APPENDIX D - EXTINCTION DEPTH DETERMINATION

APPENDIX D
Extinction-Depth Determination
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Shah et al. (2007) define extinction depth as the depth to water table at which groundwater evapotranspiration reaches zero. Their paper provides a table of extinction depths (shown below in Table 1) for various soil textures under three land covers. The estimates for bare soil appear based on soil moisture release characteristics for various soil textures (Hillel, 1998). The extinction depth represents the vertical extent over which soil moisture content declines from saturation at the water table to "wilting point", a moisture content at which plants roots cannot extract moisture. Examples of release curves for some soil textures are shown in Figure 1.

Extinction depth estimates for grass and forest covers, also shown in Table 1, appear based on the extinction depth for bare soil plus the estimated rooting depth for each land cover. The assumption is that forests have a rooting depth of 200 cm while grass has a rooting depth of 100 cm. However, a compilation of data from numerous sources shows that these assumptions may significantly underestimate rooting depths (Canadell et al., 1996). Appendix 1 of this paper shows that maximum rooting depths for longleaf pine (*Pinus palustris*), a tree that formerly dominated the uplands of Florida is 4.8 m. Various upland oak species have maximum rooting depths ranging from 3.0 to 4.4 meters. Herbaceous species are more shallowly rooted than trees. For example, corn (*Zea mays*) root depths may range from 1.3 to 2.4 m. Maximum root depths for native grass genera commonly occurring in Florida also vary widely: 2 m for fescue (*Festuca* spp.), 1.3 m for muhly grass (*Muhlenbergia* spp.), 1.5 m for dropseed (*Sporobolus* spp.), 1.5 to 3.0 m for bluestems (*Andropogon* spp.). These native and cultivated species occur widely throughout the uplands of Florida on well-drained or excessively well-drained soils. These areas are identified on SSURGO coverage as "non-hydric."

Flatwood environments in Florida have seasonally impeded drainage and alternate between abundant moisture and droughty conditions. Slash pine, a characteristic tree of flatwoods, is more shallowly rooted (3.3 m) than longleaf pine and this would appear due to the seasonally wet nature of these areas. These broad, flat landscapes are generally non-hydric but have occasional small depression wetlands. These areas are identified on SSURGO coverage as "partially hydric."

Plant root depths in wetlands are more shallow than in either uplands or flatwoods. Abundant water means that plants do not need to extend roots deep into the soil profile (Mitsch and Gosselink, 1993). Shallowly rooted wetland plants will tend to occur within one meter of the surface. Wetlands are identified on SSURGO coverage as "hydric."

Based on these data, separate rooting depths are proposed for non-hydric, partially hydric, and hydric soils. Non-hydric: 400 cm (forest) and 200 cm (grass), partially hydric: 250 cm (forest) and 150 cm (grass), hydric: 100 cm (both forest and grass covers). The proposed modifications to extinction depth estimates for forest and grass are shown in tables 2 and 3, respectively. This approach is refinement over NEF model v.3 in which extinction depths were based on coarse scale physiographic regions: 4 m for Trail Ridge, 3 m for "Meandering Plains", and 1.8 m for River Valleys.

Table D-1. Extinction Depths for Different Soil Land Covers (from Shah et al., 2007)

	Land Cover Type (cm)		
Soil Type	**Bare Soil**	**Grass**	**Forest**
sand	50	145	250
loamy sand	70	170	270
sandy loam	130	230	330
sandy clay loam	200	300	400
sandy clay	210	310	410
loam	265	370	470
silty clay	335	430	530
clay loam	405	505	610
silt loam	420	515	615
silt	430	530	630
silty clay loam	450	550	655
clay	620	715	820

