

# GLASSNET Geospatial Data for Sustainability

## Gridded Cropland Supply Elasticity for the Continental United States v.1.0.0 (5 arc-min Spatial Resolution)

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Global-Local-Global Analysis of Systems Sustainability

# GLASSNET

An International Network of Networks



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# Gridded Cropland Supply Elasticity for the Continental United States

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### Keywords

Agricultural economics; land use; conservation; sustainability; supply elasticity

### Data Items

Data items include empirically estimated cropland supply elasticity for more than 75,000 grid cells over the continental United States calculated for years around 2010. Supply elasticity is an economic concept demonstrating the response of suppliers to changes in prices given everything else is constant. In terms of cropland supply elasticity, it shows the response of cropland supply to a 1% change in rents (returns) in a given location and given time keeping everything else constant. A high cropland supply elasticity implies that a small increase in rents is sufficient for a large increase in land supply, while a low cropland supply elasticity entails that a large increase in land rents is required to motivate increases in cropland supply.

The data is provided in NetCDF, GeoTIFF, CSV, and HAR file formats. The spatial resolution is 5 arc-min. An arcminute is 1/60<sup>th</sup> of a degree. A 5 arc-minute resolution is 1/12<sup>th</sup> of a degree and equivalent to squares with the side 9.26 km at the Earth's equator. In other words, the size of grid cells declines moving away from the Earth's equator.

**Table 1. Description of the data items**

Variables	Label	File formats	Resolution	Scope	Units	Time
Gridded cropland supply elasticity	ELANDg	NetCDF, GeoTIFF, HAR, CSV	5 arc-min	Continental US	NA	~2010

<sup>1</sup> For data issues and queries contact: Iman Haqiqi, Department of Agricultural Economics, Purdue University, [ihqiqi@purdue.edu](mailto:ihqiqi@purdue.edu)

## **Purpose and application**

This dataset is developed to provide insights into the magnitude of likely responses of cropland to regional and global changes. It is valuable for potential use in quantifying the overall agricultural economic responses and land use changes to economic and environmental drivers. The proposed land supply elasticities have been used in studying the impact of global changes on local land and water resources (Baldos et al, 2020). They are also used in investigating the local responses to global and local changes (Ray et al, 2023, Haqiqi et al, 2023). The gridded land supply elasticity parameter is important for spatial economic research in agriculture. It is the major factor for analyzing the spatially heterogeneous responses of farmers to agricultural policies and shocks. It is also important for understanding the spatial distribution of the impacts of climate change on agriculture.

Here, the 5 arc-minute resolution is sufficient for many land use studies, such as land cover mapping, vegetation monitoring, and agricultural policy assessment. However, it may not be sufficient for applications that require higher details such as ecosystem services, biodiversity, and small-scale conservation practices. Users should practice discretion when downscaling and aggregating this data to different resolutions.

## **Methods**

The elasticities are validated for predicting aggregate cropland changes in the United States. We do not recommend the data for studying individual grid cells. Special considerations and further economic estimations are required when focusing on individual grid cells. For technical details about estimating the land supply elasticities for the Americas, based on accessibility, refer to Villoria and Liu (2018), for the US land supply elasticities, refer to Villoria, Chakravarty, and Delgado (2020), and Villoria et al (2022).

## **How to read the files**

The CSV file provides flexibility for a wide range of general users. It includes 75,651 rows of data and one top row for labels. The columns x and y are the coordinates of the center of the grid cell in 5-arcmin, considering “+proj=longlat +datum=WGS84”. The FIPS column shows the US county codes. The sub-region column is the code for Farm Resource Regions as described in Table 2. Finally, the ELAND column shows the cropland supply elasticity.

