Addendum to

CURRENT CALCULATIONS IN THE WISCONSIN P INDEX, November 2010:

Updates to Lookup Tables in SnapPlus v.15

December, 2015

While the Wisconsin P Index equations remain the same as those listed in the November 18, 2010 document, some P Index look-up databases are updated in SnapPlus version 15. Updates are explained below.

Precipitation databases:

The “Average precipitation by season for selected rainfall stations in Wisconsin” (p.13) and the “Appendix: Frost-free period and seasonal Rainfall Runoff Histograms for the Wisconsin P Index” have been expanded to include county-specific average precipitation and histograms for calculating average rainfall runoff. The period of record for this data is 1990 to 2012. The updated tables are in WI P Index Precipitation 2015.

Soil groups for Runoff Dissolved P calculation:

The Wisconsin P Index is designed to work within Wisconsin’s nutrient management planning framework and takes advantage of soil classifications already used within that framework. UW-Extension soil fertility guidelines are part of that framework, and they assign a Soil Group classification to each soil map unit component in Wisconsin (Soil Testing Laboratories, 2015). In the P Index, we use the Soil Group classifications to assign a factor for estimating runoff dissolved P concentrations from Surface Bray P1 as outlined in the table on p. 8. UW-Extension guidelines, however, no longer use the A, B, C, D, E, and O Soil groups shown in that table. The current guidelines use just three soil groups: Loamy (L), Sandy (S) and Organic (O) (Laboski and Peters, 2012). The L group contains most of the soils that were formerly in the A, B, C, and D groups, while the new O group is equivalent to the former one and the S group is roughly equivalent to the former E group.

To determine the relationship between the new soil groups and runoff dissolved P concentrations, we measured dissolved reactive P in 1:50 soil: water extractions of 398 soil samples. These were a subset of samples from the incubation experiments that Pagliari (2011) undertook for his PhD research (25 surface soils from 23 series x 8 manure or fertilizer amendment treatments x 2 replicates). Bray P1 ranged from 12 to 106 ppm. Of the 25 surface soils, 21 were classified as L and four were S. The L soils had an average Water-extractable P to Bray P1 ratio of 0.006 (r² = 0.76), so L soils are now assigned to the equation used for soil groups A, B, and C in table 8. Note, however, that this was relationship was established with the removal of the Chetek sandy loam samples (control and amended) from the L dataset. Chetek soils were formerly classified as E (sandy) soils but now meet the criteria for L. With the Chetek
samples included, the ratio was 0.005 and $r^2 = 0.67$. The average ratio of Water-extractable P to Bray P for samples from the S soils was 0.003 ($r^2 = 0.19$), higher than the 0.002 shown for E soils in table 8. The factor used for S is not 0.003. Due to the poor fit, particularly for the S soils, we are continuing to look for better ways to categorize soils for assigning a Water-extractable P to Bray PI ratio.

Note that the A, B, C, D, E and O groups are still used in the WI P Index to assign base winter runoff (p.5). We hope to have sufficient information to implement a new system for assigning these values by the 2016 release of SnapPlus.

**Upper limit set on water soluble P release from manure in a single season:**

To ensure that the P Index does not estimate more manure soluble P release in a season than could be carried by the average amount of precipitation in that season, we set an upper limit for the soluble P in surface-applied manure in each season that can be entered into this equation on p. 8:

$$\text{Season } n \text{ DP}_{\text{manure}} = \text{Soluble P from surface-applied manure}_{\text{season } n} \times \text{ Runoff to precipitation ratio}_{\text{season } n} \times \text{Phosphorus Distribution Factor}_{\text{season } n}$$

The Soluble P from surface applied manure should be summed for all applications for each season and the results compared to the upper limits for each season listed below.

- Fall - 20 lb/acre
- Winter - 21 lb/acre
- Spring - 27 lb/acre
- Summer - 37 lb/acre

Any amount that is greater than this should be added to the Soluble P from surface manure for the next season.

This change will only affect P Index calculations for areas with very high manure application rates such as cattle exercise lots. To illustrate, these maximum amounts of soluble P are approximately what would be in the following rates of semi-solid dairy manure applications: fall - 28 tons per acre; winter - 30 tons per acre, spring - 38 tons per acre; and summer - 52 tons per acre.

**Corrections to Frozen Ground Acute Winter Loss P Index description:**

The following statement on p.14 contains two inaccuracies, “On the Snap-Plus cropping screen for each field where the Annual Total PI components are displayed (under “details”), the Acute loss (frozen) PI is in a separate row below the Soluble PI. The Soluble P I displayed there includes all Soluble PI components except for the Frozen Ground Acute Loss Index, so if you add those two together, you will get the complete Soluble P Index.”
Correction 1: This section of the SnapPlus cropping screen display has been changed. The name of this index is now Acute Winter Loss PI and it is only displayed for WPDES-permitted farms. It is used to help permitted farms comply with NR243.

Correction 2: The Soluble P Index now includes all of the estimated runoff dissolved P loads from a field, including the losses from manure on frozen ground. When both are displayed, the Acute Winter loss PI should be considered a component of the Soluble PI and not an additional loss.

References:

