CHANGES IN TERRESTRIAL SOIL LOSS IN THE MIDDLE RIO GRANDE BASIN TO 2100

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REVISED UNIVERSAL SOIL LOSS EQUATION (RUSLE)

$$A = R*C*K*SL*P$$

- A: Soil loss - t ha^{-1} $year^{-1}$

Multiple scenarios $\left\{\right.$

- R: Erosivity - MJ mm ha^{-1} h^{-1} $year^{-1}$ – CMIP5-LOCA Precipitation
- C: Cover factor – unitless – USGS Land Carbon LULC Modeled Data

Constant, may amplify $\left\{\right.$

- K: USDA soil K factor - t ha h ha^{-1} MJ^{-1} mm^{-1}
- SL: Slope (S) and Slope Length (L) - unitless
- P: Erosion control, set to 1 - unitless

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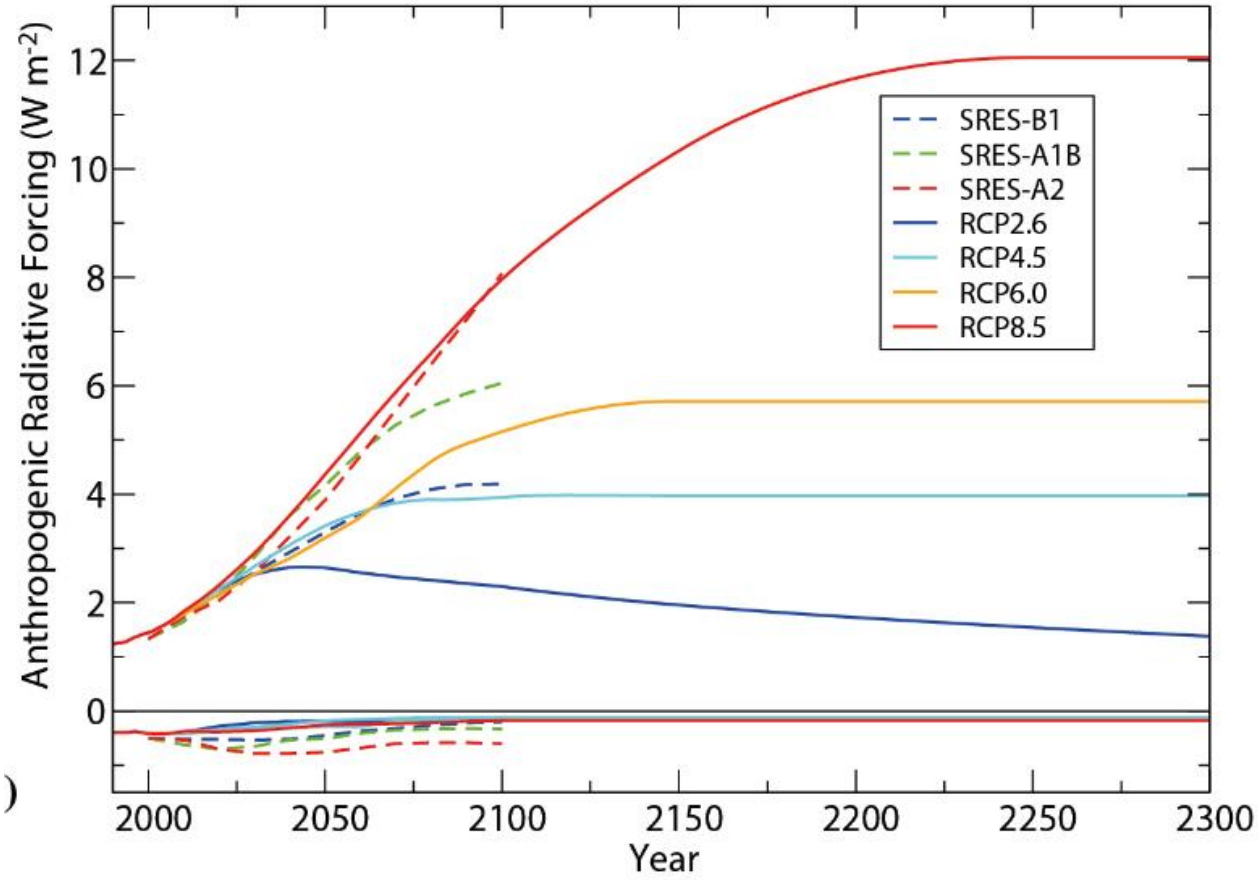
NB: FUTURE CONDITIONS DATA



Collins et al. 2013 (IPCC AR5 report)

Precipitation (CMIP5)

- RCP 8.5
- RCP 4.5

Land Cover (CMIP3)

- SRES A2
- SRES B1

Mix not ideal

Best match of data available

	Lower Scenario	Higher Scenario
Precipitation	RCP4.5 Ensemble Mean	RCP8.5 Ensemble Mean
Land Cover	SRES B1	SRES A2

