A Presentation of the 2013 Drainage Research Forum

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Conservation Based Approach for Assessing Public Drainage Benefits

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UNIVERSITY OF MINNESOTA

Who Pays for Drainage Systems?

- Landowners of benefitted properties pay all system costs
- Costs are based on the benefits assessed to each land parcel
- $My\ cost = Total\ system\ cost * (\frac{My\ benefit}{Total\ system\ benefit})$
- 10% of benefits → pay 10% of costs

Cost-Benefit Ratio

- **103E.015** states that a drainage authority may only authorize a drainage project if the "estimated benefits are greater than the total estimated costs, including damages."
- Costs are taken from the engineer's estimate
- Benefits are determined by …

Current Benefit Method in MN

- Benefits determined by ditch viewers
- 103E provides little guidance; benefits may be based on an increase in:
  - the current market value,
  - the potential for agricultural production, or
  - the potential for a different land use
- Enter ditch viewers… Minnesota Viewers Association (MVA)

Benefits

- Benefits are the separable portion of a property's value that can be attributed to the drainage system or project
- Estimates of value are made:
  - 1: pre-drainage
  - 2: post-drainage (or post-improvement)
- The benefit is the difference of these values

Current MN Method

Four Benefit Classes:

Benefit class	Description without drainage	Description with guideline drainage
A	Standing water or cattails	Seasonally ponded, low crop classification
B	Seasonally flooded/pasture	Occasionally flooded, Medium crop classification
C	Wet subsoil, low to medium crop classification	Wet subsoil, Medium-high crop classification
D	Upland soils not needing drainage, high crop classification	Upland areas not needing drainage, Medium to high crop classification

Martin-Watonwan JD-4

	Yield (as a % of maximum)		Annual net income ($ per acre)		Land value ($ per acre)	
Benefit class	**undrained**	**drained**	**undrained**	**drained**	**undrained**	**drained**
A	Too wet to farm	80	$0	$387	$0	$5500 to $6500
B	Hay or pasture	95	$60	$418	$1000 to $1500	$6500 to $7000
C	92	100	$296	$448	$5500 to $6500	$6500 to $7500
D	96	100	$410	$448	$5000 to $7000	$5500 to $7500

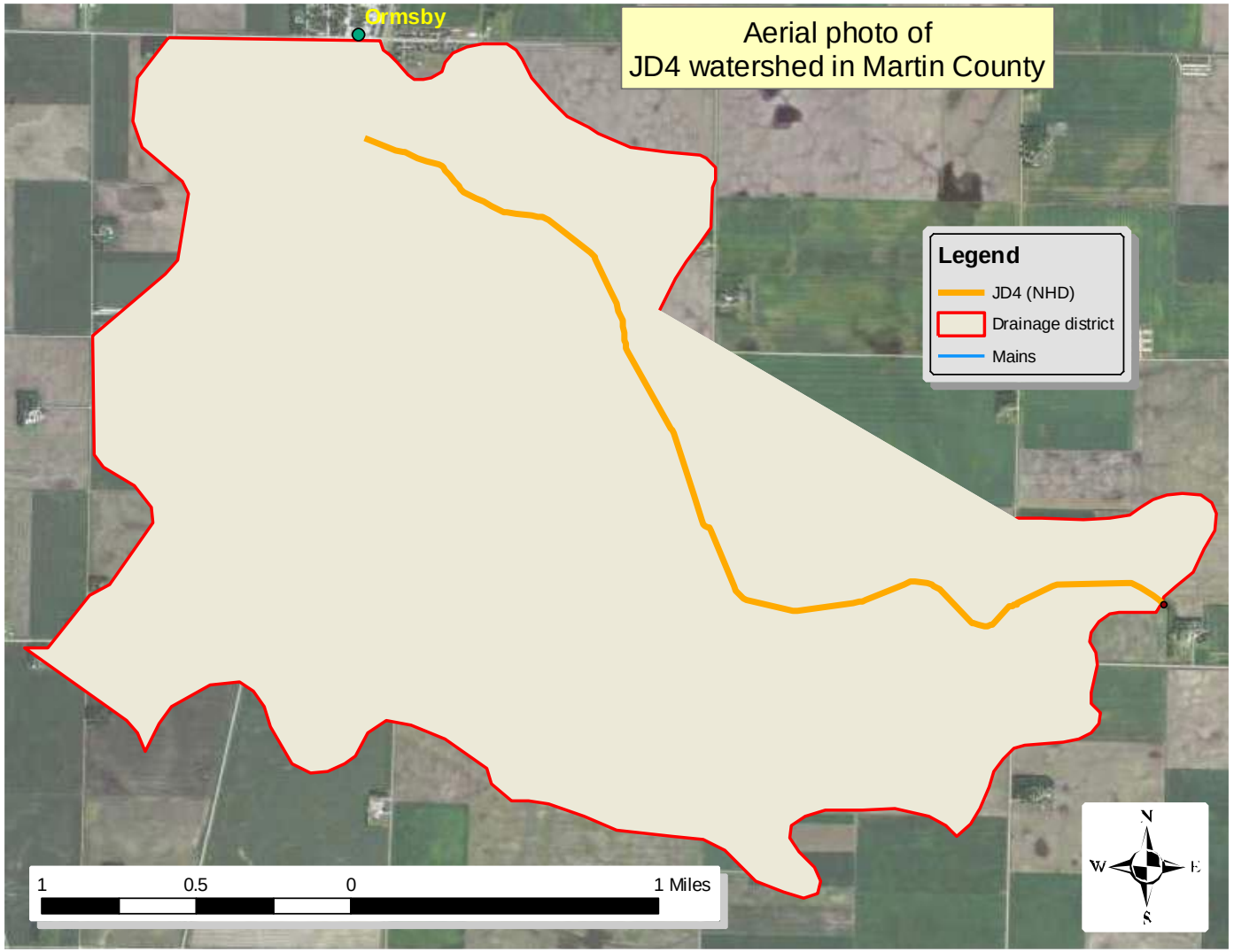
Project goal

- *Evaluate alternative methods* for assessing benefits and costs that *consider the impacts of conservation practices*
- **Important Features**
  - **Create incentives** to *implement conservation practices* that *reduce runoff contribution* to drainage systems and;
  - *Maintain fairness and transparency* in benefits determinations to ensure assessed benefits closely match real benefits.

