Assessing the Spatial Distribution of Agricultural Conservation Practices Implemented Along a Northern Utah Watershed:

Did Practices Target Critical Areas?

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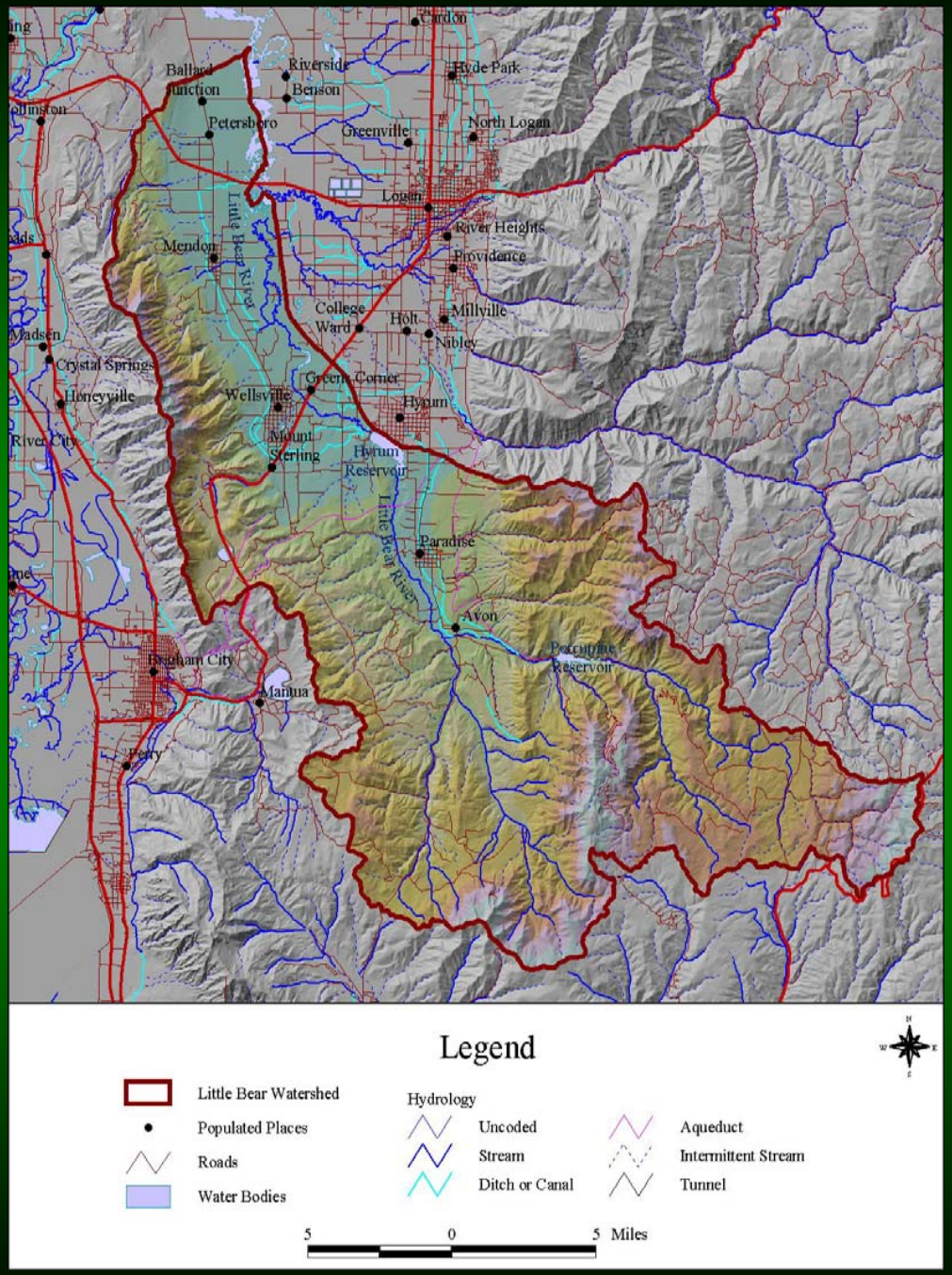
Background

- **Little Bear River:**

  682 km^2 of primarily agricultural lands
  - 70% grazing land and forests
  - **19% irrigated cropland**
  - **7% dry cropland**
  - > 50 dairies & beef/horses
- **Problem = P runoff**
- Priority Watershed 1990-2003
- Voluntary cost -share programs.



Background

Conservation Effects Assessment Program (CEAP) Competitive Grant Program

<u>Program Goal</u>: " *…explicitly investigate the linkages among a variety of conservation and land management practices as implemented over space and time and the resultant effects on water quality*". (Mausbach and Dedrick 2004).