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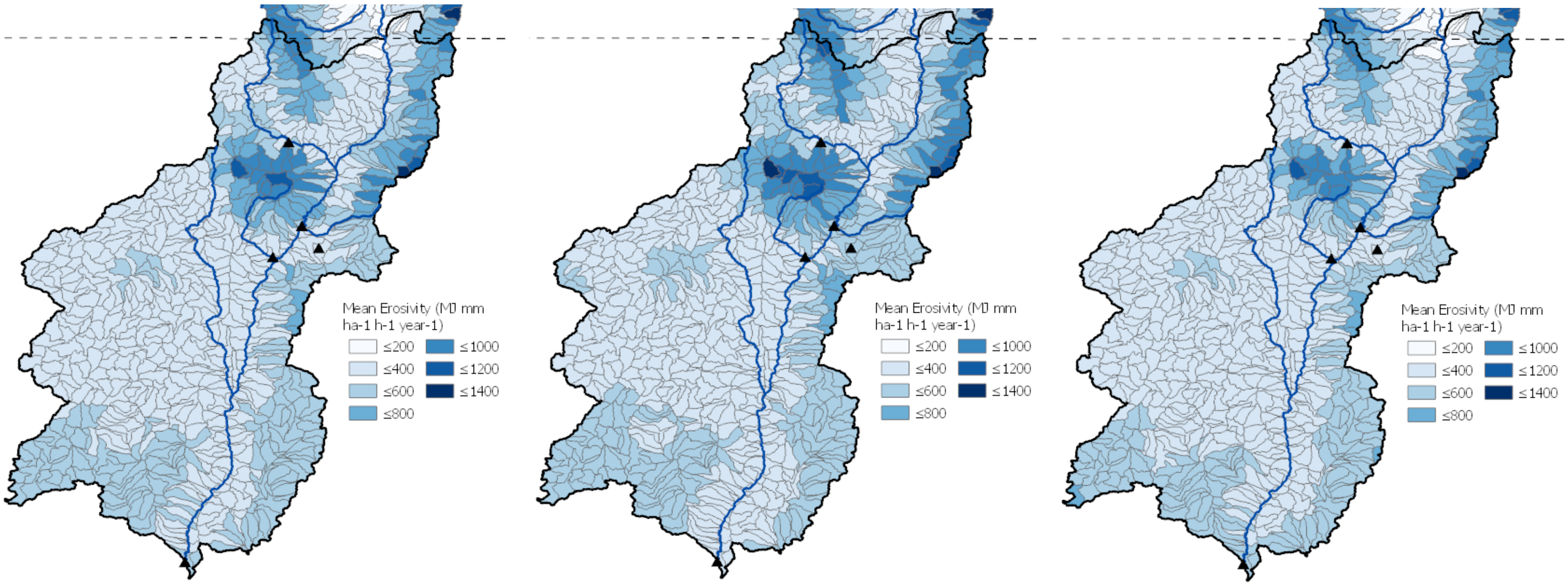
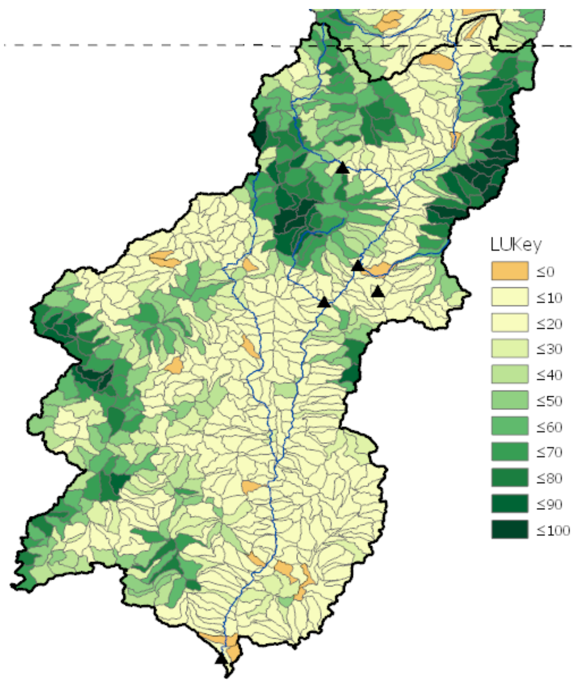
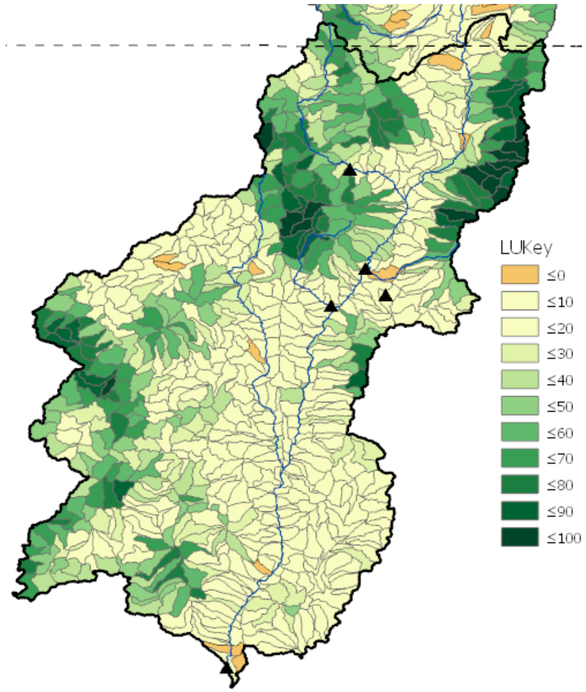
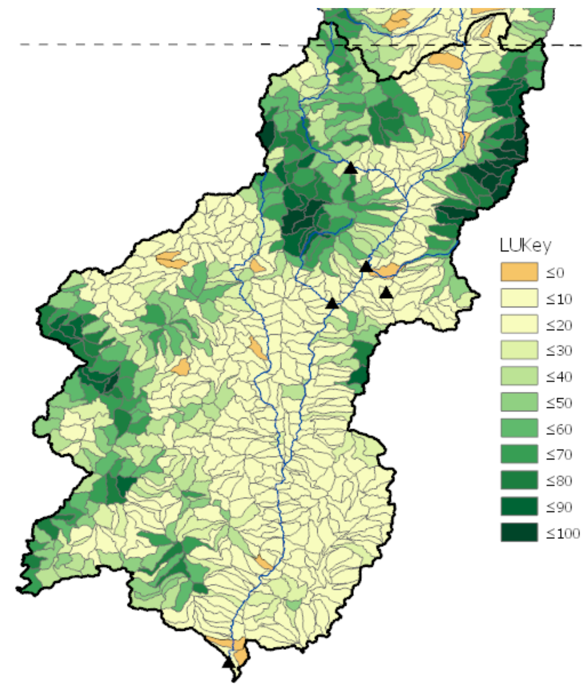
EROSIVITY (R) CHANGE