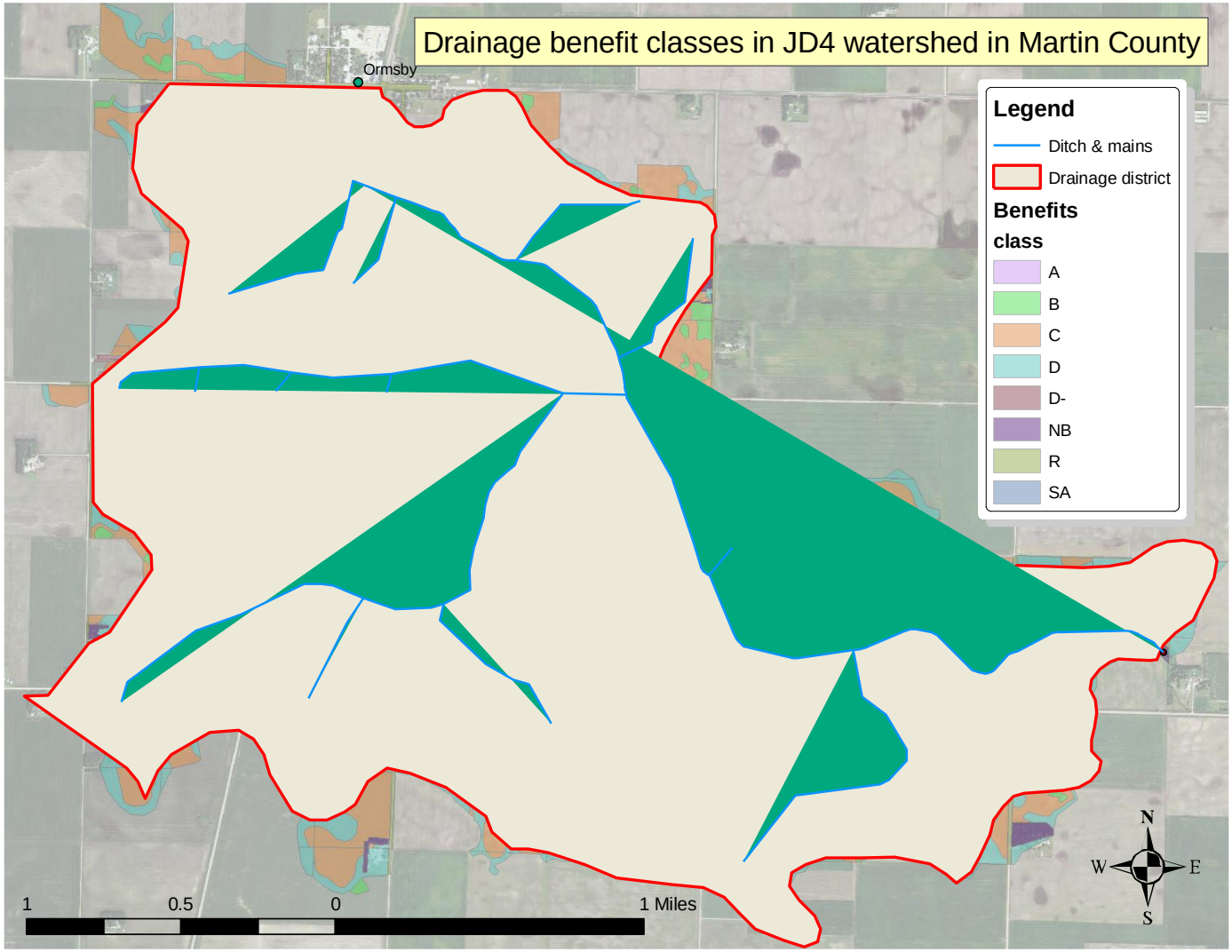
4 Methods to Estimate Benefits

1) MN-GIS method:
   "Replicate" current MN method using GIS
2) Replicate OH method (for comparison)
3) Drainage depth approach **#1: SWAT**
4) Drainage depth approach **#2: DRAINMOD**

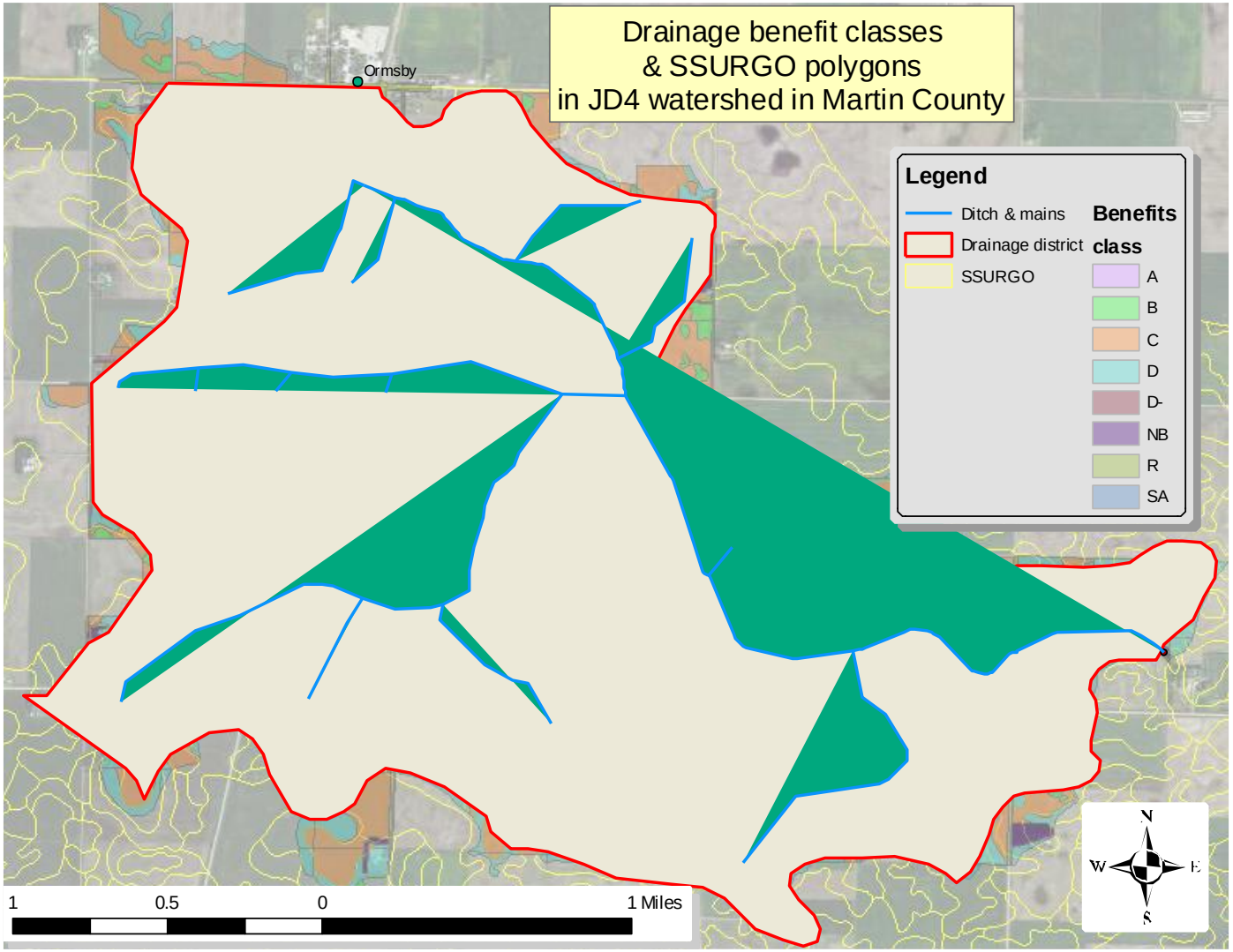
Evaluation Site (JD-4)



