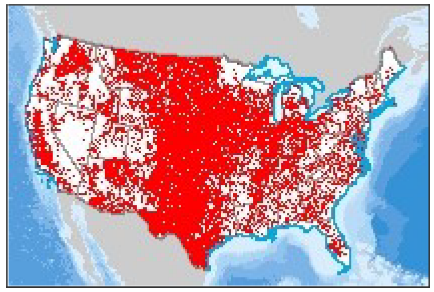
Productivity, Versatility, and Resiliency

Raster Dataset



Tags

biota, conterminous United States

Summary

To address the ongoing need to improve understanding of agricultural land patterns and rates of change to inform land use planning and policymaking at relevant scales, American Farmland Trust and Conservation Science Partners worked together to classify land cover/use across the conterminous US, with a special focus on agricultural land. This effort provides several important improvements over existing data sources by harmonizing NRI estimates of agricultural land with available spatial data; mapping agricultural land use and conversion to development in a consistent way over time; identifying the most important agricultural lands in each state based on soil productivity, versatility and resiliency; accounting for effects of low-density residential development on agricultural lands; including a new class of agricultural lands that estimates woodlands associated with farms; and mapping grazing on federal lands.

Description

The conversion of agricultural land to more-developed uses jeopardizes food security and ecosystem integrity. However, nationally consistent, high-resolution spatial data on agricultural land location and change have been largely unavailable. Through a project titled Farms Under Threat, American Farmland Trust and Conservation Science Partners mapped the extent of and change in agricultural lands within the conterminous U.S. between 2001 and 2016, producing layers that capture land cover/use and agricultural land productivity, versatility, and resiliency (PVR). This analysis used data from a number of sources, including USDA NRCS National Resources Inventory (NRI), USGS National Land Cover Database (NLCD), NRCS Soil Survey Geographic Database (SSURGO), and NRCS Digital General Soil Map of the United States (STATSGO). These data provide an improvement over previous efforts by: harmonizing NRI's ground-based estimates of agricultural land with NLCD remote sensing; mapping agricultural land conversion in a consistent way over time; and mapping new land- use classes including low-density residential, woodlands associated with farms, and grazing on federal lands. We found that, of the major land cover/use classes, agriculture dominates the continental US landscape. Yet, from 2001-2016, 11 million acres of agricultural land were converted from agriculture to more-developed land uses. Of these 11 million acres, more than 4 million were converted to urban and other highly developed (UHD) uses, while nearly 7 million acres went to low-density residential (LDR) land use. Compounding these impacts, 4.4 million acres of the nation's highest-PVR lands were converted to UHD and LDR land uses.
These trends are likely to continue, as agricultural land in LDR areas was 23 times more likely to be converted to UHD than other agricultural land. Additional findings from the analysis are available in the report (https://farmlandinfo.org/publications/farms-under-threat-the-state-of-the-states/) and on the website (http://www.farmland.org/farmsunderthreat). This file represents productivity, versatility, and resiliency (PVR) values on agricultural land. The PVR index is the first-ever assessment of agricultural land quality that explicitly accounts for productivity, versatility, and resiliency. Higher PVR values indicate higher suitability for long-term, intensive crop production, especially for food crops such as fruits, nuts, vegetables, and

staple grains. Values range from zero to one.

Credits

This data layer was developed by Conservation Science Partners in partnership with American Farmland Trust. Associated data layers should be cited as: Conservation Science Partners and American Farmland Trust. 2020. Productivity, Versatility, and Resiliency in 2016 from the Farms Under Threat: State of the States project, version 2.0. Conservation Science Partners, Truckee, CA.

