Modeling Tools Overview

Buck Creek WPP Development Project

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Land Use Analysis

- Use of aerial or satellite imagery to characterize the vegetation, water, natural surface, and cultural features on the land surface

- Several national datasets are available, but they are dated (1992 or 2001)

- TAMU Spatial Sciences Lab used recent imagery to develop current dataset for entire Buck Creek watershed

Watershed Inventory

- Watershed boundaries
- County boundaries
- Major roads
- County Roads
- Creeks, drainages, ponds, etc.
- WWTPs
- CAFOs
- City or Town boundaries
- Census data
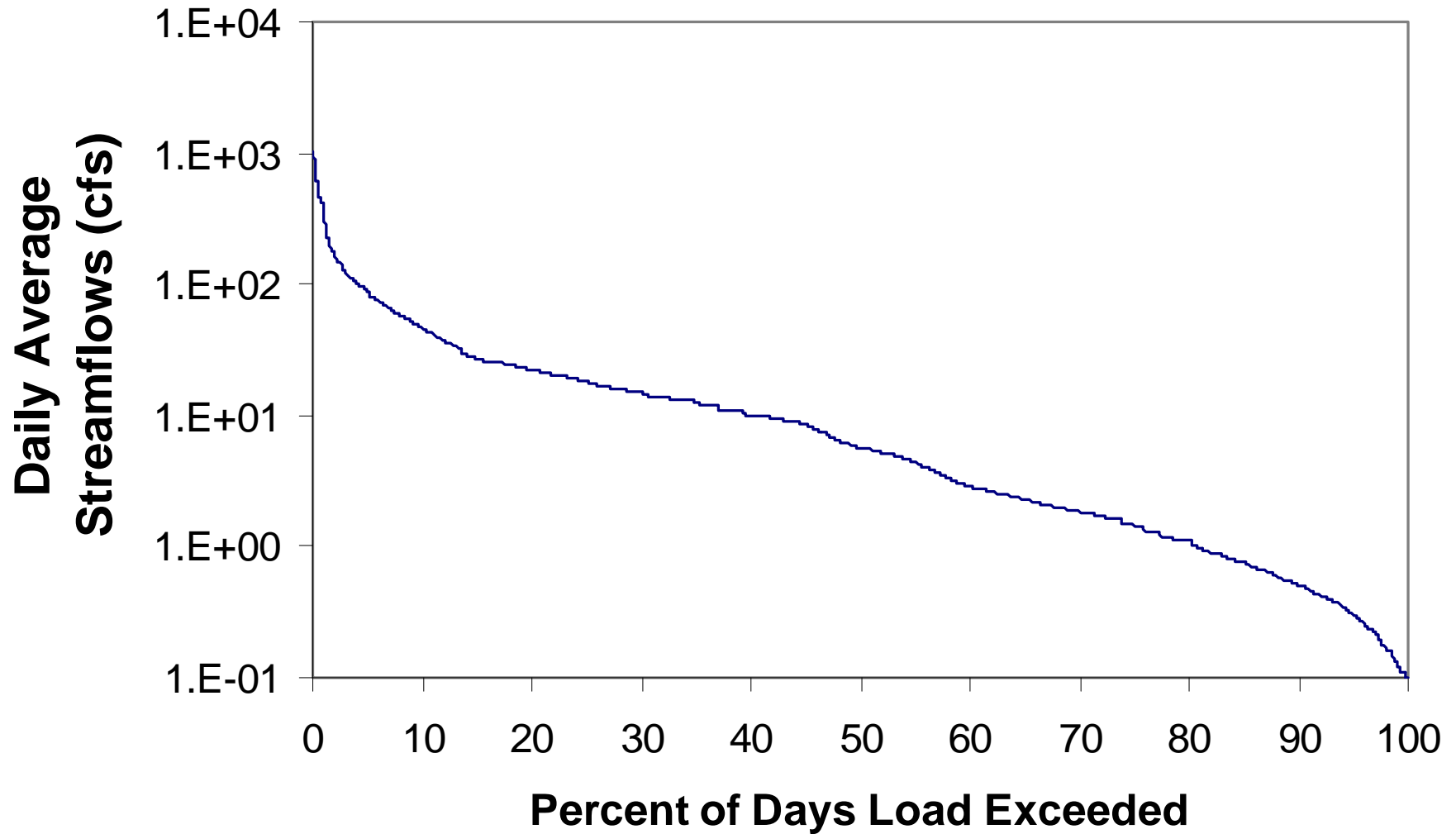- Livestock Data
- Wildlife Data
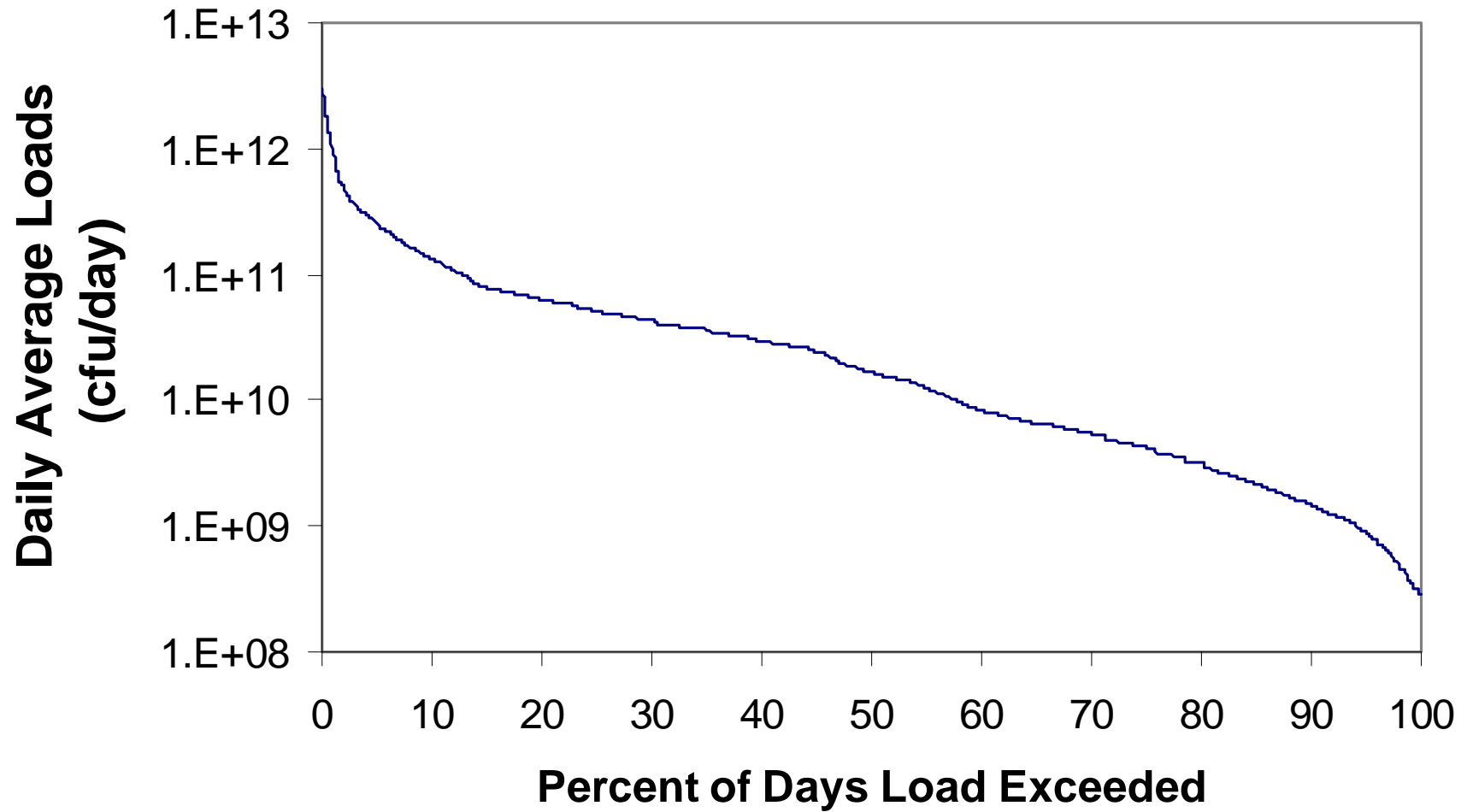
Load Duration Curve (LDC) Analysis

