Name: Sierra Nevada Multi-Source Meadow Polygons Compilation (v 1.0)
Format: ESRI ArcGIS 10 File Geodatabase

Summary

Compiled meadows layer for the Sierra Nevada containing 17,039 meadow polygons (total area = 77,659 hectares, 191,900 acres).

Citation:

Fryjoff-Hung & Viers, 2012. Sierra Nevada Multi-Source Meadow Polygons Compilation (v 1.0), Center for Watershed Sciences, UC Davis. December 2012. http://meadows.ucdavis.edu/

Contact info :

Joshua Viers
jhviers@ucdavis.edu

Access and use limitations

This is an unofficial dataset compiled from the best available sources. The University of California, Davis makes no representations or warranties regarding the accuracy of data or maps. The user will not seek to hold the University of California, Davis liable under any circumstances for any damages with respect to any claim by the user or any third party on account of or arising from the use of data or maps. The user will cite the University of California, Davis as the original source of the data, but will clearly denote cases where the original data have been updated, modified, or in any way altered from the original condition. There are no restrictions on distribution of the data by users.

Caveats – The meadow polygons in this layer contain accuracy issues due to the variable quality of the input data. Individual input data layers were created using the following methods: 'heads-up' digitization from aerial photographs (varying scales, photo years, etc.), extraction from coarse scale vegetation layers, Feature Analyst® for ArcGIS®, and field delineation using GPS devices (varying precision).

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Description

Brief Methods:

UC Davis compiled the "best available" meadow polygon layers into a single data layer. Data layers were collected from various agencies, individuals, and organizations. Data layer quality varied based on compilation methods and age; some layers were excluded due to poor data quality. A confidence rank (1 = low, 10 = high) was assigned to the remaining layers which were rasterized at a 10m resolution. The layers were combined and combined raster cells with a summed rank of 2 or less were excluded. Raster cells representing open water were also excluded. A majority filter was run on the resulting remaining cells to reduce boundary heterogeneity, which replaced cell values based on the majority of the eight neighboring cells. Individual meadow polygons were created through a raster to vector conversion that treated all contiguous cells as a single part meadow feature with boundaries smoothed using the Polynomial Approximation with Exponential Kernel (PAEK) method (20 m tolerance to reduce edge complexity). Polygons with an area less than 0.4 ha (< 1 acre) were removed from the final meadow composite. Original IDs and other attributes were attached to the meadow polygons.

Meadow Polygon Attributes

Field	Description
STATE	State in which the meadow is located (CA or NV)
ID*	Unique meadow identifier UCDSNMxxxxxx *Note: IDs are nonsequential*
HUC12	Unique identifier for the HUC12 in which the meadow is located
OWNERSHIP	Land ownership status
EDGE_COMPLEXITY	Gives an indication of the meadow's exposure to external conditions EDGE COMPLEXITY = (MEADOWperimeter/EAC perimeter) [EAC = Equal Area Circle]
DOM_ROCKTYPE	Dominant rock type on which the meadow is located
VEG_MAJORITY	Vegetation majority based on the LANDFIRE layer
SOIL_SURVEY	Soil survey from which COKEY, Kf, ClayTot_r, MUKEY, and COMP_NAME were assigned to each meadow (SSURGO or STATSGO depending on layer coverage)
MUKEY	Mapunit Key: Unique identifier for the Mapunit in which the meadow is located
COKEY	Component Key: Unique identifier for the major component of the mapunit in which the meadow is located
COMP_NAME	Component Name: Name of the soil component with the highest representative value in the mapunit in which the meadow is located
Kf	K factor: A soil erodibility factor that quantifies the susceptibility of soil particles to detachment by water. Low: 0.05-0.2 Moderate: 0.25-0.4, High: >0.4
ClayTot_r	Representative value of total clay (%)
CATCHMENT_AREA	The approximate area of the upstream catchment exiting through the meadow (sq. m)
ELEV_MEAN	Mean elevation (m)
ELEV_RANGE	Elevation range (m) across each meadow

