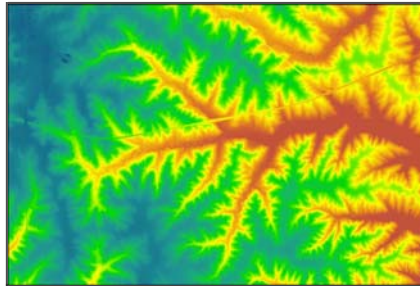


# The Iowa HUC12 S-Library: Elevation Rasters at 2-meter resolution

## Raster Dataset



## Tags

2-meter, LiDAR, Iowa, elevation, Iowa, hydrologic enforcement, elevation

## Summary

The Iowa S-Library series of elevation data are watershed-scale, high-resolution rasters that have been hydro-conditioned and include some hydrologic enforcement. These data should be considered 'bare earth data' and are suitable for large scale examination of the landscape using a variety of terrain analysis methods and visualization techniques.

## Description

The Iowa S-Library series of elevation data are LiDAR point-cloud derived, 2 meter resolution rasters that have been hydro-conditioned and include some hydrologic enforcement. The D-Library series of elevation data have been assembled using a HUC12 watershed framework consisting of 1,657 watersheds for the state of Iowa. These data should be considered 'high-resolution bare earth' and are suitable for large scale examination of the landscape using terrain analysis methods. Three production processes were used in the development of these data, see below.

The first process involves creating a digital elevation model (DEM) from the raw LiDAR point cloud data. Bare-earth elevation points are imported into an ESRI Terrain dataset using custom pyramid and thinning settings to reduce unnecessary points. The Terrain is then converted into a DEM and elevation differences smaller than 1 centimeter (cm) are truncated. This centimeter-resolution DEM is analyzed for flow characteristics to remove artifacts of processing the LiDAR that are singular "pits" in the surface. These pits are, in essence, one-cell sinks or depressions of one-cell extent that cannot be resolved using traditional processing techniques available in ArcGIS. The "pit filling" process removes all one-cell sinks.

A second process, termed "hole punching", involves defining depressions that are significant enough to maintain in the elevation model, these typically represent natural depressions or pot holes. This involves iteratively filling the DEM, defining regions where the DEM was filled, and calculating the maximum fill depth and total area filled of each region. Regions deeper than the 10 cm are considered significant depressions. The deepest point in these significant depressions is set to "Null" so that water can "flow" out the "Null" cell, and the process of filling the DEM is repeated until no significant depressions remain. In the final step, the "Null" cells are replaced with the original DEM values to create a fully populated elevation raster. The result of the "hole punching" process is a hydro-conditioned DEM with small depressions (less than 10 cm) filled. The "hole punched" DEMs are moved into the P-series DEM library.

Finally, a process of partial hydrologic enforcement uses specific elements in the IADNR's stream centerline geodatabase (Iowa Department of Natural Resources, 2016) to enhance surface flow in the PLib DEMs. This process involves a revision of the input DEM by altering elevation values along IA DNR-developed stream centerline features. The input line features

are the stream centerline feature class that represent where surface flow occurs. These features have been identified by IA DNR analysts during the stream centerline development process. The full stream centerline feature class for the watershed is used to modify the DEM. These features have been modified to insure that the modifications are relatively minor. The process of preparing the stream centerlines for use in hydro modification are as follows;

- + Stream features are extracted from the state-wide feature class for the HUC12 watershed
- + Features are generalized using the SimplifyLine method using the Bend\_SIMPLIFY algorithm and a 10m tolerance
- + Resulting features are split at vertices to create individual features with no intermediate vertices
- + Very short segments,  $\leq 8.5\text{m}$ , are merged where possible

The resulting features are used as cut lines when an obstruction to flow is present in the DEM that should be "burned through", such as a culvert which routes flow beneath a road. When the culvert is not represented in the DEM, the flow routing process will encounter an obstruction (in this case a road) forcing the flow to "back up" rather than pass through it. Grid cells in the DEM that are located along each cut line are replaced with the minimum elevation value found along the cut line. The hydrologically enforced DEMs are moved into the S-series DEM library.