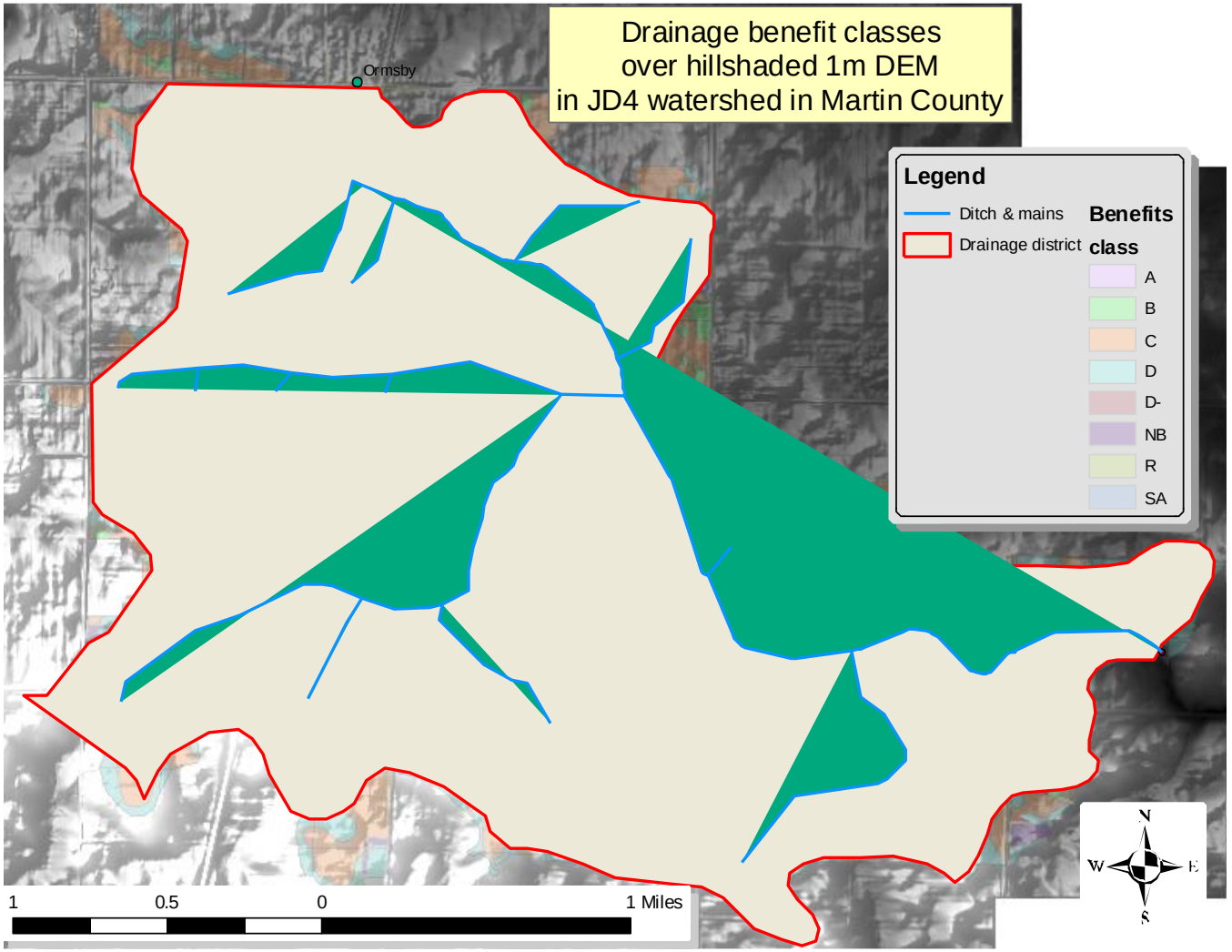
JD-4: Benefit Classes



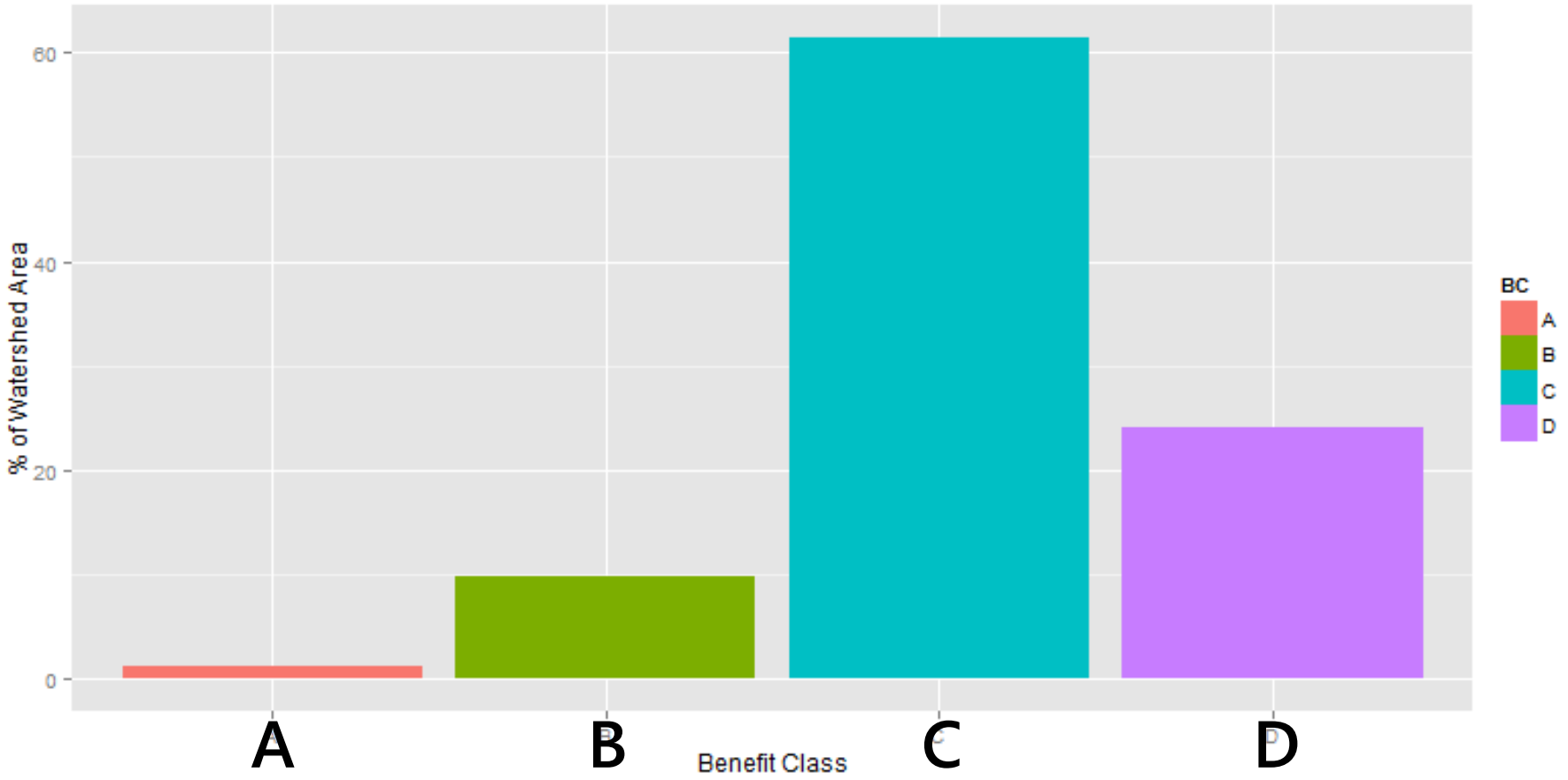
JD-4: Soils & Benefit Classes



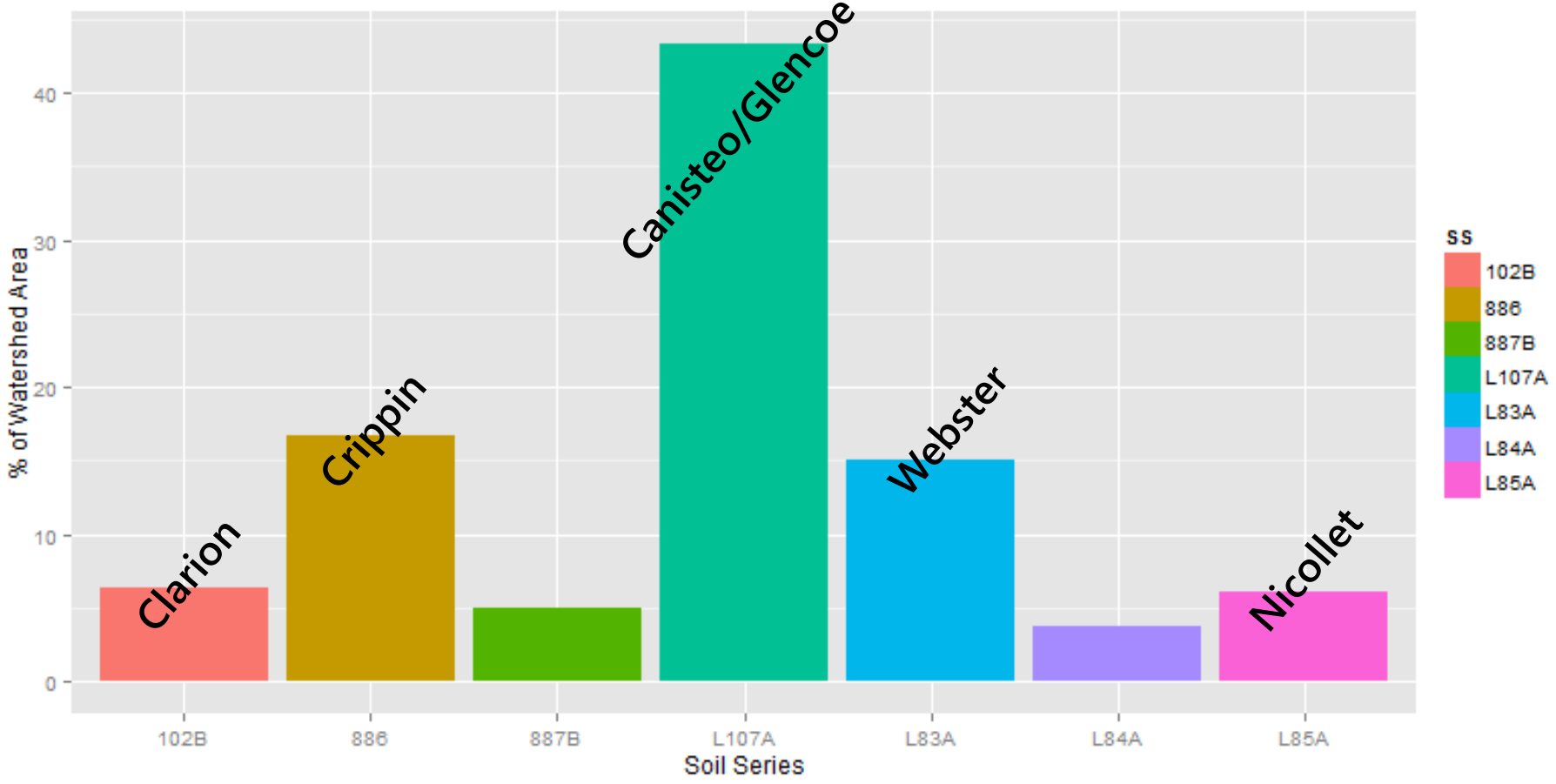
JD-4 (1m DEM w/benefit classes)