FLOW_RANGE	We ran the flow length geoprocessing tool across a statewide 30m DEM then ran Zonal Statistics for each meadow on that raster. This tool measures the number of cells from each location to the nearest ridgetop. The flow range is the range value from the zonal statistics and reflects the range of distances to ridgetop across the meadow.
FLOW_SLOPE	A slope metric utilizing the range of elevation values (the rise) and the Flow Range previously described (the run). Output is effectively Range(Elevation)/Range(Flow Length to ridgetop) for each meadow.
ED_MIN_LAKE	Minimum Euclidean Distance (m) to lake edges
ED_MIN_FLOW	Minimum Euclidean Distance (m) to NHD Streams/Rivers
ED_MIN_SEEP	Minimum Euclidean Distance (m) to NHD Seeps/Springs
ED_MIN_FStopo	Minimum Euclidean Distance (m) to Forest Service Topographic Map Data Transportation layer
HGM_Type	Meadow hydrogeomorphic type
LAT_DD	Latitude in decimal degrees
LONG_DD	Longitude in decimal degrees
Shape_Length	Meadow perimeter in meters
Shape_Area	Meadow area in sq. meters
AREA_ACRE	Meadow area in acres

Field : STATE
Description : State in which the meadow is located (CA or NV)

Field : ID*
Description : Unique meadow identifier UCDSNMxxxxxx
Note: IDs are nonsequential

Field : HUC12
Description : Unique identifier for the HUC12 in which the meadow is located

Field : OWNERSHIP
Description : Land ownership status

Field : EDGE_COMPLEXITY
Description : Gives an indication of the meadow's exposure to external conditions EDGE COMPLEXITY = (MEADOWperimeter/EAC perimeter) [EAC = Equal Area Circle]

Field : DOM_ROCKTYPE
Description : Dominant rock type on which the meadow is located

Field : VEG_MAJORITY
Description : Vegetation majority based on the LANDFIRE layer

Field : SOIL_SURVEY
Description : Soil survey from which COKEY, Kf, ClayTot_r, MUKEY, and COMP_NAME were assigned to each meadow (SSURGO or STATSGO depending on layer coverage)

Field : MUKEY
Description : Mapunit Key: Unique identifier for the Mapunit in which the meadow is located

Field : COKEY
Description : Component Key: Unique identifier for the major component of the mapunit in which the meadow is located

Field : COMP_NAME
Description : Component Name: Name of the soil component with the highest representative value in the mapunit in which the meadow is located

Field : Kf
Description : K factor: A soil erodibility factor that quantifies the susceptibility of soil particles to detachment by water. Low: 0.05-0.2 Moderate: 0.25-0.4, High: >0.4

Field : ClayTot_r
Description : Representative value (%) of total clay

Field : CATCHMENT_AREA
Description : The approximate area of the upstream catchment exiting through the meadow

Field : ELEV_MEAN
Description : Mean elevation (m)

Field : ELEV_RANGE
Description : Elevation range (m) across each meadow

Field : FLOW_RANGE
Description : We ran the flow length geoprocessing tool across a statewide 30m DEM then ran Zonal Statistics for each meadow on that raster. This tool measures the number of cells from each location to the nearest ridgetop. The flow range is the range value from the zonal statistics and reflects the range of distances to ridgetop across the meadow.

Field : FLOW_SLOPE
Description : A slope metric utilizing the range of elevation values (the rise) and the Flow Range previously described (the run). Output is effectively Range(Elevation)/Range(Flow Length to ridgetop) for each meadow.

Field : ED_MIN_LAKE
Description : Minimum Euclidean Distance (m) to lake edges

Field : ED_MIN_FLOW
Description : Minimum Euclidean Distance(m) to NHD Streams/Rivers

Field : ED_MIN_SEEP
Description : Minimum Euclidean Distance (m) to NHD Seeps/Springs

Field : ED_MIN_FStopo
Description : Minimum Euclidean Distance (m) to Forest Service Topographic Map Data Transportation layer

Field : HGM_Type
Description : Meadow hydrogeomorphic type

Field : LAT_DD
Description : Latitude in decimal degrees

Field : LONG_DD
Description : Longitude in decimal degrees

Field : Shape_Length
Description : Meadow perimeter in meters

Field : Shape_Area
Description : Meadow area in sq. meters

Field: AREA_ACRE
Description : Meadow area in acres

Datum/Projection
Projected Coordinate System: NAD_1983_California_Teale_Albers
Projection: Albers
False Easting: 0.00000000
False Northing: -4000000.00000000
Central Meridian: -120.00000000
Standard Parallel 1: 34.00000000
Standard Parallel 2: 40.50000000
Latitude of Origin: 0.00000000
Linear Unit: Meter

