Identifying Riparian Zones Appropriate for Installation of Saturated Buffers: A Multi-Watershed Assessment

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Introduction

A key aspect of agricultural watershed conservation lies in matching practices to suitable locations where pollutant delivery to streams can be most effectively decreased. This is of vital importance in the U.S. Midwest, where nitrate losses from croplands are a dominant contributor to Gulf of Mexico hypoxia (USEPA, 2008, 2013; Schilling et al., 2015). Optimal practice-placement strategies could prove most useful if they can be trialed/demonstrated over a range of landscapes. This study compared extents of suitable locations for saturated buffers across nine HUC12 watersheds selected from three different major land resources areas (MLRAs) in Iowa (Fig. 1). Saturated buffers enhance denitrification by diverting subsurface tile flow into a vegetated riparian buffer (Fig 2). Criteria for suitable sites identify soil conditions that enhance denitrification and terrain attributes that minimize unintended consequences of bank sloughing and crop inundation.

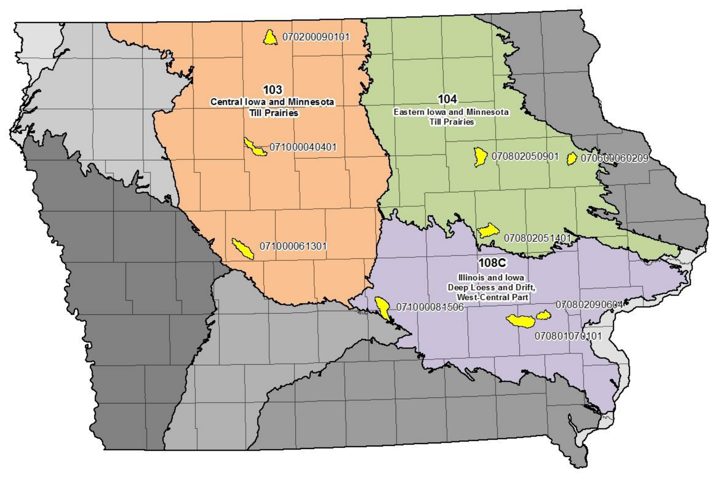


Figure 1. Three MLRAs in Iowa and randomly selected watersheds.

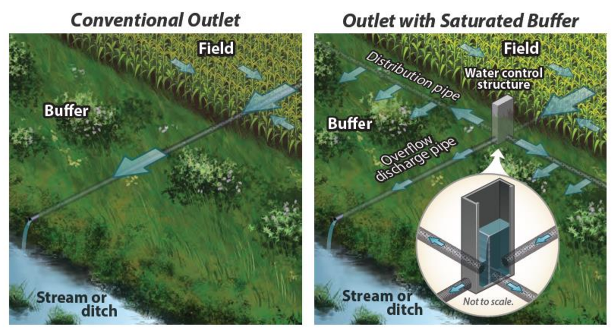


Figure 2. Basic design & function of a saturated buffer.

Methods

- Nine HUC12 watersheds were randomly chosen from three MLRAs (Fig. 1).
- The Riparian Denitrifying Practices tool from the Agricultural Conservation Planning Framework (ACPF) Version 2 Toolbox (Porter et al., 2016) was used to identify riparian assessment polygons (RAPs; Tomer et al., 2015) suited for saturated buffer placements (figure 2). Specified criteria include:
  - 35% of soils within 20 m of stream area must have average organic matter >1.7% from 0-100 cm depth, sand and gravel contents of <50% from 50-150 cm, and a seasonal water table depth of <1 meter (Apr-Jun).
  - At least 35% of the riparian zone must have slopes from 2-8% and estimated bank height must be ≤ 2.4 m.
  - Agricultural land cover (crop or pasture) must occur within the riparian zone.
- The total numbers of RAPs, and those RAPS that met the above criteria, were mapped and counted. The number of agricultural fields expected to be tile drained was also estimated for each watershed using the ACPF.
- Reasons that RAPs failed saturated buffer criteria were recorded.