What is an LDC?

- Graphical representation of streamflow and pollutant loadings

- Real data can be compared to the stream's maximum load to indicate reductions needed

- Can *HELP* to identify the type of pollutant load

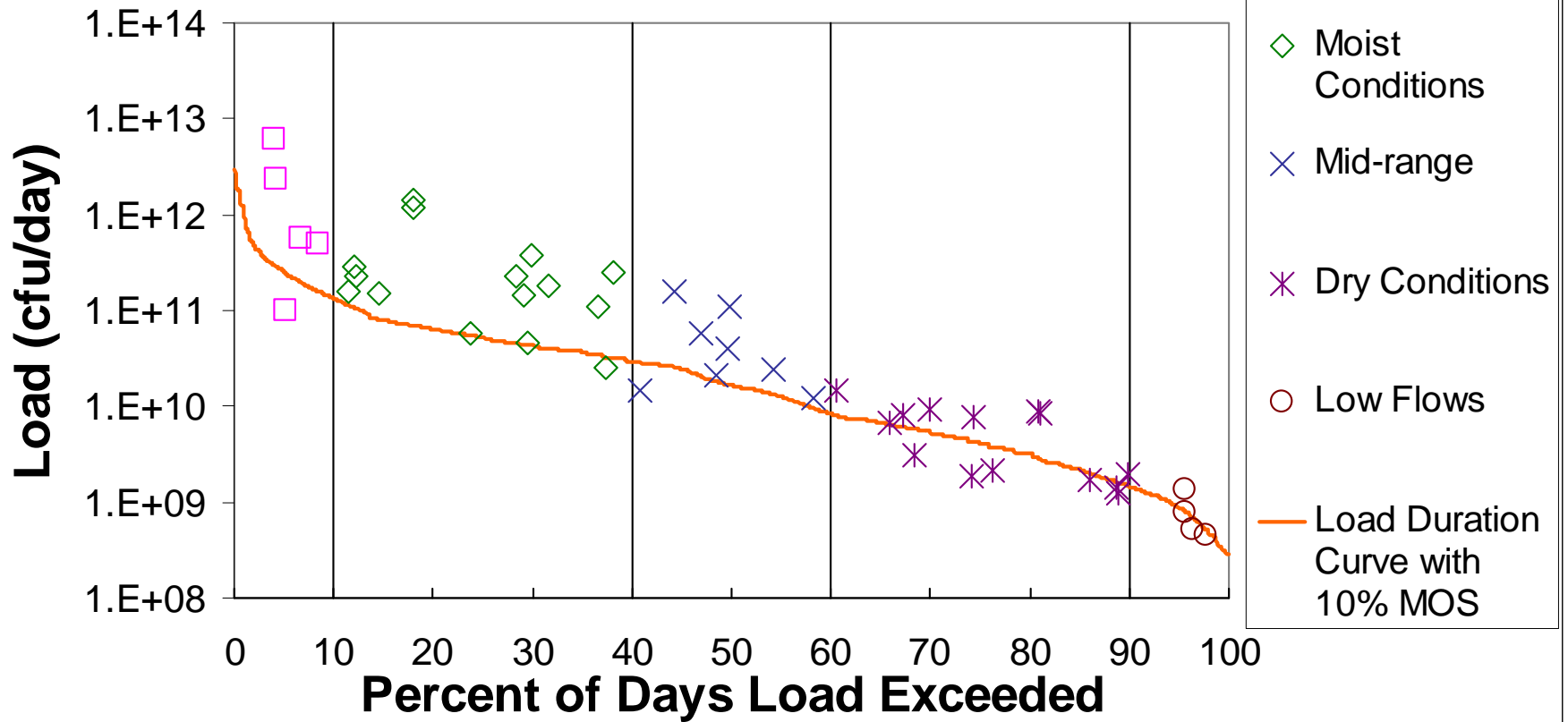# Flow Duration Curve
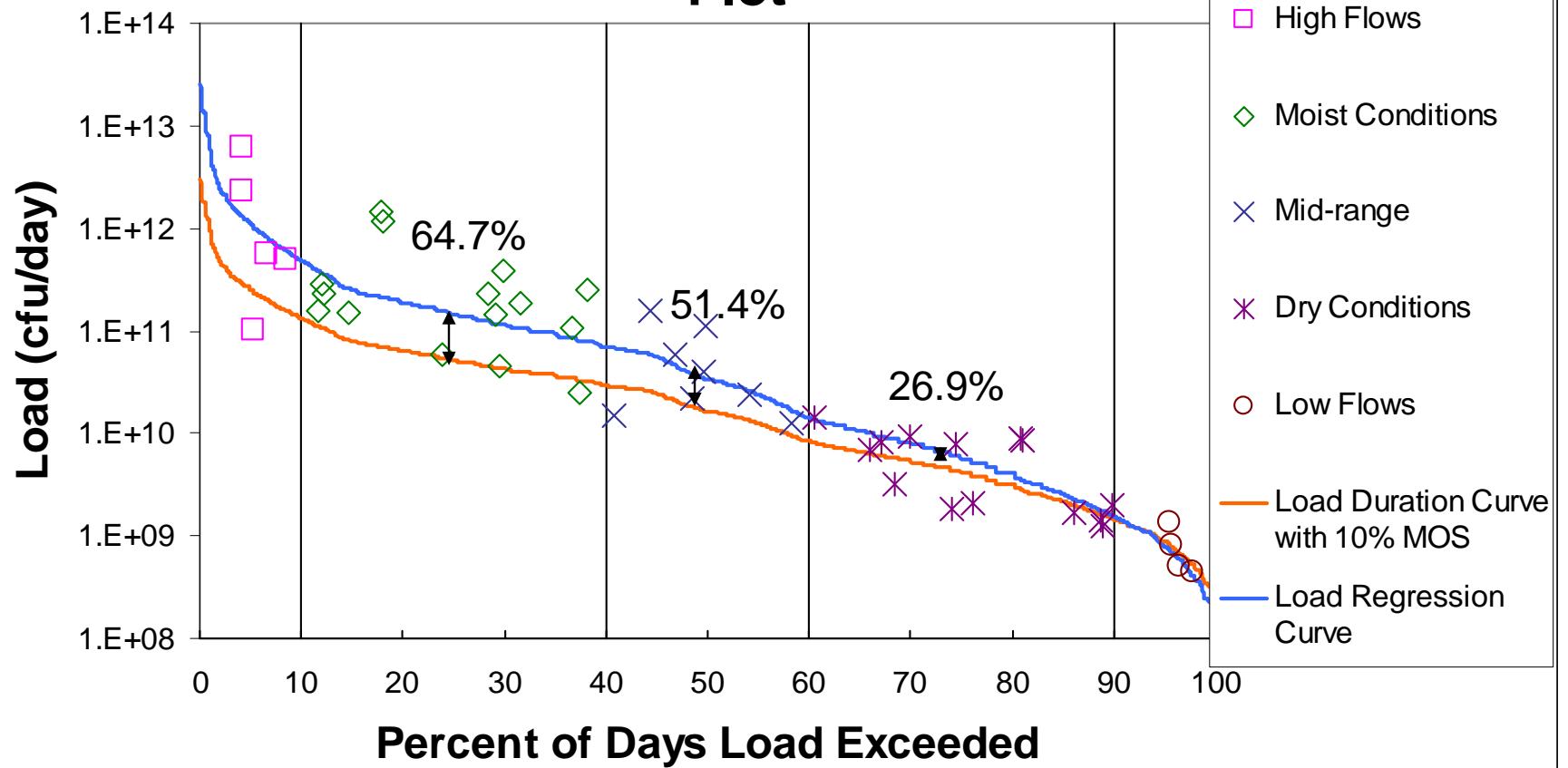