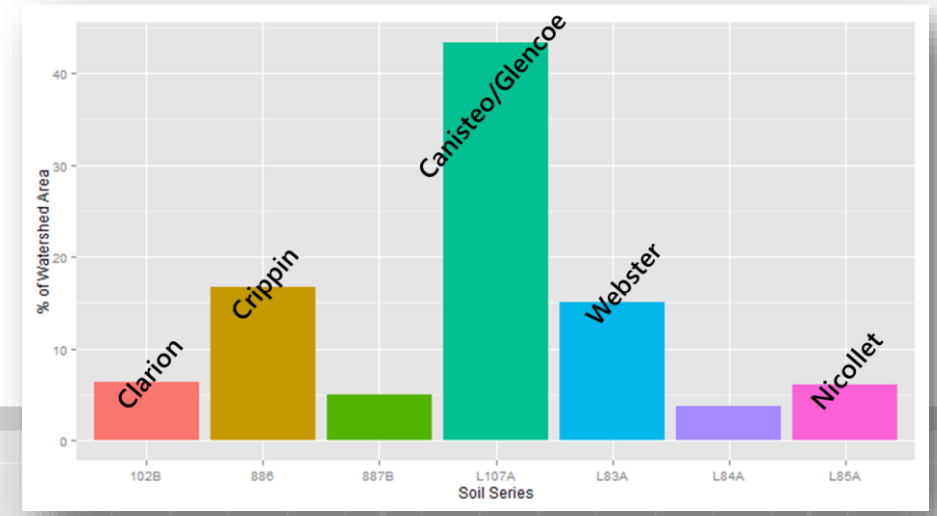
Benefit Class Distribution

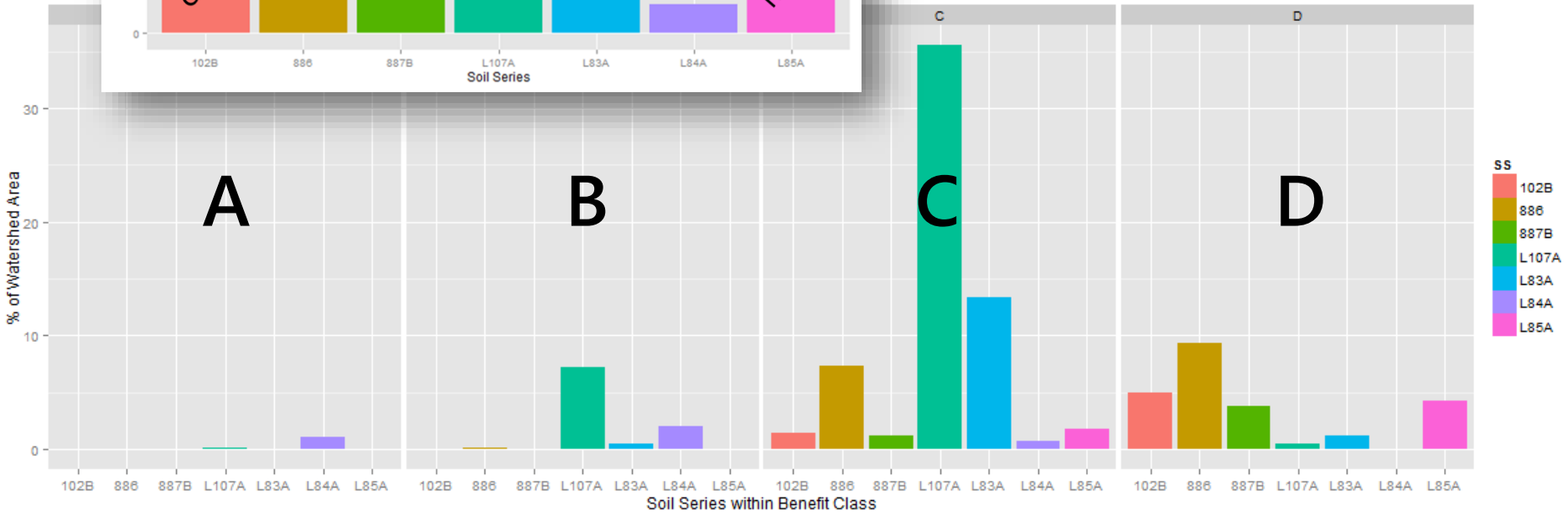


Soils Distribution

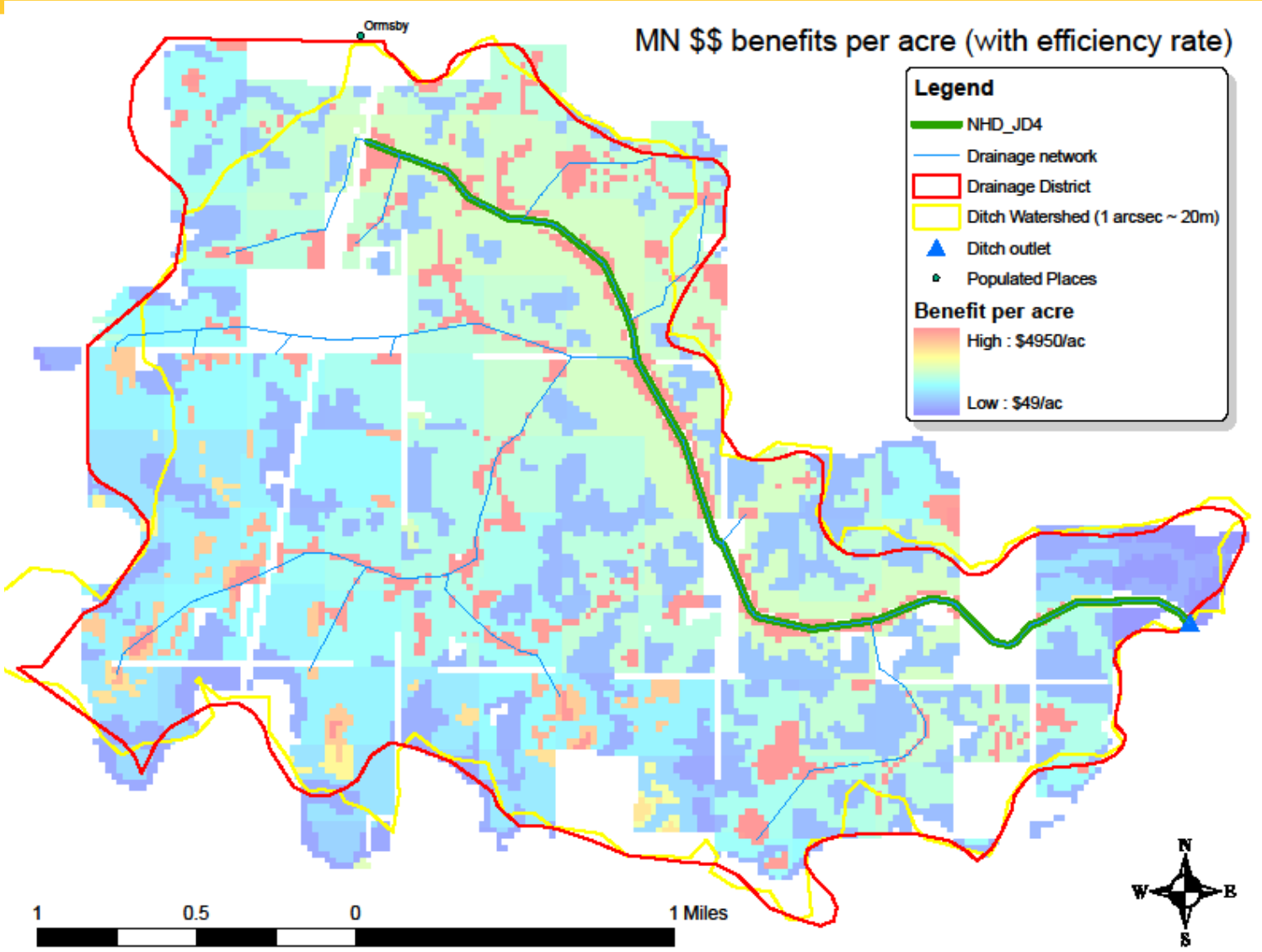


Soils Within Benefit Classes





Evaluation Site (JD-4)

