# Long-Term Watershed Monitoring - Do's and Don'ts

S.J. Livingston[1]

The USDA-ARS National Soil Erosion Research Laboratory (NSERL) initiated a watershed monitoring network in northeastern Indiana in 2002. The objectives of this network include monitoring nutrients, pesticides and soil loss from agricultural lands at the field to watershed scale, using a paired nested approach. We are also evaluating topography, land-use, and conservation practices influences on losses from these watersheds. New and innovative BMP's are being evaluated at the field and watershed scale (Smith and Livingston, 2013). The data is also being used for validation of new and existing modelling efforts. This network has expanded from three ditch sites monitoring/sampling flow, to nine stream/ditch sites and six surface/subsurface edge-of-field monitoring locations monitoring flow, turbidity, and 14 weather/soil moisture installations mostly co-located at existing water quality monitoring stations (Table 1). Each station is networked wirelessly and accessible via the internet in near real-time. Transducer level and ultrasonic velocity sensors (AV sensors) are used in ditches and in field tile monitoring locations for calculation of discharge under all conditions. Surface runoff is measured using topographic depression collector tile inlets (tile risers) as well as weirs (Figure 1) and flumes in locations with free fall to ditches utilizing instream transducer AV sensors along with bubbler and ultrasonic level sensors. This work has allowed for the study and development of an NRCS-approved alternative drainage system, the blind inlet, which has been shown to reduce sediment loads by up to 85% (Smith and Livingston, 2013). Cooperator interaction (Figure 2) is critical and an ongoing process, requiring face-to-face interaction and sharing of pertinent data. This presentation will describe the lessons learned while developing a network such as this, which is now part of the Conservation Effects Assessment Project (CEAP) (Maresch et al., 2008), the Long-Term Agroecosystem Research (LTAR) network (Walbridge and Shafer, 2011), and the Soil Moisture Active/Passive (SMAP) satellite calibration/validation project (NASA-JPL, 2016).

**Figure 1.** Edge of field monitoring.

**Figure 2.** Field trips and demonstrations.

[1]Stanley J. Livingston, Soil Scientist, USDA-Agricultural Research Service, National Soil Erosion Research Laboratory, West Lafayette, Indiana, USA. Corresponding author: S.J. Livingston, email: Stan.Livingston@ars.usda.gov.

**Table 1.** Monitoring station descriptions.

| Site ID | hectares | Site type | Major Soils | Land Use/Cropping | Site ID | hectares | Site type | Major Soils | Land Use/Cropping |
|---|---|---|---|---|---|---|---|---|---|
| AXL | 4303 | watershed | Blount silt loam<br>Pewamo silty clay,<br>Glynwood loam<br>Rawson sandy loam,<br>Rensselaer loam<br>Sebewa sandy loam | 78% Agriculture<br>14% Grass/Pasture<br>6% Forest | BLG | 1417 | watershed | Blount silt loam<br>Pewamo silty clay<br>Glynwood loam<br>Sebewa sandy loam<br>Rensselaer loam | 83% Agriculture<br>12% Grass/Pasture<br>3% Forest |
| ALG | 1934 | watershed | Blount silt loam<br>Pewamo silty clay<br>Glynwood loam<br>Rawson sandy loam<br>Morley silty clay loam | 77% Agriculture<br>16% Grass/Pasture<br>6% Forest | BME2 | 123 | watershed | Blount silt loam<br>Pewamo silty clay<br>Moreley silty clay loam<br>Glenwood loam | 78% Agriculture<br>22% forest |
| AME | 298 | watershed | Rawson sandy loam<br>Pewamo silty clay<br>Morley silty clay loam<br>Blount silt loam | 79% Agriculture<br>15% Grass/Pasture<br>4% Forest | BME2b | 2.15 | edge of field | Blount silt loam<br>Glenwood loam<br>Pewamo silty clay | 100% agriculture |
| AS1 | 2.22 | edge of field | Pewamo silty clay<br>Glynwood loam<br>Morley silty clay loam | 100% Agriculture | CLG | 1380 | watershed | Blount silt loam<br>Pewamo silty clay<br>Glynwood loam<br>Morley silty clay loam | 73% Agriculture<br>17% Grass/Pasture<br>5% Forest |
| AS2 | 2.71 | edge of field | Glynwood loam<br>Blount silt loam | 100% Agriculture | CME2 | 308 | watershed | Blount silt loam<br>Pewamo silty clay<br>Morley silty clay-loam<br>Glenwood loam | 60% Agriculture<br>40% CRP/non Ag or low density Residential |
| ADE | 4.88 | edge of field | Pewamo silty clay<br>Glynwood loam<br>Morley silty clay loam<br>Wallkill silt loam | 100% Agriculture | CME2b | 80 | watershed | Blount silt loam<br>Pewamo silty clay<br>Morley silty clay-loam<br>Glenwood loam | 93% Agriculture<br>7% Forest |
| ADW | 4 | edge of field | Pewamo silty clay<br>Glynwood loam<br>Morley silty clay loam<br>Wallkill silt loam | 100% Agriculture | F34 | 19259 | watershed | Blount silt loam<br>Pewamo silty clay<br>Glynwood loam<br>Rawson sandy loam<br>Rensselaer loam<br>Sebewa sandy loam | 74% Agriculture<br>14% Grass/Pasture<br>8% Forest<br>3% developed |
| ADWT | 2 | edge of field | Pewamo silty clay<br>Glenwood loam | 100% Agriculture | D05, D10, D20, D14 | NA | Weather/Soil only | NA | NA |


References

Maresch, W., M.R. Walbridge, and D. Kugler. 2008. Enhancing conservation on agricultural landscapes: A new direction for the Conservation Effects Assessment Project. JSWC 63(6): 198A-203A.

NASA-JPL. 2016. SMAP Soil Moisture Active Passive - Cal/Val Activities. NASA, Jet Propulsion Laboratory, California Institute of Technology. Available at: http://smap.jpl.nasa.gov/science/validation/. (Accessed 24 March 2016)

Smith, D.R., and S.J. Livingston. 2013. Managing farmed closed depressional areas using blind inlets to minimize phosphorus and nitrogen losses. Soil Use & Mgmt. 29(s1): 94-102.

Walbridge, M.R, and S.R. Shafer. 2011. A long-term agro-ecosystem research (LTAR) network for agriculture. Conference Program, Fourth Interagency Conference on Research in the Watersheds, 26–30 September 2011, Fairbanks, AK. pp. 44-45.