## Credits

David James, USDA/ARS National Laboratory for Agriculture and the Environment, Ames, Iowa  
 Brian Gelder, Department of Agricultural and Biosystems Engineering, Iowa State University, Ames, Iowa

## Use limitations

There are no access and use limitations for this item.

## Extent

**West** -94.039040    **East** -93.815092  
**North** 43.502349    **South** 43.402177

## Scale Range

**Maximum (zoomed in)** 1:5,000  
**Minimum (zoomed out)** 1:500,000

## ArcGIS Metadata ►

### Topics and Keywords ►

THEMES OR CATEGORIES OF THE RESOURCE    elevation

\* CONTENT TYPE    Downloadable Data  
 EXPORT TO FGDC CSDGM XML FORMAT AS RESOURCE DESCRIPTION    No

PLACE KEYWORDS    Iowa

THEME KEYWORDS    2-meter, LiDAR, elevation, Iowa, hydrologic enforcement

THEME KEYWORDS    elevation

**THESAURUS** ▶

TITLE ISO 19115 Topic Categories

[Hide Thesaurus ▲](#)[Hide Topics and Keywords ▲](#)**Citation** ▶TITLE The Iowa HUC12 S-Library: Elevation Rasters at 2-meter resolution  
PUBLICATION DATE 2016-02-15PRESENTATION FORMATS digital map  
FGDC GEOSPATIAL PRESENTATION FORMAT remote-sensing image[Hide Citation ▲](#)**Citation Contacts** ▶

## RESPONSIBLE PARTY

ORGANIZATION'S NAME David james, USDA/ARS National Laboratory for Agriculture and the Environment, Geographic Information Specialist  
CONTACT'S ROLE originator[Hide Citation Contacts ▲](#)**Resource Details** ▶DATASET LANGUAGES English (UNITED STATES)  
DATASET CHARACTER SET utf8 - 8 bit UCS Transfer Format

SPATIAL REPRESENTATION TYPE \* grid

PROCESSING ENVIRONMENT Microsoft Windows 7 Version 6.1 (Build 7601) Service Pack 1; Esri ArcGIS 10.3.1.4959

## CREDITS

David James, USDA/ARS National Laboratory for Agriculture and the Environment, Ames, Iowa  
Brian Gelder, Department of Agricultural and Biosystems Engineering, Iowa State University, Ames, Iowa

## ARCGIS ITEM PROPERTIES

\* NAME es2m070200090401.tif  
\* LOCATION  
file:///D:/Data/ACPF/ACPF\_Database/ACPF\_MetaData/IA\_DEM2m/es2m070200090401.tif  
\* ACCESS PROTOCOL Local Area Network[Hide Resource Details ▲](#)**Extents** ▶

## EXTENT

GEOGRAPHIC EXTENT  
BOUNDING RECTANGLE

WEST LONGITUDE -96.8  
 EAST LONGITUDE -89.9  
 SOUTH LATITUDE 40.2  
 NORTH LATITUDE 43.8

#### EXTENT

##### GEOGRAPHIC EXTENT

##### BOUNDING RECTANGLE

EXTENT TYPE Extent used for searching  
 \* WEST LONGITUDE -94.039040  
 \* EAST LONGITUDE -93.815092  
 \* NORTH LATITUDE 43.502349  
 \* SOUTH LATITUDE 43.402177  
 \* EXTENT CONTAINS THE RESOURCE Yes

##### EXTENT IN THE ITEM'S COORDINATE SYSTEM

\* WEST LONGITUDE 416000.000000  
 \* EAST LONGITUDE 434000.000000  
 \* SOUTH LATITUDE 4806000.000000  
 \* NORTH LATITUDE 4816926.000000  
 \* EXTENT CONTAINS THE RESOURCE Yes

[Hide Extents ▲](#)

## Resource Points of Contact ►

#### POINT OF CONTACT

INDIVIDUAL'S NAME David James  
 ORGANIZATION'S NAME USDA/ARS National Laboratory for Agriculture and the Environment  
 CONTACT'S POSITION Geographic Information Specialist  
 CONTACT'S ROLE point of contact

#### CONTACT INFORMATION ►

##### ADDRESS

TYPE postal  
 DELIVERY POINT 1015 N. University Blvd  
 CITY Ames  
 ADMINISTRATIVE AREA Iowa  
 POSTAL CODE 50011  
 COUNTRY US  
 E-MAIL ADDRESS david.james@ars.usda.gov