Modeled Historic | **Lower Emissions** | **Higher Emissions**



- Precipitation, therefore erosivity, **controlled by orography**
- **Lower emissions** – small increase in erosivity in mountains
- **Higher emissions** – small decrease in erosivity in mountains, slight increase in lower elevations south

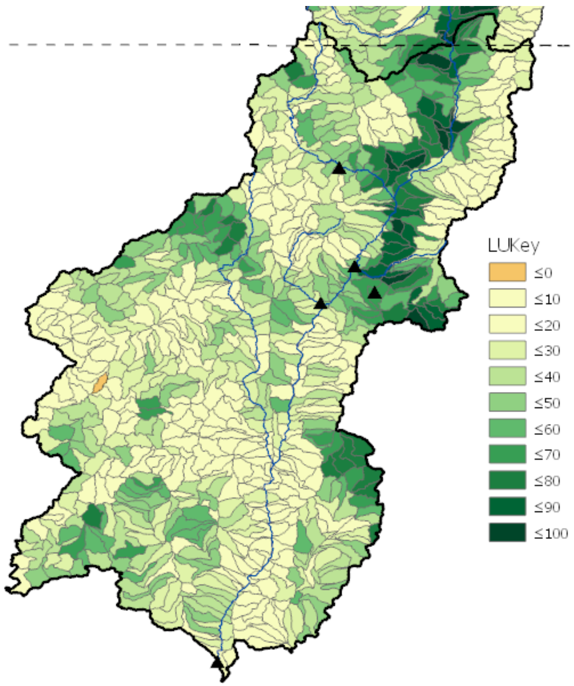
LAND COVER (C) CHANGE – PERCENT FOREST

Modeled Historic	Lower Emissions	Higher Emissions
		

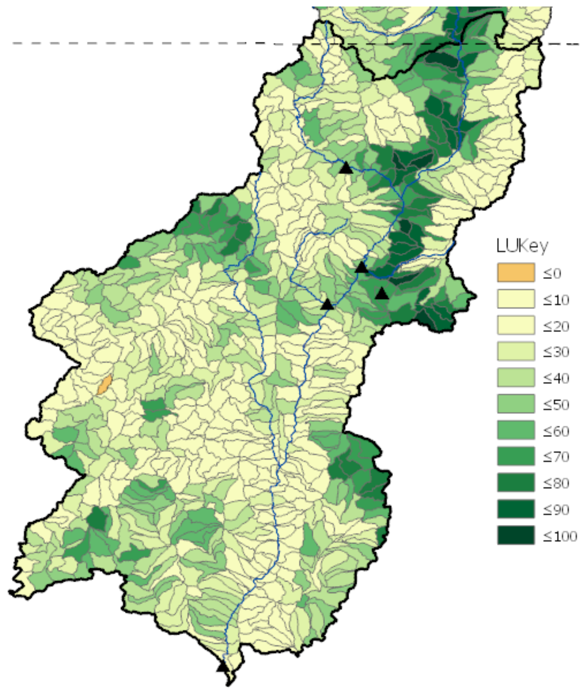
- Forest includes Coniferous, Deciduous, and Mixed Forest types
- **No significant change in forested area over time either scenario**