Use limitations

We believe that these data provide the best available spatial map of agricultural land cover/use and agricultural land conversion as a nationally consistent data product. However, as with any spatial analysis and mapping of this complexity, detail, and extent, there are some limitations to these data. First, making a direct comparison of FUT and NRI agricultural land conversion estimates is challenging due to methodological and land cover/use classification differences between the approaches. Although we calibrated our land cover model to NRI acreage estimates, limitations in mapping and statistical precision as well as uncertainty around NRI estimates prevented our model outputs from fully converging with NRI estimates. Specifically, our estimates of UHD land cover are often lower than NRI because our classification of urban land (derived from NLCD) is less expansive than the NRI definition of developed land, and because FUT does not include roads as UHD land cover. Second, the NLCD dataset is fundamental to the FUT product and thus the accuracy of NLCD is directly tied to how well we map land cover in FUT. At the time that this analysis was completed, no accuracy assessment for the 2016 NLCD products had been released. Third, our mapping of low-density residential (LDR) land use is an explicit attempt to identify areas that are not high enough in housing and impervious surface density to be mapped as urban areas, but where agricultural production may face increasing limitations due to adjacent residential land use. However, our method inevitably captures some viable agricultural areas within LDR areas. Although we produced the FUT products at a resolution of 100 m2 (or ~ 0.025 acre), we consider a reasonable minimum mapping unit to be between 100 and 200 acres, largely based on characteristics of the NLCD data. While the FUT datasets can be visualized at their native resolution, we caution against the use of these data below our recommended minimum mapping unit, for example, in calculating summary statistics such as land cover acreage or average PVR values. We recognize that there will be utility in applying the data at a relatively fine scale, but urge caution when interpreting or comparing analytical results, particularly when applying the data to site-specific planning activities. Calculating landscape change is particularly challenging. Analytical results will be most robust at the national and state scales; county and sub-county analyses should proceed under the advisement of the data developers on a case-by-case basis. Due to the aggregation process required when moving from the native 10 meter resolution data to the 30 meter and 120 meter resolution data, land cover totals may not match the official Farms Under Threat statistics, especially when using the 120 meter data. Statistical summarization: We used the following procedure to tabulate the area of specific land cover classes: Step 1: Extract the land cover class of interest into a binary (1/0) raster dataset. Step 2: Multiply the result of step 1 by a raster representing the actual area of each raster cell in the native projection (EPSG:4326). Step 3: Add together the values of all cells within the area of interest. State-level statistics were derived by summing county-level statistics. All calculations were done in Google Earth Engine.

Extent

West	-125.400142	**East**	-66.799084
North	53.127085	**South**	22.698990

Scale Range

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

ArcGIS Metadata

Topics and Keywords

THEMES OR CATEGORIES OF THE RESOURCE biota

* CONTENT TYPE Downloadable Data

PLACE KEYWORDS conterminous United States

THEME KEYWORDS biota

THESAURUS
TITLE ISO 19115 Topic Category

Hide Thesaurus

Hide Topics and Keywords

Citation

TITLE Productivity, Versatility, and Resiliency
PUBLICATION DATE 2020-05-21

PRESENTATION FORMATS digital map
FGDC GEOSPATIAL PRESENTATION FORMAT raster digital data

Hide Citation

Citation Contacts

RESPONSIBLE PARTY
ORGANIZATION'S NAME Conservation Science Partners and American Farmland Trust
CONTACT'S ROLE originator

Hide Citation Contacts

Resource Details

DATASET LANGUAGES English (UNITED STATES)

STATUS completed
SPATIAL REPRESENTATION TYPE * grid

* PROCESSING ENVIRONMENT Version 6.2 (Build 9200) ; Esri ArcGIS 10.8.0.12790

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Science Partners, Truckee, CA.

ArcGIS item properties
* Name productivity_versatility_resiliency_2016_conus_120m.tif
* Location
  * Access protocol Local Area Network

Hide Resource Details

Extents

Extent
Geographic extent
Bounding rectangle
West longitude -125.27
East longitude -66.54
South latitude 22.5
North latitude 49

Extent
Description
publication date

Temporal extent
Beginning date 2016-01-01
Ending date 2016-12-31

Extent
Geographic extent
Bounding rectangle
Extent type Extent used for searching
* West longitude -125.400142
* East longitude -66.799084
* North latitude 53.127085
* South latitude 22.698990
* Extent contains the resource Yes

Extent in the item's coordinate system
* West longitude -125.400142
* East longitude -66.799084
* South latitude 22.698990
* North latitude 53.127085
* Extent contains the resource Yes

