Apples are harvested between early September and October.
Date of Crop Maturity (MAD, MAM, IYRMAT)	30/04	
Date of Crop Harvest (HAD, HAM, IYRHAR)	31/10	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4, meadow; condition good (USDA, 1990)
Manning's N Value (MNGN)	0.040	RUSLE Project, A13OFOFN for orchards, no-till- Salem, OR (USDA, 2000)
USLE C Factor (USLEC)	0.005 - 0.034	RUSLE Project; A13OFOFN for orchards, no-till- Salem, OR (USDA, 2000)

Table 4. PRZM 3.12 Cornelius Soil Parameters for Marion County Oregon - Apples

Parameter	Value	Verification Source
Total Soil Depth (CORED)	148 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	5 (4 Base with top split in two)	
First, Second, Third, Fourth, and Fifth Soil Horizons (HORIZN = 1,2,3,4,5)		
Horizon Thickness (THKNS)	15 cm (HORIZN = 1) 13 cm (HORIZN = 2) 15 cm (HORIZN = 3) 55 cm (HORIZN = 4) 50 cm (HORIZN = 5)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.30 g $\cdot$cm^{-3} (HORIZN = 1) 1.38 g $\cdot$cm^{-3} (HORIZN = 2) 1.58 g $\cdot$cm^{-3} (HORIZN = 3) 1.52 g $\cdot$cm^{-3} (HORIZN = 4) 1.46 g $\cdot$cm^{-3} (HORIZN = 5)	

Initial Water Content (THETO)	0.329 cm^3-H_2O ·cm^{-3}-soil (HORIZN =1) 0.338 cm^3-H_2O ·cm^{-3}-soil (HORIZN =2) 0.340 cm^3-H_2O ·cm^{-3}-soil (HORIZN =3) 0.358 cm^3-H_2O ·cm^{-3}-soil (HORIZN =4) 0.202 cm^3-H_2O ·cm^{-3}-soil (HORIZN =5)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 1.0 cm (HORIZN = 2) 5.0 cm (HORIZN = 3) 5.0 cm (HORIZN = 4) 5.0 cm (HORIZN = 5)	
Field Capacity (THEFC)	0.329 cm^3-H_2O ·cm^{-3}-soil (HORIZN =1) 0.338 cm^3-H_2O ·cm^{-3}-soil (HORIZN =2) 0.340 cm^3-H_2O ·cm^{-3}-soil (HORIZN =3) 0.358 cm^3-H_2O ·cm^{-3}-soil (HORIZN =4) 0.202 cm^3-H_2O ·cm^{-3}-soil (HORIZN =5)	
Wilting Point (THEWP)	0.099 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1) 0.108 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 2) 0.110 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3) 0.148 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4) 0.142 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 5)	
Organic Carbon Content (OC)	2.30% (HORIZN = 1) 1.11% (HORIZN = 2) 0.21% (HORIZN = 3) 0.145% (HORIZN = 4) 0.07% (HORIZN = 5)	

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

EPA. 2001. Abel, S.A. Procedure for Conducting Quality Assurance and Quality Control of Existing and New PRZM Field and Orchard Crop Standard Scenarios. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

OREGON CHRISTMAS TREES

The field used to represent Christmas tree production in Oregon is located in Benton County, in the Willamette Valley. According to the 1997 Census of Agriculture, Oregon is the leading producer of Christmas trees in the U.S. with approximately 8 million trees harvested each year. More than a dozen varieties of trees are produced in the region; Douglas fir represents about half of the Pacific Northwest Production. Tree production is a long-term investment with average size trees requiring approximately 7 to 8 years to reach market size (7 to 8 foot). Modern tree operations require intensive site preparation prior to planting, including tillage, soil fertility enhancement and use of cover crops. Tree are mechanically planted in late winter and early spring. Most grower do not have a grass cover crop, but smaller operations keep a mulch grass or living sod in place. Seedlings may be hand planted in difficult or adverse sites or to replace dead trees in first or second year established plantations. Nearly all growers plant 2 to 4-year-old seedlings or 3 to 5-year-old transplants. Trees seldom require irrigation. About 2 to 3 years after planting, trees are sheared or shaped to create the shape of high-quality Christmas trees and to control the amount of annual growth and in some species increase bud set. Nearly all trimming occurs during the summer months based on tree species. Trees are harvested beginning in late October and will continue through mid-December. The soil selected to represent the field is a benchmark soil, Pilchuck fine sand. Pilchuck fine sand is a mixed, mesic Dystric Xeropsamments. The series is mostly pasture and woodland, however, Douglas fir is among the native vegetation. Pilchuck fine sand is a very deep, excessively drained and somewhat excessively drained, rapidly permeable, very slow runoff soil that formed in alluvium. They are found on floodplains at elevations of about 10 to 800 feet above mean sea level on slopes of 0 to 8 percent. The series is moderately extensive. Pilchuck fine sand is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Benton County, Oregon - Christmas Trees

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Salem, OR (W24232)
Ending Date	December 31, 1990	Meteorological File - Salem, OR (W24232)
Pan Evaporation Factor (PFAC)	0.73	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.16 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Benton County, Oregon - Christmas Trees		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.37 tons EI^{-1}*	Farm Manual, Table 3.1 (EPA, 1985).
USLE LS Factor (USLELS)	0.69	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.4 (EPA 2004).
USLE P Factor (USLEP)	1.0	Set according to guidance (EPA, 2001). No practice assumed.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	2	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	4%	Value set to median of range (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Benton County, Oregon - Christmas Trees		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	2	Set to residue prior to new crop planting; forest floor or meadow. X-mas trees production is a continuous operation; varying tree age on any given parcel; http://wwwagcomm.ads.orst.edu/AgComWebfile/EdMat/PNW227.pdf
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Salem, OR (W24232)
Maximum rainfall interception storage of crop (CINTCP)	0.25	Set to default for orchards, Table 5.4 PRZM Maunal (EPA, 2001). Values set to a moderately dense canopy as a conservative input, but density could be considered heavy for evergreens.
Maximum Active Root Depth (AMXDR)	120 cm	Roots can exceed 4 feet, http://wwwagcomm.ads.orst.edu/AgComWebfile/EdM

		at/PNW227.pdf
Maximum Canopy Coverage (COVMAX)	40	Based on aerial photography
Soil Surface Condition After Harvest (ICNAH)	2	Plantation maintained similar to a coniferous forest
Date of Crop Emergence (EMD, EMM, IYREM)	1/1	Emergence and maturity dates set to correspond to harvest date and allow for modeling of evergreen tree (i.e. continual maturity).
Date of Crop Maturity (MAD, MAM, IYRMAT)	2/1	
Date of Crop Harvest (HAD, HAM, IYRHAR)	31/12	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	80, 72, 77	Gleams Manual Table H-4, Woodland in poor condition; National Engineering Handbook indicates juniper-grass complexes with loamy texture below surface litter and less than 20 to 25 percent cover have CNs consistent with those selected. (USDA, 1990)
Manning's N Value (MNGN)	0.040	RUSLE Project, A12OFOFN Orchard; Full Cover, No-Till, Moderate cover (35-70% residue cover on soil surface during critical period) (USDA, 2000)
USLE C Factor (USLEC)	0.006 - 0.041	RUSLE Project; A12OFOFN Orchard; Full Cover, No-Till, Moderate cover (35-70% residue cover on soil surface during critical period) (USDA, 2000)

Table 4. PRZM 3.12 Pilchuck Soil Parameters for Benton County, Oregon - Christmas Trees

Parameter	Value	Verification Source
Total Soil Depth (CORED)	150 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4 (4th extended to 150 cm)	
First, Second, Third, and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 40 cm (HORIZN = 2) 50 cm (HORIZN = 3,4)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.55 g $\cdot$cm^{-3} (HORIZN = 1) 1.7 g $\cdot$cm^{-3} (HORIZN = 2)	

	1.8 g $\cdot cm^{-3}$ (HORIZN = 3,4)	Benton County Soil Survey; http://ice.or.nrcs.usda.gov/website/soils/reports_htm/oregon/benton.htm
Initial Water Content (THETO)	0.123 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.069 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3) 0.046 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5.0 cm (HORIZN = 2,3,4)	
Field Capacity (THEFC)	0.123 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.069 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3) 0.046 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4)	
Wilting Point (THEWP)	0.033 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.019 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.016 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.174% (HORIZN = 3) 0.116% (HORIZN = 4)	

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

EPA. 2001. Abel, S.A. Procedure for Conducting Quality Assurance and Quality Control of Existing and New PRZM Field and Orchard Crop Standard Scenarios. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

OREGON FILBERTS (HAZELNUTS)

The field used to represent filbert production in Oregon is located in Washington County, in the Willamette Valley. According to the 1997 Census of Agriculture, Oregon is the leading producer of filberts in the U.S. Washington County is the second highest producing county in Oregon. Trees seldom require irrigation. The floor of the groves are kept smooth to permit easy harvesting of the nuts that have fallen to the ground, which occurs from September through November. The soil selected to simulate the field is a Cornelius silt loam. Cornelius silt loam, is a fine-silty, mixed, superactive, mesic Mollic Fragixeralfs. The series is used to produce berries, orchards, small grain and seed crop, hay and pasture. Cornelius silt loam is a moderately deep, moderately well drained, moderately slowly permeable soil with slow to medium runoff. The soil has a fragipan at about 2 feet. These soils formed in silt loess-like materials over mixed, fine-silty old alluvium of mixed origin. They are found on gently sloping to rolling low hills ans steep hill slopes with convex, long slopes and ridgetops at elevation of 350 to 800 feet above mean sea level. Slopes range from 2 to 60 percent. The series is not very extensive. Cornelius silt loam is a Hydrologic Group C soil.

