

Leaching Potential

Usage of the following leaching potential criteria is based on a minimum of 5 observations (e.g. soil borings) per 40 acres of application area unless the number of borings identify the site as a problem area or a uniform area. Ground penetrating radar (GPR) should be used for the assessment of all Karst areas. At least one observation is to be made in each landform present.

Presence or absence of a loamy/clayey layer and thicknesses of sandy layers, and presence or absence of coated sand are used to evaluate leaching potentials.

Leaching Potential Rating Criteria Part A (see Table 1)

Very Low (0):

At least 80 percent of observations have a loamy or clayey layer at least 25 cm (10 inches) thick starting within 50 cm (20 inches). Typically, these soils are Typic Paleudults.

Low (1):

At least 80 percent of observations have a loamy or clayey layer at least 25 cm (10 inches) thick starting within 200 cm (80 inches). Typically, these soils are Arenic and Grossarenic Paleudults.

Medium (2):

At least 80 percent of observations have a loamy or clayey layer at least 25 cm (10 inches) thick starting at a depth below 200 cm (80 inches) but above seasonal high saturation **and** sand grains in the E and Bw horizons have coatings (chroma ≥ 3) to a depth of at least 100 cm (40 inches); or at least 80 percent of observations have no loamy or clayey layer at least 25 cm (10") thick, but have a layer at least 200 cm (80") thick with coated sand grains (chroma equal to or greater than 3). The entire 200 cm (80") layer must be above seasonal high saturation.

High (4):

At least 20 percent of observations have no loamy or clayey layer, (or the loamy or clayey layer is less than 25 cm (10 inches) thick) **and** the combined thickness of layers with coated sand grains (chroma ≥ 3 in the E, Bw, and C horizons and any chroma in the Bh horizons) is more than 50 cm (20 inches) and less than 200 cm (80 inches).

Very High (8):

At least 20 percent of observations have no loamy or clayey layer (or the layer is less than 25 cm (10 inches) thick) **and** the combined thickness of layers with coated sand grains (chroma ≥ 3 in the E, Bw, and C horizons and any chroma in the Bh horizons) is equal to or less than 50 cm (20 inches).

Leaching Potentials are presented in Table 13 based on the above criteria. These are potentials to be used in conjunction with the soil survey of Bradford County (Dearstyne, et al. 1991). Potentials presented are interpretations, and are not factual data. As with all interpretations, **leaching potentials should be confirmed by on-site investigations.**

The rating of Medium Leaching Potential may be unique to Florida. This rating is based on deeper observation of soils that would normally be rated as having a High or Very High Leaching Potential. The rating of Medium Leaching Potential is given to soils with a significant loamy/clayey layer below the normal (2m or 80 inches) soil classification depth. Use of Ground Penetrating Radar (GPR) and/or

geological investigations is needed to rate a site as having a Medium Leaching Potential and the depth to the loamy/clayey layer must be **above** the seasonal high saturation (water table).

Sinkholes occur where calcareous limestone below the land surface has been naturally dissolved by circulating ground water. A sinkhole forms when soil or weakened rock falls into underlying cavernous limestone. The sinkhole depth to width ratio tends to relate to soil slope stability-- typically the width is 5 times the depth. Bradford County does not have areas considered to be high risk for sinkhole development. However, if sinkhole development is suspect the GPR will be used to determine the leaching potential.

Phosphorus Runoff and Leaching Potentials Ratings for Florida Soil Survey Map Units

The runoff and leaching potentials (Table 13) were created by comparing estimated soil properties found in the soil survey of Bradford County (Dearstyne, et al. 1991) with the above criteria. The potentials presented herein are interpretations, and not factual data. As with all interpretations based on information in a published soil survey or other sources of estimated soil properties, **phosphorus runoff and leaching potentials should be confirmed by on-site investigations.** However, a soil survey is an excellent place to initiate off-site investigation before making on-site determinations. For information on how to use a soil survey, see Circular 959 Soil Ratings for Crop Production and Water Quality Protection (Brown, et. al. 1991). However, note that phosphorus runoff and leaching potentials were derived from criteria that are different from the criteria used to derive the pesticide runoff and leaching potentials.