Results

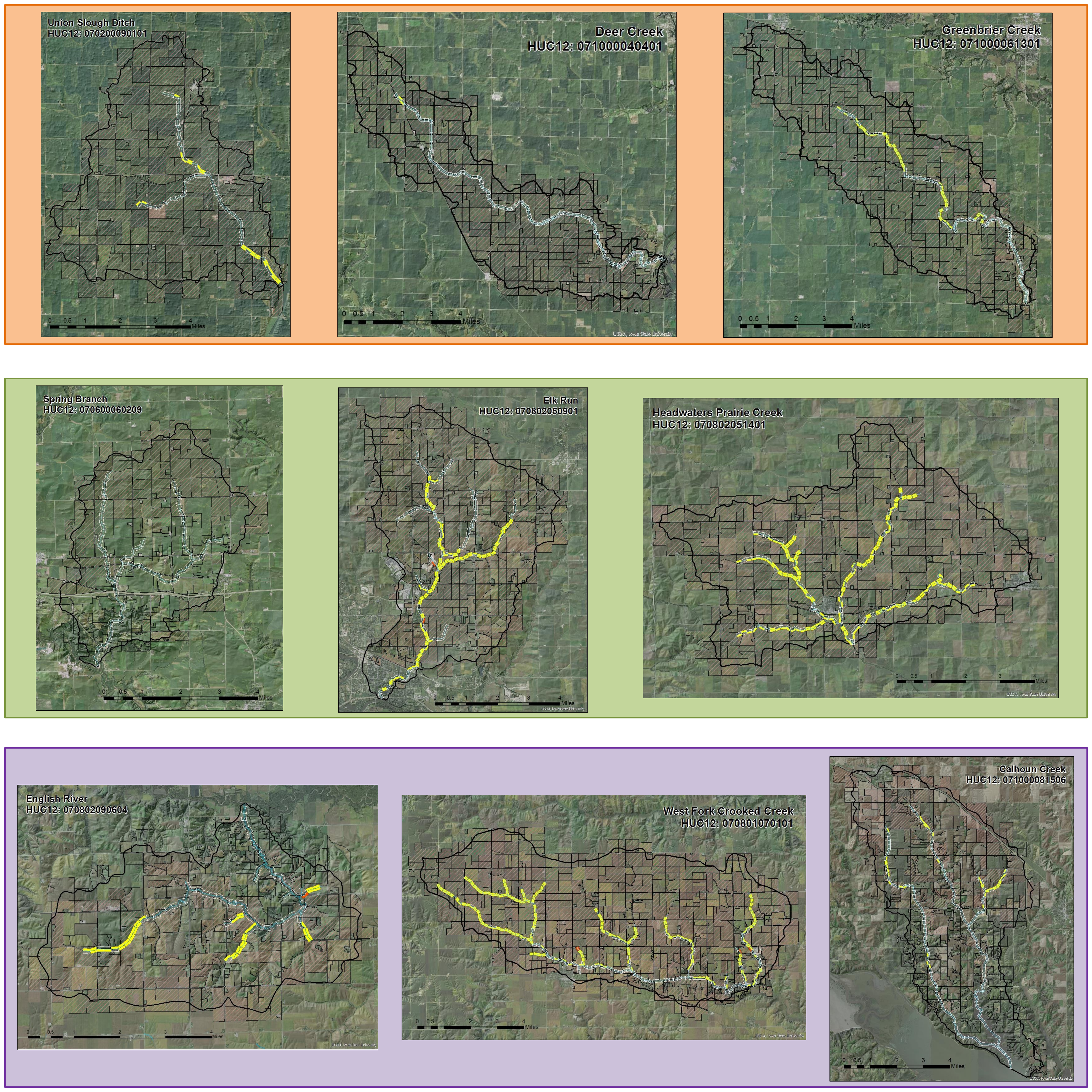


Figure 3. Riparian polygons are shown in white outline, riparian zones suitable for saturated buffers are highlighted in yellow. Where SOM criterion was the sole reason for failure, carbon enhancement (bioreactor walls) could be combined with the practice (light brown). Riparian Assessment Polygons (RAPs) are 90 by 250 m (Tomer et al., 2015). Fields likely to be tile drained are shown with pink cross-hatch.

Table 1. Count of riparian zones, percent of tile drained ag fields, and percent of RAPs found suitable for saturated buffers within each HUC12 watershed. Reasons for saturated buffer disqualification are reported below.