The meteorological station associated with this scenario is located in Salem, Oregon. As noted above, the scenario is located in Washington County, approximately 40 miles from the Oregon seacoast. Although the Portland station is geographically closer to Washington County, the Salem station is more representative of the geographic areas where filberts are grown. The USDA 1999 crop profile for Oregon Hazelnuts indicates production in the following counties in order of production: Yamhill, Washington, Marion, Clackamas, Lane, Polk, Linn, and Benton. The Salem station is located in the center of the filbert producing counties referenced above. In addition, the Salem station is closer to the seacoast than the Portland station and is expected to experience climate conditions more similar to the scenario location.

Table 1. PRZM 3.12 Climate and Time Parameters for Washington County, Oregon - Filberts

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Salem, OR (W24232)
Ending Date	December 31, 1990	Meteorological File - Salem, OR (W24232)
Pan Evaporation Factor (PFAC)	0.74	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.16 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Washington County, Oregon - Filberts

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.33 tons EI^{-1*}	Farm Manual, Table 3.1 (EPA, 1985)
USLE LS Factor (USLELS)	3.63	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	Set according to guidance (EPA, 2001)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	4	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	12%	Value set to maximum for crop (EPA, 2001) Slopes range: 2 - 60 %
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Washington County, Oregon - Filberts		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Set to reside prior to new crop planting; forest floor or meadow.
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Salem, OR (W24232)
Maximum rainfall interception storage of crop (CINTCP)	0.25	Set to default for orchards (EPA, 2001)
Maximum Active Root Depth (AMXDR)	90 cm	Set to partial soil series profile depth based on root penetrating the fragipan. Roots may grow to as much as 20 feet.
Maximum Canopy Coverage (COVMAX)	75	Based on aerial photography

Soil Surface Condition After Harvest (ICNAH)	3	Orchards floor maintained similar to a meadow
Date of Crop Emergence (EMD, EMM, IYREM)	01/03	Leaf/flower emergence http://www.orst.edu/dept/hort/orchardnet/ Date estimates based on pest pressure information and similar cultivars
Date of Crop Maturity (MAD, MAM, IYRMAT)	15/04	Full Canopy
Date of Crop Harvest (HAD, HAM, IYRHAR)	10/11	Leaf Fall
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4, meadow; condition good (USDA, 1990)
Manning's N Value (MNGN)	0.040	RUSLE Project, A13OFOFN for orchards, no-till- Salem, OR (USDA, 2000)
USLE C Factor (USLEC)	0.005 - 0.034	RUSLE Project; A13OFOFN for orchards, no-till- Salem, OR (USDA, 2000)

Table 4. PRZM 3.12 Cornelius Soil Parameters for Washington County, Oregon - Filberts

Parameter	Value	Verification Source
Total Soil Depth (CORED)	148 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	5	
First, Second, Third, Fourth, and Fifth Soil Horizons (HORIZN = 1,2,3,4,5)		
Horizon Thickness (THKNS)	15 cm (HORIZN = 1,3) 13 cm (HORIZN = 2) 55 cm (HORIZN = 4) 50 cm (HORIZN = 5)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.30 g $\cdot cm^{-3}$ (HORIZN = 1) 1.38 g $\cdot cm^{-3}$ (HORIZN = 2) 1.58 g $\cdot cm^{-3}$ (HORIZN = 3) 1.52 g $\cdot cm^{-3}$ (HORIZN = 4) 1.46 g $\cdot cm^{-3}$ (HORIZN = 5)	

Initial Water Content (THETO)	0.329 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.338 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2) 0.340 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3) 0.358 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4) 0.202 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =5)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 1.0 cm (HORIZN = 2) 5.0 cm (HORIZN = 3,4,5)	
Field Capacity (THEFC)	0.329 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.338 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2) 0.340 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3) 0.358 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4) 0.202 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =5)	
Wilting Point (THEWP)	0.099 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1) 0.108 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 2) 0.110 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.148 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4) 0.142 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 5)	
Organic Carbon Content (OC)	2.30% (HORIZN = 1) 1.11% (HORIZN = 2) 0.21% (HORIZN = 3) 0.145% (HORIZN = 4) 0.07% (HORIZN = 5)	

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr.

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EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

EPA. 2001. Abel, S.A. Procedure for Conducting Quality Assurance and Quality Control of Existing and New PRZM Field and Orchard Crop Standard Scenarios. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

OREGON GRASS FOR SEED

The field used to represent grass for seed production in Oregon is located in Linn County, in the Willamette Valley. According to the 1997 Census of Agriculture, Oregon is ranked 1st in cool season forage and turf grass seed production in the U.S. Most of the acreage is located in the Willamette Valley. Oregon's Willamette Valley produces nearly all the ryegrass, perennial ryegrass, bentgrass, and fine fescue grown in the U.S. The crop is seeded in rows using carbon band seeding to protect the crop during emergence. Seed is planted in the early Fall using specialized equipment to overcome the soil conditions call swampbuggies. The soils tend to be poorly draining which are extensive in the Willamette Valley. Harvest begins in late June or early July. After harvest, field burning is used to control disease prior to the next crop. Field burning remains a controversial practice in the region. The soil selected to simulate the field is a benchmark soil, Dayton silt loam. Dayton silt loam, is a fine, smectitic, mesic Vertic Albaqualfs. The series is used to produce spring grains, grass seed, hay and pasture. A small amount is use for vegetable production. Dayton silt loam is a very deep, poorly drained, very slowly permeable soil with slow runoff or ponded conditions. These soils formed in stratified glacio lacustrine deposits of the Pleistocene age. They are found on nearly level or somewhat concave, slightly depressed parts of broad valley terraces at elevations of 150 to 400 feet above mean sea level on slopes of 0 to 2 percent. The series is extensive in the Willamette Valley. Dayton silt loam is a Hydrologic Group D soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Linn/Marion Counties Oregon - Grass for Seed

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Salem, OR (W24232)
Ending Date	December 31, 1990	Meteorological File - Salem, OR (W24232)
Pan Evaporation Factor (PFAC)	0.74	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Linn/Marion Counties Oregon - Grass for Seed

Parameter	Value	Source
Method to Calculate	4 (MUSS)	PRZM Manual (EPA, 1998)

Erosion (ERFLAG)		
USLE K Factor (USLEK)	0.43 tons EI^{-1*}	GLEAMS Manual, Table of Representative Soils (USDA, 1990)
USLE LS Factor (USLELS)	0.20	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	Set according to guidance (EPA, 2001). Assumed no practice for row crop vegetables.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	2	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1%	Value set to median of range (0-2%) (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Linn/Marion Counties Oregon - Grass for Seed		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Set to residue prior to new crop planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Salem, OR (W24232)
Maximum rainfall interception storage of crop (CINTCP)	0.1	PRZM Manual, Table 5.4 (EPA, 1998). Set to depth for wheat, barley, and other grass-like crops.
Maximum Active Root Depth (AMXDR)	60 cm	http://www.sjrcd.org/ag/effective_root_zone.htm
Maximum Canopy Coverage (COVMAX)	100	Set to full canopy for grasses
Soil Surface Condition After Harvest (ICNAH)	1	Due to field burning, set to conservative input assuming field fallow until next crop.
Date of Crop Emergence (EMD, EMM, IYREM)	16/09	http://www.orst.edu/dept/coarc/obsersty.htm

Date of Crop Maturity (MAD, MAM, IYRMAT)	15/05	Set one weeks before harvest, no specific data available. http://www.css.orst.edu/seed-ext/pub/industry.htm
Date of Crop Harvest (HAD, HAM, IYRHAR)	30/06	http://www.css.orst.edu/seed-ext/pub/industry.htm
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	GLEAMS Table H-4; Meadow; good hydrologic condition (USDA, 1990)
Manning’s N Value (MNGN)	0.014	RUSLE Project; A12WSHLC; Wheat, Spring pnw 40; Conventional tillage, Portland, OR (USDA, 2000)
USLE C Factor (USLEC)	0.026 - 0.459	RUSLE Project; A12WSHLC; Wheat, Spring pnw 40; Conventional tillage, Portland, OR (USDA, 2000)

Table 4. PRZM 3.12 Dayton Soil Parameters for Linn/Marion Counties Oregon - Grass for Seed

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 8 cm (HORIZN = 2) 82 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.4 g $\cdot$cm^{-3} (HORIZN = 1,2,3)	
Initial Water Content (THETO)	0.312 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =1,2) 0.266 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4.0 cm (HORIZN = 2)	

	2.0 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.312 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.266 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Wilting Point (THEWP)	0.132 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.236 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	2.32% (HORIZN = 1,2) 0.29% (HORIZN = 3)	

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

EPA. 2001. Abel, S.A. Procedure for Conducting Quality Assurance and Quality Control of Existing and New PRZM Field and Orchard Crop Standard Scenarios. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S.

Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

OREGON HOPS

The field used to represent hop production in Oregon is located in Marion County, in the Willamette Valley. According to the 1997 Census of Agriculture, Oregon is ranked 2nd in hop production in the U.S. Marion County leads Oregon in acres planted in 1997. Hops require a rich organic soil, and abundant irrigation for maximum yield. The crop is perennial, old "bines" and other debris are removed in the spring and cultivated until late June or early July. Irrigation begins in May or early June. Harvest occurs from August to mid-September. Row widths vary from about 36 inches to more than 48 inches. The soil selected to simulate the field is a benchmark soil, Woodburn silt loam. Woodburn silt loam, is a fine-silty mixed, superactive, mesic Aquultic Agrixerolls. The series is used to produce berries, orchards, cannery crops, grain, hay, and pasture. Woodburn silt loam is a very deep, moderately well drained, slowly permeable soil with slow to medium runoff. These soils formed in stratified glacio lacustrine deposits of the Pleistocene age. They are found on nearly level to gently sloping broad valley terraces at elevations of 150 to 400 feet above mean sea level on slopes of 0 to 55 percent. The series is extensive in the Willamette Valley. Woodburn silt loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Marion County Oregon - Hops

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Salem, OR (W24232)
Ending Date	December 31, 1990	Meteorological File - Salem, OR (W24232)
Pan Evaporation Factor (PFAC)	0.74	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Marion County Oregon - Hops

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.32 tons EI^{-1*}	Soil Data Mart Database for Marion County, OR. Data for Woodburn silt loam, 3-12% slopes. http://soildatamart.nrcs.usda.gov/

USLE LS Factor (USLELS)	1.07	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	Set according to guidance (EPA, 2001)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	2	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Range: 0-55%. Since maximum is >12%, value is set to 6% for row crops (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Marion County, Oregon - Hops

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Set to residue prior to new crop planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Salem, OR (W24232)
Maximum rainfall interception storage of crop (CINTCP)	0.1	PRZM Manual, Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	203 cm	Set to profile maximum. Roots can be as deep as 12 feet (EPA, 2001)
Maximum Canopy Coverage (COVMAX)	90	Professional Estimate based on photography/video
Soil Surface Condition After Harvest (ICNAH)	3	Continuous cultivation
Date of Crop Emergence (EMD, EMM, IYREM)	01/04	http://www.oda.state.or.us/hops/extcr104.html

Date of Crop Maturity (MAD, MAM, IYRMAT)	30/07	
Date of Crop Harvest (HAD, HAM, IYRHAR)	01/09	
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4,Meadow, condition good. (USDA, 1990)
Manning’s N Value (MNGN)	0.023	RUSLE Project, A12GCGCM Grapes Alleyway, Mulch Tillage (USDA, 2000)
USLE C Factor (USLEC)	0.294 - 0.522	RUSLE Project; A12GCGCM Grapes Alleyway, Mulch Tillage (USDA, 2000)

Table 4. PRZM 3.12 Woodburn Soil Parameters for Marion County, Oregon - Hops

Parameter	Value	Verification Source
Total Soil Depth (CORED)	203 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	7 (Top horizon split in two)	
First, Second, Third, Fourth, Fifth, Sixth, and Seventh Soil Horizons (HORIZN = 1,2,3,4,5,6,7)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 13 cm (HORIZN = 2) 20 cm (HORIZN = 3) 40 cm (HORIZN = 4,6) 50 cm (HORIZN = 5) 30 cm (HORIZN = 7)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.44 g $\cdot cm^{-3}$ (HORIZN = 1,2,5) 1.53 g $\cdot cm^{-3}$ (HORIZN = 3) 1.45 g $\cdot cm^{-3}$ (HORIZN = 4) 1.37 g $\cdot cm^{-3}$ (HORIZN = 6,7)	
Initial Water Content (THETO)	0.301 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.350 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	

	$0.388\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN =4) $0.394\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN =5) $0.418\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN =6) $0.404\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN =7)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 1.0 cm (HORIZN = 2) 5.0 cm (HORIZN = 3,4,5,6,7)	
Field Capacity (THEFC)	$0.301\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN =1,2) $0.350\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN =3) $0.388\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN =4) $0.394\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN =5) $0.418\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN =6) $0.404\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN =7)	
Wilting Point (THEWP)	$0.134\ cm^3\text{-}H_2O \cdot cm^{3}\text{-soil}$ (HORIZN = 1,2) $0.153\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN = 3) $0.177\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN = 4) $0.185\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN = 5) $0.173\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN = 6) $0.156\ cm^3\text{-}H_2O \cdot cm^{-3}\text{-soil}$ (HORIZN = 7)	
Organic Carbon Content (OC)	1.86% (HORIZN = 1,2) 0.56% (HORIZN = 3) 0.3% (HORIZN = 4) 0.112% (HORIZN = 5) 0.07% (HORIZN = 6) 0.06% (HORIZN = 7)	

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043)

Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

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EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

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USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

OREGON MINT

The field used to represent mint production in Oregon is located in Marion County, in the Willamette Valley. According to the 1997 Census of Agriculture, Oregon is ranked 1st in peppermint production and 4th in spearmint production in the U.S. Marion County is among the top five in harvested acres in the state. Row spacing is from 20 to 30 inches and within row spacing is 4 to 6 inches. Plants spread by the second year to form a solid field of mint. Every 3 to 5 years, growers rotate the mint fields with another crop, generally perennial ryegrass or tall fescue in the Willamette Valley. Mint is mowed once or twice during the summer, depending on the variety. Plants require soils rich in organic matter with a pH range from 6.0 to 7.0. Water demand is high, therefore, irrigation is mandatory for a healthy crop. The soil selected to simulate the field is a Newberg fine sandy loam. Newberg fine sandy loam, is a coarse-loamy, mixed, superactive, mesic Fluventic Haploxerolls. The series is used to produce vegetable, fruit, and pasture. Mint is grown extensively on these soils. Newberg fine sandy loam is a very deep, somewhat excessively drained, moderately rapidly permeable soil with slow runoff. These soils formed in alluvium from sedimentary and basic igneous rocks. They are found on flood plains at elevations of 10 to 3,000 feet above mean sea level on slopes of 0 to 4 percent. The series are of moderate extent. Newberg fine sandy loam is a Hydrologic Group B soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Marion County, Oregon - Mint

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Salem, OR (W24232)
Ending Date	December 31, 1990	Meteorological File - Salem, OR (W24232)
Pan Evaporation Factor (PFAC)	0.74	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Marion County, Oregon - Mint

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor	0.19 tons EI^{-1*}	Farm Manual, Table 3.1 (EPA, 1985)

(USLEK)		
USLE LS Factor (USLELS)	0.30	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	Set according to guidance (EPA, 2001)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	2	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	2%	Value set to median value of range (0-4%) (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Marion County, Oregon - Mint

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Set to reside prior to new crop planting; forest floor or meadow.
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Salem, OR (W24232)
Maximum rainfall interception storage of crop (CINTCP)	0.25	Set to default for orchards, PRZM Manual Table 5.4 (EPA, 2001).
Maximum Active Root Depth (AMXDR)	30 cm	Gale Gingrich, Marion Co Ag Extension
Maximum Canopy Coverage (COVMAX)	100	Gale Gingrich, Marion Co Ag Extension
Soil Surface Condition After Harvest (ICNAH)	1	Orchards floor maintained similar to a meadow
Date of Crop Emergence (EMD, EMM, IYREM)	15/04	Gale Gingrich, Marion Co Ag Extension
Date of Crop Maturity (MAD, MAM, IYRMAT)	25/07	

Date of Crop Harvest (HAD, HAM, IYRHAR)	01/08	
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4, meadow; condition good (USDA, 1990)
Manning’s N Value (MNGN)	0.023	RUSLE Project, A19BSHLC, Medford barley rotated with hay; Salem OR (USDA, 2000)
USLE C Factor (USLEC)	0.019 - 0.331	RUSLE Project; A19BSHLC, Medford barley rotated with hay; Salem OR (USDA, 2000)

Table 4. PRZM 3.12 Newberg Soil Parameters for Marion County, Oregon - Mint

Parameter	Value	Verification Source
Total Soil Depth (CORED)	150 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	4	
First, Second, Third, and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 40 cm (HORIZN = 2) 25 cm (HORIZN = 3) 75 cm (HORIZN = 4)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.20 g $\cdot$cm^{-3} (HORIZN = 1,2,3,4)	
Initial Water Content (THETO)	0.308 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =1,2) 0.264 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =3) 0.216 cm^3-H_2O $\cdot$cm^{-3}-soil (HORIZN =4)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5.0 cm (HORIZN = 2,3,4)	

Field Capacity (THEFC)	0.308 cm^3-H_2O ·cm^{-3}-soil (HORIZN =1,2) 0.264 cm^3-H_2O ·cm^{-3}-soil (HORIZN =3) 0.216 cm^3-H_2O ·cm^{-3}-soil (HORIZN =4)	
Wilting Point (THEWP)	0.158 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1,2) 0.114 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3) 0.086 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.116% (HORIZN = 3) 0.058% (HORIZN = 4)	

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

EPA. 2001. Abel, S.A. Procedure for Conducting Quality Assurance and Quality Control of Existing and New PRZM Field and Orchard Crop Standard Scenarios. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

OREGON VEGETABLES (Snapbeans)

The field used to represent snapbean production in Oregon is located in Marion County, in the Willamette Valley. According to the 1997 Census of Agriculture, Oregon is ranked 2nd in common bean production in the U.S. behind Wisconsin, and Marion County growers have the largest acreage. Almost all Oregon beans are processed. The crop is generally planted in the late Spring (June) and harvested beginning in August. After the bean plants have flowered, harvest begins approximately 22 days later. Most commercial farms have replaced pole beans with bush beans to facilitate mechanized harvest. Row spacing is generally 36 inches. The crop is mostly grown under irrigation by a variety of overhead sprinkler systems. The soil selected to simulate the field is a benchmark soil, Dayton silt loam. Dayton silt loam, is a fine, smectitic, mesic Vertic, Albaqualfs. The series is used to produce spring grains, grass seed, hay and pasture. A small amount is use for vegetable production. Dayton silt loam is a very deep, poorly drained, very slowly permeable soil with slow runoff or ponded conditions. These soils formed in stratified glacio lacustrine deposits of the Pleistocene age. They are found on nearly level or somewhat concave, slightly depressed parts of broad valley terraces at elevations of 150 to 400 feet above mean sea level on slopes of 0 to 2 percent. The series is extensive in the Willamette Valley. Dayton silt loam is a Hydrologic Group D soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Marion County Oregon - Snapbeans

