

Best Management Practices- A Decision Making Framework



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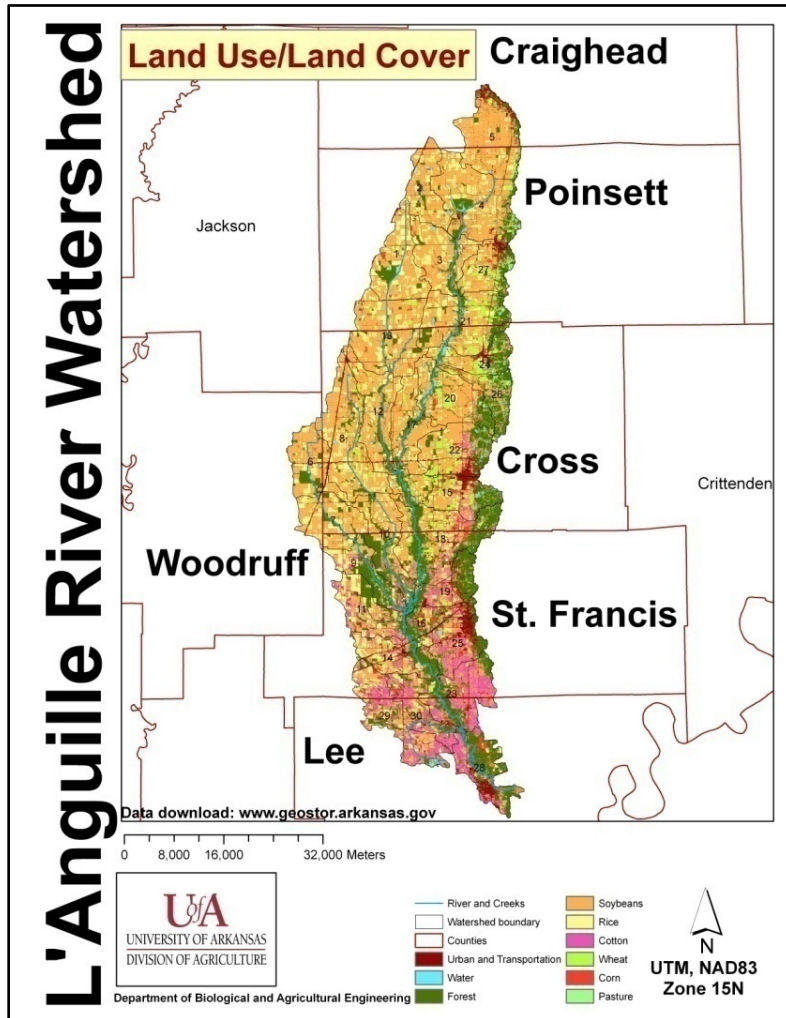
BACKGROUND

- Choice of BMPs is tied to a variety of factors (land use, soil type, slope, proximity to stream, etc.)
- E² based BMP selection and placement is usually practiced
- Number of fields and choice of BMPs are always very large
- Optimal combination of BMPs that meet E² criteria is a challenge from planning perspective
- 10 producers, 4 BMPs
>1 million evaluations¹

¹After Maringanti et al., 2008

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L'ANGUILLE RIVER WATERSHED



(Source: Center for Advanced Spatial Technologies (CAST), 2006)

- 8-digit priority watershed
- 2008 303(d) list
- Sources of impairment
 - ❖ ditching/channelization
 - ❖ Silt loads from row crops
- Area under row crops (70%)
- Reducing source loads through **BMPs**

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➤ Inventory existing BMP practices in L'Anguille

➤ Sources:

1. Arkansaswater.org (319 document database)
2. BMP demonstration reports
3. NRCS
4. Conservation districts
5. Ducks Unlimited
6. Academic literature