Specific Research Questions

- What is the spatial distribution of conservation practices (BMPs) within the watershed?
- Is there evidence that the BMPs implemented specifically targeted critical areas?
  - **Critical Areas**: *areas where the potential contribution of pollutants (i.e., sediments, phosphorus) to the receiving water is significantly higher than other areas*

Methods Overview

BMP Spatial Distribution

- Digitized BMPs
  - NRCS Files (maps)
  - Landowner input
- Geo-Database
  - Contract
  - Interview

Critical Area Assessment

- Map overlays
  - -Soil (k)
  - -Slope
  - -Land Use
  - -Water course
  - ➢ Critical Area Map

Contrasted BMP spatial distribution against map of Critical Areas

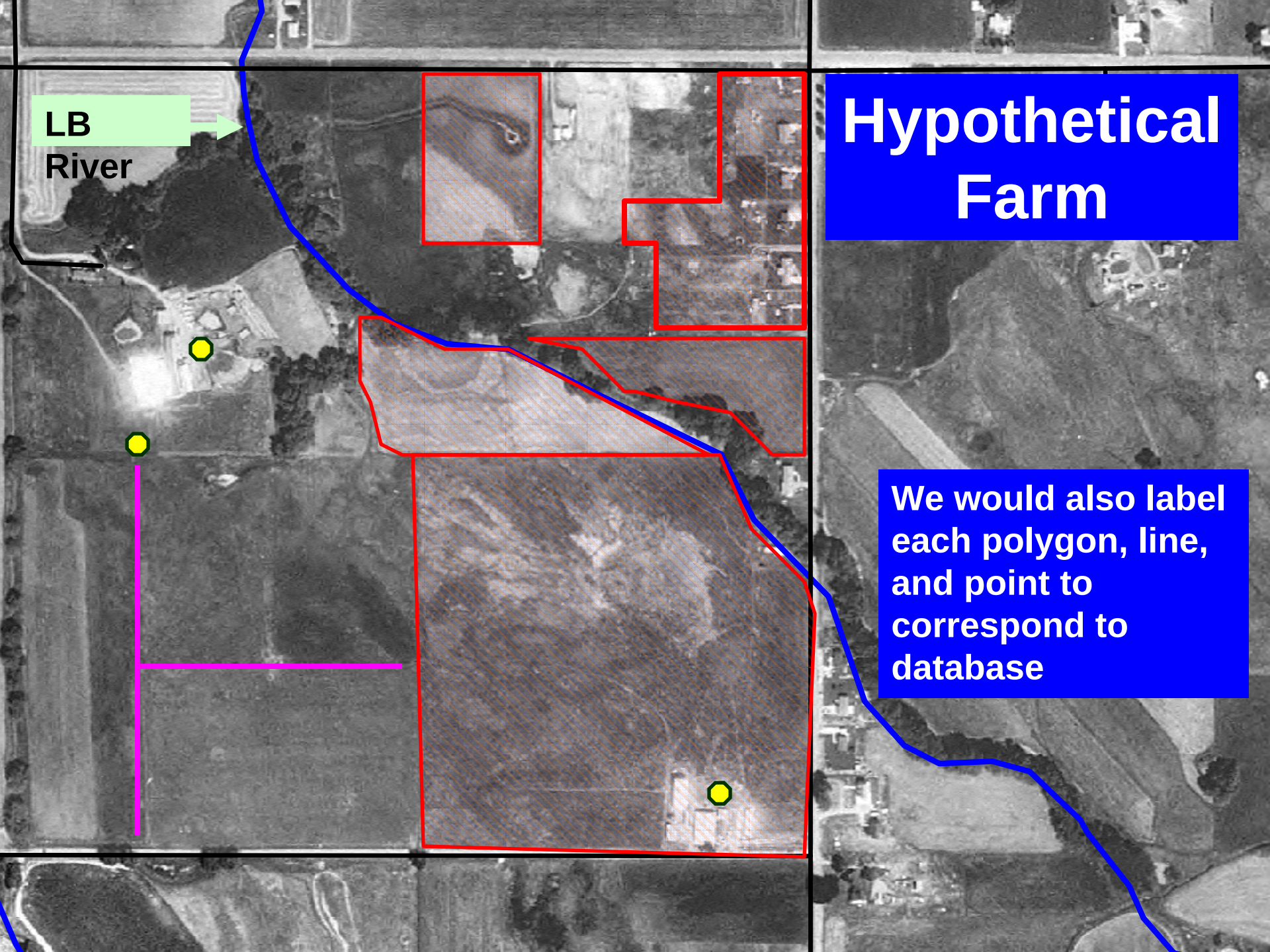
Methods: BMP spatial distribution

- **Contract Data: Formal practice info from NRCS files**
  - Worked in county USDA/NRCS office
  - Went through every file associated with LBR Watershed project (90 landowners)
  - Locate in time & space
  - Copied key maps for interviews

- **Interview Data: Field interviews with participants**
  - 55 landowners
  - Validate file information: timing, **location**, involvement experience
  - Modified maps accordingly

Methods: BMP Spatial Distribution

- **Digitized contract and interview data**
  - Points (e.g., waste storage)
  - Lines (e.g., fencing)
  - Polygons (e.g., Nutrient Management)
- **Created geo-databases for contract and interview datasets**