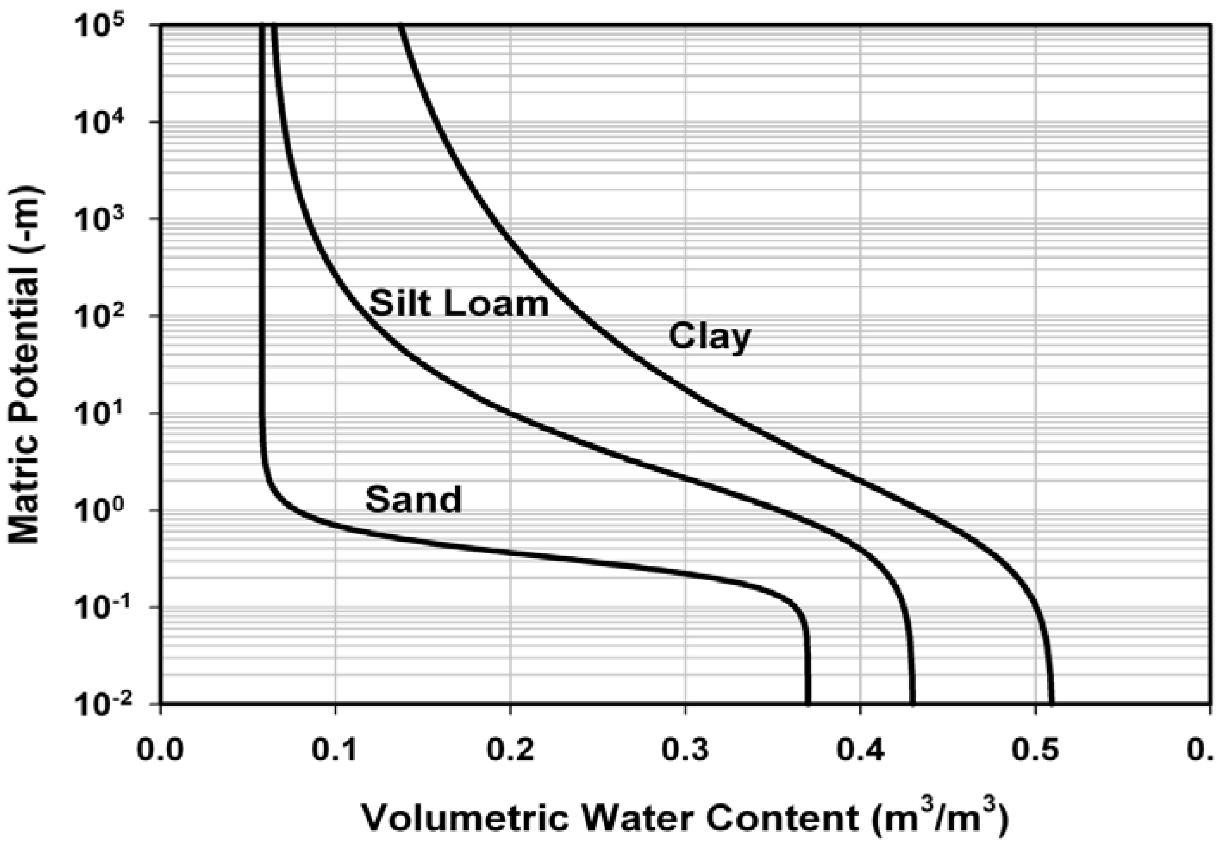

Figure D-1. Examples of Soil Moisture Release Curves.

Table D-2. Proposed Extinction Depths (cm) under Forest Land Cover

Soil Type	Hydric	Partly hydric	Non-hydric
sand	150	300	450
loamy sand	170	320	470
sandy loam	230	380	530
sandy clay loam	300	450	600
sandy clay	310	460	610
loam	365	515	665
silty clay	435	585	735
clay loam	505	655	805
silt loam	515	665	820
silt	530	680	830
silty clay loam	550	700	850
clay	720	870	1020

Table D-3. Proposed Extinction Depths (cm) under Grass Land Cover

Soil Type	Hydric	Partly hydric	Non-hydric
sand	150	200	250
loamy sand	170	220	270
sandy loam	230	280	330
sandy clay loam	300	350	400
sandy clay	310	360	410
loam	365	415	465
silty clay	435	485	535
clay loam	505	555	605
silt loam	515	565	620
silt	530	580	630
silty clay loam	550	600	650
clay	720	770	820

Citations

Canadell, J., R.B. Jackson, J.R. Ehleringer, H.A. Mooney, O.E. Dala, E.D. Schulze, 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108: 583-595.

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