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Salem, OR (W24232)
Ending Date	December 31, 1990	Meteorological File - Salem, OR (W24232)
Pan Evaporation Factor (PFAC)	0.74	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Marion County Oregon - Snapbeans

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor	0.43 tons EI^{-1*}	GLEAMS Manual, Table of Representative Soils (USDA, 1990)

(USLEK)		
USLE LS Factor (USLELS)	0.20	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.3 (EPA 2004).
USLE P Factor (USLEP)	1.0	Set according to guidance (EPA, 2001). Assumes no practice for row crop vegetables.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	2	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	1%	Value set to median of range (0 to 2%) (EPA, 2001)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Marion County Oregon - Snapbeans

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Set to residue prior to new crop planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Salem, OR (W24232)
Maximum rainfall interception storage of crop (CINTCP)	0.1	PRZM Manual, Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	38 cm	Bob McReynolds, Oregon State University Extension Date: 2/10/06, Phone: 503-678-1264 12-15 inches
Maximum Canopy Coverage (COVMAX)	100	Bob McReynolds, Oregon State University Extension Date: 2/10/06, Phone: 503-678-1264
Soil Surface Condition After Harvest (ICNAH)	1	Set to conservative input assuming field fallow until next crop.
Date of Crop Emergence (EMD, EMM, IYREM)	16/06	http://www.orst.edu/Dept/NWREC/snapbean.html Eastern Oregon Planting early May to Mid-June; emergence 10-14 days later; harvest late July to
Date of Crop Maturity	18/08	

(MAD, MAM, IYRMAT)		Mid-Sept.
Date of Crop Harvest (HAD, HAM, IYRHAR)	02/09	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	92, 89, 90	GLEAMS Table H-4; Close-seeded legumes Fallow = Fallow ST/CT/poor; Cropping and Residue = SR, conventional tillage, poor condition (USDA, 1990)
Manning's N Value (MNGN)	0.011	RUSLE Project; A12BGBGC; Bean, Green, conventional tillage, Portland, OR (USDA, 2000)
USLE C Factor (USLEC)	0.152 - 0.884	RUSLE Project; A12BGBGC; Bean, Green, conventional tillage, Portland, OR (USDA, 2000)

Table 4. PRZM 3.12 Dayton Soil Parameters for Marion County Oregon - Snapbeans

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 8 cm (HORIZN = 2) 82 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.4 g $\cdot cm^{-3}$ (HORIZN = 1,2,3)	
Initial Water Content (THETO)	0.312 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.266 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4.0 cm (HORIZN = 2) 2.0 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.312 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2)	

	$0.266\ cm^3$-$H_2O \cdot cm^{-3}$-soil (HORIZN =3)	
Wilting Point (THEWP)	$0.132\ cm^3$-$H_2O \cdot cm^{-3}$-soil (HORIZN = 1,2) $0.236\ cm^3$-$H_2O \cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	2.32% (HORIZN = 1,2) 0.29% (HORIZN = 3)	

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

EPA. 2001. Abel, S.A. Procedure for Conducting Quality Assurance and Quality Control of Existing and New PRZM Field and Orchard Crop Standard Scenarios. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

EPA. 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

PENNSYLVANIA APPLES

The field used to represent apple production in Pennsylvania is located in Lancaster County, in south-eastern Pennsylvania. According to the 1997 Census of Agriculture, Pennsylvania is ranked 5th in apple production in the U.S. Within row tree spacing depends on the root stock and cultivation method. Spacing ranges from as little as 5 feet to 25 feet. Row spacing may be as much as twice the within row spacing to allow for maintenance and harvesting equipment. The soil selected to simulate the field is a benchmark soil, Elioak silt loam. Elioak silt loam, is a clayey, kaolinitic, mesic, Typic Hapludults. The soil is used for pastures, orchards, general local crops and non-agricultural uses. Elioak silt loam is a very deep, well drained, moderately permeable soil with medium to rapid runoff. These soils formed in residuum weathered from mica schists and phyllites, and to a minor extent from granitized schist and micaeous gneiss. They are found on summits and upper slopes in northern portions of the Piedmont Plateau. Most slopes are less than 15 percent, but can range from 0 to 30 percent. The series is of moderate extent in the mid-Atlantic Piedmont Plateau. Elioak silt loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Lancaster, PA - Apples

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Harrisburg, PA (W14751)
Ending Date	December 31, 1990	Meteorological File - Harrisburg, PA (W14751)
Pan Evaporation Factor (PFAC)	0.76	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.16 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Lancaster, PA - Apples

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.42 tons EI^{-1*}	PRZM Manual, Table 3.1 (EPA, 1985)

USLE LS Factor (USLELS)	3.63	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	PRZM Table 5.6 (EPA, 1998). Assumes no supporting practice.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	12%	Since maximum of slope range (0-30%) >12%, value set to 12% for orchard crop (EPA, 2004)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Lancaster, PA - Apples

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	Orchard - material is largely left in place
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Allentown, PA (W14737)
Maximum rainfall interception storage of crop (CINTCP)	0.25	Set to default for orchards (EPA, 2001)
Maximum Active Root Depth (AMXDR)	100 cm	Set to maximum soil depth. Roots may grow to 20 feet, but tree roots limited to soil hardpans or consolidated material.
Maximum Canopy Coverage (COVMAX)	90	Ross Byers, Horticultural Specialist VPI - canopy somewhat open between rows; 90% reasonable upper end estimate. Parameter value may be inconsistent with different apple scenarios due to different sources.
Soil Surface Condition After Harvest (ICNAH)	3	Orchards floor maintained similar to a meadow
Date of Crop Emergence (EMD, EMM, IYREM)	16/04	Personal communication w/ Ross Byers, VA Tech Fruit Horticulturalist (540) 869-2560 x19 Emergence

Date of Crop Maturity (MAD, MAM, IYRMAT)	10/05	based on leaf emergence, Maturation based on canopy maturity, Harvest based on average leaf fall. Dates based on central VA and modified by: 1 day added for every 100 miles north or 100 feet higher elevation or 1day subtracted for every 100 miles south or 100 feet lower elevation.
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/10	
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4, meadow; condition good (USDA, 1990)
Manning's N Value (MNGN)	0.023	RUSLE Project; SB5OFOFN; Orchards, full canopy cover; No Till; York, PA (USDA, 2000)
USLE C Factor (USLEC)	0.008 - 0.050	RUSLE Project; SB5OFOFN; Orchards, full canopy cover; No Till; York, PA (USDA, 2000)

Table 4. PRZM 3.12 Elioak Soil Parameters for Lancaster, PA - Apples

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3 (Top horizon split in two)	
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 28 cm (HORIZN = 2) 62 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.70 g $\cdot cm^{-3}$ (HORIZN = 1,2) 1.80 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content (THETO)	0.218 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.243 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 4.0 cm (HORIZN = 2) 2.0 cm (HORIZN = 3)	
Field Capacity (THEFC)	0.218 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2)	

	$0.243 cm^3$-$H_2O \cdot cm^{-3}$-soil (HORIZN = 3)	
Wilting Point (THEWP)	$0.098 cm^3$-$H_2O \cdot cm^{-3}$-soil (HORIZN = 1,2) $0.163 cm^3$-$H_2O \cdot cm^{-3}$-soil (HORIZN = 3)	
Organic Carbon Content (OC)	1.16% (HORIZN = 1,2) 0.174 (HORIZN = 3)	

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

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Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

USDA. 1990. Davis, F.M., R.A. Leonard, W.G. Knisel. GLEAMS User Manual, Version 1.8.55. USDA-ARS Southeast Watershed Research Laboratory, Tifton GA. SEWRL-030190FMD.

USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

PENNSYLVANIA CORN

The field used to represent corn production in Pennsylvania is located in Lancaster County in the south-east portion of the state. According to the 1997 Census of Agriculture, Pennsylvania is ranked 15th among major producers of corn in the U.S. The crop is generally planted the Spring (April) and harvested beginning in September. Continuous corn is practice is much of the region. However, rotation with other crops such as soybeans is also practiced. Most of the corn is planted for feed grain. Planting depth and row spacing (generally 30 inches) follows general practices for the U.S. Conventional tillage dominates management practices, followed by no-tillage. However, conservation tillage is continuing to grow. The soil selected to simulate the field is a benchmark soil, Hagerstown silt loam. Hagerstown silt loam, is a fine, mixed, semiactive, mesic Typic Hapludalfs. These soils are used fro general crops, pastures, orchards and truck crops. Large portions are in non-farm uses. Hagerstown silt loam is a very deep, well drained, moderately permeable soil with moderate to rapid runoff. These soils formed in materials weathered from hard grey limestone of rather high purity. They are found on valley floors and the adjacent hills. In some areas rock outcrops are common surface features. Slopes are generally less than 15 percent, but may range up to 45 percent. Hagerstown silt loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Lancaster County, Pennsylvania - Corn

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Harrisburg, PA (W14751)
Ending Date	December 31, 1990	Meteorological File - Harrisburg, PA (W14751)
Pan Evaporation Factor (PFAC)	0.76	PRZM Manual Figure 5.1 (EPA, 1998.)
Snowmelt Factor (SFAC)	0.36 m C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Lancaster County, Pennsylvania - Corn

Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)

USLE K Factor (USLEK)	0.32 tons EI^{-1*}	GLEAMS Manual, table of Representative Soils (USDA, 1990)
USLE LS Factor (USLELS)	1.34	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	0.5	Set according to guidance, PRZM Table 5.6 (EPA, 2001)
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Range: <15-45%. Since maximum value is >12%, value is set to 6 percent for row crop (EPA 2004).
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Lancaster County, Pennsylvania - Corn