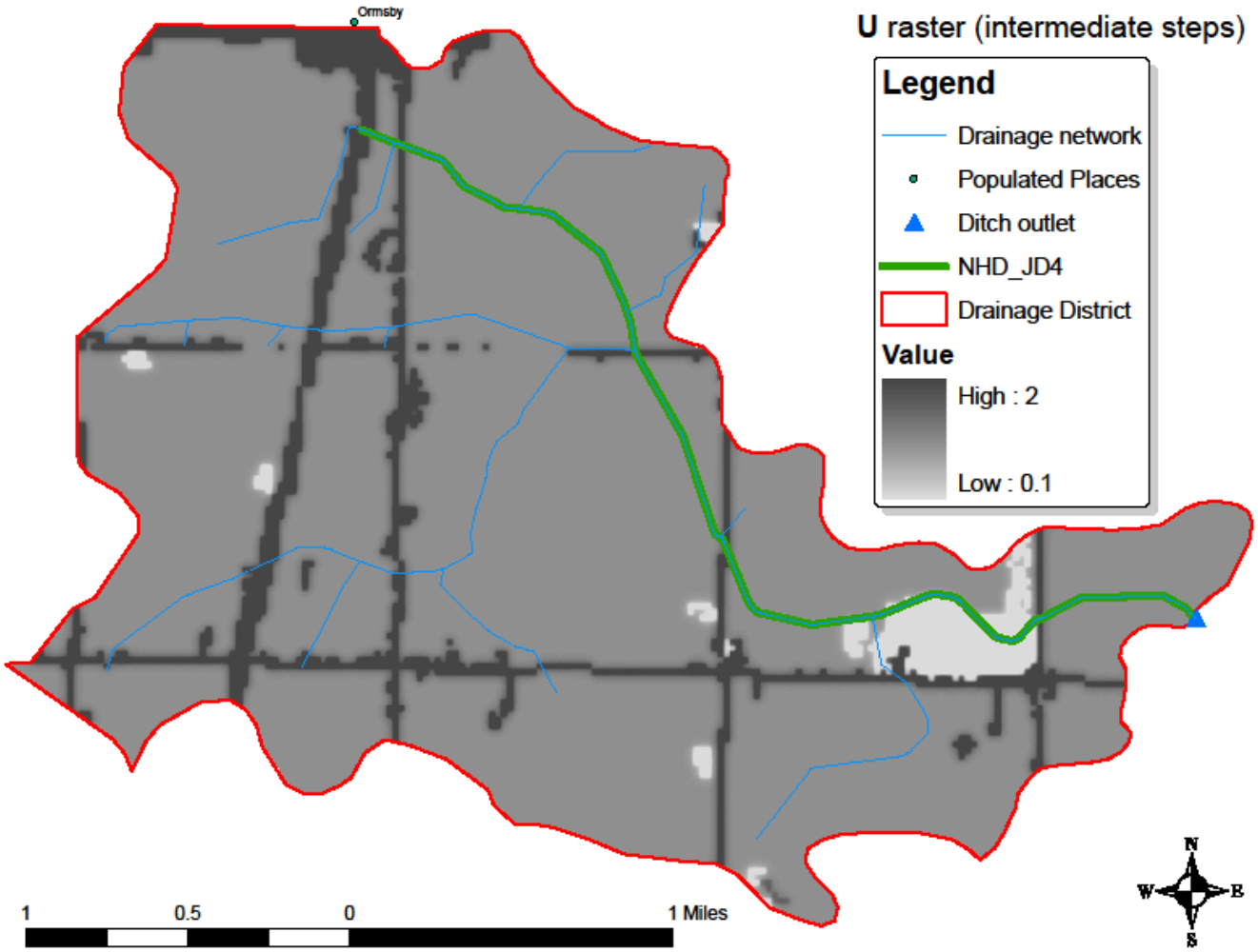


Ohio Multiplicative Methods

- Combination of:
  - Land use (U)
  - Hydrologic soil group (H)
  - Length factor (length of channel used by parcel) (L),
  - Remoteness (distance to ditch or outlet) (R), and
  - Elevation
- **Benefits = f (U, H, L, R)**

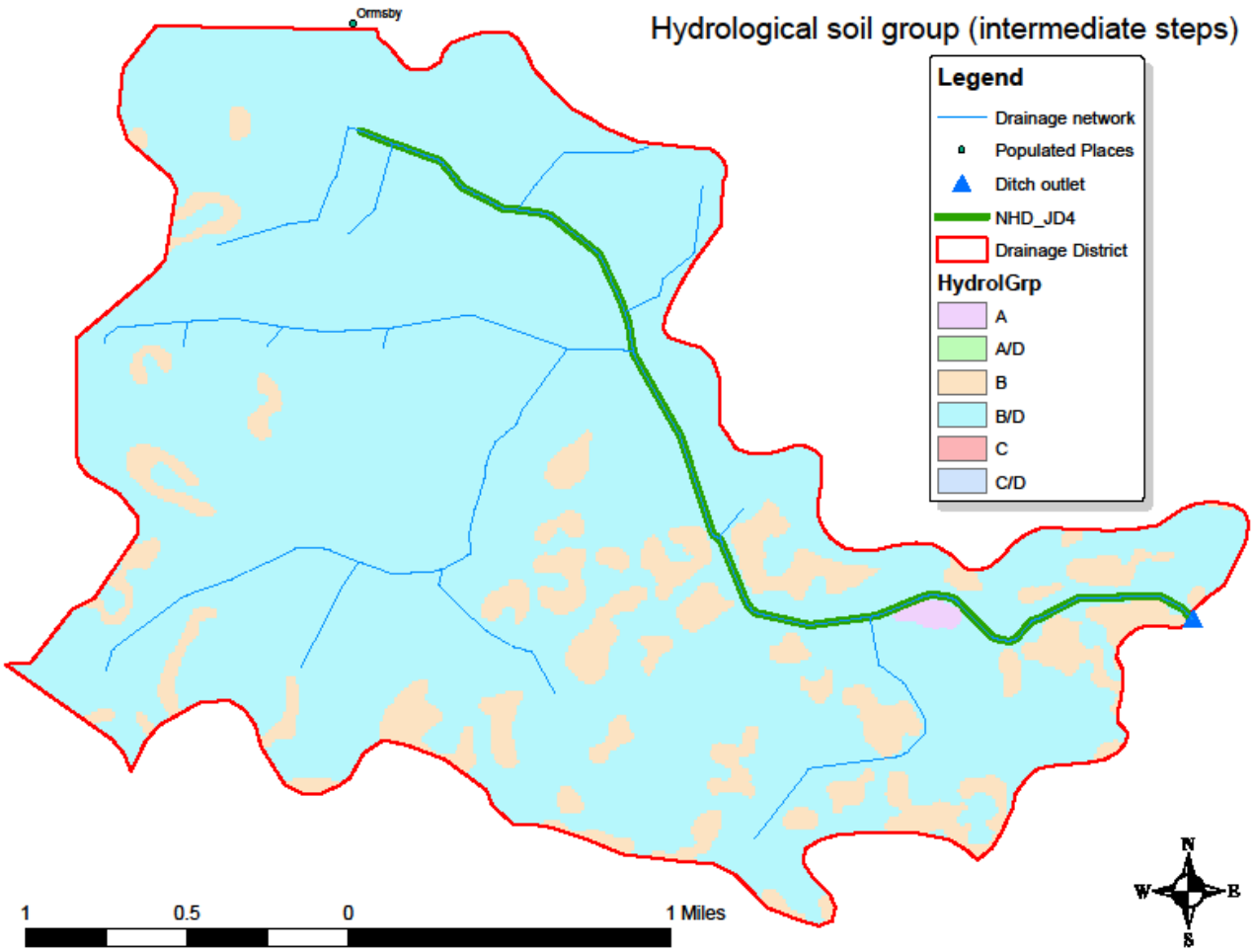
JD-4: U = Land Use

Benefits = f (U, H, L, R)