Table 13. Runoff, Leaching Potentials and K-Factors for Bradford County Soils.

Map Unit	Seq. No. ^a	Soil Name	Undrained Runoff Potential	Undrained and Drained Leaching Potential	Drained Runoff Potential	K-Factor
002	1	Albany	High	Low		0.10
003	1	Ocilla	High	Low		0.10
004	1	Mascotte	Very High	Low	High	0.10
005	1	Penney	Low ^b	High		0.10
006	1	Plummer	Very High	Low	Medium	0.10
006	2	Plummer	Very High	Low	Medium	0.10
007	1	Surrency	Very High	Low	High	0.10
007	2	Pantego	Very High	Very Low	High	0.15
008	1	Surrency	Very High	Low		0.10
008	2	Pantego	Very High	Very Low		0.15
009	1	Starke	Very High	Low		0.05
010	1	Osier	Very High	Very High	Low ^b	0.10
011	1	Allanton	Very High	Low	Medium	0.15
012	1	Sapelo	Very High	Low	Medium	0.10
013	1	Hurricane	High	High		0.10
014	1	Pamlico	Very High	Very High	Medium	0.02
014	2	Croatan	Very High	Low	Medium	0.02
015	1	Pottsburg	Very High	High	Medium	0.10
016	1	Foxworth	Low ^b	High		0.10
017	1	Blanton	Low ^b	Low		0.10

Table 13 (cont.). Runoff, Leaching Potentials and K-Factors for Bradford County Soils.

Map Unit	Seq. No. ^a	Soil Name	Undrained Runoff Potential	Undrained and Drained Leaching Potential	Drained Runoff Potential	K-Factor
018	1	Lakeland	Low ^b	High		0.10
019	1	Leon	Very High	High	Medium	0.10
020	1	Grifton	Very High	Very Low		0.20
020	2	Elloree	Very High	Low		0.15
021	1	Beaches	Very High	Very High		0.05
022	1	Chipley	High	High		0.10
023	1	Pelham	Very High	Low	High	0.10
023	2	Pelham	Very High	Low	High	0.10
024	1	Starke	Very High	Low	Medium	0.05
025	1	Fluvaquents	Very High	Variable		Variable ^c
025	2	Ousley	High	Very High		0.10
026	1	Urban Land	Very High	Variable		No Value
028	1	Arents	Variable	Variable		Variable ^c
029	1	Dorovan	Very High	Very High		0.02
030	1	Troup	Low ^b	Low		0.10
035	1	Wampee	High	Low		0.10
036	1	Udorthents	Very High	Variable		Variable ^c
037	1	Pamlico	Very High	Very High		0.02
037	2	Croatan	Very High	Low		0.02
038	1	Penney	Medium ^d	High		0.10
039	1	Blanton	Medium ^d	Low		0.10
040	1	Troup	Medium ^d	Low		0.10
043	1	Dorovan	Very High	Very High	Medium	0.02
044	1	Hydraquents	Very High	Very Low	High	Variable ^c
045	1	Meadowbrook	Very High	Low		0.10
045	1	Allanton	Very High	High		0.10

^a Seq. No. indicates a particular soil series name among one or more names constituting a map unit name.

^b Rate Very Low where percent ground cover is greater than 75%.

^c The following K-factors should be used for the following on-site surface textures: sand = 0.10, loamy sand = 0.15, sandy loam = 0.20, sandy clay loam = 0.24, and clay = 0.37

^d Rate Low or Very Low (where percent ground cover is greater than 75%) if slope is less than 8 percent.

Potential to Reach Water Body

This parameter is used to address the potential for runoff to reach a water body. If there is no direct discharge from the edge of a field, the potential to affect a water body is considered to be “very low.” If the P concentration of the runoff can be attenuated by flow through a wetland, buffer strip or overland treatment area, the potential is considered “low.” If there is ditch drainage or direct discharge to a water body, the index value is increased to “medium.” When there is potential for direct discharge to a lake, sinkhole, or natural stream the potential for water quality degradation by P is enhanced and the index rating is increased to “high.”