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Set fallow prior to new crop planting
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Allentown, PA (W14737)
Maximum rainfall interception storage of crop (CINTCP)	0.25	PRZM, Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	90 cm	Median value (60-120 cm) (Table 5-9. EPA 1998).
Maximum Canopy Coverage (COVMAX)	100	Taken from IL corn. Also consistent with default value cited in guidance (EPA 2004).
Soil Surface Condition After Harvest (ICNAH)	3	Winter cover crop planted in most areas.
Date of Crop Emergence (EMD, EMM, IYREM)	16/04	Usual Planting and Harvesting Dates for U.S. Field Crops and Penn. State Coop. Extension

Date of Crop Maturity (MAD, MAM, IYRMAT)	04/07	Usual Planting and Harvesting Dates for U.S. Field Crops and Penn. State Coop. Extension
Date of Crop Harvest (HAD, HAM, IYRHAR)	01/10	Usual Planting and Harvesting Dates for U.S. Field Crops and Penn. State Coop. Extension
Maximum Dry Weight (WFMAX)	0.0	Set to "0" Not used in simulation
SCS Curve Number (CN)	89, 83, 85	Gleams Manual Table H-4, Fallow SR/CT; Cropping and Residue = Row crop, Conservation tillage, Contour plowing" (USDA, 1990)
Manning's N Value (MNGN)	0.014	RUSLE Project, SB5CGSBC, Corn, grain, conventional tillage, York, PA (USDA, 2000)
USLE C Factor (USLEC)	0.025 - 0.701	RUSLE Project; SB5CGSBC, Corn, grain, conventional tillage, York, PA (USDA, 2000)

Table 4. PRZM 3.12 Hagerstown Soil Parameters for Lancaster County, Pennsylvania - Corn

Parameter	Value	Verification Source
Total Soil Depth (CORED)	100 cm	NRCS, National Soils Characterization Database (NRCS, 2001)
Number of Horizons (NHORIZ)	3	
First, Second, and Third and Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 40 cm (HORIZN = 2) 50 cm (HORIZN = 3)	NRCS, National Soils Characterization Database (NRCS, 2001) http://www.statlab.iastate.edu/soils/ssl/)
Bulk Density (BD)	1.6 g $\cdot cm^{-3}$ (HORIZN = 1) 1.7 g $\cdot cm^{-3}$ (HORIZN = 2) 1.8 g $\cdot cm^{-3}$ (HORIZN = 3)	
Initial Water Content (THETO)	0.282 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1) 0.242cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =2) 0.245 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3)	

Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5.0 cm (HORIZN = 2,3)	
Field Capacity (THEFC)	0.282 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1) 0.242cm^3-H_2O ·cm^{-3}-soil (HORIZN = 2) 0.245 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Wilting Point (THEWP)	0.122 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1) 0.142 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 2) 0.145 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 3)	
Organic Carbon Content (OC)	2.9% (HORIZN = 1) 0.174% (HORIZN = 2) 0.116% (HORIZN = 3)	

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1999. Jones, R.D., J. Breithaupt, J. Carleton, L. Libelo, J. Lin, R. Matzner, and R. Parker. Guidance for Use of the Index Reservoir in Drinking Water Exposure Assessments. Environmental Fate and Effects Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington. D.C.

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Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

PENNSYLVANIA TOMATOES

The field used to represent tomato production in Pennsylvania is located in Adams/Lancaster Counties in Pennsylvania. According to the 1997 Census of Agriculture, Pennsylvania is ranked 6th overall in the production of tomatoes in the U.S. Tomatoes are grown on either six-inch raised beds (20 percent) or on flat beds (80 percent). Tomato plants are transplanted from greenhouse operations. Most tomatoes are planted in late April following the last frost and the harvest may begin in July and last for up to 120 days. Most tomatoes are grown using conventional tillage; less than 2 percent use no-till. Fresh market tomatoes are grown using stakes woven with mesh, individual staking is rare. Growers use black polyethylene mulch (black plastic) for weed control in the beds. Approximately 25 percent of plastic mulch growers use red mulch instead of black. Fresh market growers use trickle irrigation systems. Tomatoes for processing are grown in a similar fashion to fresh market varieties except they are grown on bare ground using overhead drip irrigation; no plastic or stakes are used. Nearly all processed tomatoes are machine harvested. The soil selected to simulate the field is a benchmark soil, Glenville silt loam. Glenville silt loam, is a fine-loamy, mixed, active, mesic, Aquic Fragiudults. These soils are in general crop production, but mostly grain, hay and pasture. Glenville silt loam is a very deep, moderately well drained or somewhat poorly drained, medium to slowly permeable soil with medium to slow runoff and consists of a fragipan at approximately 2 feet. In the fragipan, permeability is slow to moderately slow. These soils formed in residuum weathered from mica acid schist and crystalline rock containing mica. They are found on nearly level to strongly sloping upland flats, footslopes, or near the heads of drainageways. These soils are extensive in the mid-Atlantic Piedmont. Slopes range from 0 to 15 percent. Glenville silt loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for Lancaster County, Pennsylvania - Tomatoes

Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Harrisburg, PA (W14751)
Ending Date	December 31, 1990	Meteorological File - Harrisburg, PA (W14751)
Pan Evaporation Factor (PFAC)	0.75	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	17.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Lancaster County, Pennsylvania - Tomatoes		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.32 tons EI^{-1*}	Soil Data Mart Database for Lancaster County, PA. Data for Glenville silt loam, 3-8% slopes; surface horizon.
USLE LS Factor (USLELS)	1.34	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1	Leon Restler, Ag. Extension Agent, Lancaster Co. (717) 394-6851 8/14/01). Tomatoes grown under platiculture do not follow contours. PRZM Manual Table 5.6
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	6%	Maximum slope for row crops based on guidance. Soil series exceed 12 percent slope. Leon Restler, Ag. Extension Agent, Lancaster Co. (717) 394-6851 8/14/01)
Hydraulic Length (HL	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Lancaster County, Pennsylvania - Tomatoes		
Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	1	Set to fallow prior to new crop planting.
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Allentown, PA (W14737)
Maximum rainfall interception storage of crop (CINTCP)	0.1	PRZM, Table 5.4 (EPA, 1998)
Maximum Active Root Depth (AMXDR)	20 cm	Leon Restler, Ag. Extension Agent, Lancaster Co. Phone: (717) 394-6851, Date: 8/14/01 Parameter value may be inconsistent with different

		tomato scenarios due to different sources..
Maximum Canopy Coverage (COVMAX)	80	Leon Restler, Ag. Extension Agent, Lancaster Co. Phone: (717) 394-6851, Date: 8/14/01 Parameter value may be inconsistent with different tomato scenarios due to different sources.
Soil Surface Condition After Harvest (ICNAH)	3	Set to residue for winter months after last harvest during multi-year growth and during winter of last years of growth.
Date of Crop Emergence (EMD, EMM, IYREM)	16/04	Leon Restler, Ag. Extension Agent, Lancaster Co. Phone: (717) 394-6851, Date: 8/14/01 Tomatoes are transplanted approximately 40-45 days after seeding in greenhouses Emergence date set to transplant date. Maturation set to beginning of harvest - mid-June. Range from 55-85 days depending on variety after transplanting from greenhouse. Most popular range from 70-80 days Harvesting may last up to 120 or more days; set to mid Oct for PA as end of harvest season. http://www.urbanext.uiuc.edu/veggies/tomato1.html
Date of Crop Maturity (MAD, MAM, IYRMAT)	30/06	
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/10	
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	87, 83, 85	Gleams Manual Table H-4, pasture/range, non-CNT, poor condition (USDA, 1990)
Manning’s N Value (MNGN)	0.011	RUSLE Project, SB5BGBWC; Hay, legume, conventional till, York (USDA, 2000)
USLE C Factor (USLEC)	0.097-0.634	RUSLE Project, SB5BGBWC; Hay, legume, conventional till, York (USDA, 2000)

Table 4. PRZM 3.12 Glenville Soil Parameters for Lancaster County, Pennsylvania - Tomatoes

Parameter	Value	Verification Source
Total Soil Depth (CORED)	157 cm	Soil Data Mart Database for Lancaster County, PA. Data for Glenville silt loam, 3-8% slopes. Number of horizons is inconsistent with PA turf scenario (also Glenville Soil) due to
Number of Horizons (NHORIZ)	5 (Top horizon split in two)	

		addition of thatch layer in turf scenario.
First, Second, and Third Soil Horizons (HORIZN = 1,2,3)		
Horizon Thickness (THKNS)	10 cm (HORIZN = 1) 13 cm (HORIZN = 2) 15 cm (HORIZN = 3) 58 cm (HORIZN = 4) 61 cm (HORIZN = 5)	Soil Data Mart Database for Lancaster County, PA. Data for Glenville silt loam, 3-8% slopes. http://soildatamart.nrcs.usda.gov/ Note on inconsistencies between scenarios: Glenville silt loam soil data values are slightly different in the Soil Data Mart Lancaster (PA Tomato) and York County (PA Alfalfa, PA Turf) databases.
Bulk Density (BD)	1.3 g $\cdot cm^{-3}$ (HORIZN = 1,2) 1.5 g $\cdot cm^{-3}$ (HORIZN = 3) 1.7 g $\cdot cm^{-3}$ (HORIZN = 4) 1.5 g $\cdot cm^{-3}$ (HORIZN = 5)	
Initial Water Content (THETO)	0.33 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.31 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3) 0.24 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4) 0.17 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =5)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 1 cm (HORIZN = 2) 5 cm (HORIZN = 3) 2 cm (HORIZN = 4) 1 cm (HORIZN = 5)	
Field Capacity (THEFC)	0.33 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =1,2) 0.31 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =3) 0.24 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =4) 0.17 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN =5)	Field capacity and wilting point were calculated using the Rawls and Brakensiek method with data from the SoilDataMart Database.
Wilting Point (THEWP)	0.15 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 1,2) 0.17 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 3) 0.12 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN = 4) 0.1 cm^3-H_2O $\cdot cm^{-3}$-soil (HORIZN	

	= 5)	
Organic Carbon Content (OC)	1.74% (HORIZN = 1,2) 0.2% (HORIZN = 3) 0.17% (HORIZN = 4) 0.0% (HORIZN = 5)	

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

EPA. 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

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Haan, C.T. and B.J. Barfield. 1978. *Hydrology and Sedimentology of Surface Mined Lands.* Office of Continuing Education and Extension, College of Engineering, University of Kentucky, Lexington, Kentucky 40506. pp. 286.