Hide Extents

Resource Points of Contact

Point of contact
Individual's name Brett G. Dickson
Organization's name Conservation Science Partners
Contact's role point of contact

Contact information
Phone

VOICE 530.214.8905

ADDRESS
TYPE both
DELIVERY POINT 11050 Pioneer Trail, Suite 202
CITY Truckee
ADMINISTRATIVE AREA CA
POSTAL CODE 96161
COUNTRY US
E-MAIL ADDRESS info@csp-inc.org

Hide Contact information

Hide Resource Points of Contact

Resource Maintenance

RESOURCE MAINTENANCE
UPDATE FREQUENCY not planned

Hide Resource Maintenance

Resource Constraints

LEGAL CONSTRAINTS
LIMITATIONS OF USE
Distributor assumes no liability for misuse of data.

OTHER CONSTRAINTS
This layer was created by Conservation Science Partners and American Farmland Trust. Any applications or publications drawing on these data, in novel analyses, reports, peer-reviewed articles, theses, or other forms, should be undertaken in consultation with the creators. The source of the data should be properly referenced using the citation provided under Credits. This file should not be shared with others without express permission.

CONSTRAINTS
LIMITATIONS OF USE
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Hide Resource Constraints

Spatial Reference

ArcGIS coordinate system
- * Type Geographic
- * Geographic coordinate reference GCS_WGS_1984
- * Coordinate reference details
  - Geographic coordinate system
    - Well-known identifier 4326
    - X origin -400
    - Y origin -400
    - XY scale 11258999068426.238
    - Z origin -100000
    - Z scale 10000
    - M origin -100000
    - M scale 10000
    - XY tolerance 8.983152841195215e-09
    - Z tolerance 0.001
    - M tolerance 0.001
    - High precision true
    - Left longitude -180
    - Latest well-known identifier 4326
    - Well-known text GEOGCS["GCS_WGS_1984",DATUM["D_WGS_1984",SPHEROID ["WGS_1984",6378137.0,298.257223563]],PRIMEM["Greenwich",0.0],UNIT ["Degree",0.0174532925199433],AUTHORITY["EPSG",4326]]

Reference system identifier
- * Value 4326
- * Codespace EPSG
- * Version 6.14(3.0.1)

Hide Spatial Reference

Spatial Data Properties

Georectified Grid
* Number of dimensions 2

Axis dimensions properties
Dimension type column (x-axis)
* Dimension size 54362
* Resolution 0.001078 deg (degree)

Axis dimensions properties
Dimension type row (y-axis)
* Dimension size 28227
* Resolution 0.001078 deg (degree)

* Cell geometry area
* Point in pixel center

* Transformation parameters are available Yes

* Check points are available No

Corner points
* Point -125.400142 22.698990
* Point -125.400142 53.127085
* Point -66.799084 53.127085
* Point -66.799084 22.698990

* Center point -96.099613 37.913037

Hide Georectified Grid

ArcGIS Raster Properties
General Information
* Pixel depth 32
* Compression type LZW
* Number of bands 1
* Raster format TIFF
* Source type continuous
* Pixel type floating point
* No data value -9999
* Has colormap No
* Has pyramids No

Hide ArcGIS Raster Properties

Hide Spatial Data Properties

Spatial Data Content

Image Description
* Type of information image

Band information
* Description Band_1
* Number of bits per value 32

Hide Spatial Data Content

Data Quality

Scope of quality information

Resource level dataset

Hide Scope of quality information

Data quality report - Conceptual consistency

Measure description

No formal logical accuracy tests were conducted.

Hide Data quality report - Conceptual consistency

Data quality report - Completeness omission

Measure description

Data set is considered complete for the information presented, as described in the abstract. Users are advised to read the rest of the metadata record carefully for additional details.

Hide Data quality report - Completeness omission

Data quality report - Quantitative attribute accuracy

Measure description

No formal attribute accuracy tests were conducted.

Hide Data quality report - Quantitative attribute accuracy

Data quality report - Absolute external positional accuracy

Dimension horizontal

Measure description

A formal accuracy assessment of the horizontal positional information in the data set has either not been conducted, or is not applicable.