LAND COVER (C) CHANGE – PERCENT GRASS-SHRUB

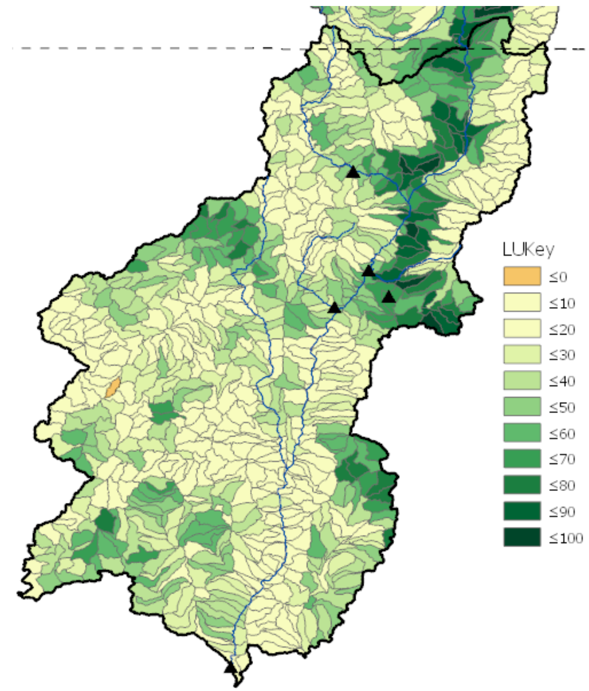
Modeled Historic



Lower Emissions



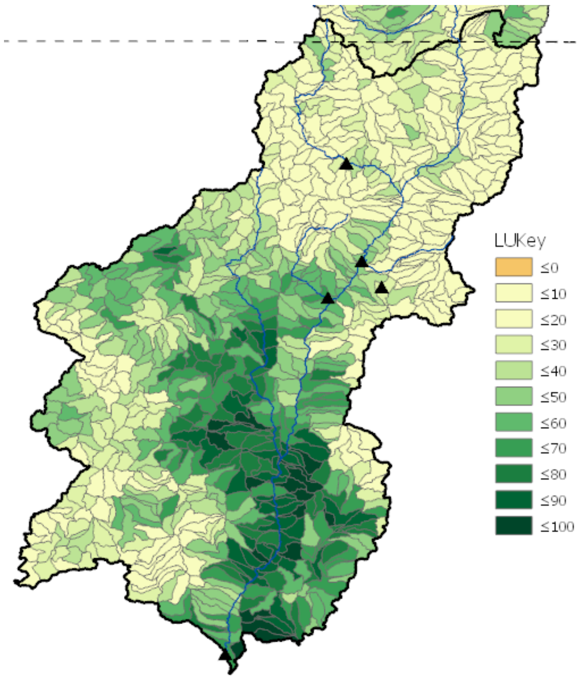
Higher Emissions



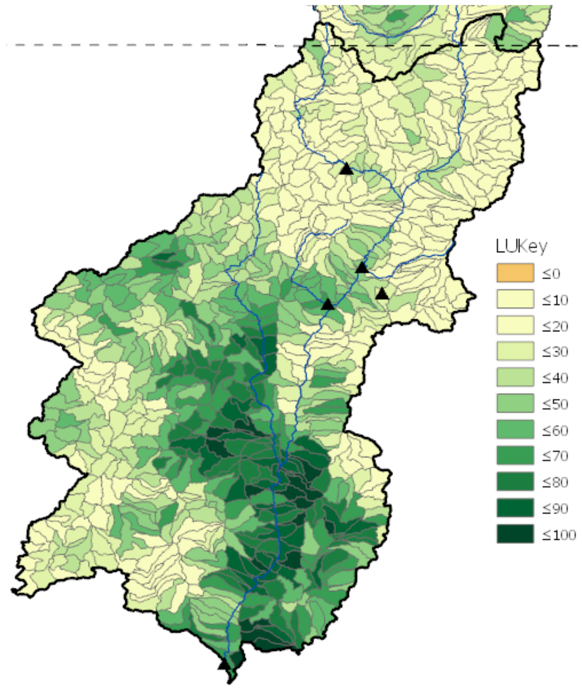
- **No significant change in percent of watershed in grassland and shrubland**

LAND COVER (C) CHANGE – PERCENT AGRICULTURAL

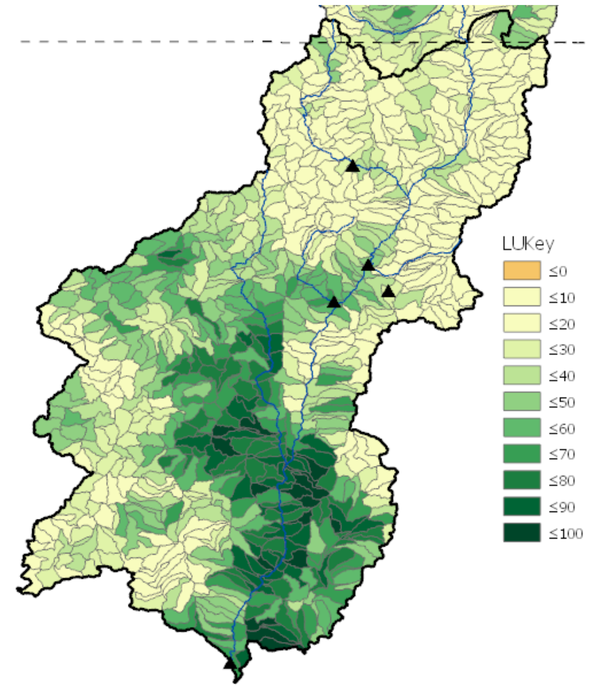
Modeled Historic



Lower Emissions



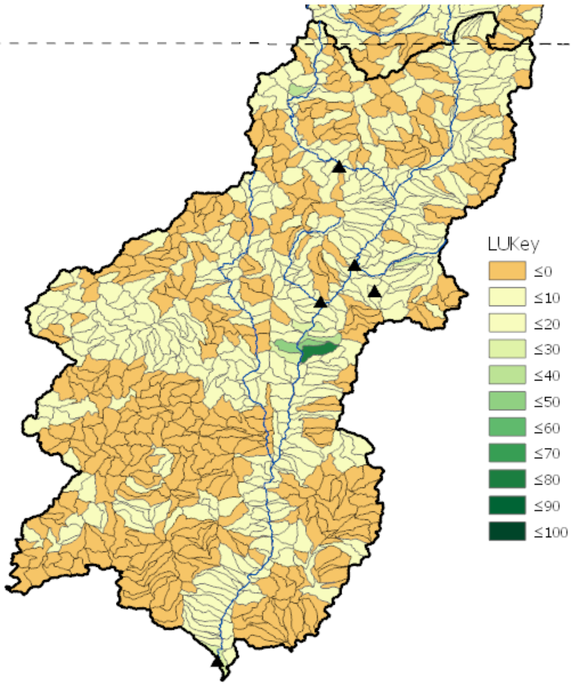
Higher Emissions



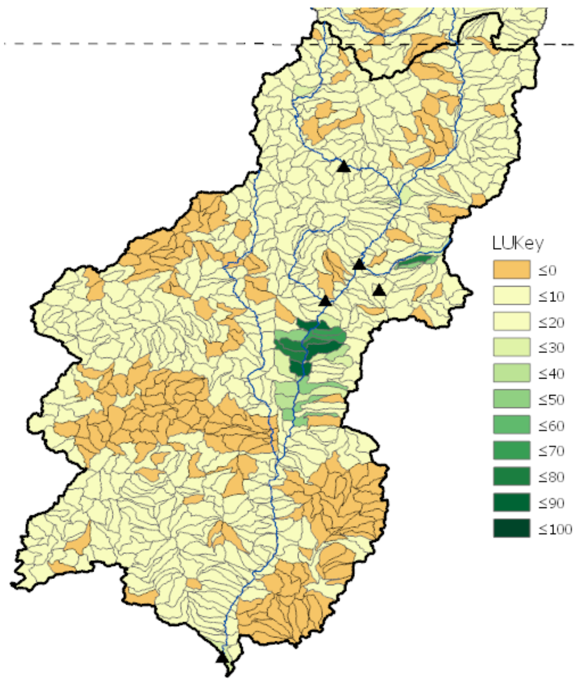
- **No significant change in percent of watershed in cropland and pasture land**