Hypothetical Farm

We would also label each polygon, line, and point to correspond to database

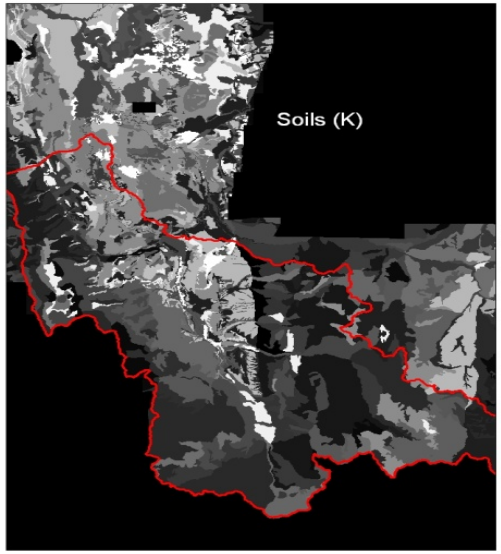
Prop ID	GIS Ref. #	GIS type	Practice Code	Applied Units	Practice Units	Intended End Date	Structure or Event Certified Complete	Mgmt start date (spring of this year)	Mgmt end date (fall of this year)	Notes
1	1-A1	polygon	312	1	plan	Oct-96	10/21/96	NA	NA	a plan to put in the facilities and store when speading is not feasible
1	1-B1	point	313	1	structures	Oct-95	10/16/95	NA	NA	solid and liquid storage facilities
1	1-B1	point	313	1	structure		10/16/95	NA	NA	
1	1-C1	point	313	1	structure	Oct-95	12/05/95	NA	NA	animal holding areas/stalls as a manure containment method
1	1-A2	polygon	382	1750	feet of fence	Dec-95	12/4/1995	NA	NA	all the way around a pasture but it protects Hyrum Slough to the East
1	1-D1	line	382	350	feet of fence	Dec-95	12/4/1995	NA	NA	along Hyrum Slough to prevent cattle in stream and erosion. Jay thinks this may not have happened and actually they convinced him to abandon this area
1	1-E1	polygon	645	62.3	acres	NA	NA	Jan-95	09/26/95	wildlife habitat
1	1-F1	polygons	645	116.3	acres	NA	NA	Jan-96	11/08/96	wildlife habitat
2	NONE	NONE	312	1	nagement System	09/01/00	09/20/00	NA	NA	Waste storage facility was constructed properly.
2	2-A2	point	313	1	e Storage Facitlity	09/01/00	09/20/00	NA	NA	see comment
2	2-B1	polygon	449	36	acres	NA	NA	Jun-96	09/29/97	Irrigation water management- irrigate to meet peak demand of the crop. Specifics were given: Alfalfa- 9 days, Small grain- 12 days, Corn- 16 days.
2	2-C1	polygon	449	479	acres	NA	NA	Jun-95	09/29/97	Irrigation water management- irrigate to meet peak demand of the crop. Specifics were given: Alfalfa- 9 days, Small grain- 12 days, Corn- 16 days.
2	2-B2	polygon	510	36	acres	NA	NA	May-96	09/29/97	Pasture and Hayland Mgmt.
2	2-C2	polygon	510	479	acres	NA	NA	May-95	09/29/97	Pasture and Hayland Mgmt.
2	2-B3	polygon	633	36	acres	NA	NA	Jan-96	09/29/97	Waste utilzation
2	2-C3	polygon	633	479	acres	NA	NA	Jan-95	09/29/97	Waste utilzation
2	2-A1	point	634	1	e Transfer System	09/01/00	09/20/00	NA	NA	Liquid waste pump
2	2-D1	polygon	645	94	acres	NA	NA	Jan-95	09/27/95	Upland Wildlife Magmt- Wildlife secondary concern. Maintained vegetation along roadways and fences for wildlife cover and feed.
2	2-E1	polygon	645	96	acres	NA	NA	Jan-95	09/29/97	Upland Wildlife Magmt- Wildlife secondary concern. Maintained vegetation along roadways and fences for wildlife cover and feed.
2	NONE	NONE	991	479	acres	NA	NA	Jan-95	09/29/97	Record Keeping- Attended a training course to learn how to keep records properly.
3	3-B3	line	322	0.2	acres	9/1/2001	04/07/02	NA	NA	at intersection of 3 fields
3	3-A1	line	382	1453	feet of fence	9/1/2001	05/15/01	NA	NA	cross fencing
3	3-B1	line	382	4500	feet of fence	9/1/2000	04/07/02	NA	NA	drainpipe from water control structures
3	3-F1	line	430	40	feet of pipe	9/1/2000	08/16/00	NA	NA	structure for water control
3	3-H2	polygon	449	9.8	acres	NA	NA	Jun-96	10/22/96	channel vegetation
3	3-H1	polygon	464	9.8	acres	9/1/1996	10/22/96	NA	NA	riparian fencing

