

Barton Springs Meadow

This scenario is intended to represent a meadow that may include cultivation of herbaceous, non-grass animal feeds (IR4 generalized crop group #18 including forage, fodder, straw, and hay). The USDA census of agriculture (USDA 1997, 2002) indicates that hay of varying types is grown extensively in Travis and Hays Counties (Table 6). Discussions with extension agents in Hays and Travis counties indicated that some cultivation of sorghum hay, hay grazer, and sweet sorghum does occur in the Barton Springs Segment (BSS) of the Edward Aquifer. Bermuda grass is also planted but is primarily for grazing and not harvested (Perez 2006). Most of this type of crop is for livestock grazing (Davis, 2006). Crop parameters for this scenario were chosen to be reflective of hay and grass in the BSS.

Soils were selected based on the extent within herbaceous planted areas (USGS 2003) in BSS and the potential to yield high-end runoff and erosion. Based on a geospatial analysis of soils (USDA 2006) and land use data (USGS 2003) for herbaceous planted areas, Brackett soils were chosen to represent meadow areas in the BSS (Table 5). It should be noted that much of the Planted/cultivated land is highly managed pastureland. Therefore, the location of Brackett soils was also cross-checked with aerial photography (TWDB 2004) and a local expert to ensure that the soil chosen coincided with herbaceous planted areas where pesticides would reasonably be applied. A local soil expert confirmed that Brackett soils are extensive soil types of meadows in the BSS (Perez, 2006)

The Brackett series was selected because it is a benchmark soil, is highly representative of meadow areas in the BSS, and represents the 90th percentile of vulnerability, drainage, erodibility, and slope. The Brackett series account for 4.5% of natural herbaceous areas (Table 5). Brackett is a Hydrologic Group C soil which account for approximately 49% of natural herbaceous soils in drainage. Brackett soils have a USLE K factor of 0.37 which includes the 90th percentile of these soils in erodibility (Table 5). Slopes range from 1 to 60 percent (Soil Survey Staff, 2006); however the most typical range for the Brackett series in rangeland areas is 1-8 percent (USDA 2006; USGS 2003). Soil parameters for the “Brackett-Rock outcrop-Comfort complex, 1 to 8 percent slopes” were selected from Soil Data Mart to parameterize this scenario since this soil type is the most extensive soil collocated with herbaceous planted areas within the Brackett series (USDA 2006; USGS 2003). Data from Hays County were selected since the majority of this landcover is located in this county.

The meteorological station selected for this scenario is located in Austin, Texas. This station is the closest available weather station that includes data required for PRZM.

Table 1. PRZM 3.12 Climate and Time Parameters for Barton Springs, TX.		
Parameter	Value	Source/Comments
Starting Date	Jan. 1, 1961	Meteorological File from Austin, TX (W13958)
Ending Date	Dec. 31, 1990	Meteorological File from Austin, TX (W13958)
Pan Evaporation Factor (PFAC)	0.69	PRZM Manual Figure 5.1 (EPA 1998).
Snowmelt Factor (SFAC)	0.36	PRZM Manual, Table 5.1 (EPA 1998).
Minimum Depth of Evaporation (ANETD)	25	Mid point of range (20-30), PRZM Manual, Figure 5.2 (EPA 1998).