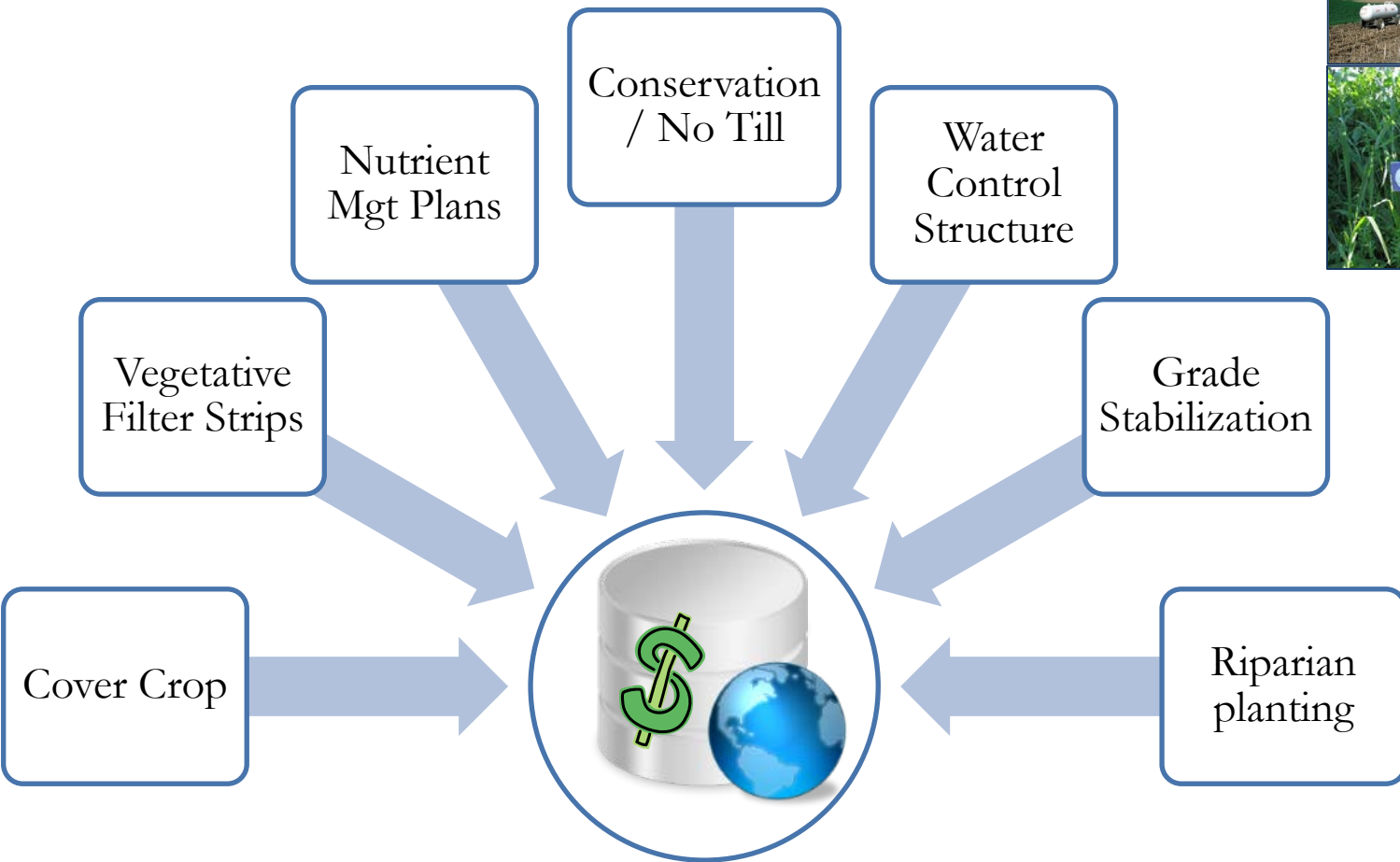
DUCKS
UNLIMITED

**Arkansas Natural
Resources Commission**



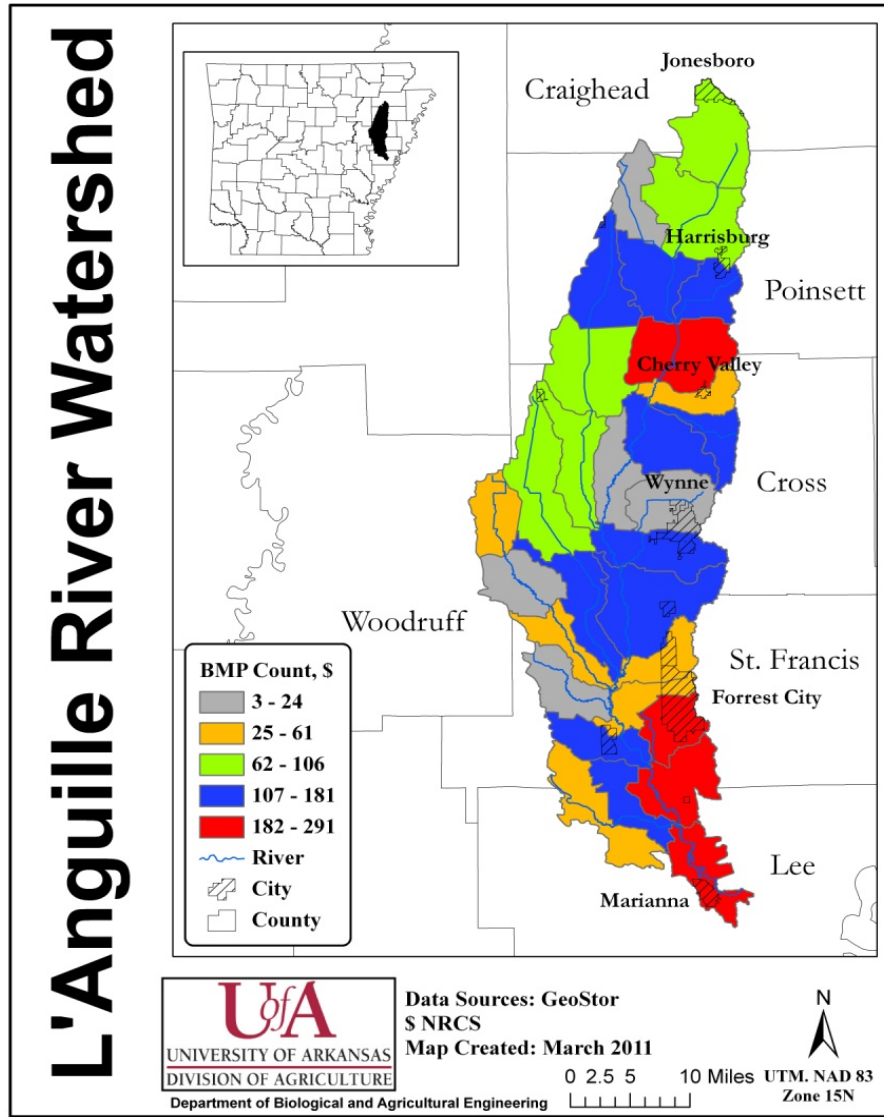
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➤ **Cost information from NRCS eFOTG guide on \$/acre basis**

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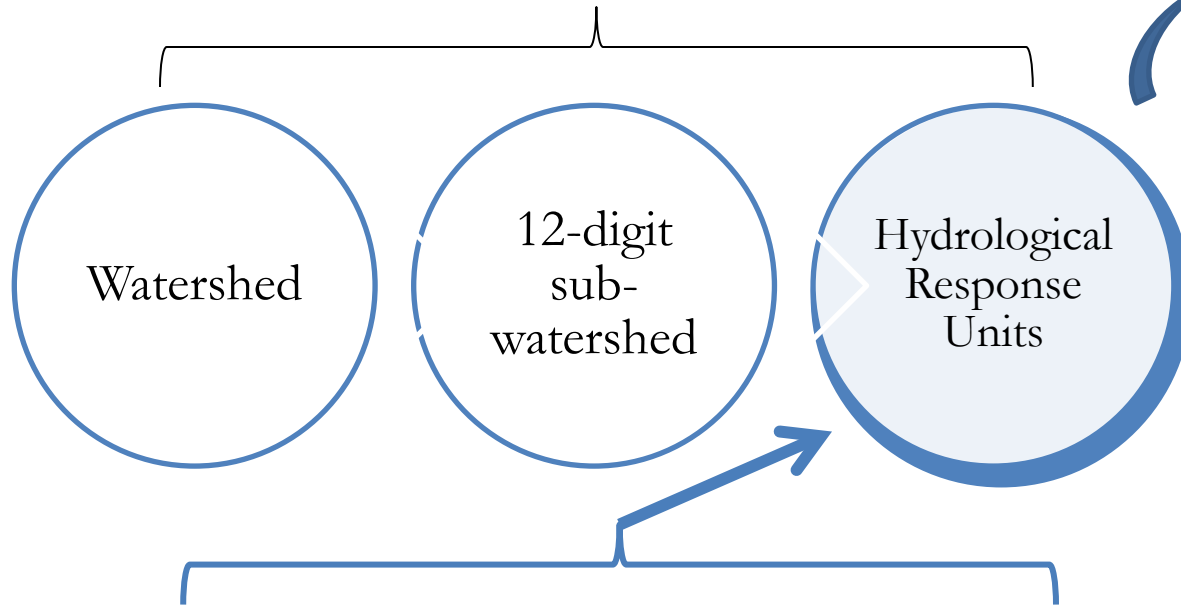