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PENNSYLVANIA TURF

The field used to represent turf grass in Pennsylvania is located in York County, although turf grasses (golf courses, sod farms, etc.) are located throughout the state. This turf scenario is considered to be essentially generic, with no distinction made between sod farms, golf course fairways, greens and tees, or residential lawns. For pesticides applied to golf courses, the fraction of the total area composed of greens, tees, and fairways may, however be used to modify the results of a modeling run, somewhat in the fashion of a percent cropped area (PCA) adjustment. The approximate average percent areas (confirmed by Mike Kenna, USGA, personal communication) are as follows: fairways, 23%; greens, 2%; tees, 2%. Thus if a pesticide is only used on greens and tees, for example, the modeling results would be multiplied by a factor of 0.04. It is possible that current PCA development efforts may produce PCAs for golf courses, turf farms, and/or residential lawns that may also be used to refine the results of modeling runs.
To develop a turf scenario the soil was modified by adding a 2 cm thick layer of Athatch@ on top of the soil profile. The thatch layer has the following properties: bulk density = 0.37; field capacity = 0.47; wilting point = 0.27; organic carbon = 7.5%. Curve numbers were selected based on Agood condition@ open space areas as specified in TR-55, that is for hydrologic soil groups C. A 2 cm layer of thatch is typical for golf course fairways, but is probably thicker than average for golf course greens.

Sod Production. Sod may be grown on most soil types in Pennsylvania. Two types of grass species are grown in Pennsylvania. The cool season grasses comprise species such as *Kentucky bluegrass, rough bluegrass, perennial ryegrass,* fine and tall *fescues, and bentgrass*. The only warm season grass hardy enough to survive the Pennsylvania winters is *zoysiagrass*. Where necessary, irrigation systems are installed before operation of a sod farm begins. Fields are generally laser-leveled before planting to allow for uniform harvesting of sod by the “cutter blade.” Small hills and valleys can be accommodated by the cutter blade, but irregularities in the field left by poor maintenance will reduce yield. Irrigation is generally necessary for successful production. Nearly all forms of irrigation are used in sod production except “flood” irrigation. Depending on the type of grass, seed, sprigs, plugs or sod are used to establish the field. Harvesting occurs mainly in mid-spring through early fall. The soil selected to simulate the field is a benchmark soil, Glenville silt loam. Glenville silt loam, is a fine-loamy, mixed, active, mesic, Aquic Fragiudults. These soils are in general crop production, but mostly grain, hay and pasture. Glenville silt loam is a very deep, moderately well drained or somewhat poorly drained, medium to slowly permeable soil with medium to slow runoff and consists of a fragipan at approximately 2 feet. In the fragipan, permeability is slow to moderately slow. These soils formed in residuum weathered from mica acid schist and crystalline rock containing mica. They are found on nearly level to strongly sloping upland flats, footslopes, or near the heads of drainageways. Slopes range from 0 to 15 percent. These soils are extensive in the mid-Atlantic Piedmont. Glenville silt loam is a Hydrologic Group C soil.

Table 1. PRZM 3.12 Climate and Time Parameters for York County, Pennsylvania - Turf		
Parameter	Value	Source
Starting Date	January 1, 1961	Meteorological File - Harrisburg, PA (W14751)
Ending Date	December 31, 1990	Meteorological File - Harrisburg, PA (W14751)
Pan Evaporation Factor (PFAC)	0.76	PRZM Manual Figure 5.1 (EPA, 1998)
Snowmelt Factor (SFAC)	0.36 cm C^{-1}	PRZM Manual Table 5.1 (EPA, 1998)
Minimum Depth of Evaporation (ANETD)	12.5 cm	PRZM Manual Figure 5.2 (EPA, 1998)

Table 2. PRZM 3.12 Erosion and Landscape Parameters for York County, Pennsylvania - Turf		
Parameter	Value	Source
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.32 tons EI^{-1*}	Soil Data Mart Database for York County, PA. Data for Glenville silt loam, 3-8% slopes.
USLE LS Factor (USLELS)	3.63	Calculated according to Haan and Barfield (1978) equation: LS = $((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, x = SLP/100 and m = constant. In this case, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1.0	Continuous turf without conventional agricultural practices
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA 2004).
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	12%	Leon Restler, Ag. Extension Agent, Lancaster Co. (717) 394-6851 8/14/01)
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for York County, Pennsylvania - Turf

Parameter	Value	Source
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001)
Initial Surface Condition (ISCOND)	3	According to Agricultural Extension Agent
Number of Different Crops (NDC)	1	Set to crops in simulation - generally one
Number of Cropping Periods (NCPDS)	30	Set to weather data. Allentown, PA (W14737)
Maximum rainfall interception storage of crop (CINTCP)	0.1	Due to management practices for turf (golf courses or farming) very little water interception is desired to prevent diseases.
Maximum Active Root Depth (AMXDR)	10 cm	Recommendation following discussion with Mike Davy, Plant Biologist, OPP/EFED (2001)
Maximum Canopy Coverage (COVMAX)	100	Default
Soil Surface Condition After Harvest (ICNAH)	3	Set to residue for winter months after last harvest during multi-year growth and during winter of last years of growth.
Date of Crop Emergence (EMD, EMM, IYREM)	01/04	Arbitrarily set to date when grass is likely to green after overwintering. Note: does not indicate grass will not grow during period from harvest to emergence the following year.
Date of Crop Maturity (MAD, MAM, IYRMAT)	15/04	Set to date when first cutting likely
Date of Crop Harvest (HAD, HAM, IYRHAR)	01/11	Set arbitrarily to date when grass begins to overwinter. Note: does not indicate further cuttings will not occur between harvest and emergence the following year.
Maximum Dry Weight (WFMAX)	0.0	Set to “0" Not used in simulation
SCS Curve Number (CN)	74, 74, 74	Gleams Manual Table H-4, Hydrologic group C good condition, open space (USDA, 1990). Same number year round, since no cropping season.
Manning’s N Value (MNGN)	0.110	RUSLE Project, SB5HLHLC; Hay, legume, conventional till, York (USDA, 2000)
USLE C Factor (USLEC)	0.001 - 0.017	RUSLE Project; SB5HLHLC; Hay, legume, conventional till, York (USDA, 2000)

Table 4. PRZM 3.12 Glenville Soil Parameters for York County, Pennsylvania - Turf		
Parameter	Value	Verification Source
Total Soil Depth (CORED)	154 cm	Soil Data Mart Database for York County, PA. Data for Glenville silt loam, 3-8% slopes. CORED value is different than other scenarios with this soil series due to addition of thatch layer.
Number of Horizons (NHORIZ)	6 (Top horizon split in two and thatch layer added)	
First, Second, Third, and Fourth Soil Horizons (HORIZN = 1,2,3,4)		
Horizon Thickness (THKNS)	2 cm (HORIZN = 1) 10 cm (HORIZN = 2) 15 cm (HORIZN = 3) 23 cm (HORIZN = 4) 54 cm (HORIZN = 5) 50 cm (HORIZN = 6)	Soil Data Mart Database for York County, PA. Data for Glenville silt loam, 3-8% slopes. http://soildatamart.nrcs.usda.gov/ Note on inconsistencies between scenarios: Glenville silt loam soil data values are slightly different in the Soil Data Mart Lancaster (PA Tomato) and York County (PA Alfalfa, PA Turf) databases. To develop a turf scenario the soil was modified by adding a 2 cm thick layer of thatch on top of the soil profile.
Bulk Density (BD)	0.37 g $\cdot$cm^{-3} (HORIZN = 1) 1.3 g $\cdot$cm^{-3} (HORIZN = 2,3) 1.5 g $\cdot$cm^{-3} (HORIZN = 4) 1.7 g $\cdot$cm^{-3} (HORIZN = 5) 1.5 g $\cdot$cm^{-3} (HORIZN = 6)	
Initial Water Content (THETO)	0.47 cm^{3}-H_2O $\cdot$cm^{-3}-soil (HORIZN =1) 0.33 cm^{3}-H_2O $\cdot$cm^{-3}-soil (HORIZN =2,3) 0.31 cm^{3}-H_2O $\cdot$cm^{-3}-soil (HORIZN =4) 0.24 cm^{3}-H_2O $\cdot$cm^{-3}-soil (HORIZN =5) 0.21 cm^{3}-H_2O $\cdot$cm^{-3}-soil (HORIZN =6)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN = 2) 5 cm (HORIZN = 3) 1 cm (HORIZN = 4) 3 cm (HORIZN = 5)	

	5 cm (HORIZN = 6)	
Field Capacity (THEFC)	0.47 cm^3-H_2O ·cm^{-3}-soil (HORIZN =1) 0.33 cm^3-H_2O ·cm^{-3}-soil (HORIZN =2,3) 0.31 cm^3-H_2O ·cm^{-3}-soil (HORIZN =4) 0.24 cm^3-H_2O ·cm^{-3}-soil (HORIZN =5) 0.21 cm^3-H_2O ·cm^{-3}-soil (HORIZN =6)	Field capacity and wilting point for Horizons 2-6 were calculated using the Rawls and Brakensiek method with data from the SoilDataMart Database.
Wilting Point (THEWP)	0.27 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 1) 0.15 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 2,3) 0.16 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 4) 0.12 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 5) 0.09 cm^3-H_2O ·cm^{-3}-soil (HORIZN = 6)	
Organic Carbon Content (OC)	7.5% (HORIZN = 1) 1.74% (HORIZN = 2,3) 0.15% (HORIZN = 4) 0.15% (HORIZN = 5) 0.15% (HORIZN = 6)	

EPA. 1985. Field Agricultural Runoff Monitoring (FARM) Manual, (EPA/600/3-85/043) Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

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USDA. 2000. Revised Universal Soil Loss Equation (RUSLE) EPA Pesticide Project. U.S. Department of Agriculture, National Resources Conservation Service (NRCS) and Agricultural Research Service (ARS).