[Hide Contact information ▲](#)

[Hide Resource Points of Contact ▲](#)

## Resource Maintenance ►

#### RESOURCE MAINTENANCE

UPDATE FREQUENCY not planned

[Hide Resource Maintenance ▲](#)

## Spatial Reference ►

#### ARCGIS COORDINATE SYSTEM

\* TYPE Projected  
 \* GEOGRAPHIC COORDINATE REFERENCE GCS\_North\_American\_1983  
 \* PROJECTION NAD\_1983\_UTM\_Zone\_15N  
 \* COORDINATE REFERENCE DETAILS  
   PROJECTED COORDINATE SYSTEM  
     WELL-KNOWN IDENTIFIER 26915  
     X ORIGIN -5120900  
     Y ORIGIN -9998100  
     XY SCALE 450445547.3910538  
     Z ORIGIN -100000  
     Z SCALE 10000  
     M ORIGIN -100000  
     M SCALE 10000  
     XY TOLERANCE 0.001  
     Z TOLERANCE 0.001  
     M TOLERANCE 0.001  
     HIGH PRECISION true  
     LATEST WELL-KNOWN IDENTIFIER 26915  
     WELL-KNOWN TEXT PROJCS["NAD\_1983\_UTM\_Zone\_15N",GEOGCS  
     ["GCS\_North\_American\_1983",DATUM["D\_North\_American\_1983",SPHEROID  
     ["GRS\_1980",6378137.0,298.257222101]],PRIMEM["Greenwich",0.0],UNIT  
     ["Degree",0.0174532925199433]],PROJECTION["Transverse\_Mercator"],PARAMETER  
     ["False\_Easting",500000.0],PARAMETER["False\_Northing",0.0],PARAMETER  
     ["Central\_Meridian",-93.0],PARAMETER["Scale\_Factor",0.9996],PARAMETER  
     ["Latitude\_Of\_Origin",0.0],UNIT["Meter",1.0],AUTHORITY["EPSG",26915]]

#### REFERENCE SYSTEM IDENTIFIER

\* VALUE 26915  
 \* CODESPACE EPSG  
 \* VERSION 6.13(3.0.1)

*Hide Spatial Reference ▲*

## Spatial Data Properties ►

#### GEORECTIFIED GRID ►

NUMBER OF DIMENSIONS 2

#### AXIS DIMENSIONS PROPERTIES

DIMENSION TYPE row (y-axis)  
 DIMENSION SIZE 7524  
 \* RESOLUTION 2.000000 m (meter)

#### AXIS DIMENSIONS PROPERTIES

DIMENSION TYPE column (x-axis)  
 DIMENSION SIZE 13000  
 \* RESOLUTION 2.000000 m (meter)

\* CELL GEOMETRY area  
 \* POINT IN PIXEL center

\* TRANSFORMATION PARAMETERS ARE AVAILABLE Yes

\* CHECK POINTS ARE AVAILABLE No

#### CORNER POINTS

\* POINT 416000.000000 4806000.000000  
 \* POINT 416000.000000 4816926.000000

\* POINT 434000.000000 4816926.000000  
 \* POINT 434000.000000 4806000.000000  
 \* CENTER POINT 425000.000000 4811463.000000

[Hide Georectified Grid ▲](#)

#### ARCGIS RASTER PROPERTIES ►

##### GENERAL INFORMATION

\* PIXEL DEPTH 16  
 \* COMPRESSION TYPE LZW  
 \* NUMBER OF BANDS 1  
 \* RASTER FORMAT TIFF  
 \* SOURCE TYPE continuous  
 \* PIXEL TYPE unsigned integer  
 \* NO DATA VALUE 0  
 \* HAS COLORMAP No  
 \* HAS PYRAMIDS Yes

[Hide ArcGIS Raster Properties ▲](#)

[Hide Spatial Data Properties ▲](#)

## Spatial Data Content ►

#### IMAGE DESCRIPTION

\* TYPE OF INFORMATION image

#### BAND INFORMATION

\* DESCRIPTION Band\_1  
 \* MAXIMUM VALUE 37821.000000  
 \* MINIMUM VALUE 33926.000000  
 \* NUMBER OF BITS PER VALUE 16