Potential to Reach Water Body Rating Criteria (see Table 1)

Very Low (0):

No direct discharge from the edge of the field.

Low (1):

Discharge through wetlands, buffer area (refer to table below for buffer width), storm water detention, or overland treatment.

Medium (2):

No buffer, ditch drainage to or direct discharge to a water body.

High (4):

Direct discharges to a lake, sinkhole, or natural stream.

Non-Application Buffer Widths ¹		
Object, Site	Situation	Base Buffer Width from Object, Site (ft.)
Well, potable	Located up-slope of application site	150
Well, potable	Located down-slope of application site provided conditions warrant application	300
Waterbody, Stream ^{2/} , sinkhole or wetland	Good vegetation ^{3/} . Add 2 feet for each 1% slope for slopes up to 8%.	50 (+)
Waterbody, Stream ^{2/} , sinkhole or wetland	Poor vegetative cover or Predominant slope > 8% ^{3/}	100
Public Road – roadside ditch	Irrigated wastewater or solids applied with spreader	30

1/ Research has shown that forested or forest/grass buffers are more effective at removing phosphorus. Grass buffers are more effective at removing nitrogen. Every effort should be made to reduce phosphorus inputs at their sources. If phosphorus is managed responsibly on-site, buffers can store significant amounts of the excess; but if phosphorus is uncontrolled buffers can quickly become saturated and over whelmed. Even with their limits, buffers still perform a valuable service by displacing phosphorus-producing activities away from streams and regulating the flow of phosphorus. Taken in part from “A Review Of The Scientific Literature On Riparian Buffer Width, Extent And Vegetation”, Institute of Ecology, University of Georgia.

2/ Waterbody includes pond, lake, or open sinkhole. Open sinks include paleo sinks without a confining layer within 80 inches of the surface. Stream includes both perennial and intermittent streams and canals.

3/ Good vegetation refers to a well-managed, dense stand that is not overgrazed.

Phosphorus Transport Potential Due to Phosphorus Source Management - Part B (Table 2)

Phosphorus transport potential due to phosphorus source management is as follows:

- Fertility Index Value
- P Application Source and Rate
- Application Method
- Waste Water Application

Criteria

Fertility Index Value:

Existing soil P levels are included in the P Index and identified as the “fertility index”. The “fertility index” is defined as Mehlich-3 extractable P, of a 0-15 cm (0-6 inches) depth soil sample, in ppm (parts per million) multiplied by 2 to convert to pounds per acre. The 0.025 multiplication factor was selected to provide a value range similar to those used for other parameters in the P Index.

Obtain soil samples by taking 15 to 20 small cores (for areas up to 40 acres) at random over the entire area to a depth of about 6 inches. Place the 15 to 20 plugs in a container, mix them thoroughly, and send approximately one pint of the mixed sample to the UF/IFAS Extension Soil Testing Laboratory (ESTL) or other qualified laboratory for analysis.

P Application Source and Rate:

The multiplication factors for the application of P vary based on the source (fertilizer, manure, compost, biosolids, or waste water). Fertilizer, manure, and compost have the multiplier 0.05. For biosolids the multiplier is lower (0.015) because of evidence that the Fe and Al content of biosolids will decrease the P availability in biosolids-amended soils. In contrast, P in water from municipal and lagoon effluents is mostly in a soluble form and therefore the multiplier is higher (0.10).

Application Method:

The application method is not a consideration for sites that have No Surface Outlet or where solids are incorporated immediately after application or injected (value 0). For all other sites, effluent applied via irrigation are typically applied frequently (weekly, bi-weekly) and in small amounts or where solids are incorporated within one day of application; therefore, the potential for P loss is low (value 2). In contrast, solids (fertilizers, compost, biosolids, manures) surface-applied and not incorporated would have a higher potential for loss, particularly through surface runoff (value 6). Incorporated solids within 5 days of application have a medium potential for loss (value 4).

Waste Water Application Volume:

Excessive volumes of water may exacerbate movement of P via downward or lateral leaching, depending on the landscape. The 0.20 multiplication factor was selected to provide a value range similar to those used for other parameters in the P Index.