Chart: Y-axis "Daily Average Streamflows (cfs)" with values 1.E-01, 1.E+00, 1.E+01, 1.E+02, 1.E+03, 1.E+04. X-axis "Percent of Days Load Exceeded" with values 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100.

Load Duration Curve

Load Duration Curve With Observed Loads During Different Flow Conditions

Legend:
- ☐ High Flows
- ◇ Moist Conditions
- ✕ Mid-range
- ✳ Dry Conditions
- ○ Low Flows
- — Load Duration Curve with 10% MOS

Y-axis: Load (cfu/day) — 1.E+08, 1.E+09, 1.E+10, 1.E+11, 1.E+12, 1.E+13, 1.E+14

X-axis: Percent of Days Load Exceeded — 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100

Load Regression Model on Load Duration Curve Plot

LDC Usefulness (source ID based on LDC)
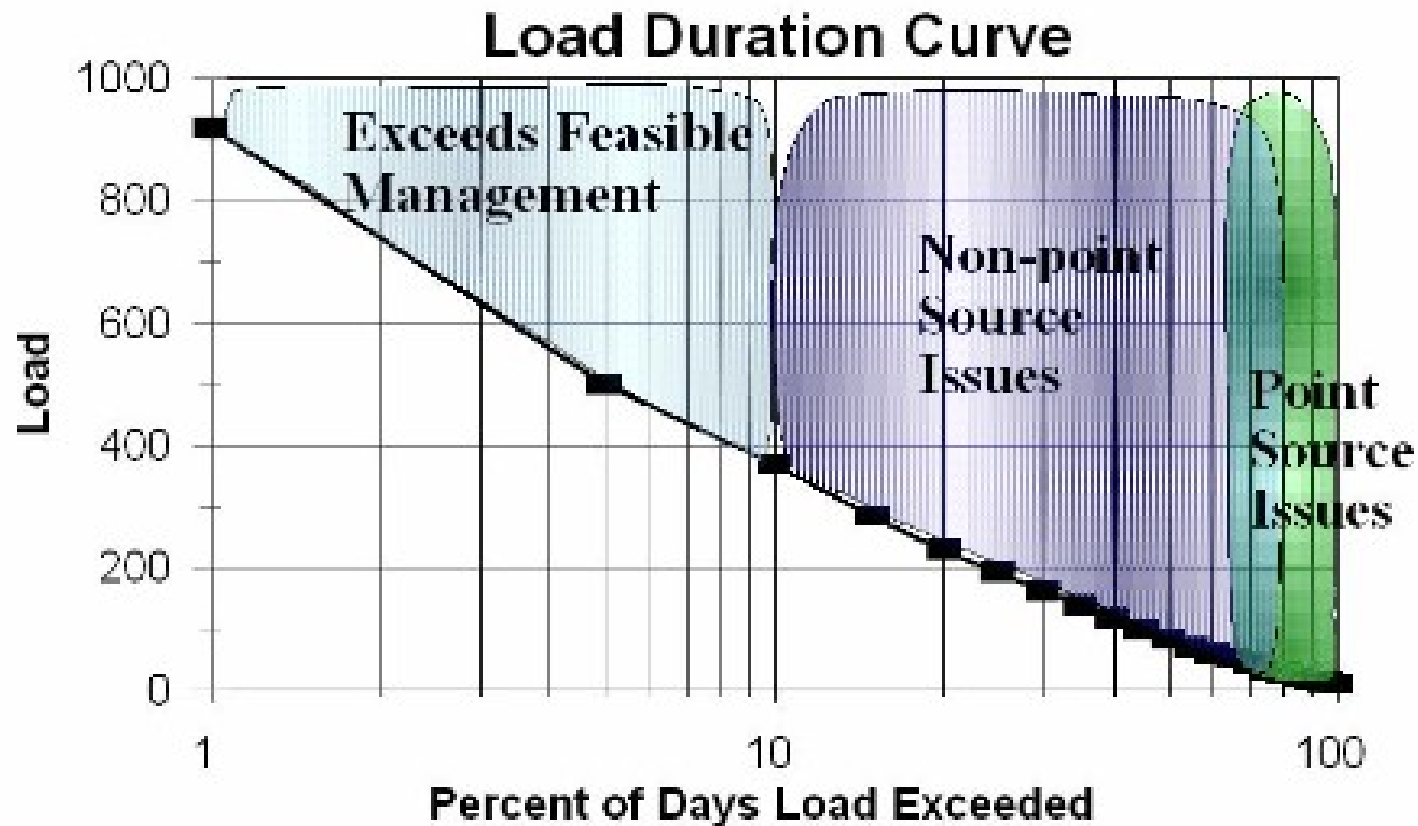
Questions about LDCs?

