

Economic Opportunities for Producing Bioenergy Feedstocks and Optimizing Aquifer Life in the US High Plains

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Introduction

This project seeks to estimate the maximum long-term benefits and opportunities of producing alternative bioenergy feedstocks from agricultural lands overlying the Ogallala aquifer, emphasizing the importance of land use management, groundwater limitations, and market conditions. Significance of the U.S. High Plains region:

Freshwater

- ❑ Ogallala is the largest freshwater aquifer in the U.S. linked to the High Plains system

Grain Production

- ❑ The region is dominated by 41% agriculture (~14% are irrigated for grain production) and 56% rangeland with high productive soils

Agricultural Industry

- ❑ \$35 billion in crop sales each year (Basso et al., 2013)

There is a dual need to address dwindling groundwater supplies and increasing climate change. Drought tolerant bioenergy crops may offer a solution to both.

- ✔ Crop producers have experienced decreased well capacities, low crop yields, and higher extraction costs.
- ✔ These challenges have been forcing producers to either adopt alternative irrigated crops that give more returns per unit of water, transition to dryland production, or cease their farming operations.

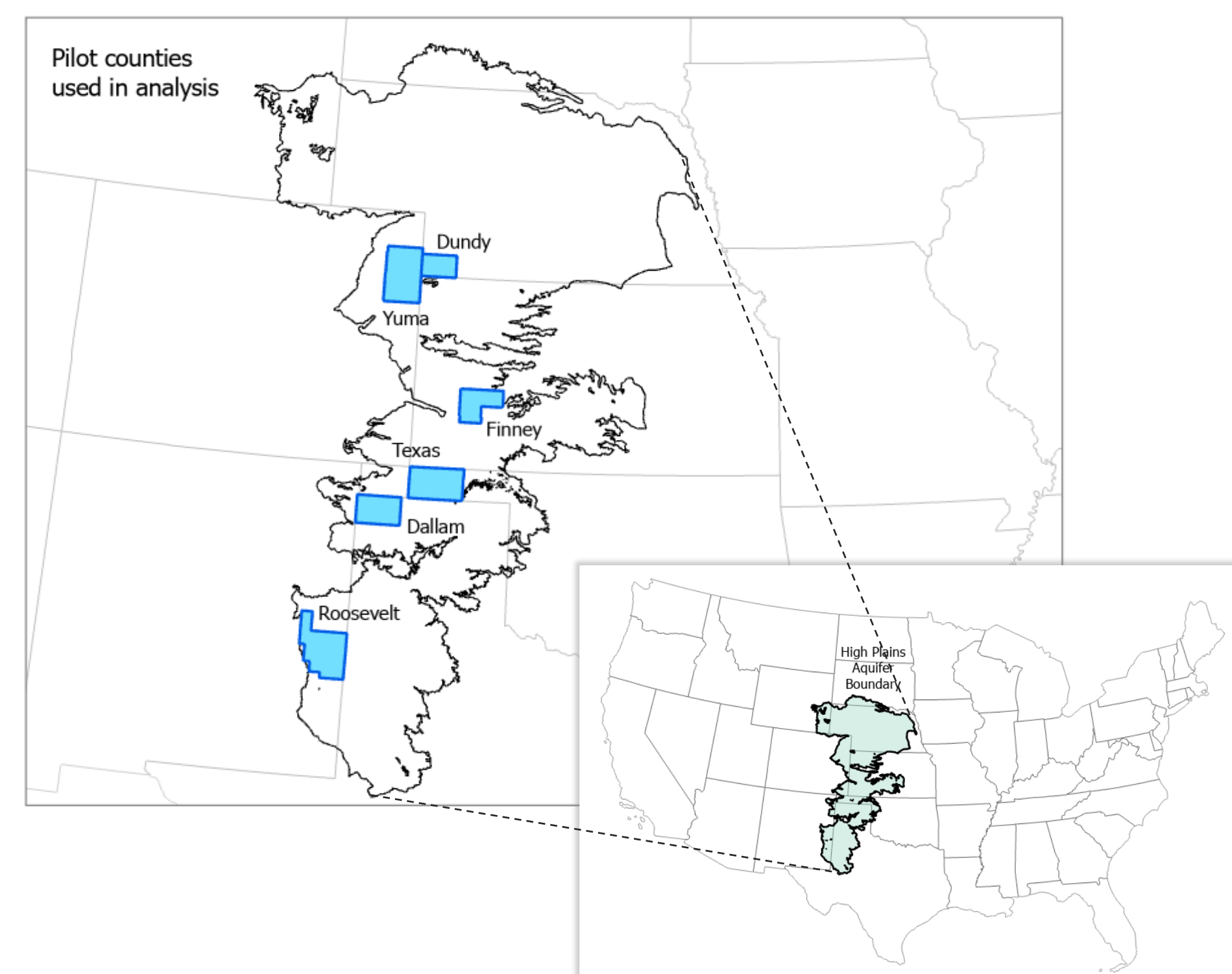


Figure 1. Selected pilot counties in five states overlying the U.S. High Plains aquifer

Study Methods

SPECIFIC APPROACH

Step 1: Construct county-level economic analysis to estimate the net returns of growing different agricultural systems (NASS, 2022 & U.S. DOE, 2016).

Step 2: Utilize remote sensing methods to identify groundwater characteristics in the study area (Gleeson et al., 2014).

Step 3: Intersect the groundwater permeability and porosity to estimate the minimum saturated thickness to sustain 90-days pumping (Ramaswamy et al., 2017).

Step 4: Calculate annual profits for irrigated and non-irrigated agricultural systems using an enterprise budgets approach.

Step 5: Determine the optimal irrigated crop choices for five major irrigated locations across the US High Plains, subject to groundwater constraint, using a 30-year multiperiod model.