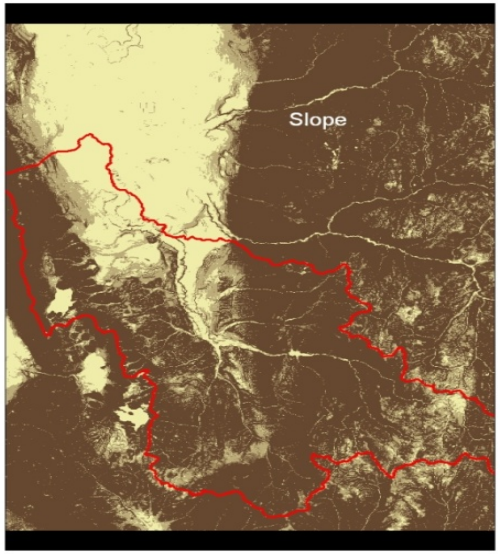
Methods: Critical Area Assessment

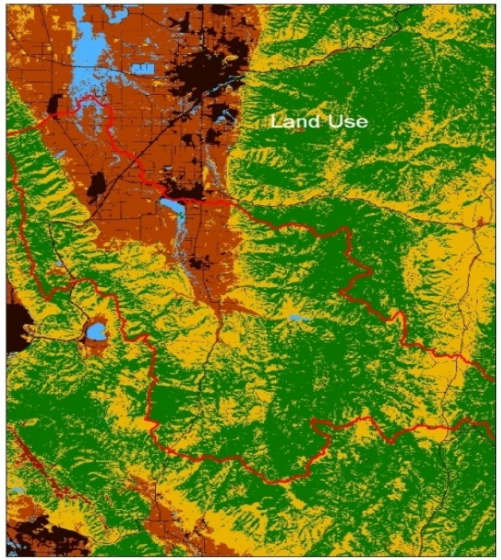
- GIS METHOD *(Sivertun et al, 1988 and 2003)*
  - Focus on selecting critical areas for problems of sediment-related water quality
  - Based on USLE *(Wischmeier and Smith 1978)*
  - Map overlays: simple raster multiplication

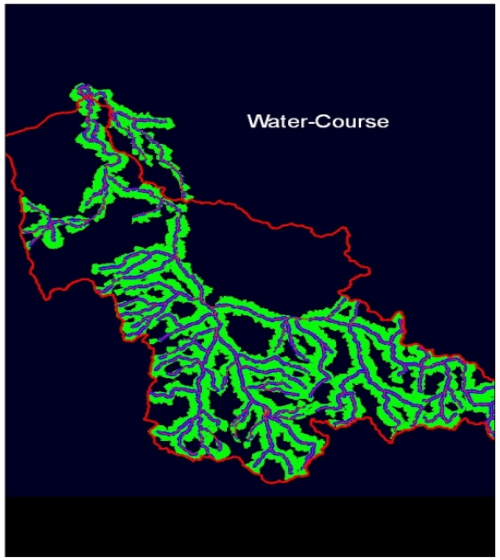
$$P = K * S * U * W$$

  - 4 Digitized factors maps
    - **Soil (K):** Soil Survey Geographic (SSURGO) database
    - **Slope (S):** From USGS National Elevation Dataset (NED); analyzed using terrain analysis software (TauDEM)
    - **Land Use (U):** Utah State Geographic Information Database (SGID)
    - **Water Course (W)**: River network and analysis of proximity to surface water