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Barton Springs - Meadow.		
Parameter	Value	Source/Comments
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	Default value.
USLE K Factor (USLEK)	0.37 tons EI ¹ *	Brackett-Rock Outcrop-Comfort Complex Soil (USDA 2006).
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, $\lambda = 400$ m (default value) and $m = 0.4$ (EPA 2004).
USLE P Factor (USLEP)	1	No contour plowing assumed.
Field Area (AFIELD)	10 ha	Default value for area of standard farm pond.
NRCS Hyetograph (IREG)	4	PRZM Manual, Figure 5.12 (EPA, 1998).
Slope (SLP)	4 %	Brackett-Rock Outcrop-Comfort Complex Soil Slope range 1-8% (USDA 2006).
Hydraulic Length (HL)	356 m	Default value for Pond (EPA, 2004)
Irrigation Flag (IRFLAG)	0	Cris Perez, NRCS - District Conservationist Date: 3-16-06, Phone: 512-392-4050 x3
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Barton Springs - Meadow.		
Parameter	Value	Source/Comments
Initial Crop (INICRP)	1	Default value
Initial Surface Condition (ISCOND)	3	Cris Perez, NRCS - District Conservationist Date: 3-16-06, Phone: 512-392-4050 x3 Residue is left on a field until the next year.
Number of Different Crops (NDC)	1	Set to number of crops in simulation. Default value.
Number of Cropping Periods (NCPDS)	30	Set to weather data in meteorological file: Austin, TX (W13958).
Maximum rainfall interception storage of crop (CINTCP)	0.25	Table 5-4 PRZM manual for moderate density crops (EPA, 1998). Consistent with alfalfa scenarios.
Maximum Active Root Depth (AMXDR)	41	Cris Perez, NRCS - District Conservationist Date: 3-16-06, Phone: 512-392-4050 x3 Roots reach 8-16”.
Maximum Canopy Coverage (COVMAX)	100	Cris Perez, NRCS - District Conservationist Date: 3-16-06, Phone: 512-392-4050 x3
Soil Surface Condition After Harvest (ICNAH)	3	Cris Perez, NRCS - District Conservationist Date: 3-16-06, Phone: 512-392-4050 x3 Residue is left on a field after harvest.
Maximum Canopy Height (HTMAX)	152 cm	Cris Perez NRCS - District Conservationist Date: 3-16-06, Phone: 512-392-4050 x3 (Max height: 4-5 ft)
Date of Crop Emergence (EMD, EMM, IYREM)	01/03/61	Cris Perez, NRCS - District Conservationist Date: 3-16-06, Phone: 512-392-4050 x3
Date of Crop Maturity (MAD, MAM, IYRMAT)	01/04/61	Grass is planted February –March, It is first harvested April-May. The crop may be cut 1-2 more times until September.
Date of Crop Harvest (HAD, HAM, IYRHAR)	01/09/61	
Maximum Dry Weight (WFMAX)	0.0	Not used in scenario.
SCS Curve Number (CN)	84, 79, 82	Gleams Manual Table H-4, meadow, hydrologic group C, good condition (USDA, 2000)
Manning's N Value (MNGN)	0.110	San Antonio Hay/Grass (I93HGHGC). This file incorporates tillage and has a cover code (2) representing first year meadow/hay. According to Cris Perez, these fields are tilled for new crops in Jan/Feb.
USLE C Factor (USLEC)	0.000 – 0.004	San Antonio Hay/Grass (I93HGHGC)

Table 4. PRZM 3.12 Brackett-Rock Outcrop-Comfort Complex Soil Parameters for Barton Springs - meadow.		
Parameter	Value	Source/Comments
Total Soil Depth (CORED)	43 cm	NRCS Soil Data Mart Database, Hays County, for Brackett-Rock outcrop-Comfort complex, 1 to 8 percent slopes. (http://soildatamart.nrcs.usda.gov/).
Number of Horizons (NHORIZ)	3	According to an extension agent (Cris Perez), meadows reside on a variety of soils. Brackett is one of the more extensive soil types of meadows in this area.
Horizon Thickness (THKNS)	10 cm (HORIZN =1) 5 cm (HORIZN =2) 28 cm (HORIZN =3)	Additional data were listed for a 4 th HORIZN. However, these were not included in this soil profile since the 4 th HORIZN is composed of bedrock. PRZM Scenario Guidance (2004).
Bulk Density (BD)	1.4 g/cm ³ (HORIZN =1) 1.4 g/cm ³ (HORIZN =2) 1.4 g/cm ³ (HORIZN =3)	
Initial Water Content (THETO)	0.28 cm ³ /cm ³ (HORIZN =1) 0.28 cm ³ /cm ³ (HORIZN =2) 0.251 cm ³ /cm ³ (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN =1) 5 cm (HORIZN =2) 4 cm (HORIZN =3)	
Field Capacity (THEFC)	0.28 cm ³ /cm ³ (HORIZN =1) 0.28 cm ³ /cm ³ (HORIZN =2) 0.251 cm ³ /cm ³ (HORIZN =3)	
Wilting Point (THEWP)	0.164 cm ³ /cm ³ (HORIZN =1) 0.164 cm ³ /cm ³ (HORIZN =2) 0.142 cm ³ /cm ³ (HORIZN =3)	
Organic Carbon Content (OC)	1.16 % (HORIZN =1) 1.16 % (HORIZN =2) 0.73 % (HORIZN =3)	

Table 5. Soils co-located with planted/cultivated herbaceous areas of the Barton Spring Segment based on USDA 2006 soils data and USGS 2003 land use data. Bold font indicates a benchmark soil.