In this study, one pilot county is selected from Colorado, Kansas, Nebraska, Oklahoma and Texas based on Deines et al., 2020 and data availability as shown in Figure 1. The methods approach is shown in the flowchart is Figure 2.

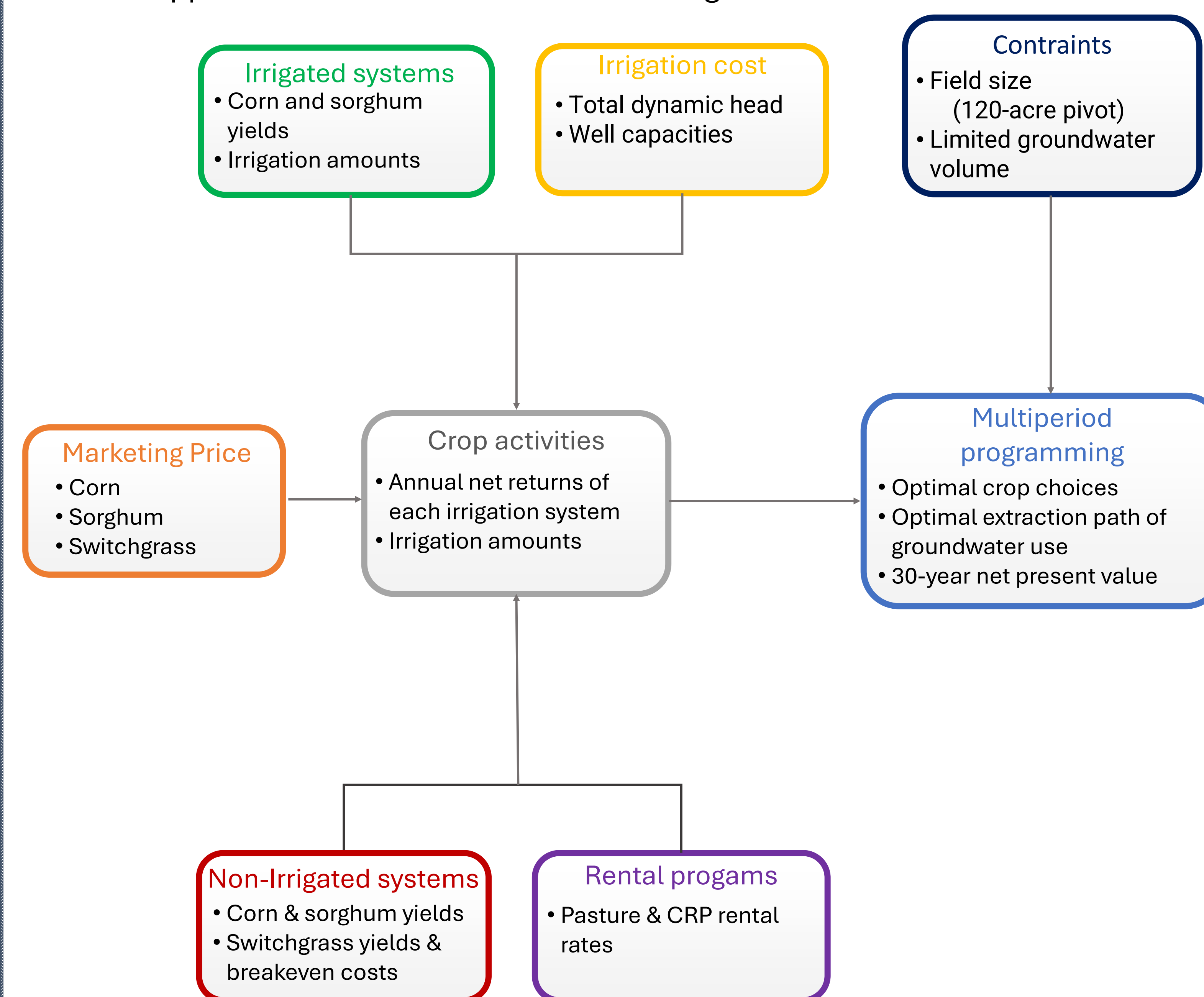
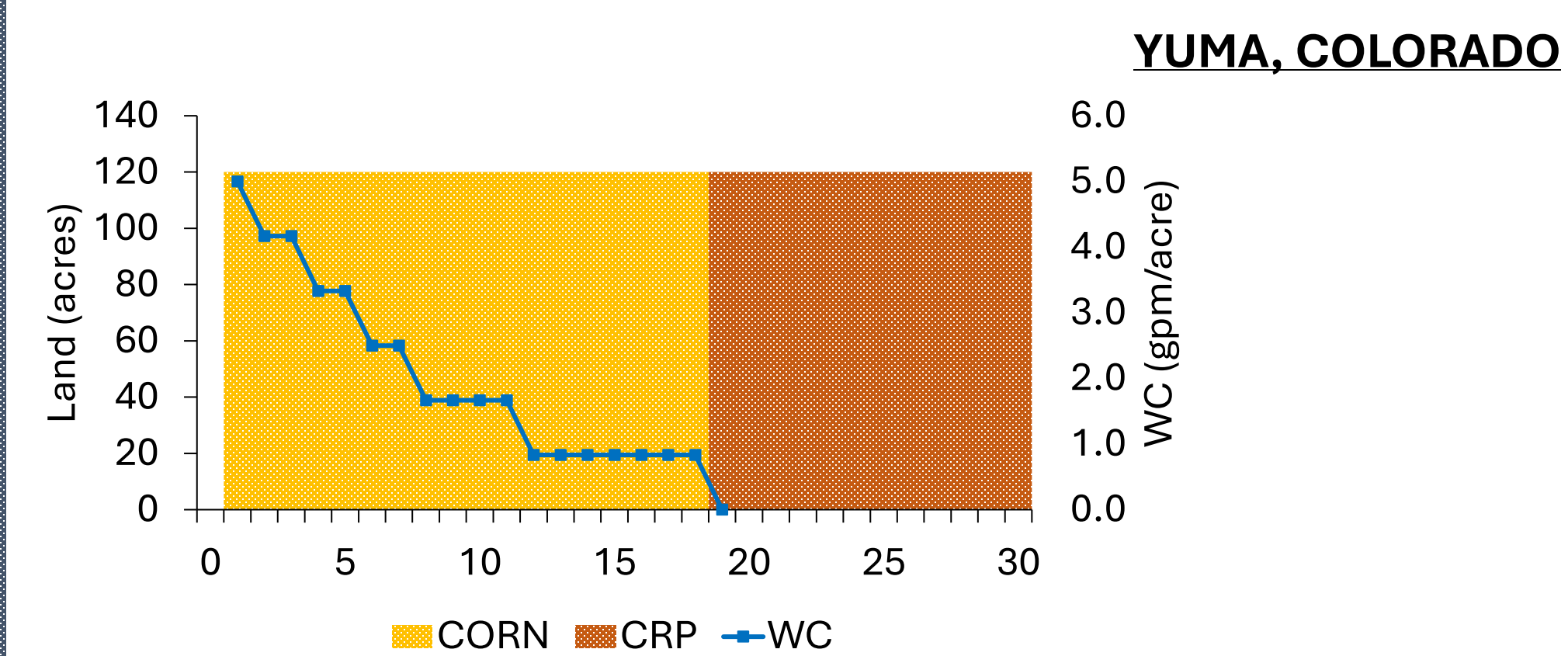