LAND COVER (C) CHANGE – PERCENT DISTURBED OR BARREN

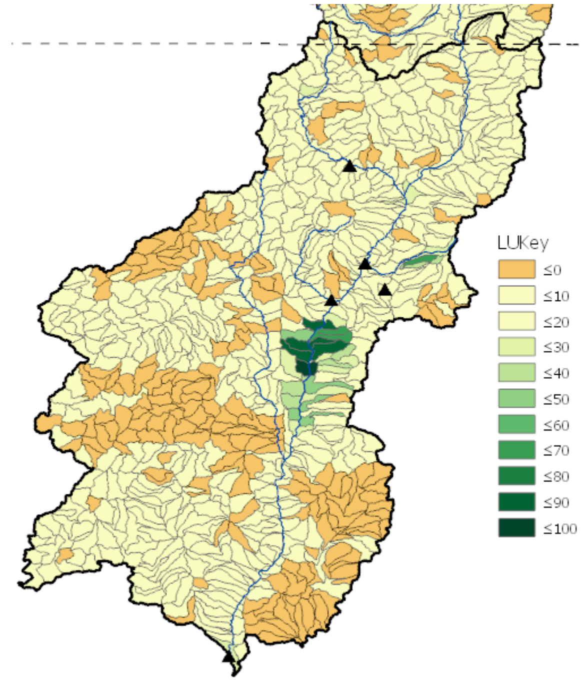
Modeled Historic



Lower Emissions



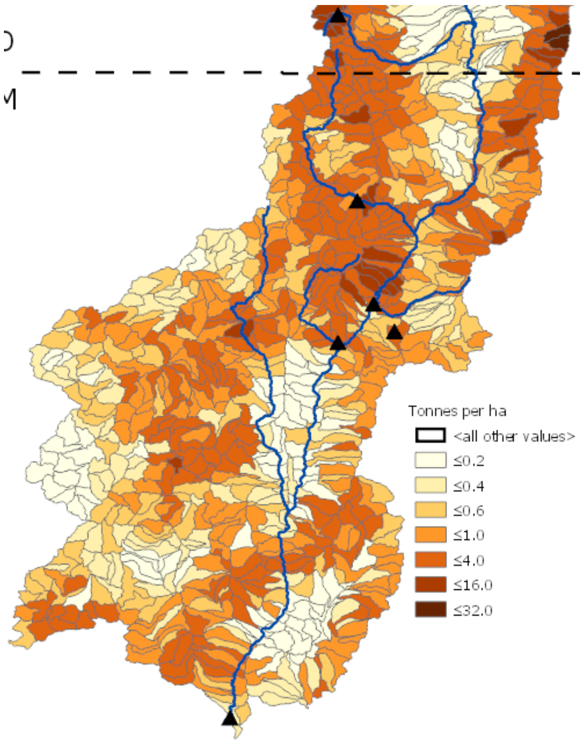
Higher Emissions



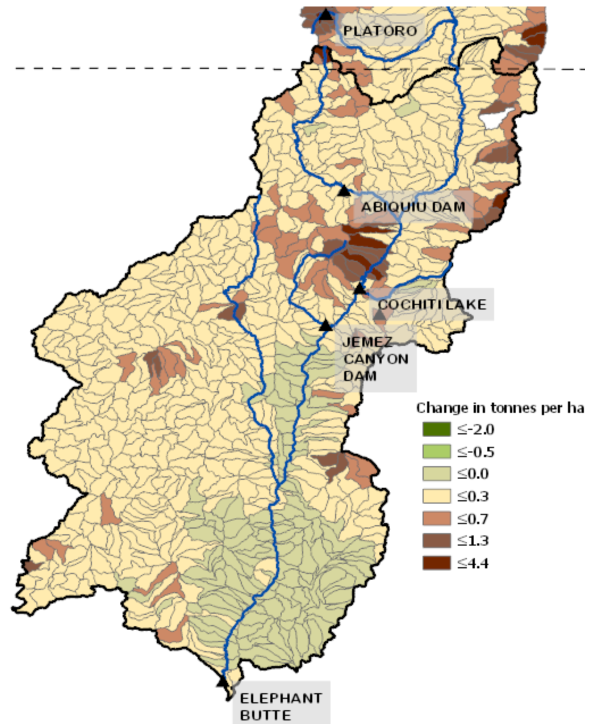
- **Orange = 0**
- **Slight increases in disturbance across most watersheds (mining, logging, development)**
- **Continued development in the Albuquerque area and Belen/Los Lunas areas, and Santa Fe**

