

Historical Irrigation Water Use and Groundwater Pumpage Estimates in the Harney Basin, Oregon, 1991–2018



Tags

evaporation, transpiration, groundwater, irrigation, remote sensing, agriculture, water use, evapotranspiration measurement

Summary

This geodatabase contains feature classes that describe estimates of evapotranspiration for agricultural areas within Oregon's Harney basin. These feature classes contain data for 13 years spanning 1991 - 2018, with each feature class representing a single year.

Description

Current and historical crop water use and groundwater pumpage estimates are needed for the Harney Basin in southeastern Oregon for a complete evaluation of the basin's groundwater budget. This information will inform the overarching cooperative Oregon Water Resources Department (OWRD) and U.S. Geological Survey (USGS) study of the groundwater resource. This open file report describes the process used by OWRD to quantify crop water use from agricultural fields and associated groundwater pumpage in the Greater Harney Valley Area (GHVA) and presents findings of the analysis. Evapotranspiration (ET), consumptive use (CU; ET minus precipitation), and groundwater pumpage were estimated for 13 individual years spanning 1991 to 2018. The average annual growing season for irrigated areas was assumed to occur from May to September.

ET of applied surface water and groundwater and groundwater pumpage for irrigation during 1991-2018 were estimated by coupling modeled field level ET estimates with available groundwater-pumpage data. Field-level ET was estimated using a remotely-sensed ET model - Mapping EvapoTranspiration at High Resolution with Internalized Calibration (METRIC) - scaled to ET measurements from an alfalfa field in the basin, GridMET precipitation data, and mapped agricultural fields. The source of water used to irrigate each field was obtained from OWRD water rights information. Estimated pumpage volumes associated with each ET estimates were determined using reported pumpage volumes from OWRD's Water Use Reporting database and literature-reported irrigation efficiencies. The METRIC estimated average growing season net ET (ET minus precipitation) for mapped irrigated fields over 1991 to 2018 was 1.51 feet per year (ft/yr) for fields irrigated with primarily groundwater, 1.49 ft/yr for fields irrigated with combined groundwater and surface water, and 1.43 ft/yr for fields irrigated with primarily surface water.

In order to facilitate comparison of recharge and discharge volumes and evaluate groundwater development in the USGS groundwater study, the Harney Basin was separated into three analysis regions based on topography and groundwater movement. Current groundwater pumpage estimates for each region represent the mean-annual values of pumpage for the five year period of 2014 to 2018. The mean annual groundwater pumpage volume for each region is as follows: 76,000 acre-feet for the northern region, 20,000 acre-feet in the southern region, and 41,000 acre-feet in western region. The average total pumpage estimate for the GHVA area during 2014-2018 is estimated at 140,000 acre-feet per year from 67,400 groundwater irrigated acres, which represents an increase of 80,000-90,000 acre-feet since the early 1990s. Regional groundwater pumpage rates for fields irrigated with primary groundwater rights averaged 2.16 acre-feet per acre (ac-ft/ac), whereas rates for fields irrigated with supplementary groundwater rights averaged 1.24 ac-ft/ac.

Credits

This project was funded by NASA Water Resources Applied Sciences Program Grant # NNX17AF53G for state water agency staff to access the tools, training, and technical support required to create maps of historical evapotranspiration (ET) from irrigated areas using satellite-based remote sensing models in the Harney Basin and the Oregon Watershed Enhancement Board Monitoring Grant # 219-5046-16766 for the ET data collection.

Use limitations

There are no access and use limitations for this item.

Extent

West -119.728267 **East** -118.425959
North 43.889232 **South** 42.916152

Scale Range

Maximum (zoomed in) 1:5,000
Minimum (zoomed out) 1:150,000,000

ArcGIS Metadata ►

Topics and Keywords ►

Hide Topics and Keywords ▲

Citation ►

TITLE Historical Irrigation Water Use and Groundwater Pumpage Estimates in the Harney Basin, Oregon, 1991–2018
PUBLICATION DATE 2021-08-01 00:00:00

Hide Citation ▲

Citation Contacts ►

RESPONSIBLE PARTY

INDIVIDUAL'S NAME Jordan Beamer
ORGANIZATION'S NAME Oregon Water Resources Department
CONTACT'S POSITION Hydrologist
CONTACT'S ROLE originator