Soil	Total Acreage	% Area ^a	Drainage Class	KF	Slope (%)	pH	OM (%)	Sand (%)	Silt (%)	Clay (%)
Doss	1,501	18.6	D	0.32	1 - 5	8	2	7	49	44
Krum	1,139	14.1	D	0.32	0 - 1	8	2	26	29	45
Sunev	774	9.6	B	0.32	0 - 1	8	2	18	52	30
Denton	421	5.2	D	0.32	1 - 3	8	3	6	48	46
Brackett	367	4.5	C	0.37	1 - 12	8	2	34	38	28
Austin	367	4.5	C	0.32	1 - 3	8	3	7	48	45
Heiden	352	4.4	D	0.32	1 - 3	8	3	22	28	50
Bolar	343	4.2	C	0.32	1 - 3	8	2	34	37	30
Lewisville	322	4.0	B	0.32	0 - 1	8	2	8	51	41
Houston Black	311	3.8	D	0.32	1 - 3	8	3	17	28	55
Purves	310	3.8	D	0.32	1 - 5	8	3	23	29	48
Tarpley	216	2.7	D	0.32	1 - 3	7	3	30	30	40
Anhalt	199	2.5	D	0.32	1 - 3	7	3	26	29	45
Volente	194	2.4	C	0.32	1 - 8	8	3	7	54	39
Crawford	186	2.3	D	0.32	0 - 1	7	2	22	28	50
Seawillow	180	2.2	B	0.32	1 - 3	8	1	35	34	31
Gruene	165	2.0	D	0.28	1 - 5	8	2	28	29	43
Branyon	120	1.5	D	0.32	0 - 1	8	3	22	28	50
Real	115	1.4	D	0.28	1 - 8	8	6	36	34	31
Speck	115	1.4	D	0.32	1 - 3	7	2	34	37	30
Rumple	96	1.2	C	0.32	1 - 8	7	2	34	37	30
Castephen	69	0.9	C	0.32	3 - 5	8	2	34	32	34
San Saba	68	0.8	D	0.32	1 - 2	8	3	18	29	53
Comfort	45	0.6	D	0.32	1 - 8	8	6	28	29	43
Medlin	32	0.4	D	0.32	1 - 8	8	2	22	28	50
Oakalla	27	0.3	B	0.32	0 - 1	8	4	18	48	34
Tarrant	13	0.2	D	0.32	5 - 18	8	5	22	28	50
Orif	10	0.1	A	0.28	0 - 1	8	2	82	9	9
Boerne	7	0.1	B	0.28	1 - 3	8	1	65	20	16
Patrick	7	0.1	B	0.32	2 - 5	8	2	28	29	43
Tinn	7	0.1	D	0.32	0 - 1	8	3	22	28	50
Urban land	5	0.1	D	0.00	0 - 5	0	0	0	0	0
Alluvial land	2	0.0	A	0.15	0 - 1	8	1	90	0	5
Eddy	2	0.0	C	0.32	3 - 6	8	1	38	36	26
Eckrant	0	0.0	D	0.32	8 - 40	8	7	22	28	50

^a percent of all soils located in herbaceous planted areas.

OM, pH, Sand, Silt, Clay values based on “representative” values in Soil Data Mart.

Table 6. Acreage of hay crops in Hays and Travis Counties, TX (USDA 1997, 2002). NA is not available.				
Crop	HAYS		TRAVIS	
	1997 Harvested Acres	2002 Harvested Acres	1997 Harvested Acres	2002 Harvested Acres
Hay - All Hay Including Alfalfa, Other Tame, Small Grain, And Wild	NA	7657	NA	20471
All Haylage, Grass Silage, And Greenchop	140	229	769	357
Forage - Land Used For All Hay And All Haylage, Grass Silage, And Greenchop	NA	7855	NA	20367
Other Haylage, Grass Silage, And Greenchop	NA	229	NA	357
Other Tame Hay	8287	5358	14020	16737
Small Grain Hay	600	NA	943	2219
Wild Hay	840	1228	NA	1411
Alfalfa Hay	65	NA	NA	104

References

Davis, B. 2006. Texas Cooperative Extension. Hays County Extension Agent. Agriculture and Natural Resources. Personal communication. 17 March 2006.

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.

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.

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.

Perez, C. 2006. NRCS - District Conservationist. Personal communication. March 17 & 20, 2006.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions [Online WWW]. Available URL: "http://soils.usda.gov/technical/classification/osd/index.html" [Accessed 6 March 2006].

Texas Water Development Board (TWDB), Texas Natural Resource Information System (<http://www.tnris.state.tx.us/digital.htm>). 2004. 1-Meter Aerial Photography for Travis and Hays Counties. Accessed March 3, 2006.

USDA 2000. Knisel, W.G., and Davis, F.M., 2000, GLEAMS: Groundwater Loading Effects of Agricultural Management Systems, Version 3.0: Agricultural Research Service, U.S. Department of Agriculture, Publication No. SEWRL-WGK/FMD-050199, 191 p.

USDA. 1997. 1997 Census of Agriculture. U.S. Department of Agriculture, National Agricultural Statistics Service. Accessed March 2006. Online at: <http://www.nass.usda.gov/index.asp>.

USDA. 2002. 2002 Census of Agriculture. U.S. Department of Agriculture, National Agricultural Statistics Service. Accessed March 2006. Online at: <http://www.nass.usda.gov/index.asp>.

USDA. 2006. Soil Survey Areas of Hays Counties, Texas. U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), Soil Data Mart. March 1, 2006. Online at: <http://soildatamart.nrcs.usda.gov>.

USDA. 2001. Official Series Description. Brackett Series. Information from the website: <http://ortho.ftw.nrcs.usda.gov/osd/dat/B/BRACKETT.html>.

USGS, National Mapping Division, Rocky Mountain Mapping Center. 2003. Edwards Aquifer Land Use / Land Cover. Denver, Colorado.