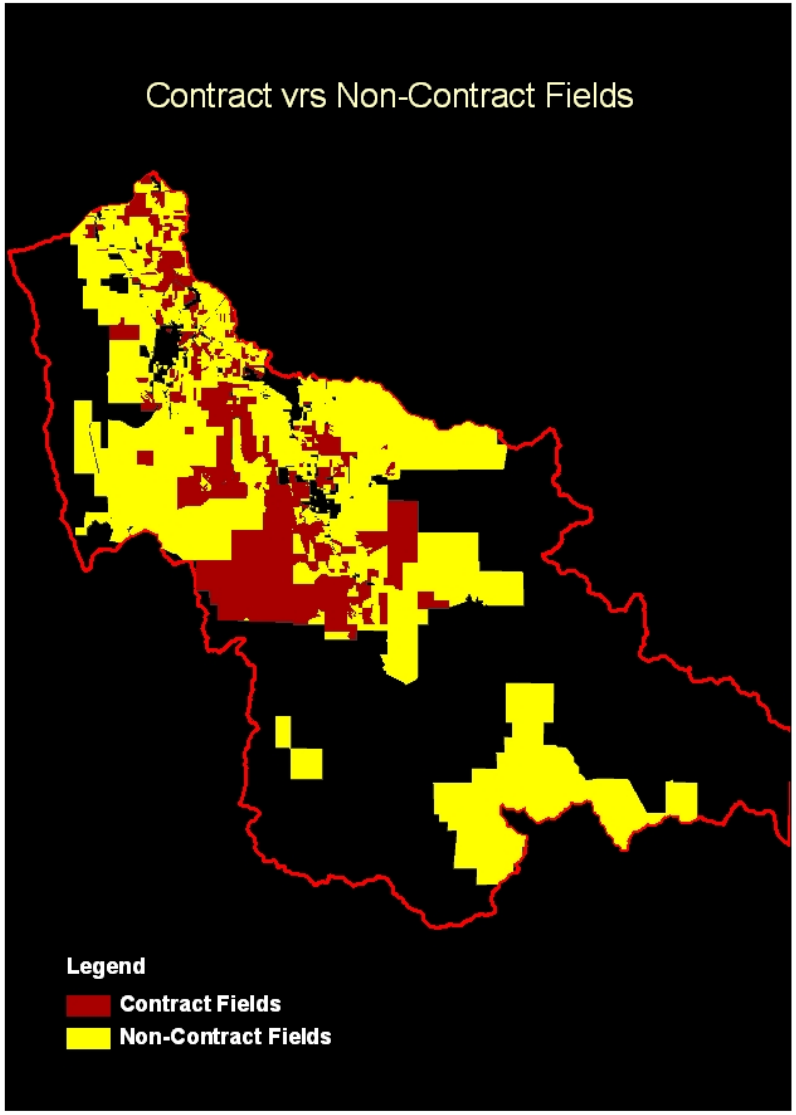

Soils (K)


Slope

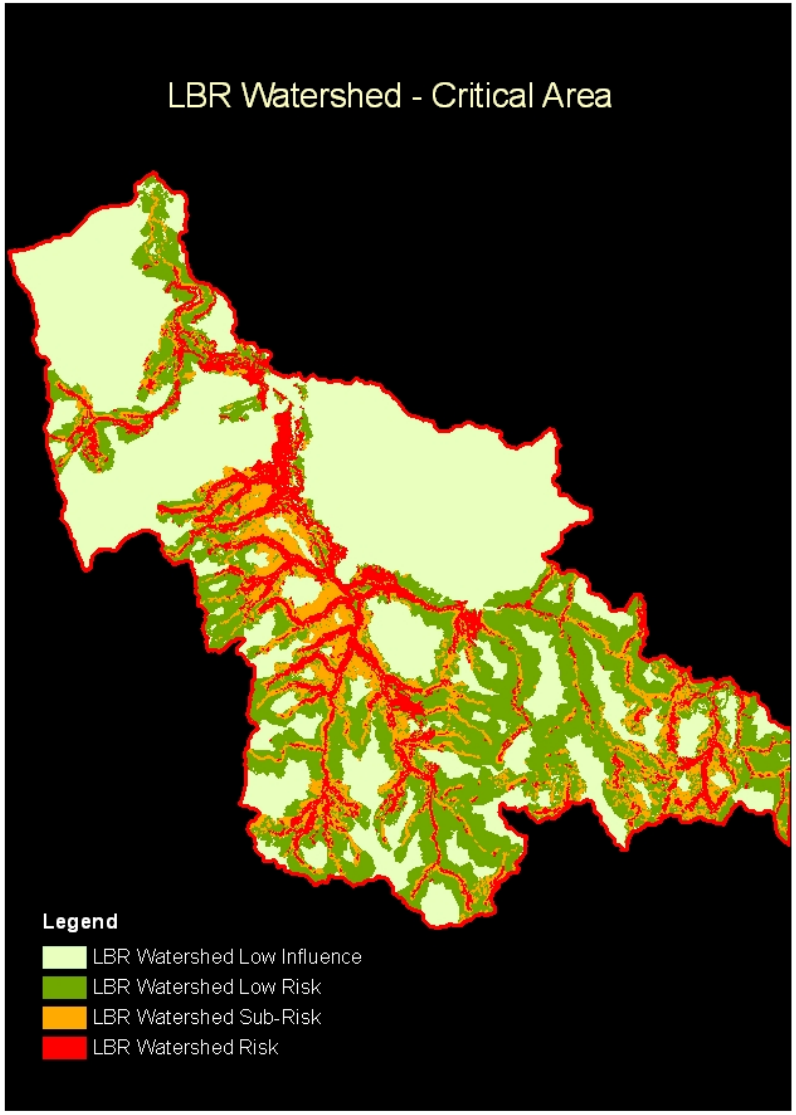

Land Use


Water-Course

Results



	Area (km^2)	%
Total LBR Watershed	682	
Farm Fields	312	46 %
Non-Contract	**232**	**74 %**
Contract	**80**	**26 %**