TRIANGULATION HAS BEEN PERFORMED No  
 RADIOMETRIC CALIBRATION IS AVAILABLE No  
 CAMERA CALIBRATION IS AVAILABLE No  
 FILM DISTORTION INFORMATION IS AVAILABLE No  
 LENS DISTORTION INFORMATION IS AVAILABLE No

[Hide Spatial Data Content ▲](#)

## Data Quality ►

#### SCOPE OF QUALITY INFORMATION ►

RESOURCE LEVEL dataset

[Hide Scope of quality information ▲](#)

[Hide Data Quality ▲](#)

## Lineage ►

#### PROCESS STEP ►

WHEN THE PROCESS OCCURRED 2016-01-15

DESCRIPTION

The first process involves creating a digital elevation model (DEM) from the raw LiDAR point cloud data. Bare-earth elevation points are imported into an ESRI Terrain dataset using custom pyramid and thinning settings to reduce unnecessary points. The Terrain is then converted into a DEM and elevation differences smaller than 1 centimeter (cm) are truncated. This centimeter-resolution DEM is analyzed for flow characteristics to remove artifacts of processing the LiDAR that are singular "pits" in the surface. These pits are, in essence, one-cell sinks or depressions of one-cell extent that cannot be resolved using traditional processing techniques available in ArcGIS. The "pit filling" process removes all one-cell sinks. Inputs to this process included the Iowa state-wide bare-earth LiDAR point cloud collection in HUC12 watershed framework as derived from the Iowa state-wide LiDAR point cloud collection in 2km tiles. contact the originator for details.

*Hide Process step ▲*

PROCESS STEP ►

WHEN THE PROCESS OCCURRED 2016-01-15

DESCRIPTION

A second process, termed "hole punching", involves defining depressions that are significant enough to maintain in the elevation model, these typically represent natural depressions or pot holes. This involves iteratively filling the DEM, defining regions where the DEM was filled, and calculating the maximum fill depth and total area filled of each region. Regions deeper than the 10 cm are considered significant depressions. The deepest point in these significant depressions is set to "Null" so that water can "flow" out the "Null" cell, and the process of filling the DEM is repeated until no significant depressions remain. In the final step, the "Null" cells are replaced with the original DEM values to create a fully populated elevation raster. The result of the "hole punching" process is a hydro-conditioned DEM with small depressions (less than 10 cm) filled. The "hole punched" DEMs are moved into the P-series DEM library.

*Hide Process step ▲*

PROCESS STEP ►

WHEN THE PROCESS OCCURRED 2016-01-20 00:00:00

DESCRIPTION

Finally, a process of partial hydrologic enforcement uses specific elements in the IADNR's stream centerline geodatabase (Iowa Department of Natural Resources, 2016) to enhance surface flow in the PLib DEMS. This process involves a revision of the input DEM by altering elevation values along IA DNR-provided polyline features. The input line features are the stream centerline feature class that represent where surface flow occurs. These features have been identified by IA DNR analysts during the stream centerline development process. The full stream centerline feature class for the watershed is used to modify the DEM. These features have been modified to insure that the modifications are relatively minor. The process of preparing the stream centerlines for use in hydro modification are as follows;

- + Stream features are extracted from the state-wide feature class for the HUC12 watershed

- + Features are generalized using the SimplifyLine method using the Bend\_SIMPLIFY algorithm and a 10m tolerance

- + Resulting features are split at vertices to create individual features with no intermediate vertices

- + Very short segments,  $\leq 8.5\text{m}$ , are merged where possible

The resulting features are used as cut lines when an obstruction to flow is present in the DEM that should be "burned through", such as a culvert which routes flow beneath a road. When the culvert is not represented in the DEM, the flow routing process will encounter an obstruction (in this case a road) forcing the flow to "back up" rather than pass through it. Grid cells in the DEM that are located along each cut line are replaced with the minimum elevation value found along the cut line. The hydrologically enforced DEMs are moved into the S-series DEM library.