CHANGE IN SOIL LOSS RATES - TOTAL

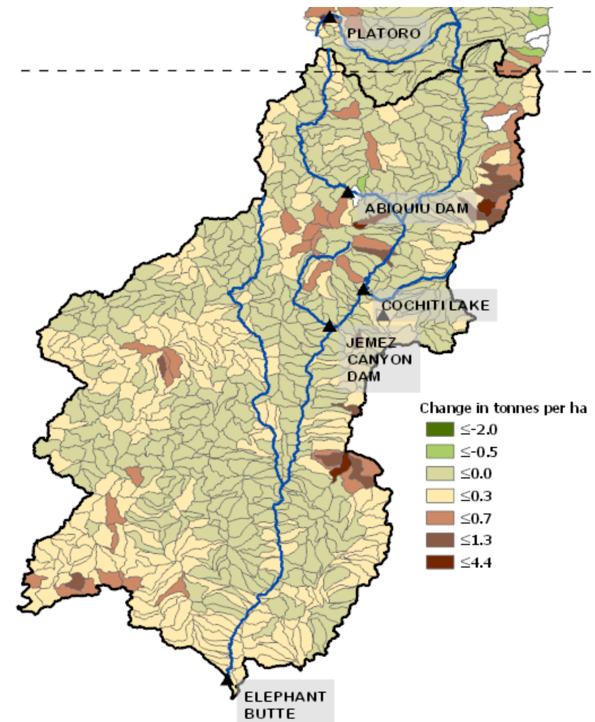
Modeled Historic



Lower Emissions



Higher Emissions



- Reductions in low elevationsoil loss rates over time in both scenarios
  - Greater reductions under higher emissions
- Increases occur in steep, mountainous terrain

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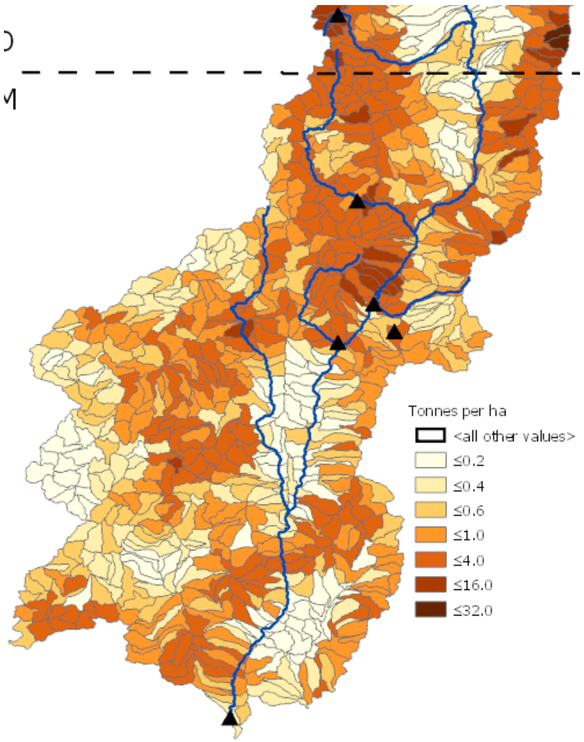
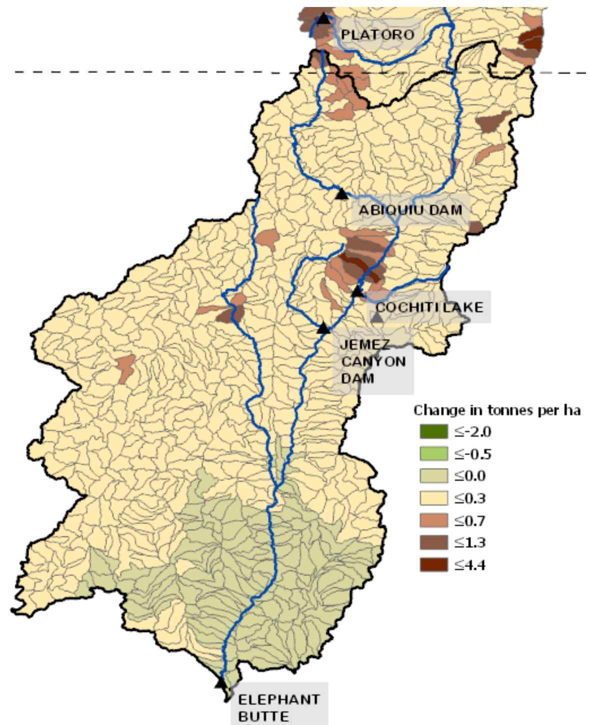
CHANGE IN SOIL LOSS RATES – DUE TO EROSIVITY

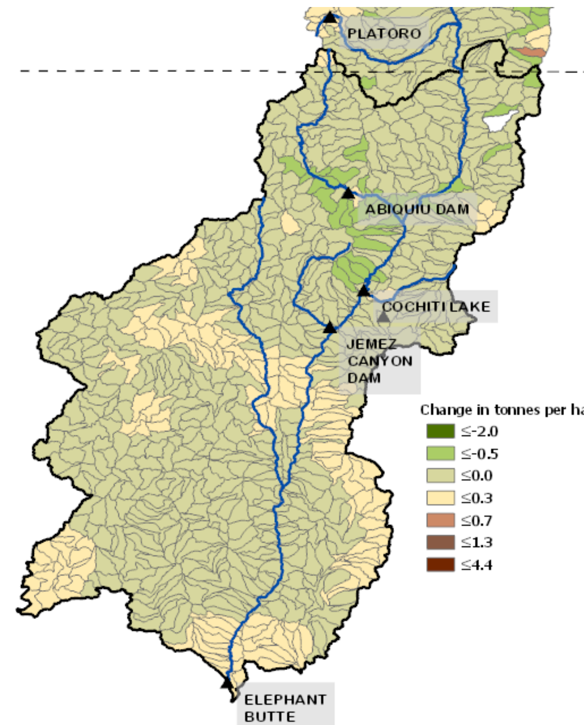
Modeled Historic



Lower Emissions



Higher Emissions



- **Orange = 0**
- **Overall picture is one of reductions in soil loss due to erosivity**
  - **Some increases in high elevation areas under lower scenario**