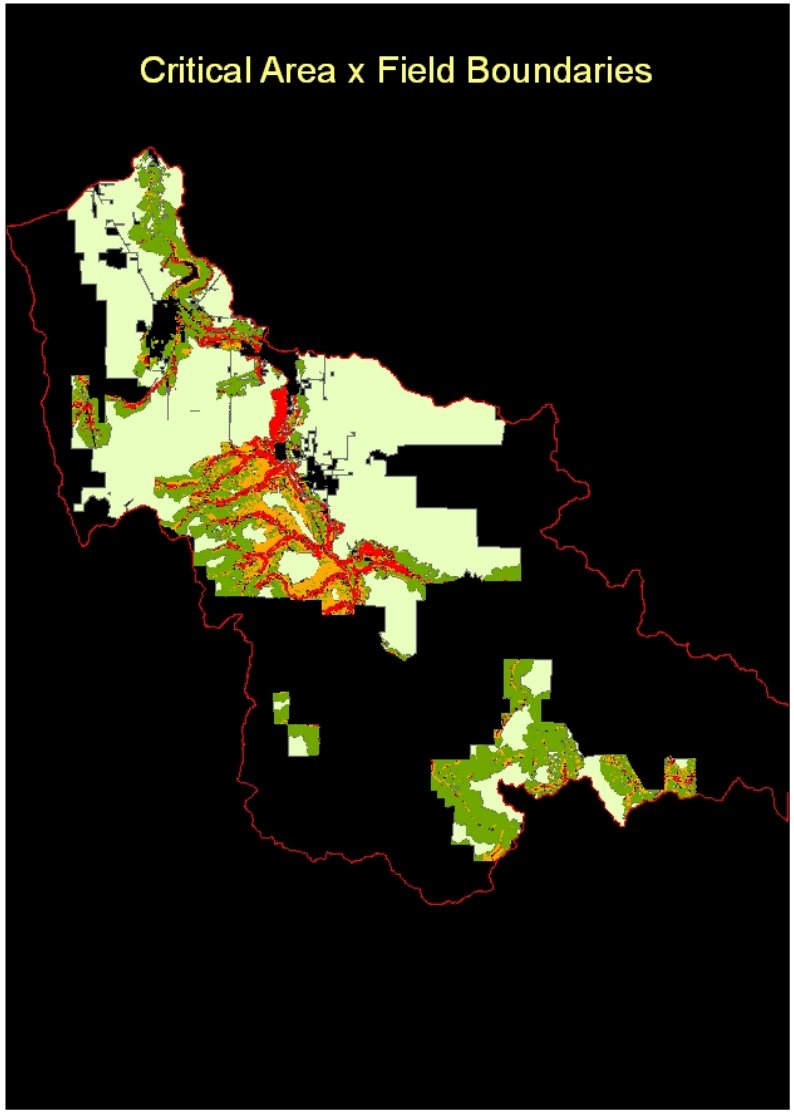
P = K * S * U * W

Range= 0 – 22,500

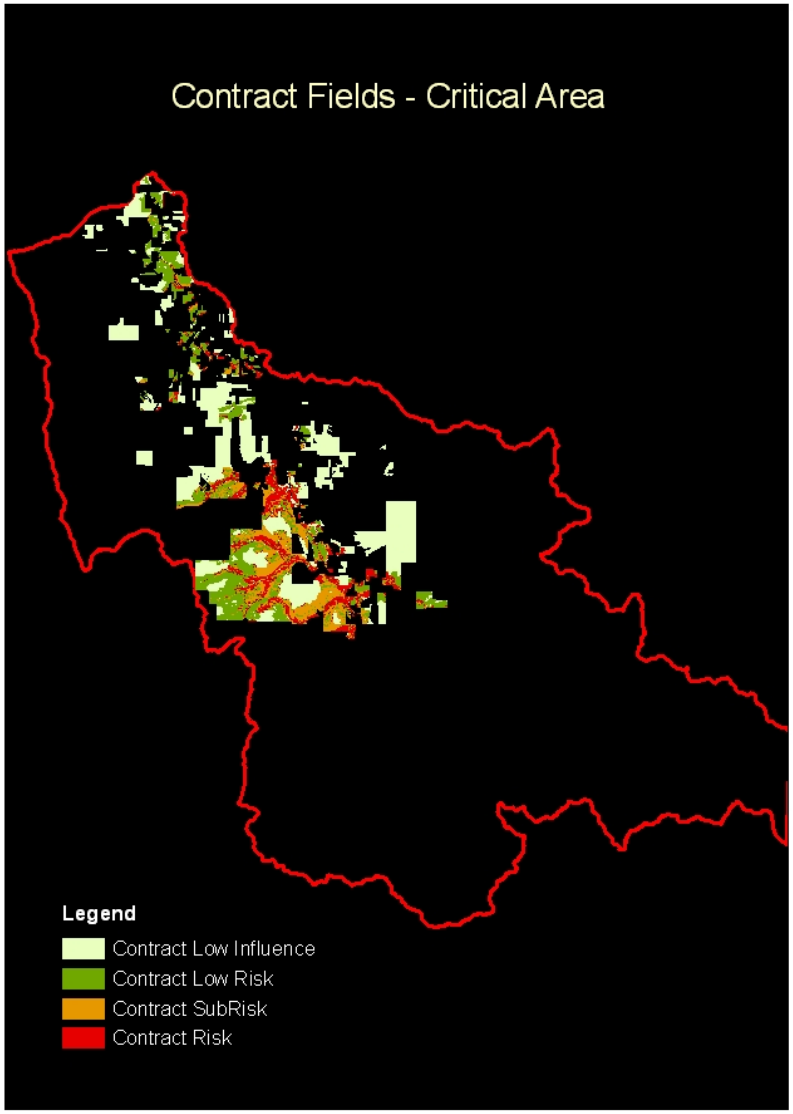
Mean = 99

SD= 320

Critical Area	LBR Watershed (Km^2)	%
Low Influence [< mean]	365	53
Low Risk [0-1 SD]	225	33