- ## LDC Summary

    - Compare flow to pollutant levels
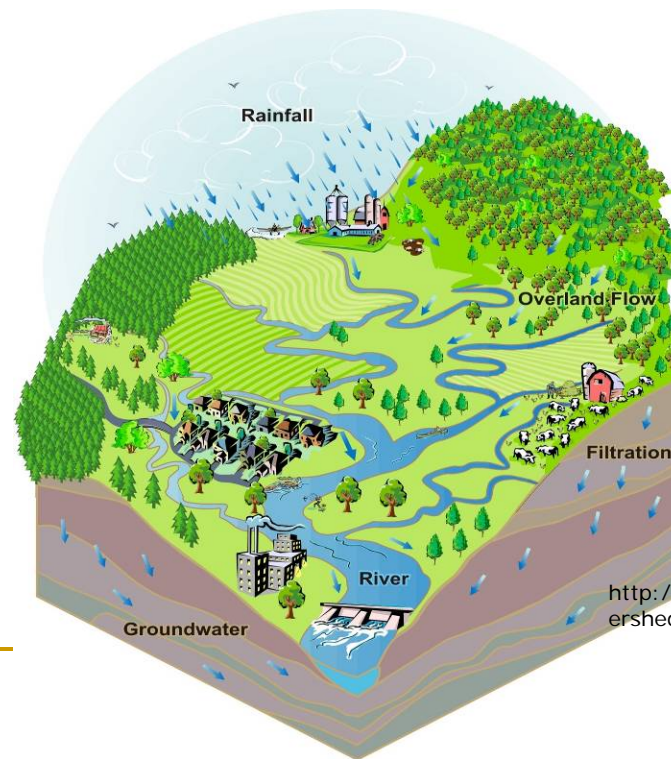
    - Shows general problem areas to target management (high, normal, low flows)

    - Results in a target level of needed reduction

Spatially Explicit Load Enrichment Calculation Tool (SELECT)

Purpose of SELECT

- Spatially explicit analysis of LULC, animals/humans in watershed, etc. to assess/determine potential sources of bacteria

http://www.awag.org/Education/Watershed_diagram.jpg

How SELECT Works

- **Determine Potential Load**
  - Spatially distribute source populations for appropriate habitats
  - Apply fecal production rate
  - Aggregate to level of interest
- **Develop a Qualitative Assessment of Pollutant Connectivity**
  - Pollution Indicator
  - Run-off Indicator
  - Distance Indicator