Table 2. USDA Farm Resource Regions

	Abbreviation	USDA Farm Resource Regions
1	Heartland	Heartland
2	NorthCrescen	Northern Crescent
3	NorthGreatPl	Northern Great Plains
4	PrairieGatew	Prairie Gateway
5	EastUplands	Eastern Uplands
6	SouthSeabr	Southern Seaboard
7	FruitfulRim	Fruitful Rim
8	BasinaRange	Basin Range
9	MississippiP	Mississippi Portal

\* For more details look at USDA ERS Farm Resource Regions.

People familiar with geospatial raster files (GeoTiff and NetCDF) can open the files in R, Python, Panoply (Figure 1), or any other GIS software. This is a more convenient way for spatial analysis and illustration of the data. The basic Coordinate Reference System is “+proj=longlat +datum=WGS84”. If there is no estimate for the grid cell, NA is assigned.

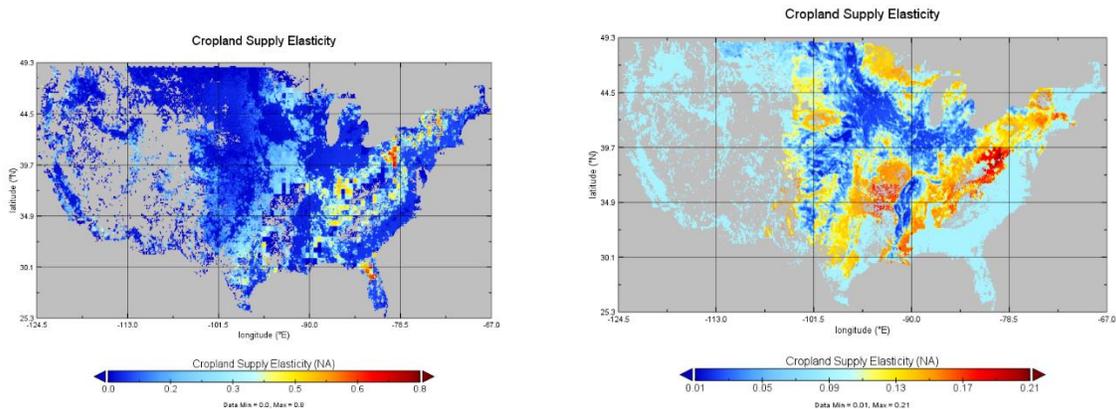


Figure 1. The spatial distribution of land supply elasticity is illustrated by Panoply using the NetCDF file.

The HAR files are provided for GEMPACK and SIMPLE-G users. Figure 1 illustrated the available data headers in the HAR file. Each header includes specific information. Note that the LON and LAT headers are showing the coordinate values (longitude and latitude) for the center of the grid cell (in some versions

they are multiplied by 120, and the user needs to divide them by 120 to get to the precise coordinates). The mapping is provided to county FIPS codes and USDA Farm Resource Regions. A working GEMPACK is required to read the HAR files. A free version of GEMPACK software is available on the CoPS website (Harrison & Pearson, 1996; Horridge et al, 2018): [www.copsmodels.com/gpwingem.htm](http://www.copsmodels.com/gpwingem.htm) and [www.copsmodels.com/gpmark9.htm](http://www.copsmodels.com/gpmark9.htm).

Header	Type	Dimension	Coeff	Total	Min	Max	Name
1 ELND	RE	GID	ELAND	6768	0.000	0.755	Cropland supply elasticities, grid
2 FIPS	RE	75651	FIPS	2366368469	1001	56045	FIPS codes for US counties
3 FRR	RE	75651	Farm_res_reg	320510	1.00	9.00	USDA Farm Resource Regions
4 FRRS	1C	9 length 12					Set US_SMKT market for similar products, USDA Farm Resource Regions
5 LON	RE	75651	Longitude	-863602465	-14935	-8045	120x Longitude of the center of the grid cell
5 LAT	RE	75651	Latitude	359151735	3045	5915	120x Latitude of the center of the grid cell
7 YEAR	1C	1 length 12					Dataset for average conditions around 2010

Figure 2. The summary of the information provided in the HAR file for use in GEMPACK::ViewHAR.

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