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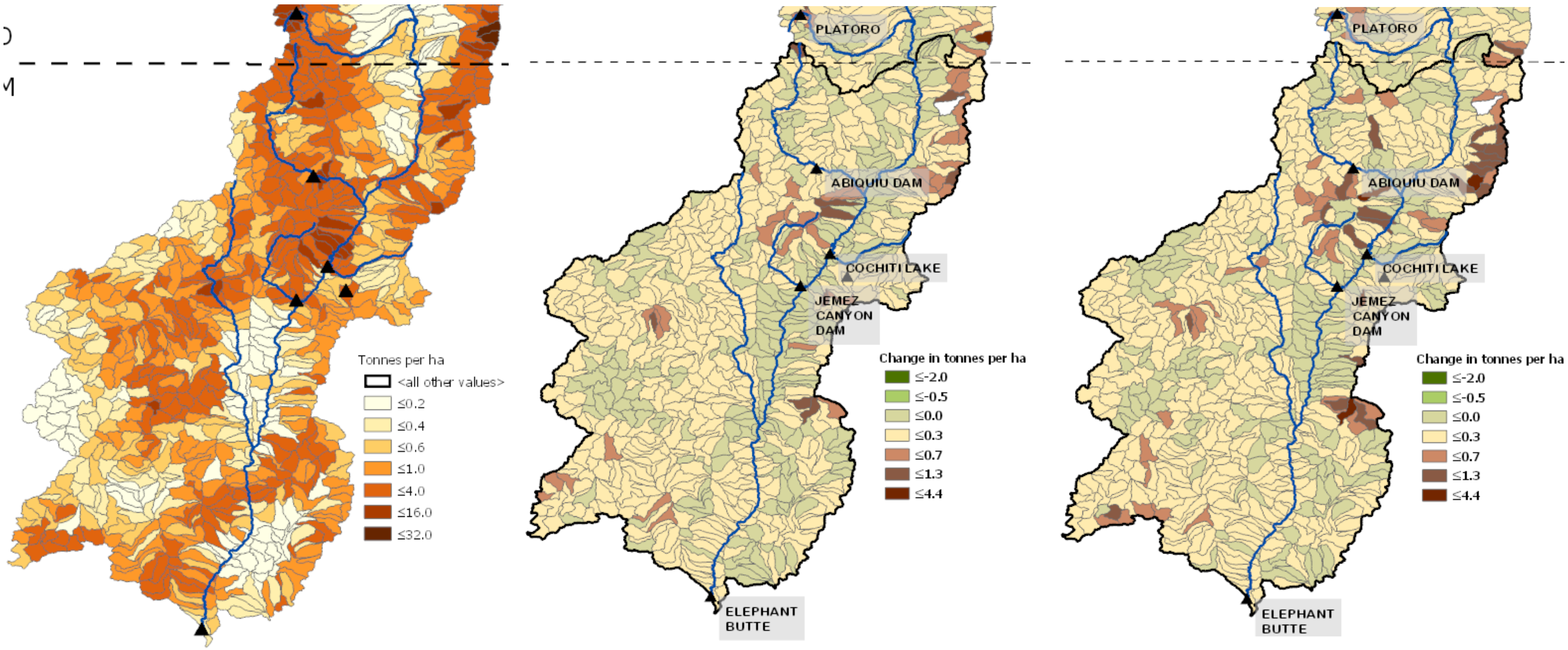
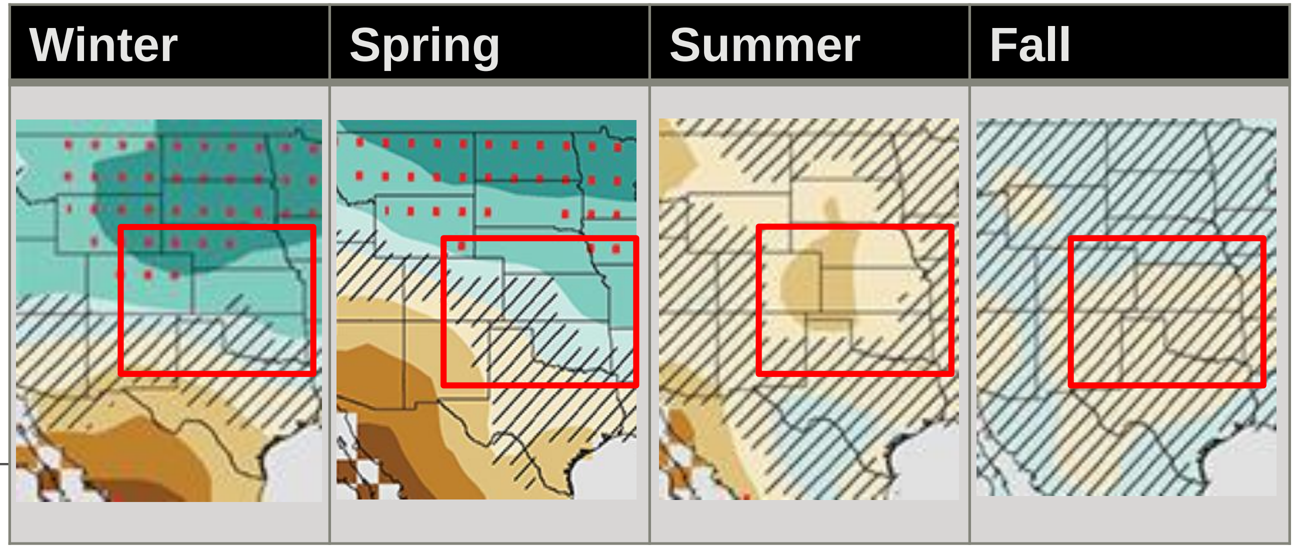
CHANGE IN SOIL LOSS RATES – DUE TO LAND COVER