Potential Sources

AgriLIFE RESEARCH & EXTENSION
Texas A&M System

- **Domestic**
  - Septic Systems
  - Pets
- **Feral Hogs**
- **Livestock**
  - Cattle
  - Other (Goats, Horses, Sheep, Swine)

- **Wastewater Treatment Facilities**
- **Wildlife**
  - Deer
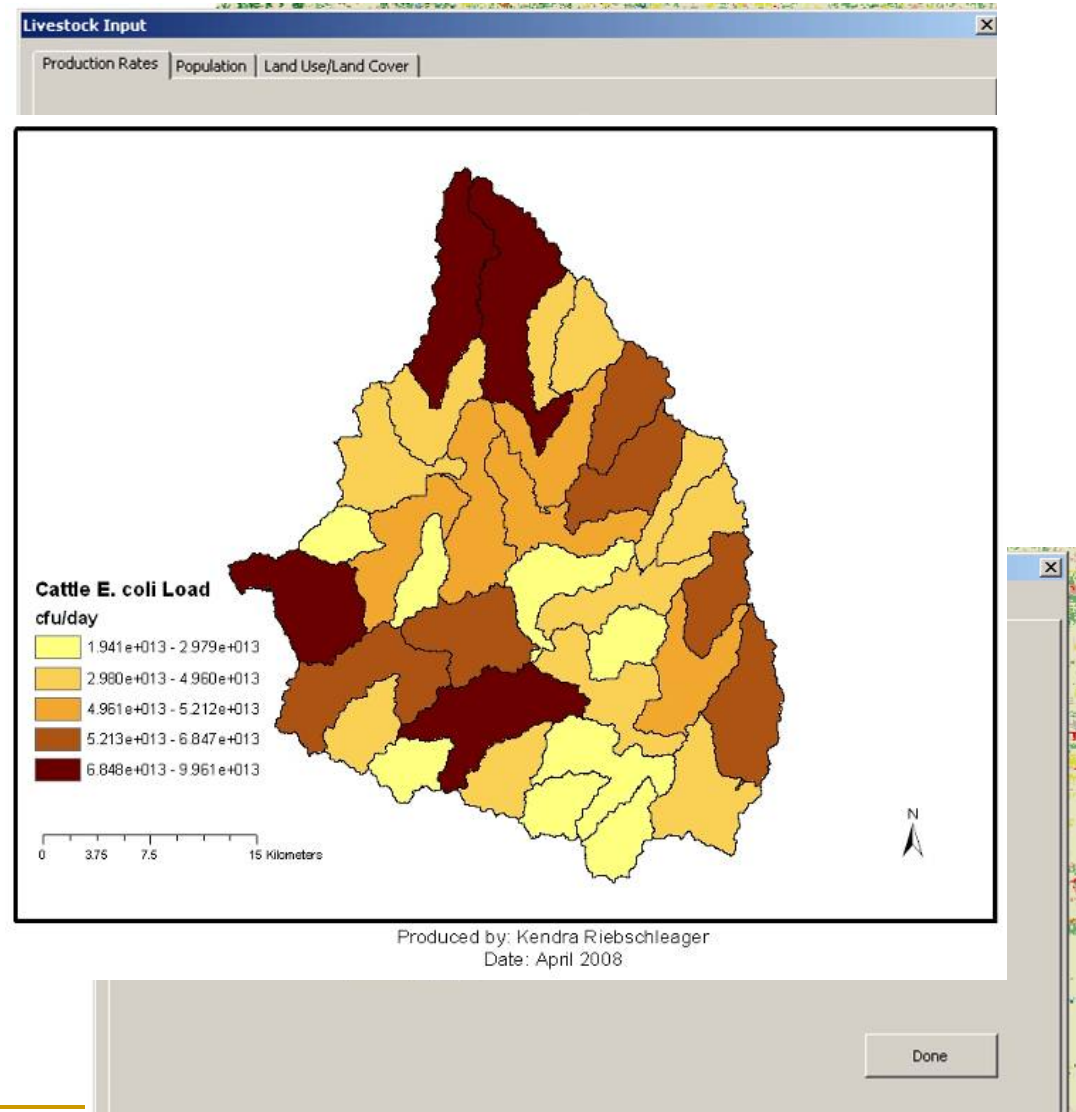 - Other (Raccoons, Birds, Rodents)