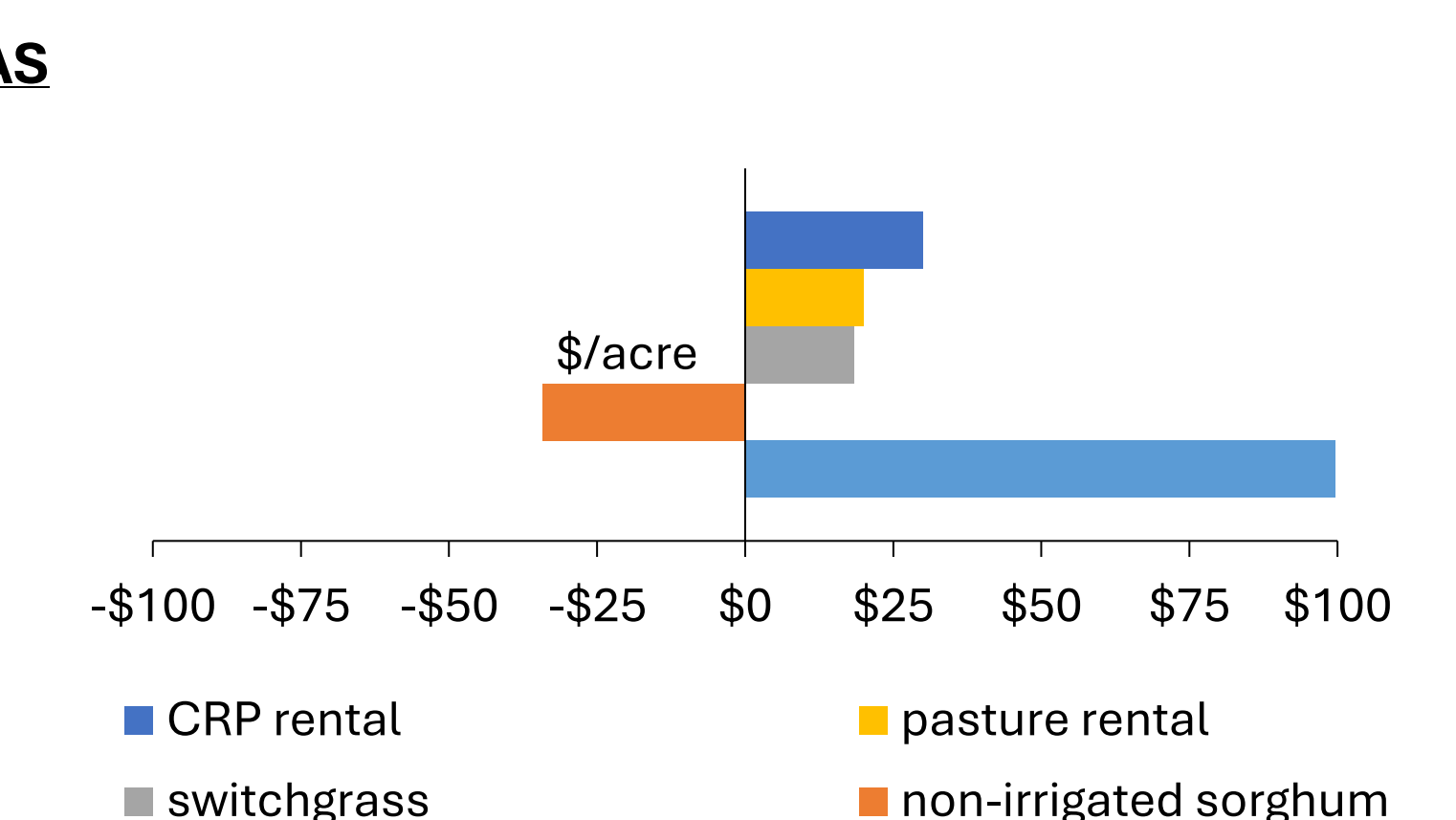
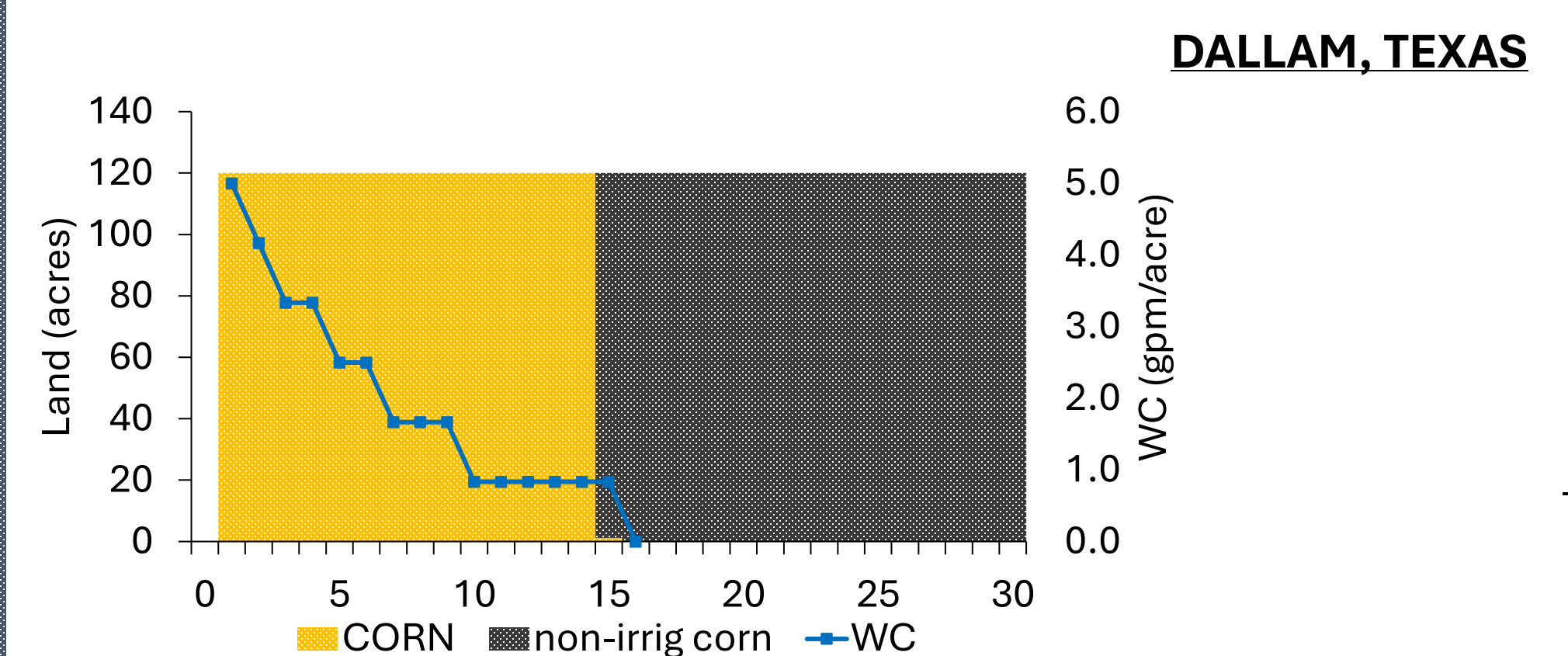
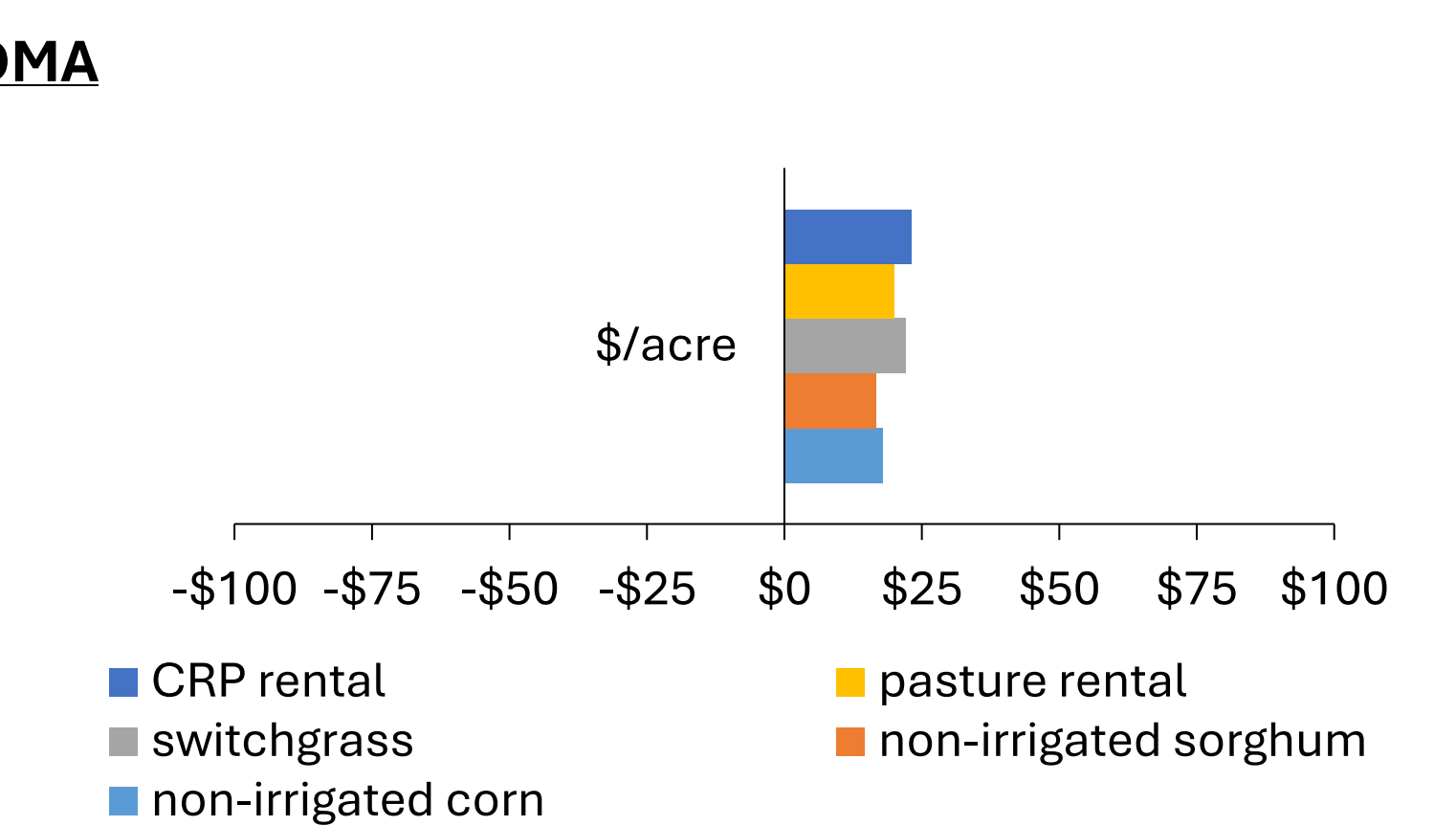