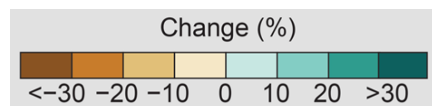
Modeled Historic | Lower Emissions | Higher Emissions



- **Orange = 0**
- **Land cover exerts more change on soil loss, contributing to increased losses in mountainous regions and reduced rates of loss at low elevations.**

CONSISTENT WITH OTHER STUDIES…





Percent Change in Seasonal Precipitation
RCP 8.5, for 2085 compared to 1976-2005 Average
Fourth National Climate Assessment (2017)

Climate Change Associated Sediment Yield Changes on the Rio Grande in New Mexico: Specific Sediment Evaluation for Cochiti Dam and Lake

August 2012

(Revised)

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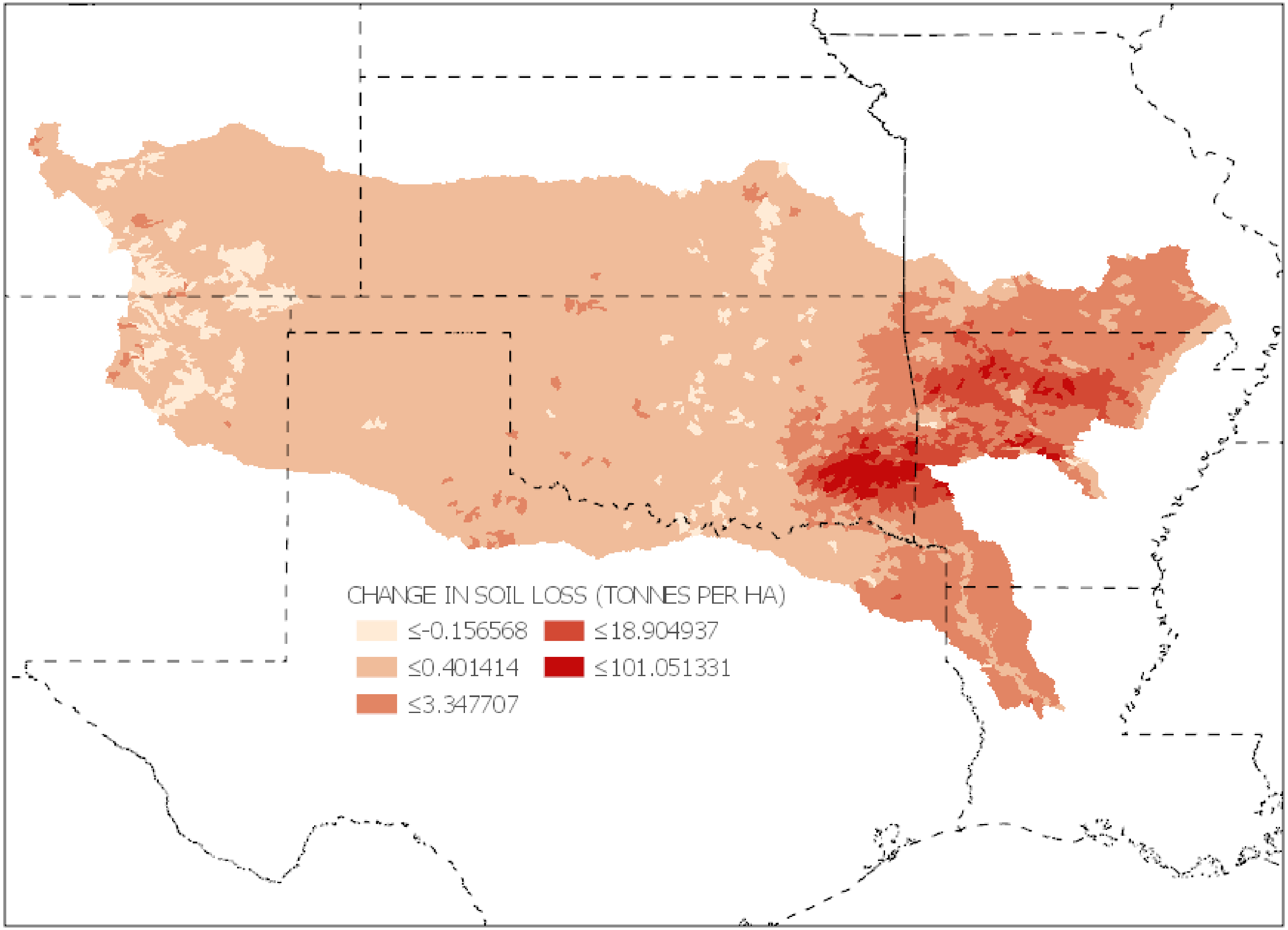
ARKANSAS-WHITE-RED RIVER BASIN
CHANGE IN SOIL LOSS, HIGHER FUTURE SCENARIO



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CONCLUSION AND DISCUSSION

- Long-term average soil loss rates may change comparatively little with projected changes in precipitation (largely summer) and land use-land cover in the Middle Rio Grande Basin.
- However, projected reductions in runoff volumes on the Rio Grande seen in other studies suggest the system may be challenged to moved this sediment in the future, at least in some years.
- The evolution of the summer monsoon and of eastern Pacific tropical storms remains uncertain, so it is not clear how these changes might affect sediment production and transport.