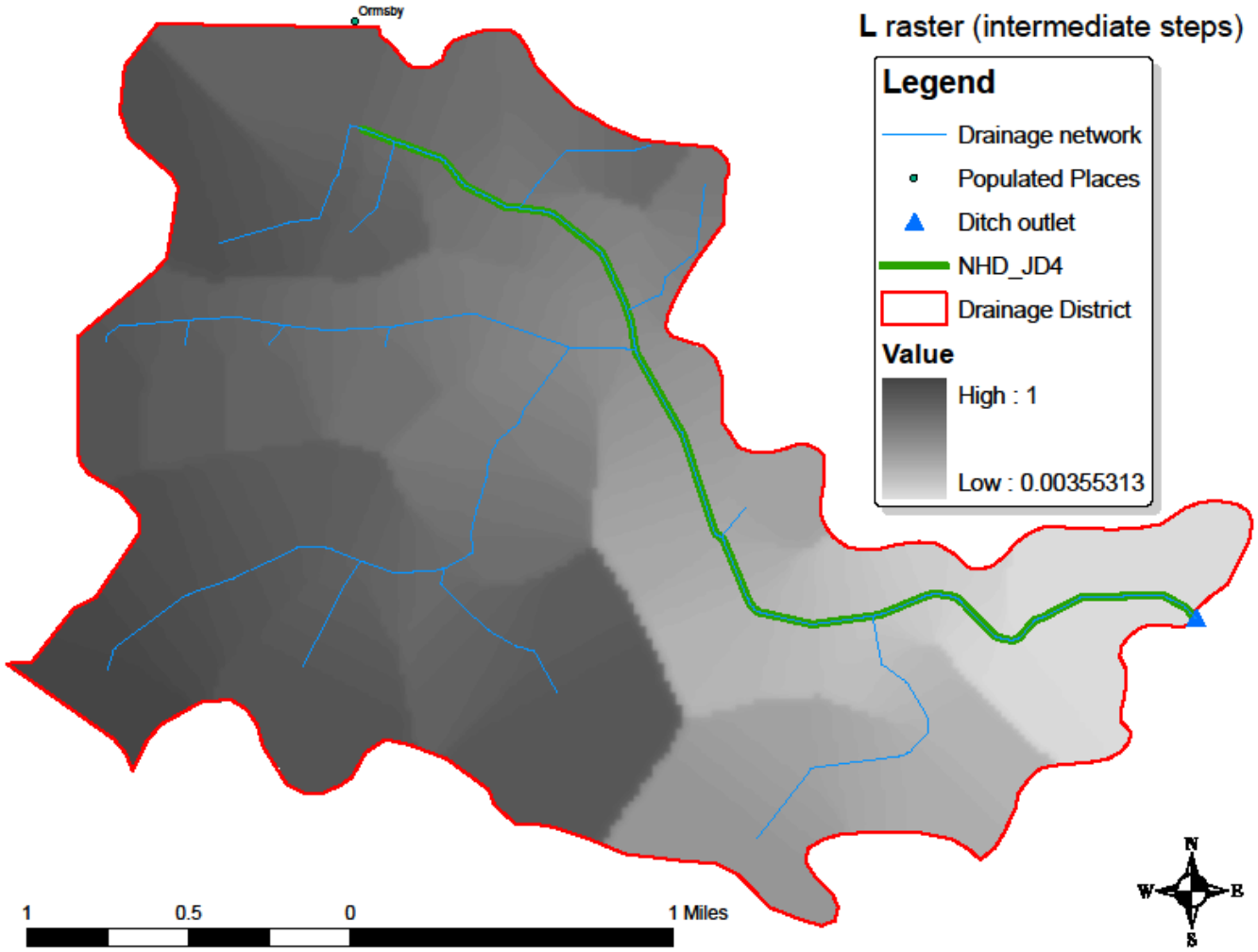
JD-4: H = Hydro Soil Group

Benefits = f (U, H, L, R)



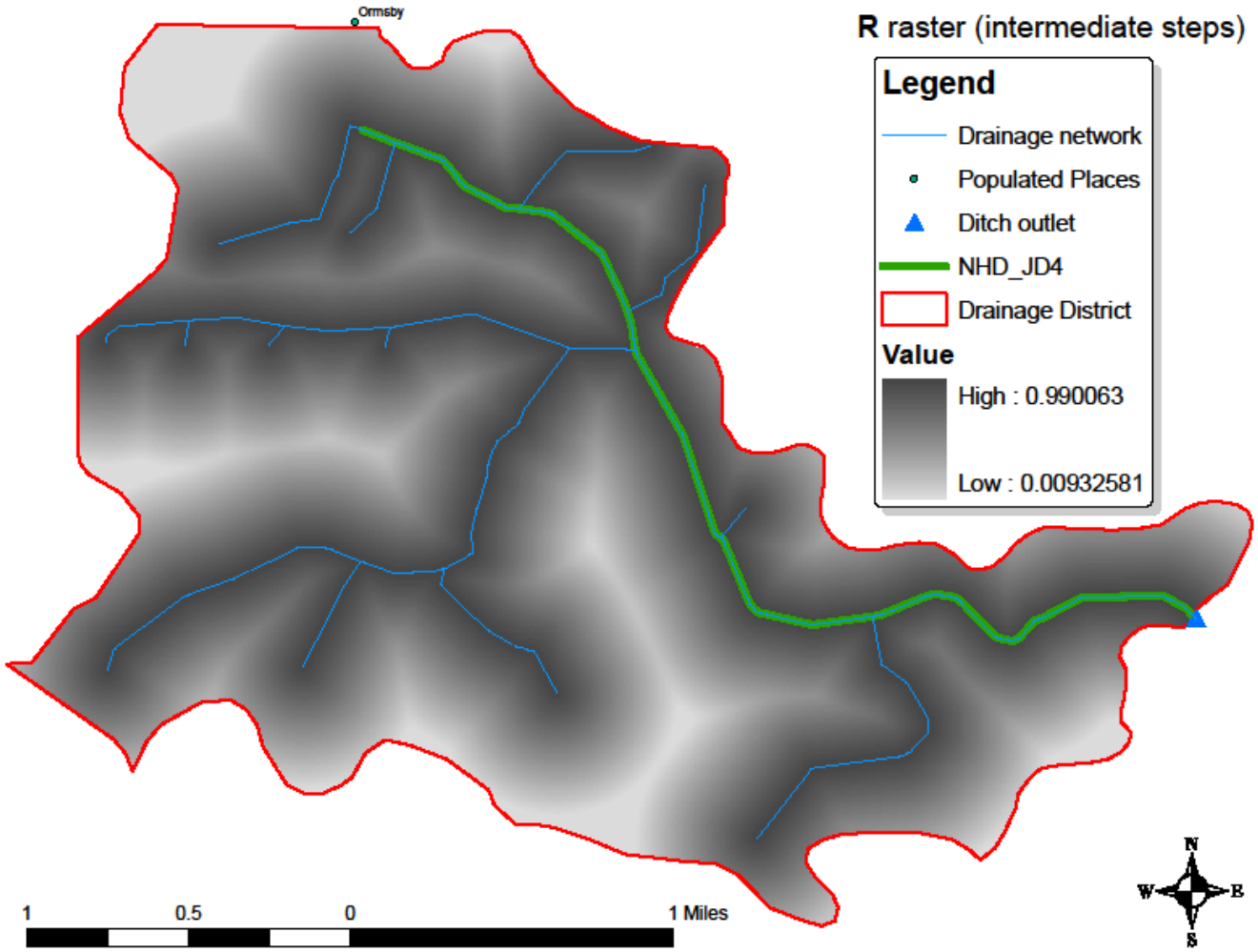
JD-4: L = Length of Ditch

Benefits = f (U, H, L, R)