Input Parameters - Cattle

- ## Data Sources
  - National Agricultural Statistics Service (NASS) - Livestock Populations per County
  - NRCS stocking rates
  - Landuse data
  - County Maps

- ## Assume
  - Livestock evenly distributed on grasslands (71) and pasture/hay (81)
  - Fecal Production Rate (USEPA, 2000)
    - 10×10^{10} cfu/animal*day

Livestock Input

Production Rates | Population | Land Use/Land Cover

Cattle E. coli Load
cfu/day

- 1.941e+013 - 2.979e+013
- 2.980e+013 - 4.960e+013
- 4.961e+013 - 5.212e+013
- 5.213e+013 - 6.847e+013
- 6.848e+013 - 9.961e+013

0   3.75   7.5   15 Kilometers

Produced by: Kendra Riebschleager
Date: April 2008

Done

Total Potential *E. coli* Load

E. coli Load
cfu/day

	1.974e+013 - 3.047e+013
	3.048e+013 - 4.970e+013
	4.971e+013 - 5.254e+013
	5.255e+013 - 6.863e+013
	6.864e+013 - 1.002e+014

0   3.75   7.5   15 Kilometers

Produced by: Kendra Riebschleager
Date: April 2008

Legend
Landuse
Barren Land (Rock/Sand/Clay)
Cultivated Crops
Deciduous Forest
Developed, High Intensity
Developed, Low Intensity
Developed, Medium Intensity
Developed, Open Space
Emergent Herbaceous Wetlands
Evergreen Forest
Grassland/Herbaceous
Mixed Forest
Open Water
Pasture/Hay
Shrub/Shrub
Woody Wetlands

0   3.75   7.5   15 Kilometers

Pollutant Connectivity

- **Contribution of Contaminants based on**
  - Soil types
  - Slope of landscape
  - Ground cover
  - Distance from the creek

- **Estimate influence of driving forces using weighted overlay**

SELECT Model Inputs

- **Land Use Map for the watershed**
- **Livestock stocking rates**
  - (25-28 ac./animal unit) native rangeland
  - (8-10 ac./animal unit) improved pasture
- **Estimated Wildlife Numbers**
- **Human influences**
- **Point sources**

Livestock Numbers

- NRCS recommended Livestock stocking rates
  - (25-28 ac./animal unit) native rangeland
  - (8-10 ac./animal unit) improved pasture

- Based on Current Landuse Map Acreages
  - Rangeland
    - 25ac/au = 5,400 head
    - 28ac/au = 4,800 head

- Are these numbers close to being correct?

Wildlife Numbers

- TPWD Surveys for RMU 30
- Applied to entire Buck Creek Watershed
- Do you think these are correct? Over-estimates?

Table X. TPWD estimated animal densities applied to the Buck Creek watershed						
	Year and Acres per Animal				**Average Acre/Animal**	**Estimated Watershed Population**
	2005	2006	2007	2008		
White-tailed Deer	77.65	74.36	50.88	29.01	57.98	**3,190**
	2006	2007	2008	2009		
Mule Deer	137.73	125.38	160.97	92.46	129.14	**1,432**
				2009		
Feral Hogs				200	200	**925**

Next Steps for Modeling

- LDCs on historical data will be developed and presented at the next meeting (Summer 09)

- Begin setting up the SELECT model with your inputs

- Present initial SELECT results (Fall 09) and refine based on your comments (Winter 09)

Questions?

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