RESULTING P INDEX

The P Index is obtained by multiplying the site and transport characteristics totals – Part A (Table 1) by the phosphorus source totals – Part B (Table 2). The results are interpreted according to guidelines in Table 3.

On sites with a LOW or MEDIUM vulnerability rating, it is possible to use a nitrogen-based budget to determine application rates. On sites with a HIGH or VERY HIGH vulnerability rating, it is necessary to use a phosphorus-based budget to determine application rates.

Assessing the P Index Results

The numerical result of the P Index has no absolute value, but is immediately translated into a qualitative rating (LOW, MEDIUM, HIGH, or VERY HIGH). For each qualitative rating a description is given for the level of concern that each specifically assessed field has for P loss potential (Table 3). Some general guidance is given for each qualitative level as to the intensity and type of remedial action or mitigation that would be necessary to reduce P loss risk.

Conservation Planning Notes

Since output from the P Index includes information that is specific to each of the site and transport characteristics – Part A (Table 1) and phosphorus source management – Part B (Table 2), the conservation planner can identify which characteristics/management have the greatest influence in determining the final vulnerability rating and may be targeted for remedial action. Table 14 may be used to record notes to explain, clarify, and/or define site characteristics and source management used to evaluate a site. Each factor can be revisited and planning changes made, thereby changing the resulting P Index. For example, terraces can be installed, thereby lowering soil erosion and the final P Index. Similarly, the P Index can be lowered by reducing the planned P application rate.

Table 14. Conservation Planning Notes.

Client Name:	County:	Date:
Planner:	Field(s):	Crop:
Site and Transport Characteristics	Remarks	
Soil Erosion		
Runoff Potential		
Leaching Potential		
Potential to Reach Water Body		
Phosphorus Source Management		
Fertility Index Value		
P Application Source and Rate		
P Application Method		
Waste Water Application		

GLOSSARY (as used in the P Index the following definitions apply)

No Surface Outlet – The combination of slope and permeability of the application site that will not discharge surface flow from that site in a 2 year – 24 hour rainfall event.

(This level of evaluating runoff is not intended to require calculation for the rainfall events but is intended to evaluate those sites that do not have external surface flows during most years. Where these sites occur, additional comments may need to be recorded on the back of form FL-CPA-41)

Compost – animal wastes and plant debris that has gone through the composting process.

Biosolids – Residuals, domestic wastewater residuals and/or septage as defined in Chapter 62-640 Florida Administrative Code. Biosolids include co-compost with a minimum of 50% biosolids.

Landform - Any physical, recognizable form or feature of the earth's surface, having a characteristic shape and produced by natural causes.

Examples of individual landforms and their definitions are:

Karst - Topography with sinkholes, caves, and underground drainage that is formed in limestone, gypsum, or other rocks by dissolution, and that is characterized by sinkholes, caves, and underground drainage.

Knoll - A small, low, rounded hill rising above adjacent landforms.

Subsurface Drainage – Lowering of the water table in order to improve vegetative growth, remove surface runoff from wet areas, or relieve artesian pressure. Subsurface drainage can be achieved by either using drainage tile or drainage ditches, typically spaced at regular intervals.

REFERENCES

Brown, R.B., A.G. Hornsby, and G.W. Hurt. 1991. Soil ratings for crop production and water quality protection. Circular 959. Florida Cooperative Extension Service, University of Florida, Gainesville, FL.

Dearstyne, D.A., D.E. Leach, and K.J. Sullivan, D.A. 1991. Soil Survey of Bradford County, Florida. USDA/SCS in cooperation with the University of Florida, Institute of Food and Agricultural Sciences, Agricultural Experimental Stations and Soil and Water Science Department; Florida Department of Transportation; and Florida Department of Agriculture and Consumer Services.

Florida Ecological Sciences Staff. 1999. Florida Agronomy Field Handbook, Chapter 6. USDA, NRCS, Gainesville, FL.

Florida Phosphorus Index Work Group. 2000. The Florida phosphorus index. <http://efotg.nrcs.usda.gov/treemenuFS.aspx?Fips=12001&MenuName=menuFL.zip> (The Florida Phosphorus Index sheets are located in Section IV of the Table of Contents under C.Tools.)