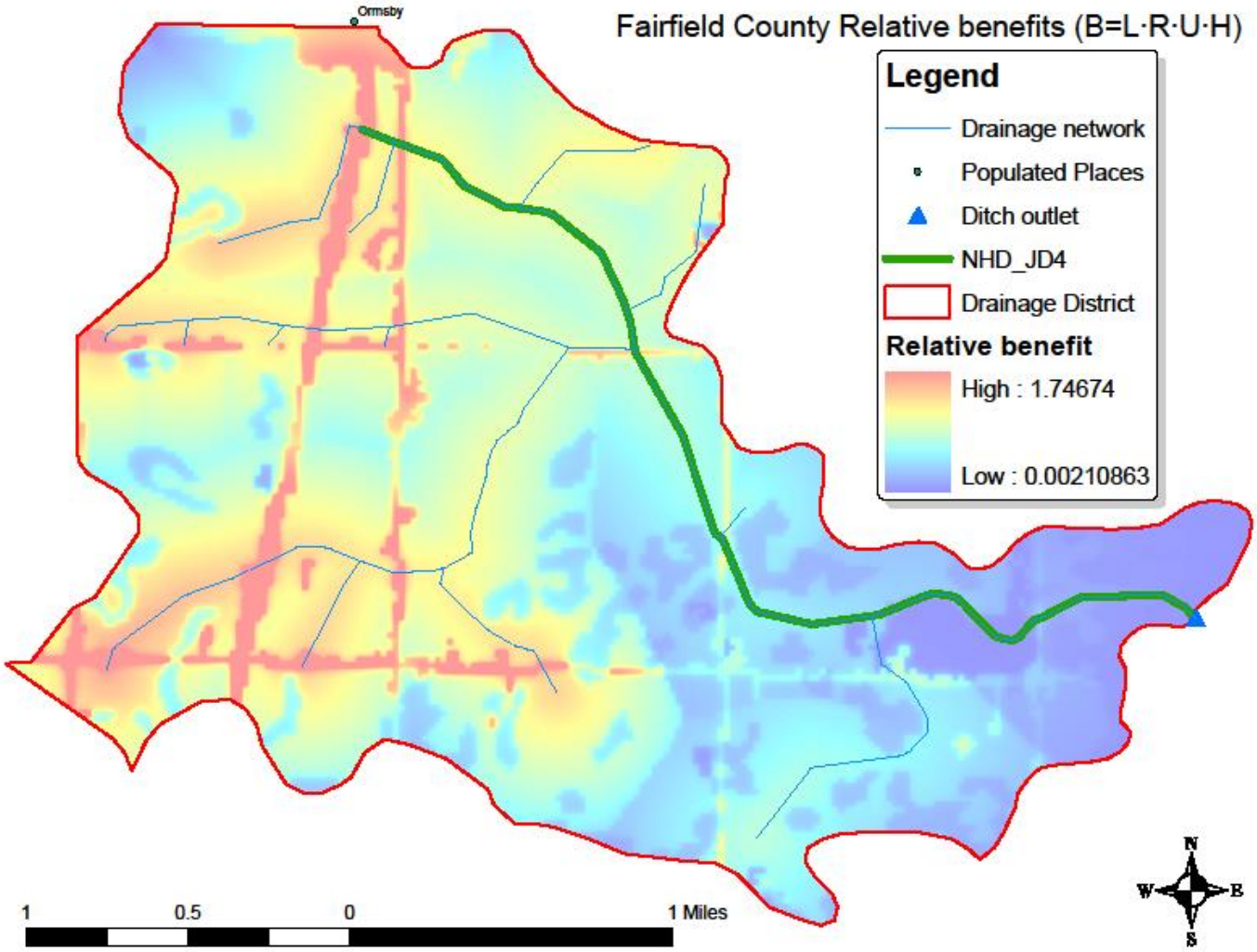
JD-4: R = Distance to Ditch

Benefits = f (U, H, L, R)



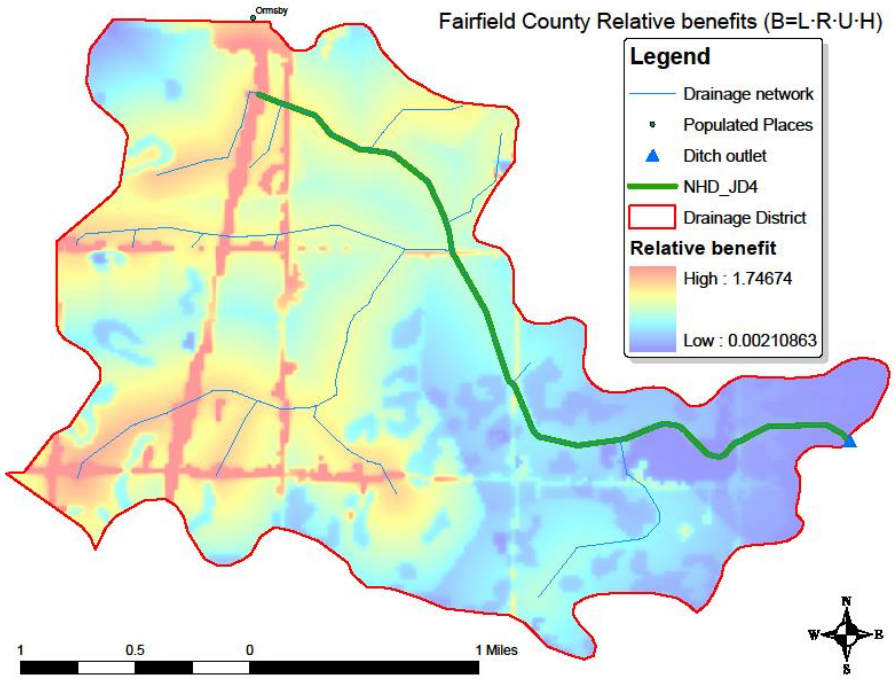
JD-4: B=U×H×L×R

Benefits = f (U, H, L, R)