HUC12	Name	# Riparian Polygons	% Agric. Fields Tile Drained / % RAPS Suited for Saturated Buffers
70200090101	Union Slough Ditch	120	79% / 21%
71000040401	Deer Creek	186	80% / 1%
71000061301	Greenbrier Creek	170	80% / 33%
70600060209	Spring Branch	158	35% / 0%
70802050901	Elk Run	262	63% / 49%
70802051401	Headwaters Prairie Creek	258	76% / 65%
70802090604	English River	156	34% / 27%
70801070101	West Fork Crooked Creek	430	63% / 63%
71000081506	Calhoun Creek	332	24% / 11%

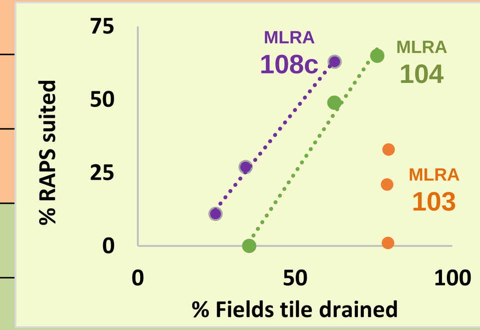
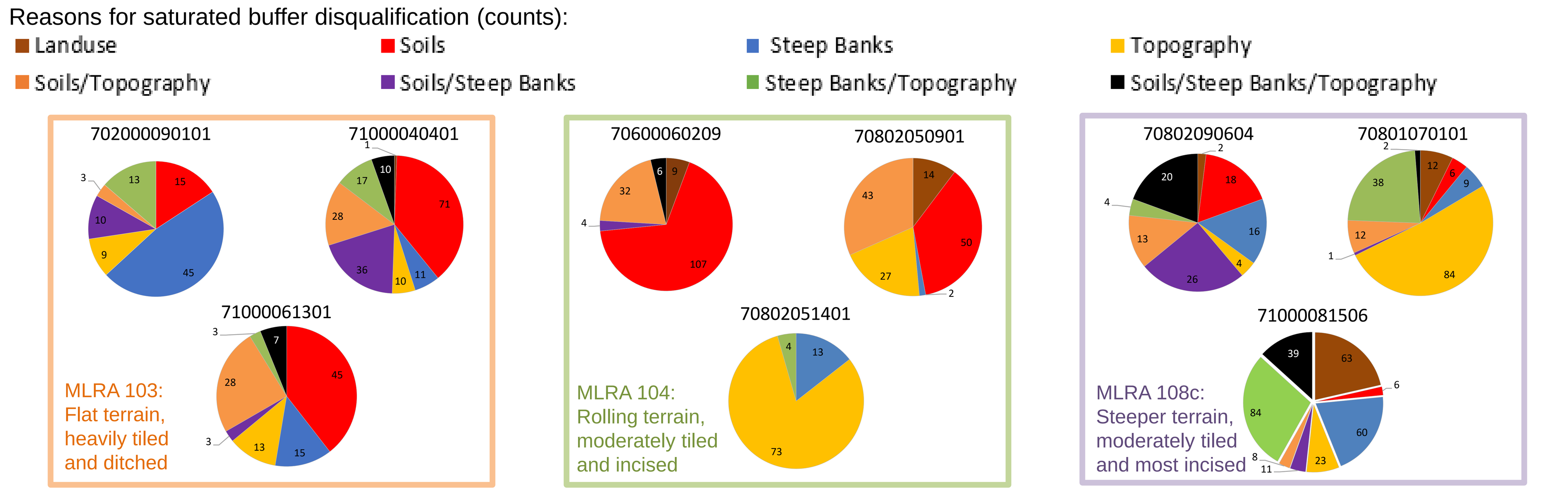


Figure 4. Extents of tile drained fields and of RAPs suited as saturated buffers, by watershed, were correlated (R=0.99) in two of the three MLRAs

Reasons for saturated buffer disqualification (counts):



Concluding comments

- Proportions of RAPs suitable for saturated buffers found within watersheds varied within and among MLRAs. Landform region (MLRA) does not indicate the potential extent of the saturated buffer practice. However, the extents of tile drainage and of RAPs suited for the saturated buffer practice were correlated (R=0.99) in two MLRAs, but not MLRA 103 which is most heavily tile drained and most extensively ditched.
- Major reasons for RAP disqualification varied but topography/high banks were major reasons in watersheds with steep and dissected landscapes.
- The saturated buffer siting tool was evaluated in the field in about ten watersheds during the 2016 field season, with favorable results. Site specific investigations are required for site specific design and installation.

References

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