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SWAT BMP REPRESENTATION

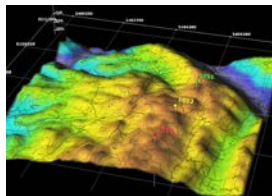
SWAT Watershed Division



Precipitation



Land-uses



Topography



Soil

Crop Growth



Filter Strips

Nutrient Mgt. Plan

No Till

Cover Crop

33 BMP Combinations

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BMP SCENARIOS

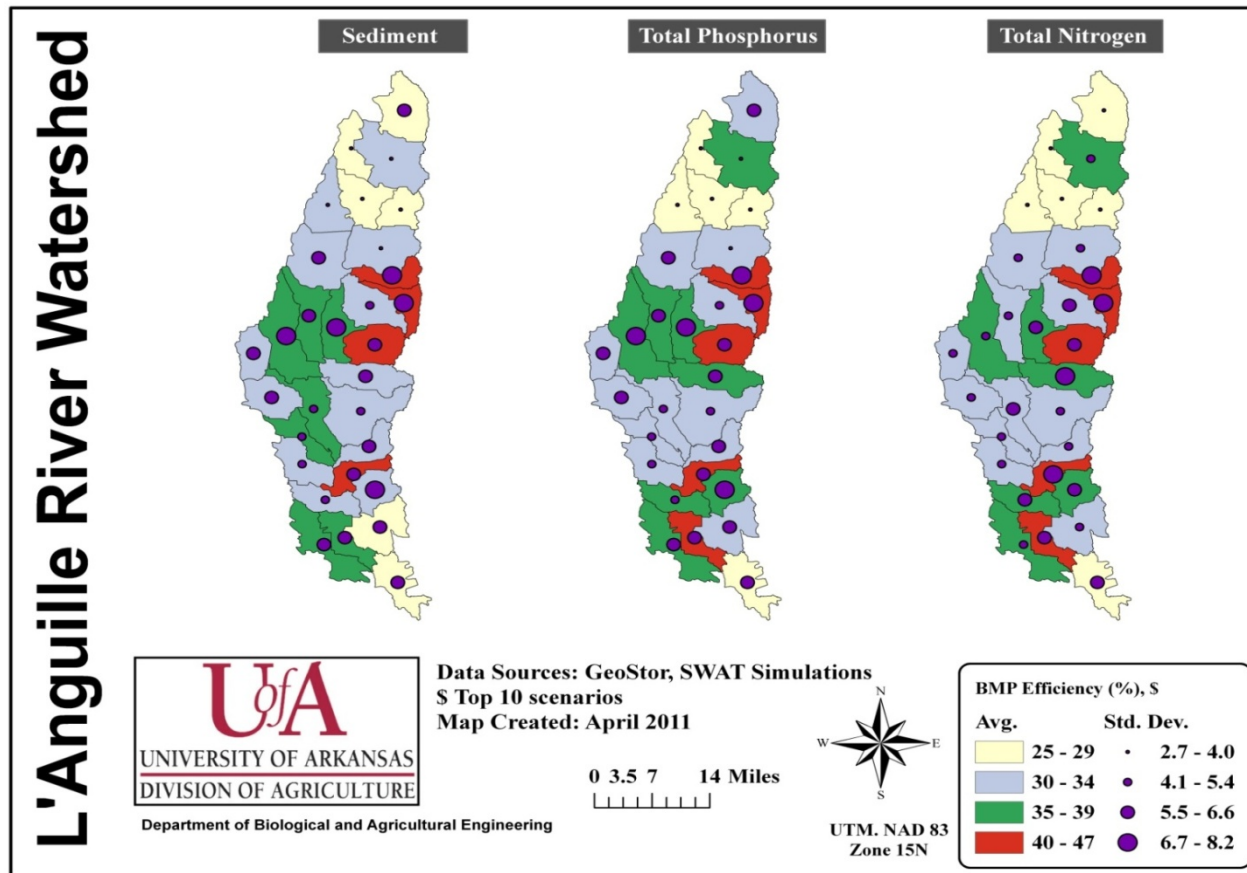
Each scenario was run for a period of 23 years (1986 – 2008) at an annual time stamp.