[Hide Process step ▲](#)

SOURCE DATA ►

DESCRIPTION

Iowa state-wide LiDAR point cloud collection in 2km tiles

[Hide Source data ▲](#)

SOURCE DATA ►

DESCRIPTION

Iowa state-wide bare-earth LiDAR point cloud collection in HUC12 watershed framework

[Hide Source data ▲](#)

[Hide Lineage ▲](#)

## Geoprocessing history ►

PROCESS

PROCESS NAME

DATE 2016-09-01 02:29:51

TOOL LOCATION c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Data Management Tools.tbx\CopyRaster

COMMAND ISSUED

```
CopyRaster C:\Users\James\AppData\Local\Temp\scratch\ifthe_ras
E:\sourceData\IowaLidar2015\IAHUC12_SLib2015\2mDEM\es2m070200090401.tif # # 0
NONE NONE # NONE NONE
```

INCLUDE IN LINEAGE WHEN EXPORTING METADATA No

PROCESS

PROCESS NAME

DATE 2016-09-01 02:29:53

TOOL LOCATION c:\program files (x86)\arcgis\desktop10.3\ArcToolbox\Toolboxes\Data Management Tools.tbx\BuildPyramids

COMMAND ISSUED

```
BuildPyramids E:\sourceData\IowaLidar2015\IAHUC12_SLib2015
\2mDEM\es2m070200090401.tif -1 NONE NEAREST DEFAULT 75 OVERWRITE
```



INCLUDE IN LINEAGE WHEN EXPORTING METADATA No

[Hide Geoprocessing history ▲](#)

## Distribution ►

DISTRIBUTION FORMAT

\* NAME Raster Dataset

[Hide Distribution ▲](#)

## Fields ►

DETAILS FOR OBJECT [es2m070200090401.tif.vat](#) ►

\* TYPE Table

\* ROW COUNT 3883

FIELD VALUE ►

\* ALIAS VALUE

\* DATA TYPE Integer

\* WIDTH 10

\* PRECISION 10

\* SCALE 0

FIELD DESCRIPTION

The elevation of the cell in centimeters (cm) above mean sea level (MSL)

DESCRIPTION SOURCE

originator

[Hide Field VALUE ▲](#)

FIELD COUNT ►

\* ALIAS COUNT

\* DATA TYPE Integer

\* WIDTH 10

\* PRECISION 10

\* SCALE 0

FIELD DESCRIPTION

The number of cells at a discrete elevation

DESCRIPTION SOURCE

ESRI

[Hide Field COUNT ▲](#)

FIELD OID ►

\* ALIAS OID

\* DATA TYPE OID

\* WIDTH 4

\* PRECISION 0

\* SCALE 0

FIELD DESCRIPTION

Internal feature number.

DESCRIPTION SOURCE

ESRI

## DESCRIPTION OF VALUES

Sequential unique whole numbers that are automatically generated.

[Hide Field OID ▲](#)

[Hide Details for object es2m070200090401.tif.vat ▲](#)

[Hide Fields ▲](#)

## 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 2016-02-02

### 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 2016-09-01 02:29:51  
 LAST MODIFIED IN ARCGIS FOR THE ITEM 2016-09-16 14:17:14

### AUTOMATIC UPDATES

HAVE BEEN PERFORMED Yes  
 LAST UPDATE 2016-09-16 11:36:15

[Hide Metadata Details ▲](#)

## Metadata Contacts ►

### METADATA CONTACT

INDIVIDUAL'S NAME David James  
 ORGANIZATION'S NAME USDA/ARS National Laboratory for Agriculture and the Environment  
 CONTACT'S POSITION Geographic Information Specialist  
 CONTACT'S ROLE point of contact

### CONTACT INFORMATION ►

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 VOICE (515) 294-6858

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 CITY Ames  
 ADMINISTRATIVE AREA Iowa  
 POSTAL CODE 50011  
 COUNTRY US

E-MAIL ADDRESS david.james@ars.usda.gov

*Hide Contact information ▲*

*Hide Metadata Contacts ▲*

## **Metadata Maintenance ►**

MAINTENANCE

UPDATE FREQUENCY not planned

*Hide Metadata Maintenance ▲*

## **Thumbnail and Enclosures ►**

THUMBNAIL

THUMBNAIL TYPE JPG

*Hide Thumbnail and Enclosures ▲*

## **FGDC Metadata (read-only) ▼**