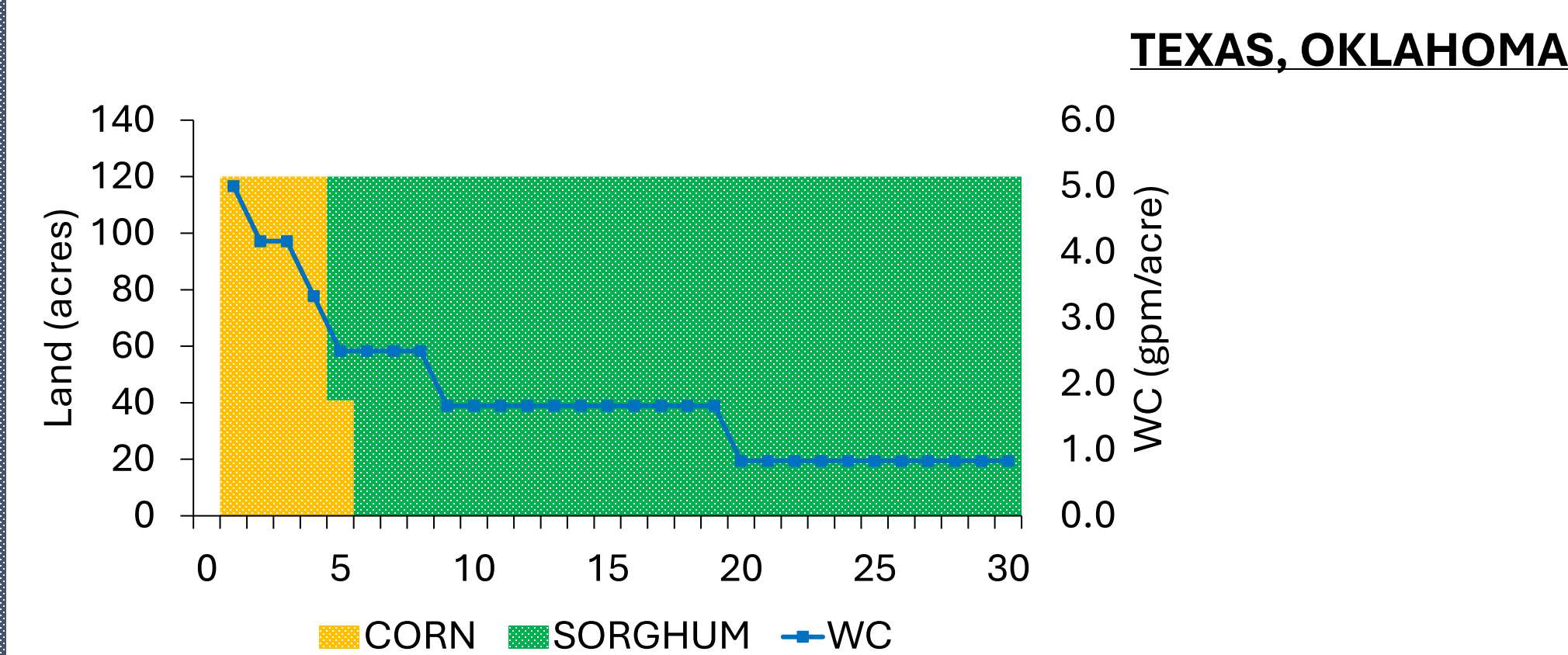
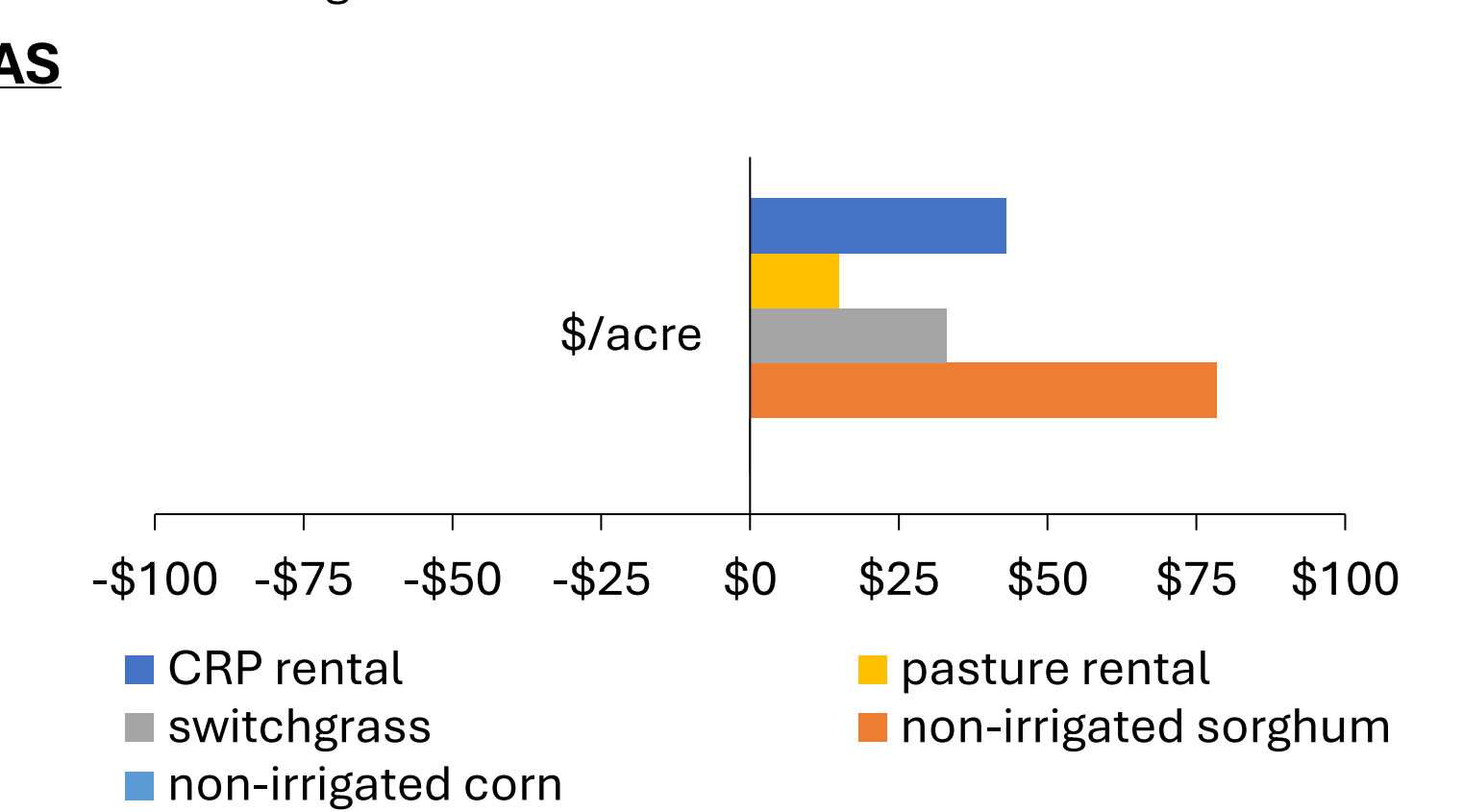
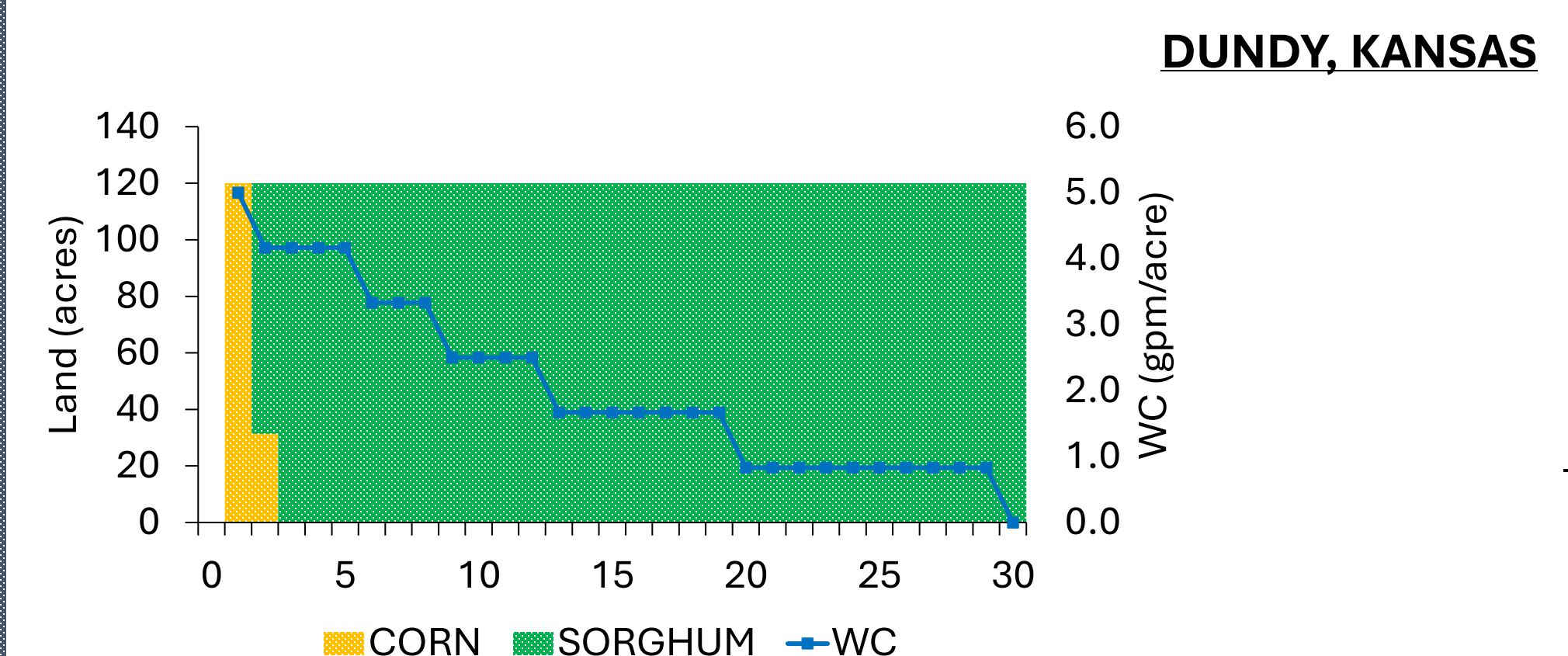