BMP#	Rice	BMP#	Soybean	BMP#	Cotton
1	with NMP ¹	4	with NMP	19	with NMP
2	with cover crop	5	with no-till	20	with no-till
3	with NMP and cover crop	6	with VFSRatio 10	21	with VFSRatio 10
		7	with VFSRatio 30	22	with VFSRatio 30
		8	with VFSRatio 60	23	with VFSRatio 60
		9	with NMP and no-till	24	with NMP and no-till
		10	with NMP, and VFSRatio 10	25	with NMP, and VFSRatio 10
		11	with NMP, and VFSRatio 30	26	with NMP, and VFSRatio 30
		12	with NMP, and VFSRatio 60	27	with NMP, and VFSRatio 60
		13	with no-till and VFSRatio 10	28	with no-till and VFSRatio 10
		14	with no-till and VFSRatio 30	29	with no-till and VFSRatio 30
		15	with no-till and VFSRatio 60	30	with no-till and VFSRatio 60
		16	with NMP, no-till, and VFSRatio 10	31	with NMP, no-till, and VFSRatio 10
		17	with NMP, no-till, and VFSRatio 30	32	with NMP, no-till, and VFSRatio 30
		18	with NMP, no-till, and VFSRatio 60	33	with NMP, no-till, and VFSRatio 60

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BMP EFFECTIVENESS

$$\text{BMP Load Effectiveness (\%)} = \frac{(\text{PreBMP Annual Load} - \text{PostBMP Annual Load})}{\text{PreBMP Annual Load}} \times 100$$