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RESPONSIBLE PARTY

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CONTACT'S POSITION Water Availability Analyst
CONTACT'S ROLE originator

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E-MAIL ADDRESS mellony.d.hoskinson@oregon.gov

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[Hide Citation Contacts ▲](#)

Resource Details ►

DATASET LANGUAGES English
DATASET CHARACTER SET utf8 - 8 bit UCS Transfer Format

STATUS completed

CREDITS

This project was funded by NASA Water Resources Applied Sciences Program Grant # NNX17AF53G for state water agency staff to access the tools, training, and technical support required to create maps of historical evapotranspiration (ET) from irrigated areas using satellite-based remote sensing models in the Harney Basin and the Oregon Watershed Enhancement Board Monitoring Grant # 219-5046-16766 for the ET data collection.

ARCGIS ITEM PROPERTIES

[Hide Resource Details ▲](#)

Extents ►

EXTENT

DESCRIPTION

The Harney Basin encompasses about 5,240 square miles in southeastern Oregon. Irrigation from pumped groundwater predominantly occurs in the Greater Harney Valley Area (GHVA), which lies within central Harney Basin. Hydrologically, three major watersheds comprise the GHVA. The State of Oregon (State of Oregon Water Resources Board, 1967) identify these watersheds as Silver Creek (Western Region), Silvies River (Northern Region), and Donner und Blitzen River (Southern Region). The elevation of the agricultural area within the GHVA ranges from 4,100 feet near Malheur Lake to 4,300 feet in Silver Creek Valley.

GEOGRAPHIC EXTENT

BOUNDING RECTANGLE

EXTENT TYPE Extent used for searching
WEST LONGITUDE -119.728267
EAST LONGITUDE -118.425959
NORTH LATITUDE 43.889232
SOUTH LATITUDE 42.916152
EXTENT CONTAINS THE RESOURCE Yes

TEMPORAL EXTENT

BEGINNING DATE 1991-03-01 00:00:00
ENDING DATE 2018-09-30 00:00:00

[Hide Extents ▲](#)

Resource Maintenance ►

RESOURCE MAINTENANCE
UPDATE FREQUENCY not planned

[Hide Resource Maintenance ▲](#)

Lineage ►

LINEAGE STATEMENT

Lineage includes data sets used to delineate agricultural fields and to develop ET estimates.

PROCESS STEP ►

DESCRIPTION

The base field polygon shapefile used was the Common Land Unit (CLU; United States Department of Agriculture, 2008) shapefile available for Harney County representing the year 2008. In order to create the feature classes of actively irrigated fields in the basin for each year METRIC was run, we overlayed the CLU dataset on high-resolution aerial imagery from National Agriculture Imagery Program (NAIP) to edit (remove) CLU polygons that were not cultivated or irrigated and manually draw in fields missing from CLU dataset. We started the year 2016, theoretically the year with greatest irrigated footprint, and worked backwards to the earliest year of analysis (1991). For years without NAIP imagery, we supplemented with Landsat May-September maximum normalized vegetation index available from Climate Engine (<https://app.climateengine.org/>). Field polygons were created or removed based on the available imagery in order to create a complete dataset of actively irrigated polygons in the study area. Once the digitized field polygon datasets for irrigated fields outside of the Malheur Wildlife Refuge were finalized, each field polygon was assigned a unique field ID value as well as the start year (year when field first identified as actively irrigated).

Hide Process step ▲

SOURCE DATA ►

DESCRIPTION

U.S. Department of Agriculture National Agriculture Imagery Program (NAIP) imagery - years 1994, 1995, 2000, 2005, 2009, 2011, 2014, 2015, 2016

SOURCE CITATION ►

TITLE National Agriculture Imagery Program imagery

ALTERNATE TITLES NAIP

RESOURCE LOCATION ONLINE

LOCATION <https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery/>

Hide Source citation ▲

Hide Source data ▲

SOURCE DATA ►

DESCRIPTION

Earth Observation System Normalized Difference Vegetation Index (NDVI) - years 1992, 1994, 1998, 2000, 2001, 2015