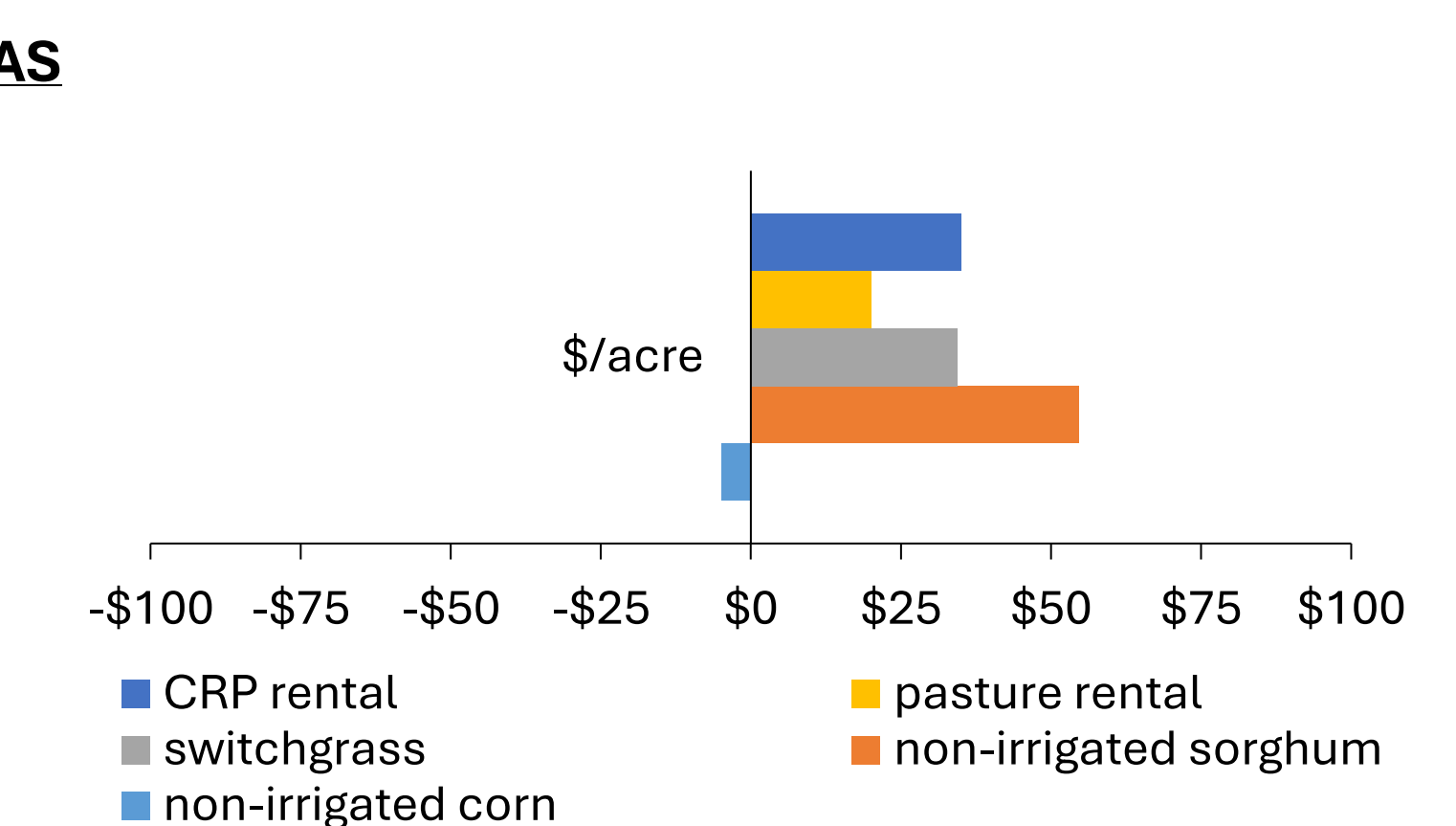
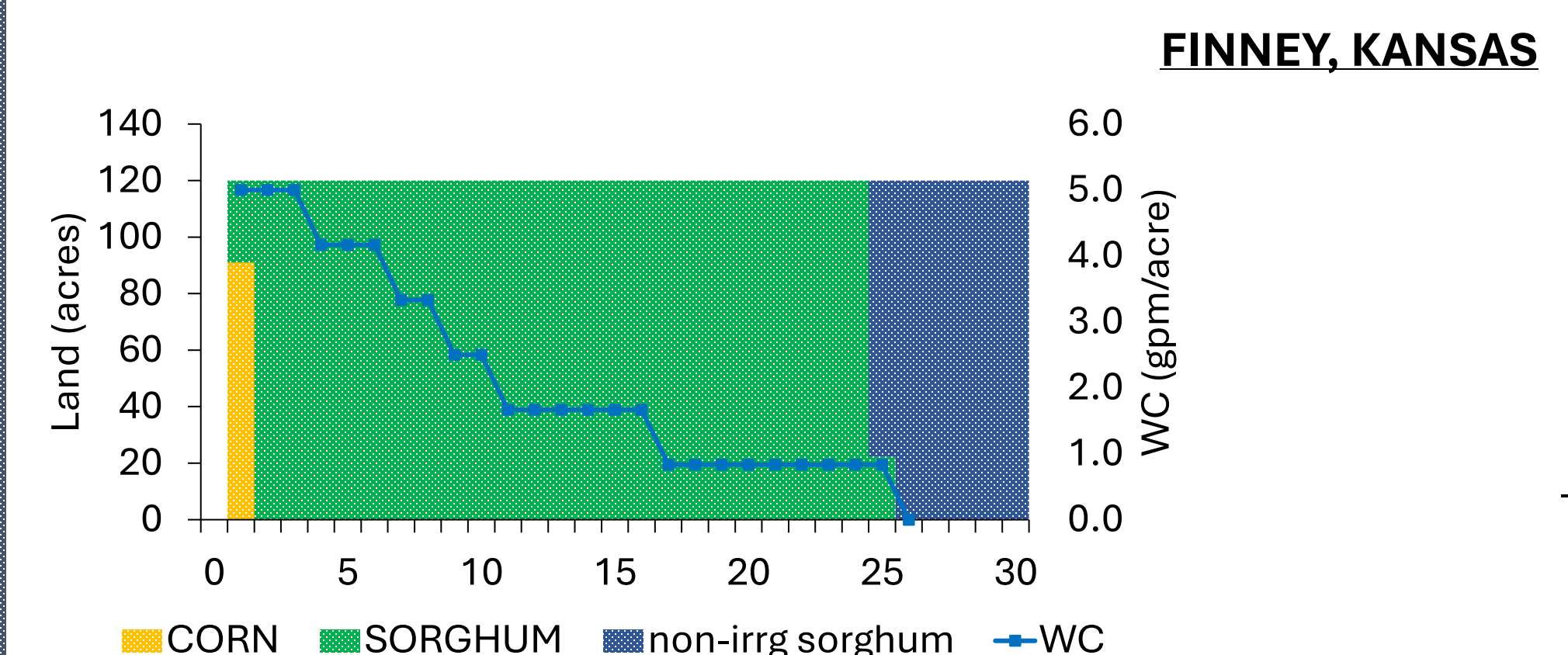
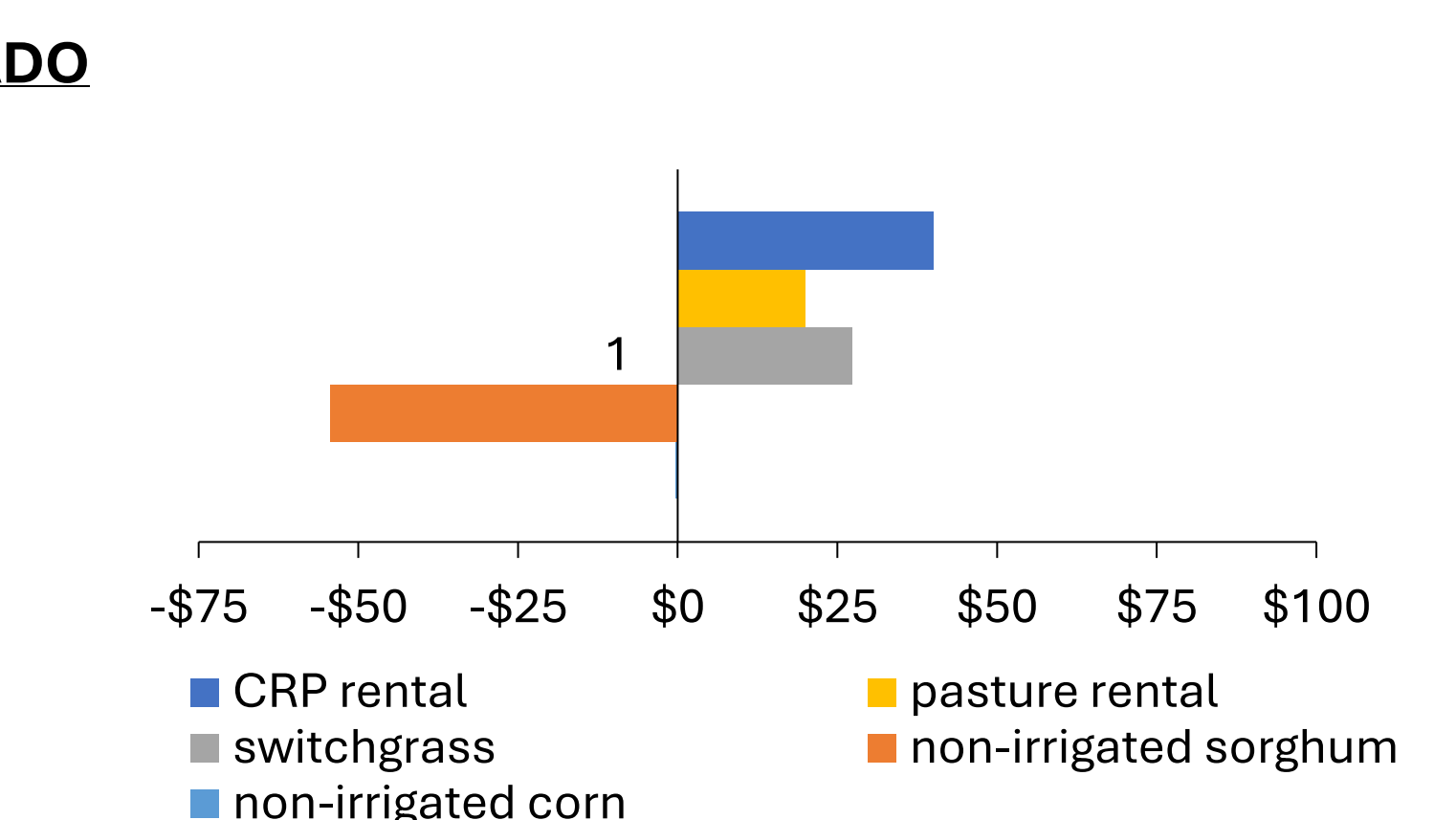
Figure 2. Flowchart showing the data and methods approach used for the pilot study analysis

Results

Irrigated system followed by dryland transition choices for 120-acre pivot with well capacity of 600 GPM



Static crop budgets showing the most profitable dryland system choices for non-irrigated land



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