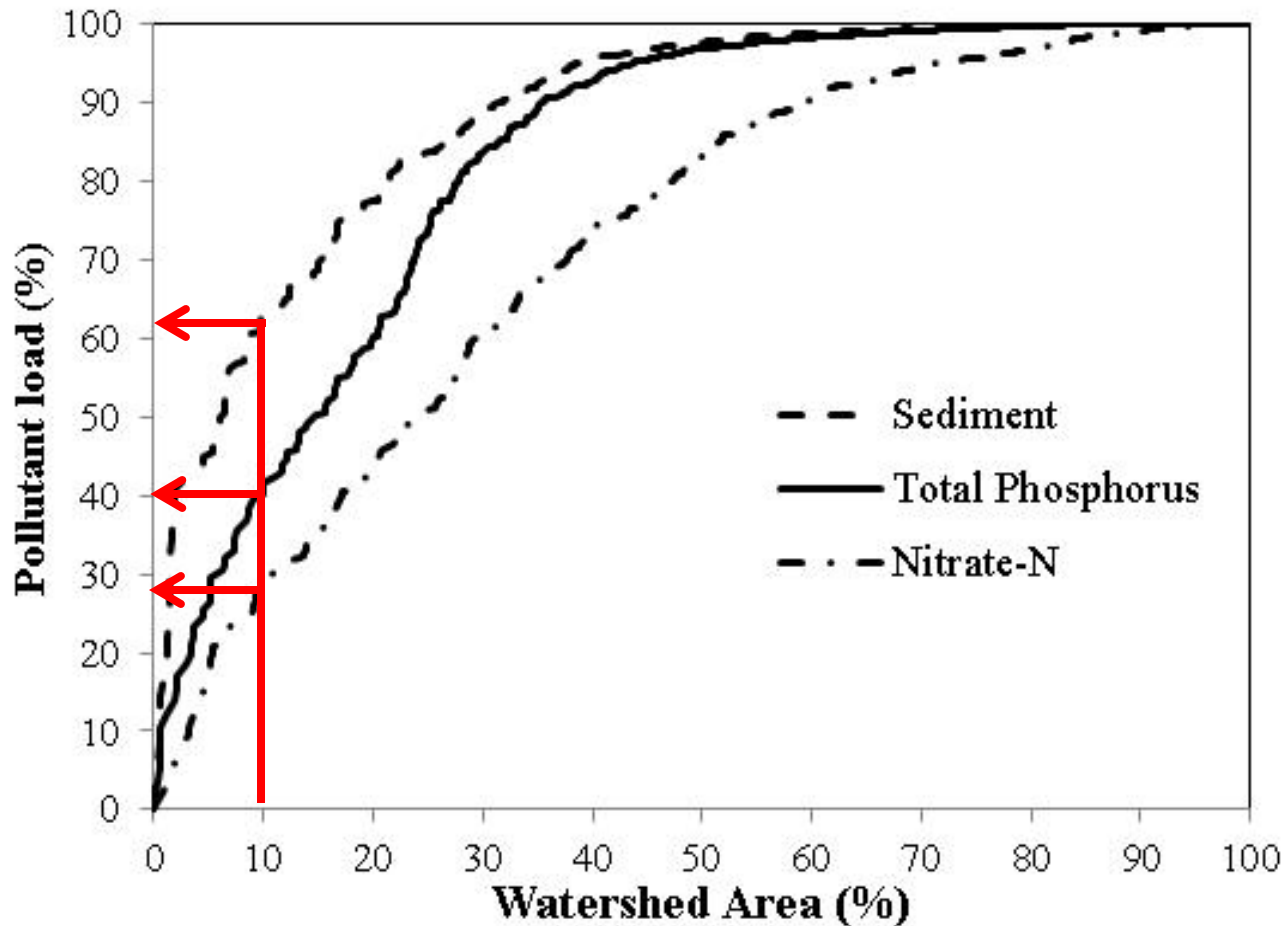


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WHY OPTIMIZE SPATIALLY?

➤ Non-uniform pollutant contribution



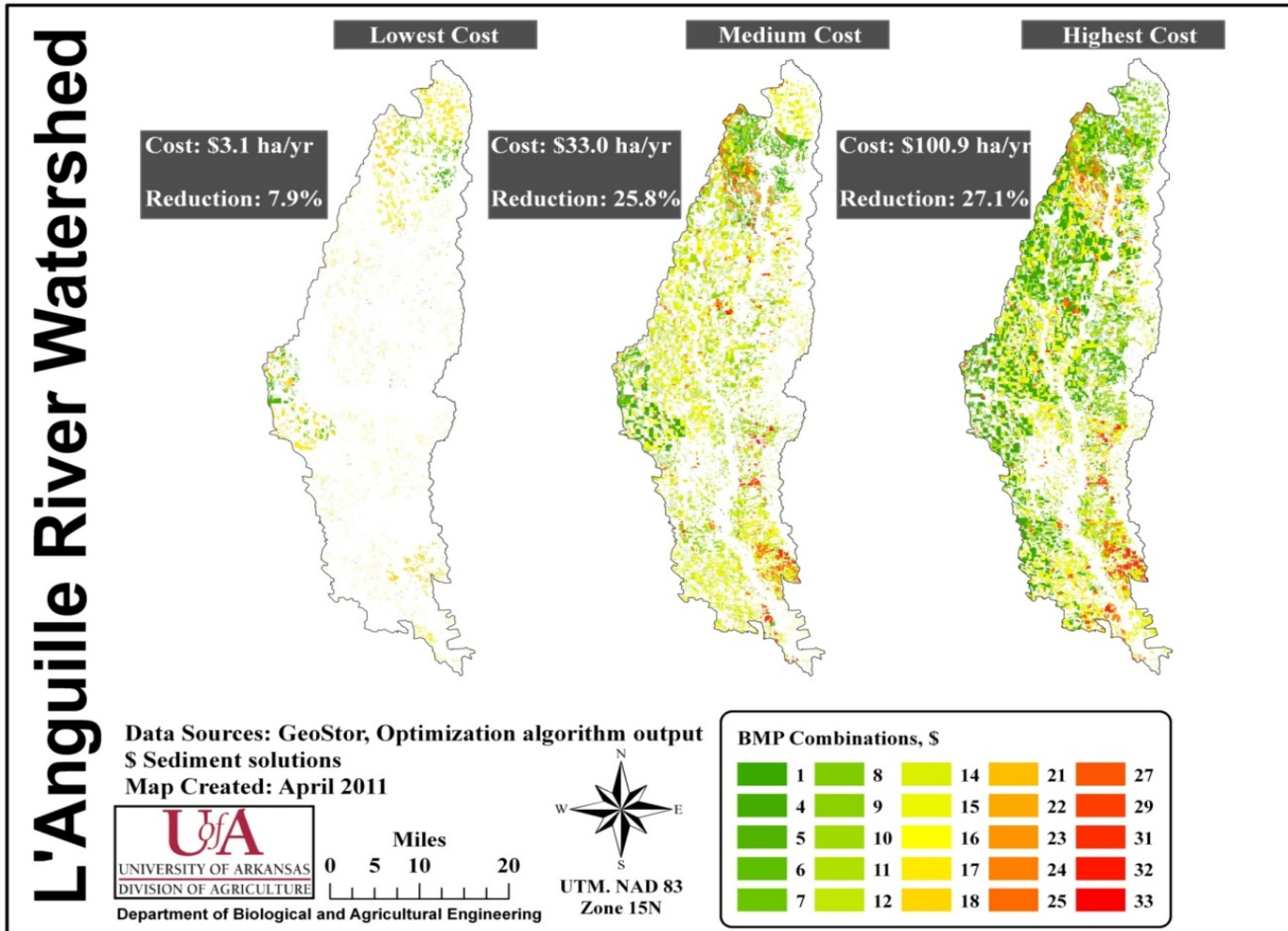
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- Computational challenge
 - 33 BMP combination possibilities
 - 833 HRUs
 - 23-year model run; daily basis
 - Minimize cost Vs. maximize BMP efficiency
- Artificial intelligence techniques on AHPCC used to reduce computations load¹
- Identify optimal locations for placing BMPs