Hide Data quality report - Absolute external positional accuracy

Data quality report - Absolute external positional accuracy

Dimension vertical

Measure description

A formal accuracy assessment of the vertical positional information in the data set has either not been conducted, or is not applicable.

Hide Data quality report - Absolute external positional accuracy

Hide Data Quality

Lineage

PROCESS STEP

WHEN THE PROCESS OCCURRED 2020-05-21

DESCRIPTION

For a detailed description of methods used to produce FUT data, please see the full technical report: https://csp-fut.appspot.com/downloads/AFT_CSP_FUT_Technical_Doc.pdf. The land cover and use dataset uses classes consistent with the NRI (cropland, pastureland, rangeland and forest land) and introduces three additional land cover/use classes: 1) woodland (a subset of the forest class identifying wooded land associated with and adjacent to farms, an attempt to spatially represent the woodland class reported in the USDA Census of Agriculture [CoA]); 2) low-density residential land use (U.S. Census blocks with average acres per housing unit below the 10th percentile farm size in the corresponding county); and 3) federal lands with active grazing allotments. Additionally, FUT explicitly maps roads separately from other developed land cover as a new class called transportation. The principal steps in our modeling process were to: (a) define desired land cover/use classes that were consistent with the NRI; (b) map and mask out non-agricultural land cover including urban areas, water, barren areas, and forest; (c) generate a suitability surface for intensive agricultural production; (d) assign pixels of each agricultural land cover class using the principle of highest, best use (first cropland, then pastureland, and then rangeland), starting from the pixel with the highest suitability rating and continuing until total pixels for each type is equal to the acres of that agriculture class estimated in the NRI by county; (e) map woodlands associated with farms by harmonizing county level estimates from the USDA CoA and a woodland suitability surface which considered cost-distance from crop/pasturelands and slope; (f) map federal lands including grazing allotments on US Forest Service and Bureau of Land Management lands; (f) map major roads; and (g) merge county-level data layers with state-level data to form a national dataset. In addition to classifying land cover/use across the US, we quantified soil productivity (soil classifications that relate to crop yield per acre), versatility (soil and climate characteristics that make land able to support a wide range of crops), and resiliency (the ability of land to maintain its potential to provide ecosystem services). This PVR analysis considers soils, their limitations, climate, land cover/use, and recent production history to quantify whether land would be capable of producing commonly cultivated crops and pasture plants without deterioration over a long period of time. To identify the most important agricultural land, we calculated the minimum PVR value of land that could support long-term, intensive production of food and other crops, typically associated with increased management intensity and high-value crops. We used this PVR value as a threshold to identify the best land across the U.S., calling all land with PVR values above the threshold “Nationally Significant.” To identify the highest potential lands in each state—which we term “each state’s best land”—we mapped the lands with PVR values equal to or greater than the approximate median PVR value for a state’s agricultural lands. These two categories of high-quality lands overlap and the same land may be included in both.

Hide Process step

Hide Lineage

Distribution

Distributor
Contact information
Individual's name Ryan Murphy
Organization's name American Farmland Trust
Contact's role distributor

Contact information
Phone
Voice (800) 370-4879

Address
Type both
Delivery point 1 Short Street, Suite 2
City Northampton
Administrative area MA
Postal code 01060
Country US
E-mail address maps@farmland.org

Hide Contact information

Hide Distributor

Distribution format
* Name Raster Dataset

Hide Distribution

Metadata Details

Metadata language English (UNITED STATES)
Metadata character set utf8 - 8 bit UCS Transfer Format

Scope of the data described by the metadata dataset
Scope name * dataset

* Last update 2020-12-08

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 2020-12-02 11:55:43
Last modified in ArcGIS for the item 2020-12-08 12:05:26

Automatic updates
Have been performed Yes
Last update 2020-12-08 11:40:04

Hide Metadata Details

Thumbnail and Enclosures

THUMBNAIL

THUMBNAIL TYPE JPG

Hide Thumbnail and Enclosures