SOURCE CITATION ►

TITLE Normalized Difference Vegetation Index

ALTERNATE TITLES NDVI

RESOURCE LOCATION ONLINE

LOCATION <http://climateengine.org/>

NAME Climate Engine

Hide Source citation ▲

[Hide Source data](#) ▲

SOURCE DATA ►

DESCRIPTION

U.S. Department of Agriculture Common Land Unit (CLU) 2008

SOURCE CITATION ►

TITLE Common Land Unit

ALTERNATE TITLES CLU

RESOURCE LOCATION ONLINE

LOCATION <https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-products/common-land-unit-clu/index>

[Hide Source citation](#) ▲

[Hide Source data](#) ▲

SOURCE DATA ►

DESCRIPTION

Malheur Wildlife Refuge Habitat Units shapefile 2016

SOURCE CITATION ►

TITLE Malheur Wildlife Refuge Habitat Units shapefile

[Hide Source citation](#) ▲

[Hide Source data](#) ▲

SOURCE DATA ►

DESCRIPTION

Oregon Water Resources Department Place of Use shapefile

SOURCE CITATION ►

TITLE Oregon Water Resources Department Place of Use shapefile

RESOURCE LOCATION ONLINE

LOCATION https://www.oregon.gov/owrd/access_Data/Pages/Data.aspx?wp7803=se:%22spatial%22

[Hide Source citation](#) ▲

[Hide Source data](#) ▲

SOURCE DATA ►

DESCRIPTION

USGS Earth Resources Observation and Science (EROS) Center Landsat Optical and Thermal Data

SOURCE CITATION ►

TITLE Landsat Optical and Thermal Data
 PUBLICATION DATE 2018-12-31 00:00:00

RESPONSIBLE PARTY

ORGANIZATION'S NAME USGS Earth Resources Observation and Science (EROS) Center

RESOURCE LOCATION ONLINE

LOCATION <http://landsat.usgs.gov/>

Hide Source citation ▲

Hide Source data ▲

SOURCE DATA ►

DESCRIPTION

Gridded Surface Meteorological Dataset (gridMET)

SOURCE CITATION ►

TITLE gridMET

RESPONSIBLE PARTY

ORGANIZATION'S NAME University of Idaho Climatology Lab

RESOURCE LOCATION ONLINE

LOCATION <http://www.climatologylab.org/gridmet.html>

Hide Source citation ▲

Hide Source data ▲

SOURCE DATA ►

DESCRIPTION

pyMETRIC: Python based tools for computing ET estimates using the Mapping EvapoTranspiration at high Resolution and Internalized Calibration (METRIC) model

SOURCE CITATION ►

TITLE pyMETRIC

RESOURCE LOCATION ONLINE

LOCATION <https://github.com/WSWUP/pymetric#references>

Hide Source citation ▲

Hide Source data ▲

SOURCE DATA ►

DESCRIPTION

North American Land Data Assimilation System (NLDAS)

SOURCE CITATION ►

TITLE North American Land Data Assimilation System

ALTERNATE TITLES NLDAS

RESOURCE LOCATION ONLINE

LOCATION <https://ldas.gsfc.nasa.gov/nldas>

Hide Source citation ▲

Hide Source data ▲

SOURCE DATA ►

DESCRIPTION

U. S. Bureau of Reclamation Pacific Northwest AgriMet weather stations

SOURCE CITATION ►

TITLE AgriMet

RESOURCE LOCATION ONLINE

LOCATION <https://www.usbr.gov/pn/agrimet/proginfo.html>

Hide Source citation ▲

Hide Source data ▲

SOURCE DATA ►

DESCRIPTION

Desert Research Institute Eddy Flux Tower Station

SOURCE CITATION ►

TITLE Desert Research Institute Eddy Flux Tower Station

RESOURCE LOCATION ONLINE

LOCATION <https://wrcc.dri.edu/cgi-bin/rawMAIN.pl?orocrn>

Hide Source citation ▲

Hide Source data ▲

SOURCE DATA ►

DESCRIPTION

OWRD Water Use Reporting Database

SOURCE CITATION ►

TITLE OWRD Water Use Reporting Database

RESPONSIBLE PARTY

ORGANIZATION'S NAME Oregon Water Resources Department

CONTACT'S POSITION Water Use Reporting

RESOURCE LOCATION ONLINE

LOCATION https://apps.wrd.state.or.us/apps/wr/wateruse_query/

[Hide Source citation ▲](#)[Hide Source data ▲](#)[Hide Lineage ▲](#)