Sub-Risk [1-2 SD]	57	8
Risk [> 2 SD]	35	5
Total	682	100



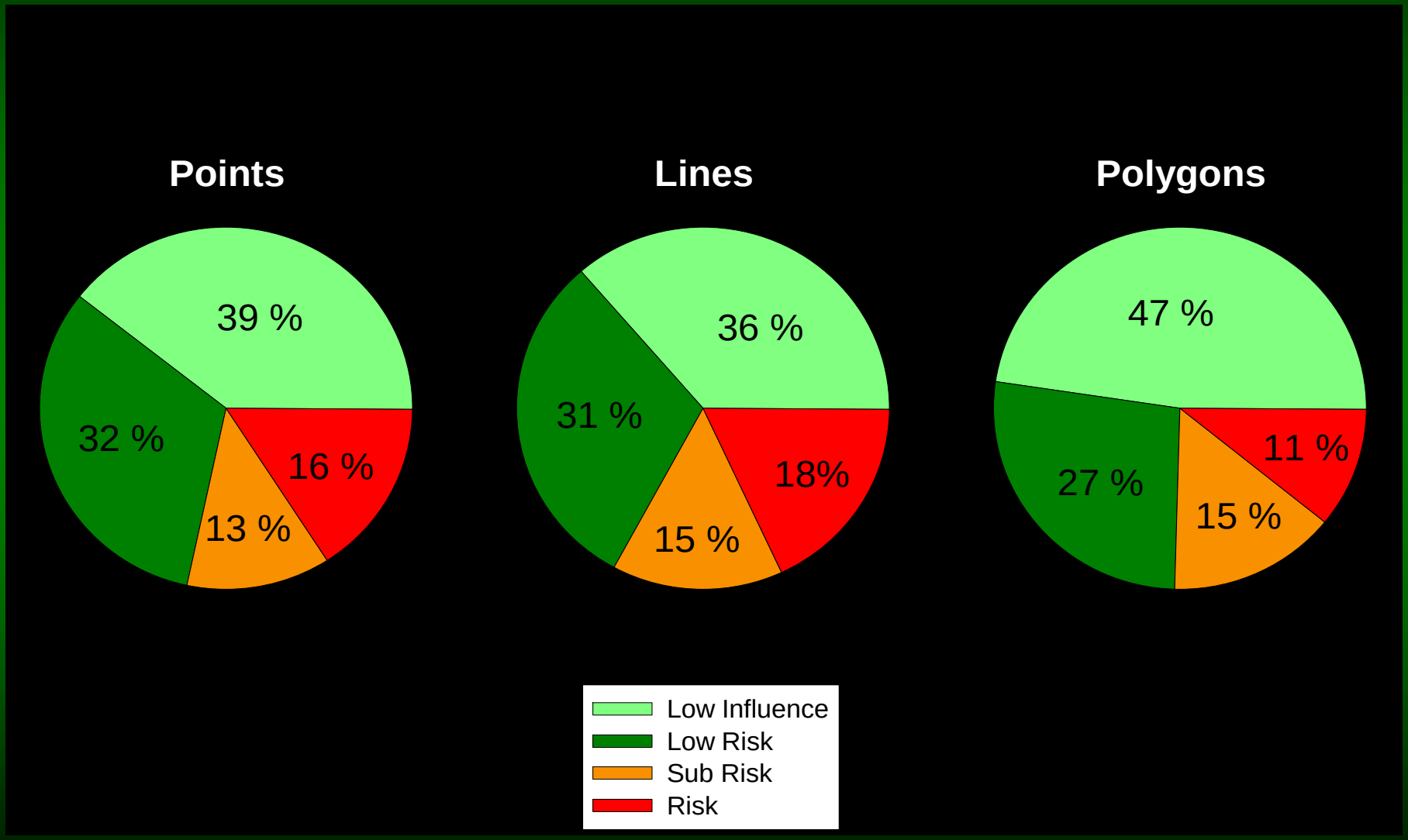
Critical Area	Farm Fields (Km2)	%
Low Influence	191	61
Low Risk	77	25
Sub-Risk	24	8
Risk	20	6
Total	312	100