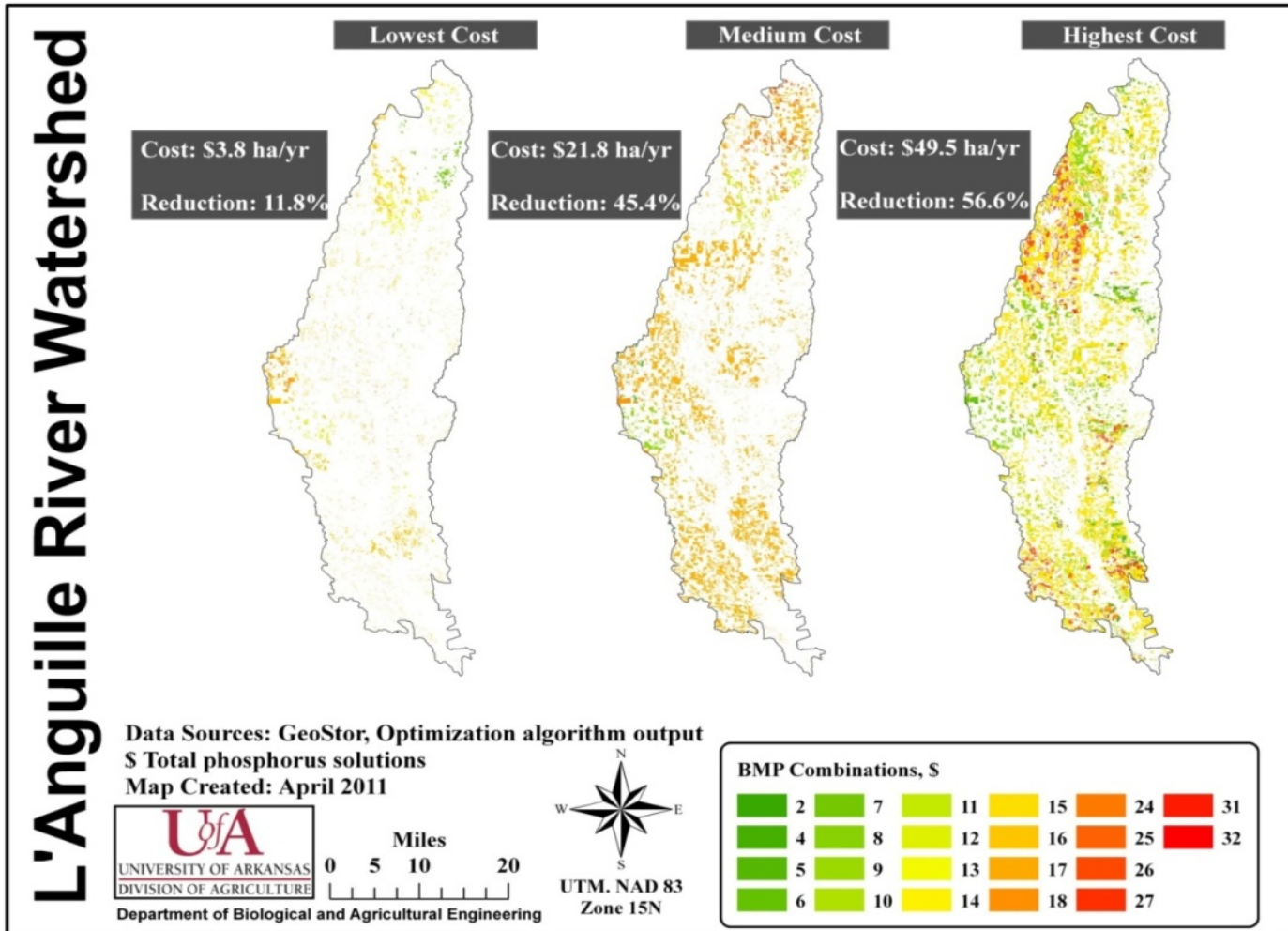
¹Maringanti et al. (2009)