Geoprocessing history ►

PROCESS

PROCESS NAME

DATE 2021-05-11 09:54:30

TOOL LOCATION c:\program files (x86)\arcgis\desktop10.5\ArcToolbox\Toolboxes\Conversion Tools.tbx\FeatureClassToGeodatabase

COMMAND ISSUED

```
FeatureClassToGeodatabase E:\temp\Harney_AGOL_map_202104
\monthly_ETnet_rate\harney_fields_2018_ET_summaries.shp;E:\temp\Harney_AGOL_map_202104
\monthly_ETnet_rate\harney_fields_1991_ET_summaries.shp;E:\temp\Harney_AGOL_map_202104
\monthly_ETnet_rate\harney_fields_1992_ET_summaries.shp;E:\temp\Harney_AGOL_map_202104
\monthly_ETnet_rate\harney_fields_1994_ET_summaries.shp;E:\temp\Harney_AGOL_map_202104
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\monthly_ETnet_rate\harney_fields_2001_ET_summaries.shp;E:\temp\Harney_AGOL_map_202104
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\monthly_ETnet_rate\harney_fields_2009_ET_summaries.shp;E:\temp\Harney_AGOL_map_202104
\monthly_ETnet_rate\harney_fields_2011_ET_summaries.shp;E:\temp\Harney_AGOL_map_202104
\monthly_ETnet_rate\harney_fields_2014_ET_summaries.shp;E:\temp\Harney_AGOL_map_202104
\monthly_ETnet_rate\harney_fields_2015_ET_summaries.shp;E:\temp\Harney_AGOL_map_202104
\monthly_ETnet_rate\harney_fields_2016_ET_summaries.shp;E:\temp\Harney_AGOL_map_202104
\monthly_ETnet_rate\harney_fields_2017_ET_summaries.shp E:\temp\Harney_AGOL_map_202104
\monthly_ETnet_rate\harney_ET_summaries.gdb
```

INCLUDE IN LINEAGE WHEN EXPORTING METADATA No

PROCESS

PROCESS NAME

DATE 2021-05-11 15:57:04

TOOL LOCATION c:\program files (x86)\arcgis\desktop10.5\ArcToolbox\Toolboxes\Data Management Tools.tbx\Compact

COMMAND ISSUED

```
Compact E:\temp\Harney_AGOL_map_202104\monthly_ETnet_rate\harney_ET_summaries.gdb
```

INCLUDE IN LINEAGE WHEN EXPORTING METADATA No

[Hide Geoprocessing history ▲](#)

Fields ►

DETAILS FOR OBJECT **Attribute table** ►

DEFINITION

Table containing attribute information associated with the data set.

DEFINITION SOURCE

Producer defined

FIELD **field_id** ►

DATA TYPE Number

FIELD DESCRIPTION

Unique field ID for mapped field

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field field_id ▲](#)

FIELD from_year ►

DATA TYPE Number

FIELD DESCRIPTION

Year field first mapped starting in 1991

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field from_year ▲](#)

FIELD area_ac ►

DATA TYPE Number

FIELD DESCRIPTION

Area of field in acres

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field area_ac ▲](#)

FIELD MAJORITY ►

DATA TYPE Number

FIELD DESCRIPTION

Irrigation source type where 1 = groundwater, 2 = surface water, 3 = combined groundwater and surface water

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field MAJORITY ▲](#)

FIELD FIELD_ID ►

DATA TYPE Number

FIELD DESCRIPTION

Field ID used for table join

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field FIELD_ID ▲](#)

FIELD PIXELS ►

DATA TYPE Number

FIELD DESCRIPTION

Number of 30m pixels from METRIC raster to compute zonal statistics

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field PIXELS ▲](#)

FIELD YEAR ►

DATA TYPE Number

FIELD DESCRIPTION

Year of METRIC output

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field YEAR ▲](#)