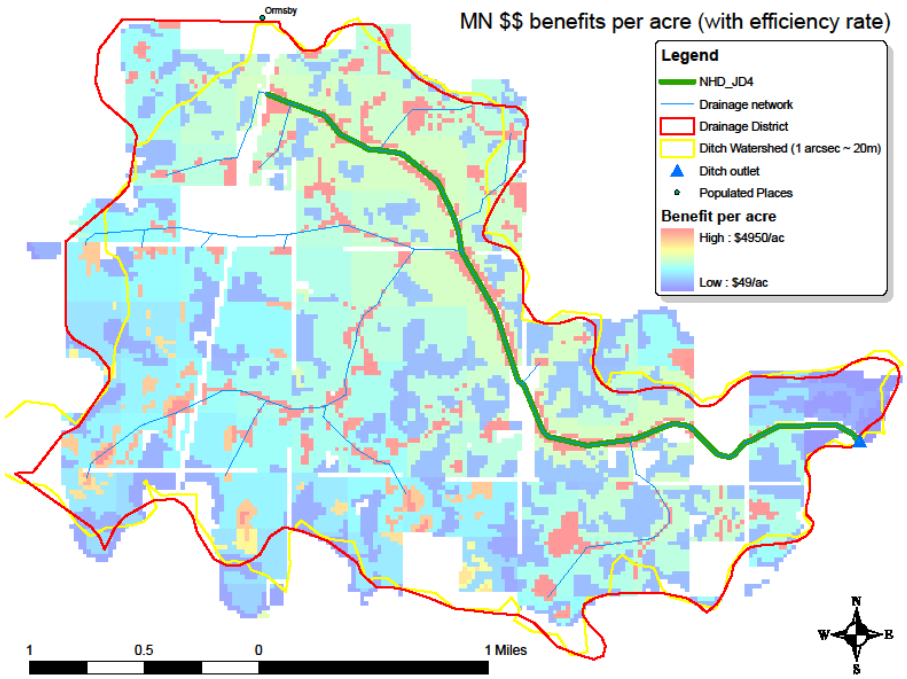


JD-4: Comparison

OH Method



Mn Method



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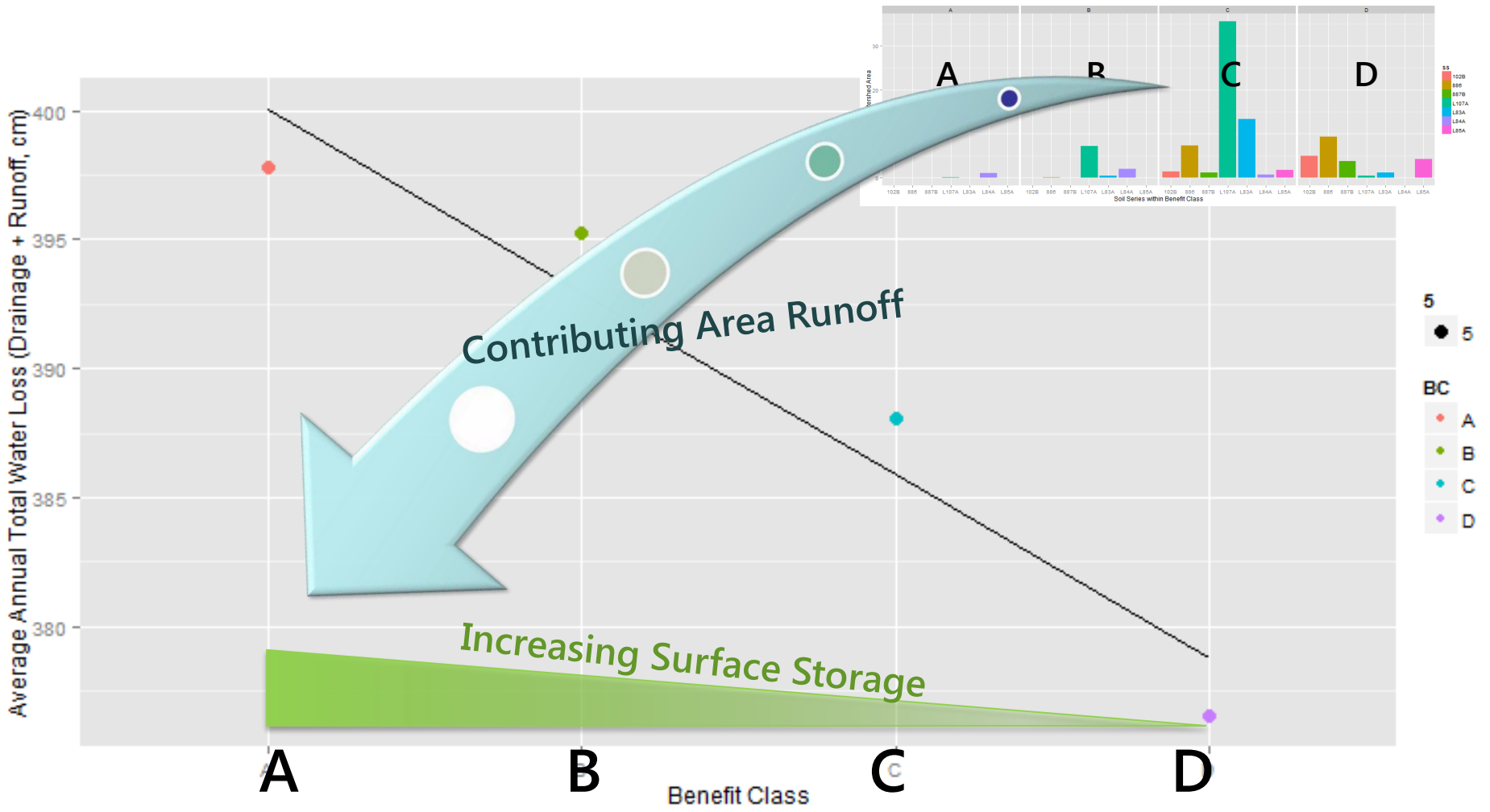
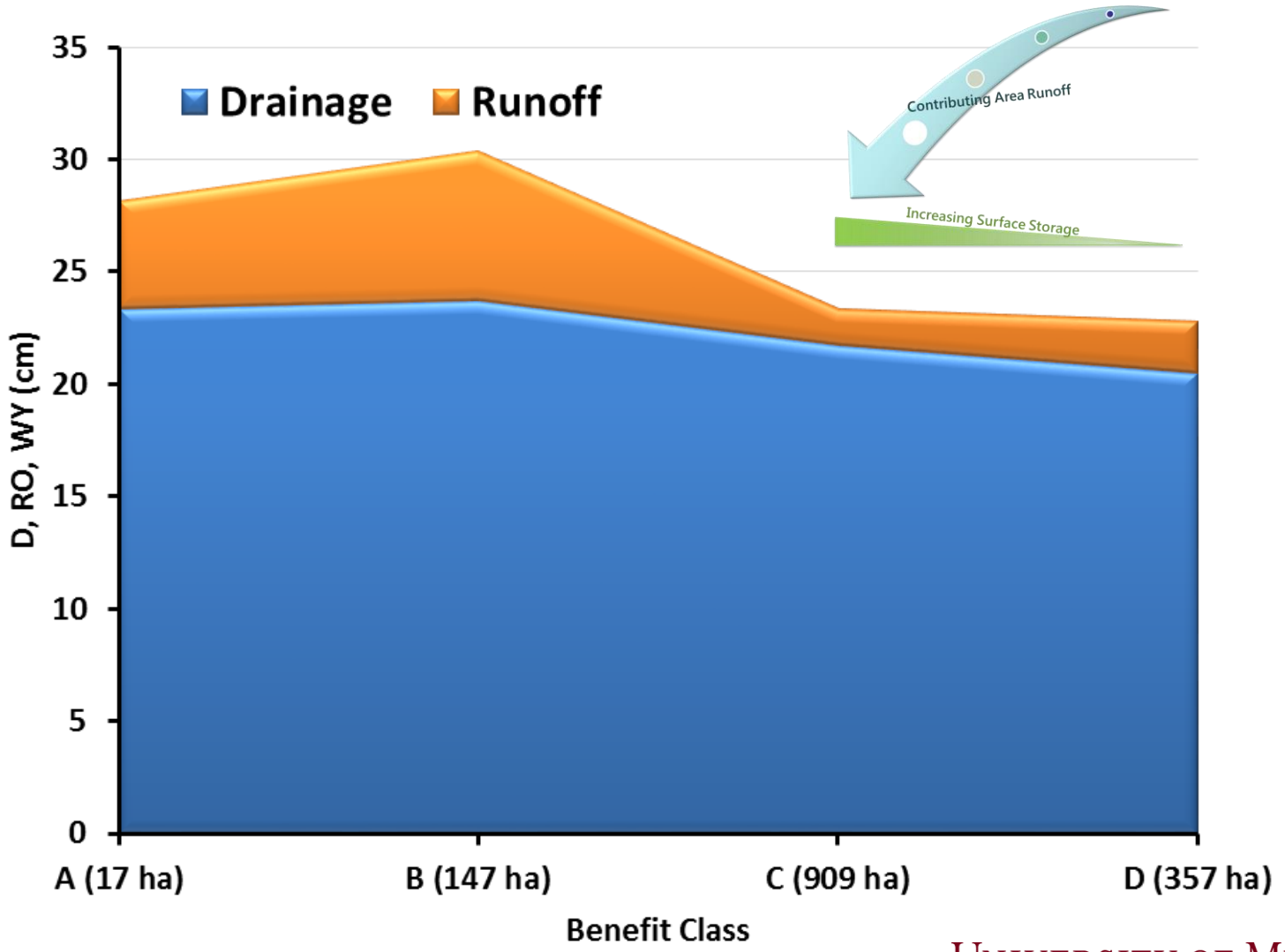
Initial DRAINMOD Simulation

(only variable was soil composition)



Prelim DRAINMOD Simulation

(variable storage and contributing area runoff)



Conservation Approach to Assessing Drainage Benefits in MN

SUMMARY

Summary

- Looking for incentives to conserve water
- Current method has physical basis, but is somewhat heuristic
- GIS framework for determining benefits could add objectivity and efficiency
- Drainage depth-based methods may allow a conservation approach
- Clearer picture upon project completion (2013)

Questions & Comments?

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