PUERTO RICO COFFEE

Elevations above 1500 feet in west-central Puerto Rico characterize the coffee production region of the island (USDA, 2002). These elevations optimize the cherry yield and chemistry of the most common coffee species, *Coffea arabica*.[2] According to the U.S. Department of Agriculture (USDA) 2002 Census of Agriculture and Crop Profiles, Puerto Rico accounts for 87 to 89% of the U.S. area planted to coffee (USDA 2000, 2002, 2002a). Most of the remainder is grown across the Hawaiian Islands. MLRA 270 dominates areas of Puerto Rico where coffee is grown (USDA, 2002b). The USDA National Resources Conservation Service (NRCS) claims that approximately 491 square kilometers of MLRA 270 are planted to coffee (USDA, undated). However, the USDA Crop Profile for Coffee in Puerto Rico claims that approximately 263 square kilometers are produced annually (USDA, 2002).

Coffee is an evergreen tree that flowers on its previous year's growth (USDA, 2000). It is grown in Puerto Rico both in direct sunlight and in varying degrees of shading from cover crops. An understory of weeds is usually maintained at 8 to 10 inches high, along with prunings and cuttings left onsite to control erosion on high slopes.[3] In contrast to many Hawaiian coffee plantations, irrigation is never used in Puerto Rico (USDA, 2002). Trees bud from January to February, bloom three to four times from February to May, and mature six to eight months after blooming.[4] Cherries are hand-harvested from August to January in three to four partial harvests (USDA, 2002).

Metfile W11641 is the sole meteorological data set available to represent Puerto Rico. Its data were collected at the airport by the coast of San Juan, which receives an average annual rainfall of around 60 inches (NOAA, 2005). The coffee production region of Puerto Rico receives an average rainfall of 75 inches (USDA, 2002). This discrepancy is not very significant, however, because most rainfall occurs during the coffee harvest in the months of September and October, when pesticides are not as likely to be applied. The month of May is the remaining period of significant precipitation discrepancy (TWCII, 2005). PRZM may yield slight underestimates of runoff for pesticide applications in May.

The Mucara series is the most common soil found in Puerto Rico where coffee is grown, accounting for 30% of coffee plantation acreage (USDA, 2004). It is a fine-loamy, mixed, superactive, isohyperthermic Dystric Eutrudepts soil found on slopes of 5 to 60%, which includes 50%, the maximum slope on which coffee plants are grown.[3] Location and metfile selections are often the most important developments affecting scenario vulnerability and protectiveness. Because only one metfile was available for Puerto Rico, however, soil selection became an important protectiveness factor. The Mucara series was selected for this scenario because it is both highly representative of coffee bearing soils and because it includes the 90th

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[2] Coffee: All Ground Up! by ThinkQuest Team 01639 (http://www.allgroundup.com/en/science/plant/arabica).

[3] Website of Professor Miguel Monroig Ingles, UPRM Extension Agent (http://academic.uprm.edu/mmonroig).

[4] Email communication with Professor Miguel Monroig Ingles, UPRM Extension Agent, Nov. 22, 2005.

percentile of vulnerability in drainage, erodibility, and slope, which indicates that the 90th percentile of exposure is likely within the range of conditions represented by this soil (Table 5).

Mucara is a Hydrologic Group D soil, which includes the 90^{th} percentile of these soils in drainage. Mucara soils have a USLE K factor of 0.10, which is common to 64% of coffee bearing soils and includes the 90^{th} percentile of these soils in erodibility. 69% of coffee bearing soils have a pH lower than Mucara soils. However, soil pH is not currently a PRZM input parameter and is not expected to often affect chemical fate in the acidic range. Mucara soils have an A horizon from 0 to 5 inches (0-13 cm) deep, a B horizon from 5 to 18 inches (13-46 cm) deep, and a C horizon from 18 to 32 inches (46-81 cm) deep (USDA, 2005a). No benchmark soils of Puerto Rico were selected for this scenario, as none bear coffee production (USDA, 2005).

Table 1. PRZM 3.12 Climate and Time Parameters for San Juan, Puerto Rico - Coffee.

Parameter	Value	Source/Comments
Starting Date	Jan. 1, 1961	Meteorological File from San Juan, PR (W11641)
Ending Date	Dec. 31, 1990	Meteorological File from San Juan, PR (W11641)
Pan Evaporation Factor (PFAC)	0.77	PRZM Manual Figure 5.1. Value represents southeastern U.S. coastal areas and most of Florida. It is used as an approximate value for Puerto Rico, as the island is not found in the figure.
Snowmelt Factor (SFAC)	0	The Weather Channel Interactive, Inc. (TWCII, 2005)
Minimum Depth of Evaporation (ANETD)	10.0 cm	PRZM Manual (EPA, 1998) Set to guidance default for soils of limited drainage.

Table 2. PRZM 3.12 Erosion and Landscape Parameters for San Juan, Puerto Rico - Coffee.		
Parameter	**Value**	**Source/Comments**
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	PRZM Manual (EPA, 1998)
USLE K Factor (USLEK)	0.1 tons EI^{-1}*	USDA NRCS Soil Data Mart (http://soildatamart.nrcs.usda.gov) Value listed for the soil series Mucara.
USLE LS Factor (USLELS)	43.6	LS equation (Haan and Barfield, 1978) LS value for 50% slope and 400' slope length
USLE P Factor (USLEP)	0.5	Prof. Miguel Monroig Ingles, UPRM Extension Agent and Ontario Ministry of Agriculture USLE Factsheet, Table 5 (http://www.omafra.gov.on.ca/english/engineer/facts/00-001.htm) Set to value for contour farming.
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA, 1999)
NRCS Hyetograph (IREG)	3	PRZM Manual Figure 5.12 (EPA, 1998)
Slope (SLP)	50%	Prof. Miguel Monroig Ingles, UPRM Extension Agent Maximum slope recommended to plant coffee
Hydraulic Length (HL)	600 m	Shipman Reservoir (EPA, 1999)
Irrigation Flag (IRFLAG)	0	USDA Crop Profile for Coffee in Puerto Rico (USDA, 2002)
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for San Juan, Puerto Rico - Coffee.		
Parameter	**Value**	**Source/Comments**
Initial Crop (INICRP)	1	Set to one for all crops (EPA, 2001).
Initial Surface Condition (ISCOND)	2	Coffee Research Institute coffee plant overview (http://www.coffeeresearch.org/agriculture/coffeeplant.htm)
Number of Different Crops (NDC)	1	Set to number of crops in simulation.
Number of Cropping Periods (NCPDS)	30	Set to weather data in meteorological file: San Juan, PR (W11641).
Maximum rainfall interception storage of crop (CINTCP)	0.25	Recommended value for orchards (EPA, 2001).
Maximum Active Root Depth (AMXDR)	81 cm	Prof. Miguel Monroig Ingles, UPRM Extension Agent Value is constrained by the scenario soil depth.
Maximum Canopy Coverage (COVMAX)	100	Prof. Miguel F. Monroig Ingles' website (http://academic.uprm.edu/mmonroig) Weed understory covers canopy gaps between usnshaded trees.
Soil Surface Condition After Harvest (ICNAH)	2	Coffee Research Institute coffee plant overview (http://www.coffeeresearch.org/agriculture/coffeeplant.htm) Coffee trees are perennial evergreens.
Date of Crop Emergence (EMD, EMM, IYREM)	01/01	Values are set to keep E/T and canopy coverage terms working correctly for this evergreen scenario.
Date of Crop Maturity (MAD, MAM, IYRMAT)	02/01	Values are set to keep E/T and canopy coverage terms working correctly for this evergreen scenario.
Date of Crop Harvest (HAD, HAM, IYRHAR)	31/12	Values are set to keep E/T and canopy coverage terms working correctly for this evergreen scenario.
Maximum Dry Weight (WFMAX)	0.0	Not used in scenario.
SCS Curve Number (CN)	87, 85, 86	Gleams Manual Table H-4; meadows; no fallow conditions (USDA, 1990)
Manning's N Value (MNGN)	0.014	RUSLE Project; UC0CCCCM for Florida citrus with cover in alleyways (USDA, 2000a). These data were used to approximate values in Puerto Rico, as no data for Puerto Rico or Hawaii were included in the project.
USLE C Factor (USLEC)	0.025	Ontario Ministry of Agriculture USLE Factsheet, Tables 4A and 4B (http://www.omafra.gov.on.ca/english/engineer/facts/00-001.htm) Set to value for fruit trees with no tillage.