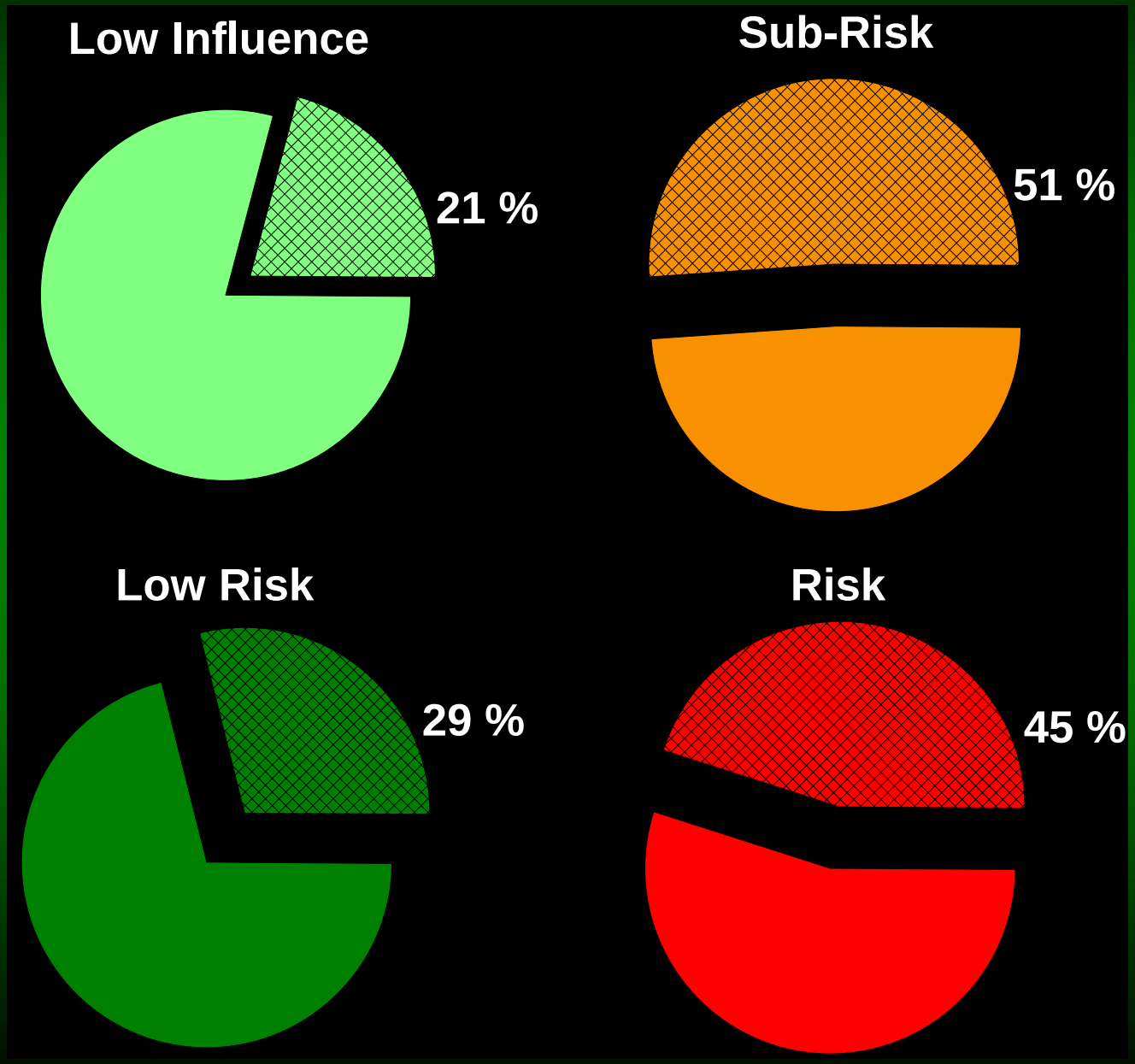
Critical Area	Contract Farm Fields (Km^2)	%
Low Influence	38	47
Low Risk	21	26
Sub-Risk	12	15
Risk	9	11
Total	80	100

Critical Area	Farm Fields (Km^2)	Contract Farm Fields (Km^2)	%
Low Influence	191	38	20
Low Risk	77	21	27
Sub-Risk	24	12	51
Risk	20	9	43
Total	312	80	26

Percent of Practice Area within Risk Categories



Relative coverage of contract polygons



Conclusions

- Targeting occurred
  - Practices found in Risk & Sub-risk areas at higher rates than expected if no targeting
  - Conservation practices were implemented on a substantial proportion of Risk and Sub-Risk areas within contract fields.
  - About half of the Risk Area within field boundaries has not been targeted (i.e., total risk area in non-contract fields).
  - Significant efforts still directed at areas of Low Influence & Low Risk.

Future Research Questions

- What types of practices were more prevalent in critical areas?
- Are there any relationships between practices maintained and their spatial distribution?

Acknowledgements

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