FIELD ET_SEAS ►

DATA TYPE Number

FIELD DESCRIPTION

Sum of May - September adjusted METRIC total ET depth, in feet

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field ET_SEAS ▲](#)

FIELD NET_SEAS ►

DATA TYPE Number

FIELD DESCRIPTION

Sum of May - September adjusted METRIC total ET minus GRIDMET precipitation depth, in feet

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field NET_SEAS ▲](#)

FIELD ET_M05 ►

DATA TYPE Number

FIELD DESCRIPTION

Sum of May adjusted METRIC total ET depth, in feet

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field ET_M05 ▲](#)

FIELD ET_M06 ►

DATA TYPE Number

FIELD DESCRIPTION

Sum of June adjusted METRIC total ET depth, in feet

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field ET_M06 ▲](#)

FIELD ET_M07 ►

DATA TYPE Number

FIELD DESCRIPTION

Sum of July adjusted METRIC total ET depth, in feet

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field ET_M07 ▲](#)

FIELD ET_M08 ►

DATA TYPE Number

FIELD DESCRIPTION

Sum of August adjusted METRIC total ET depth, in feet

DESCRIPTION SOURCE

Oregon Water Resources Department

Hide Field ET_M08 ▲**FIELD ET_M09** ►

DATA TYPE Number

FIELD DESCRIPTION

Sum of September adjusted METRIC total ET depth, in feet

DESCRIPTION SOURCE

Oregon Water Resources Department

Hide Field ET_M09 ▲**FIELD NET_M05** ►

DATA TYPE Number

FIELD DESCRIPTION

Sum of May adjusted METRIC total ET minus GRIDMET precipitation depth, in feet

DESCRIPTION SOURCE

Oregon Water Resources Department

Hide Field NET_M05 ▲**FIELD NET_M06** ►

DATA TYPE Number

FIELD DESCRIPTION

Sum of June adjusted METRIC total ET minus GRIDMET precipitation depth, in feet

DESCRIPTION SOURCE

Oregon Water Resources Department

Hide Field NET_M06 ▲**FIELD NET_M07** ►

DATA TYPE Number

FIELD DESCRIPTION

Sum of July adjusted METRIC total ET minus GRIDMET precipitation depth, in feet

DESCRIPTION SOURCE

Oregon Water Resources Department

Hide Field NET_M07 ▲**FIELD NET_M08** ►

DATA TYPE Number

FIELD DESCRIPTION

Sum of August adjusted METRIC total ET minus GRIDMET precipitation depth, in feet

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field NET_M08 ▲](#)

FIELD NET_M09 ►

DATA TYPE Number

FIELD DESCRIPTION

Sum of September adjusted METRIC total ET minus GRIDMET precipitation depth, in feet

DESCRIPTION SOURCE

Oregon Water Resources Department

[Hide Field NET_M09 ▲](#)

[Hide Details for object Attribute table ▲](#)

[Hide Fields ▲](#)

Metadata Details ►

METADATA CHARACTER SET utf8 - 8 bit UCS Transfer Format

SCOPE OF THE DATA DESCRIBED BY THE METADATA dataset

LAST UPDATE 2021-06-03

ARCGIS METADATA PROPERTIES

METADATA FORMAT ArcGIS 1.0

METADATA STYLE FGDC CSDGM Metadata

STANDARD OR PROFILE USED TO EDIT METADATA FGDC

CREATED IN ARCGIS FOR THE ITEM 2021-05-11 09:54:30

LAST MODIFIED IN ARCGIS FOR THE ITEM 2021-08-05 04:15:50

AUTOMATIC UPDATES

HAVE BEEN PERFORMED No

[Hide Metadata Details ▲](#)

Metadata Contacts ►

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CONTACT'S POSITION Hydrologist

CONTACT'S ROLE originator

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CONTACT'S POSITION Water Availability Analyst
CONTACT'S ROLE originator

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[Hide Metadata Contacts ▲](#)

Thumbnail and Enclosures ►

THUMBNAIL

THUMBNAIL TYPE JPG

[Hide Thumbnail and Enclosures ▲](#)

FGDC Metadata (read-only) ▼