SEDIMENT OPTIMIZATION



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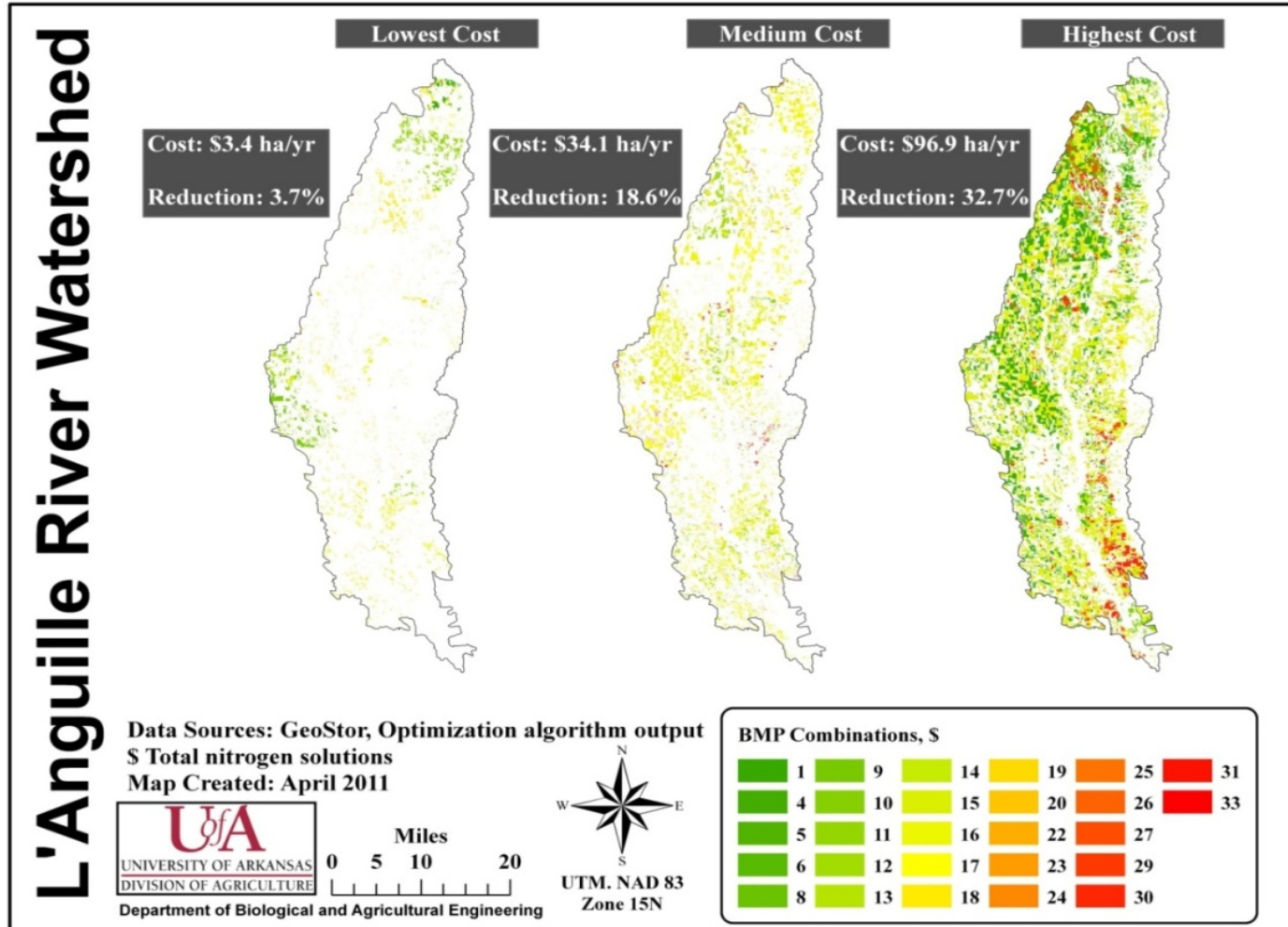
PHOSPHORUS OPTIMIZATION



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NITROGEN OPTIMIZATION



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- **BMP database for LRW developed**
- **33 BMP scenarios evaluated over 23 year period**
- **Spatially optimized for maximum WQ benefits at least cost using AI techniques**
- **Multiple BMP combination was more effective compared to single BMP**
- **This approach could be extended to other watersheds in the state**

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ACKNOWLEDGEMENTS

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QUESTIONS/SUGGESTIONS

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