Table 4. PRZM 3.12 Mucara Soil Parameters for San Juan, Puerto Rico - Coffee.		
Parameter	**Value**	**Source/Comments**
Total Soil Depth (CORED)	81 cm	NRCS Official Soil Series Descriptions (OSD) (USDA, 2005) (http://soils.usda.gov/technical/classification/osd/index.html/)
Number of Horizons (NHORIZ)	4	NRCS OSD; soil consists of three horizons: A, B, and C. The A horizon spans scenario horizons 1 and 2 in order to conform to PRZM input requirements.
Horizon Thickness (THKNS)	7 cm (HORIZN = 1) 6 cm (HORIZN = 2) 33 cm (HORIZN = 3) 35 cm (HORIZN = 4)	NRCS Soil Data Mart (SDM) (USDA, 2004) and NRCS OSD (USDA, 2005)
Bulk Density (BD)	0.96 g/cm3 (HORIZN = 1) 0.96 g/cm3 (HORIZN = 2) 1.11 g/cm3 (HORIZN = 3) 1.28 g/cm3 (HORIZN = 4)	NRCS Soil Characterization Database (SCD) (USDA, 2005b); values are mean 1/3-bar moist bulk densities of a soil sampled as a Mucara soil, but later correlated with a Typic Eutrodept soil. No SCD data were found to correlate with Mucara soils. SDM values were incomplete, leading to errors in PRZM.
Initial Water Content (THETO)	0.494 cm3/cm3 (HORIZN =1) 0.494 cm3/cm3 (HORIZN =2) 0.383 cm3/cm3 (HORIZN =3) 0.343 cm3/cm3 (HORIZN =4)	NRCS SCD (USDA, 2005b); values are mean 1/3-bar water contents of a soil sampled as a Mucara soil, but later correlated with a Typic Eutrodept soil. No SCD data were found to correlate with Mucara soils.
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 1.0 cm (HORIZN = 2) 3.0 cm (HORIZN = 3) 5.0 cm (HORIZN = 4)	NRCS SDM and OSD (USDA, 2004, 2005)
Field Capacity (THEFC)	0.494 cm3/cm3 (HORIZN =1) 0.494 cm3/cm3 (HORIZN =2) 0.383 cm3/cm3 (HORIZN =3) 0.343 cm3/cm3 (HORIZN =4)	NRCS SCD (USDA, 2005b); values are mean 1/3-bar water contents of a soil sampled as a Mucara soil, but later correlated with a Typic Eutrodept soil. No SCD data were found to correlate with Mucara soils.
Wilting Point (THEWP)	0.369 cm3/cm3 (HORIZN =1) 0.369 cm3/cm3 (HORIZN =2) 0.193 cm3/cm3 (HORIZN =3) 0.338 cm3/cm3 (HORIZN =4)	NRCS SCD and SDM (USDA, 2005b, 2004); value is the THEFC value minus the available water capacity midpoint value in the Soil Data Mart reports for Mucara soils.
Organic Carbon Content (OC)	2.3% (HORIZN = 1) 2.3% (HORIZN = 2) 1.2% (HORIZN = 3) 0.6% (HORIZN = 4)	NRCS SDM (USDA, 2004); values for horizons 1 to 3 = mean %OM / 1.724. No %OM value is reported for horizon 4; value is midpoint between that of horizon 3 and zero, the expected amount of OM in bedrock.

Sensitive Parameter Uncertainties

Meteorological File

As characterized above, only one metfile exists for Puerto Rico. It is a description of conditions at the airport by the coast in San Juan, which may underestimate rainfall in the mountainous areas of coffee production in May and during the harvesting months September and October. Metfile data from a coffee producing area of Puerto Rico would reduce uncertainty in PRZM results.

Slope

The typical slope that coffee in Puerto Rico is grown on is 30%. The maximum slope recommended to plant coffee is 50%.[5] The maximum slope was selected for this scenario to include the high-end of slope vulnerability.

USLE C Factor and Manning's N Value

The RUSLE Project did not include data for Puerto Rico or other tropical islands such as Hawaii. Therefore, Manning's N values were selected from data on Florida citrus orchards with cover in the alleyways, due to the similarities between conditions. Citrus and coffee are evergreen crops. Of the available locations, Florida has the most similar tropical conditions to Puerto Rico. And cover in alleyways is a similarity as well. The scenario USLEC values were calculated from estimates tabulated by the Ministry of Agriculture, Ontario, Canada[6] for fruit trees grown without tillage.

USLE P Factor

The USLE P factor was chosen from an estimate reported by the Ministry of Agriculture, Ontario, Canada[5] for contour farming, in contrast to the default for orchards recommended by the PRZM scenario development guidance (EPA, 2001), which appeared to represent rows parallel with slope.

USLE LS Factor

The scenario USLELS value was calculated with the Haan and Barfield equation (1978) using a 50% slope and an assumed 400-foot slope length, as per PRZM scenario development guidance (EPA, 2001). LS values for slopes longer than 300 feet or steeper than 18% are extrapolations beyond the research data range, however, which increases uncertainty in them. A 50% slope combined with a 400-foot slope length is so far past the research data range that the uncertainty in the calculated value is very great.

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[5] Email communication with Professor Miguel Monroig Ingles, UPRM Extension Agent, Nov. 22, 2005.

[6] Online at: http://www.omafra.gov.on.ca/english/engineer/facts/00-001.htm.

Soil Data

Data sets on the Mucara series were used when possible, such as horizon depth and organic matter content values from the USDA NRCS Soil Data Mart (SDM) and Official Soil Series Descriptions (OSD). However, these sources lacked values for the 1/3-bar water content needed for PRZM inputs THETO and THEFC. The USDA NRCS Soil Characterization Database (SCD) reported these values, not specifically for the Mucara series, but for a soil sampled as a Mucara soil and later correlated with a Typic Eutrudepts soil. Running PRZM with these water content data from the SCD and bulk density data from the SDM resulted in soil saturation errors due to the discrepancy between data sources. For scenario consistency, both 1/3-bar bulk density and water content values were adopted from the Typic Eutrudepts data in the SCD.

The remaining mix of data sources did not result in errors. Organic matter content values remain from the SDM. Wilting point (THEWP) values were calculated by subtracting available water capacity values reported in the SDM from water content values in the SCD.

Pan Factor

The pan evaporation factor (PFAC) is not a very sensitive parameter. However, some uncertainty exists around its value in coffee bearing regions of Puerto Rico, as no data were located from the Caribbean Islands. Because values for coastal areas of the southeastern U.S. and most of Florida were stable at 0.77 in Figure 5.1 of the PRZM Manual (EPA, 1998), the scenario contains this value in order to approximate those for Puerto Rico.

Table 5. Coffee Bearing Soils of Puerto Rico Ranked by Area.													
Soil	**Total Acreage**	**% Area**	**Yield (Cwt)**	**% Yield**	**Drainage**	**Erodibility**	**Slopes (%)**	**pH**	**OM (%)**	**% Sand**	**% Silt**	**% Clay**	**Texture**
Mucara	160270	30%	88	11%	D	0.10	5-60	6.45	4	7.7-28.1	29.4-49.8	42.5	Clay to silty clay
Humatas	123348	23%	105	13%	C	0.02	12-60	5	5	17.1	27.9	55.0	Clay & complex
Los guineos	45219	8%	74	9%	C	0.10	12-60	4.25	7	18.2	29.3	52.5	Clay
Maricao	36199	7%	40	5%	B	0.10	20-60	4.25	2.5	16.2	26.3	57.5	Clay
Naranjito	32741	6%	22	3%	C	0.10	12-60	4.5	1.5	18.7	47.8	33.5	Silty clay loam
Consumo	25780	5%	24	3%	B	0.10	20-40	4.75	2.5	26.1	28.9	45.0	Clay
Pellejas	24639	5%	30	4%	B	0.17	40-60	5	3.5	34.8	33.2	32.0	Clay to clay loam
Malaya	15549	3%	14	2%	D	0.17-0.24	20-60	6.05	2	22.1-35.3	27.9-33.2	31.5-50.0	Clay to clay loam
Daguey	14696	3%	72	9%	C	0.02	2-40	5	4.5	12.1	27.9	60.0	Clay
Los guineos-maricao	12771	2%	12	2%	Mix	0.10	Steep	4.25	Mix	Mix	Mix	Mix	Outcrop complex
Maraguez	12672	2%	12	2%	B	0.10	40-60	6.05	3	20.0	48.5	31.5	Silty clay loam
Alonso	7302	1%	63	8%	B	0.02	12-60	5	4.5	16.2	26.3	57.5	Clay
Lares	7275	1%	50	6%	C	0.10	0-20	5	3.5	22.1	27.9	50.0	Clay
Naranjo	4835	1%	38	5%	C	0.20	5-60	8.15	3.5	22.5	28.0	49.5	Clay
Anones	2995	1%	24	3%	C	0.10	12-40	5.3	2.5	31.5	31.0	37.5	Clay loam
Consejo	2381	0%	20	3%	C	0.10	20-60	4.25	2.5	16.2	26.3	57.5	Clay
Adjuntas	2186	0%	8	1%	C	0.10	40-60	4.5	5	23.3	29.2	47.5	Clay
Juncos	2026	0%	14	2%	D	0.10	5-20	6.45	2	22.5	28.0	49.5	Clay
Cidral	1705	0%	9	1%	C	0.10	2-12	4.75	3.5	22.1	27.9	50.0	Clay
Plata	1705	0%	10	1%	B	0.10	20-40	5.3	2	22.1	27.9	50.0	Clay
Quebrada	1671	0%	16	2%	C	0.17- 0.20	12-20	6.05	2	5.4-18.7	45.1-47.8	33.5-49.5	Silty clay to silty clay loam
Aibonito	1217	0%	18	2%	D	0.02	12-40	4.5	4	22.1	27.9	50.0	Clay
Sabana	799	0%	8	1%	D	0.24	40-60	5.3	2	18.7	47.8	33.5	Silty clay loam
Morado	369	0%	12	2%	C	0.10	12-20	6.7	3.5	35.3	33.2	31.5	Clay loam
Catalina	267	0%	10	1%	B	0.02	4-12	5.25	5.5	10.4	24.6	65.0	Clay

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