Compiled Sources

Layer Name	Source	Spatial Coverage
AMPH	Stanislaus National Forest	Sierra Nevada
AMR	American Rivers	Yuba and Mokelumne watersheds
CALVEG	USFS Region 5 Clearinghouse	Sierra Nevada
ENFa	Eldorado National Forest	Eldorado National Forest
INFa	Inyo National Forest	Inyo National Forest
INFb	Inyo National Forest	Inyo National Forest
INFd	Inyo National Forest	Inyo National Forest
INFe	Inyo National Forest	Inyo National Forest
INFf	Inyo National Forest	Kern Plateau
JMAA	Inyo National Forest	John Muir and Ansel Adams Wilderness
LAVO*	Lassen Volcanic National Park	Lassen Volcanic National Park
LNFa	Lassen National Forest	Lassen National Forest
LNFc	Lassen National Forest	Lassen National Forest
LNFd	Lassen National Forest	Lassen National Forest
NHD	USGS - National Hydrography Dataset	Sierra Nevada
NWI	USFWS - National Wetlands Inventory	Sierra Nevada
PNFa	Plumas National Forest	Plumas National Forest
SEKIa	UC Merced	Sequoia Kings Canyon National Park
SNFa	Sierra National Forest	Sierra National Forest
SQFa	Sequoia National Forest	Sequoia National Forest

STFa	Stanislaus National Forest	Stanislaus National Forest
STI	Stillwater Sciences	Sierra Nevada
TMUa	Lake Tahoe Basin Management Unit	LTBMU
TMUb	Lake Tahoe Basin Management Unit	LTBMU
TMUc	Lake Tahoe Basin Management Unit	LTBMU
TNFa*	Tahoe National Forest	Tahoe National Forest
TNFb	Tahoe National Forest	Tahoe National Forest
UCD**	UC Davis	Sierra Nevada
WEIX	USFS Region 5 Range	Sierra Nevada
WIFL	USFS Region 5 Clearinghouse	Sierra Nevada
YOSEa	UC Merced	Yosemite National Park

Restricted layer use **Two layers**

Layer: AMPH
Source: Stanislaus National Forest
Coverage: Sierra Nevada

Layer: AMR
Source: American Rivers
Coverage: Yuba and Mokelumne watersheds

Layer: CALVEG
Source: USFS Region 5 Clearinghouse
Coverage: Sierra Nevada

Layer: ENFa
Source: Eldorado National Forest
Coverage: Eldorado National Forest

Layer: INFa
Source: Inyo National Forest
Coverage: Inyo National Forest

Layer: INFb
Source: Inyo National Forest
Coverage: Inyo National Forest

Layer: INFd
Source: Inyo National Forest
Coverage: Inyo National Forest

Layer: INFe
Source: Inyo National Forest
Coverage: Inyo National Forest

Layer: INFf
Source: Inyo National Forest
Coverage: Kern Plateau

Layer: JMAA
Source: Inyo National Forest
Coverage: John Muir and Ansel Adams Wilderness

Layer: LAVO*

Source: Lassen Volcanic National Park
Coverage: Lassen Volcanic National Park

Layer: LNFa
Source: Lassen National Forest
Coverage: Lassen National Forest

Layer: LNFc
Source: Lassen National Forest
Coverage: Lassen National Forest

Layer: LNFd
Source: Lassen National Forest
Coverage: Lassen National Forest

Layer: NHD
Source: USGS - National Hydrography Dataset
Coverage: Sierra Nevada

Layer: NWI
Source: USFWS - National Wetlands Inventory
Coverage: Sierra Nevada

Layer: PNFa
Source: Plumas National Forest
Coverage: Plumas National Forest

Layer: SEKIa
Source: UC Merced
Coverage: Sequoia Kings Canyon National Park

Layer: SNFa
Source: Sierra National Forest
Coverage: Sierra National Forest

Layer: SQFa
Source: Sequoia National Forest
Coverage: Sequoia National Forest

Layer: STFa
Source: Stanislaus National Forest
Coverage: Stanislaus National Forest

Layer: STI
Source: Stillwater Sciences
Coverage: Sierra Nevada

Layer: TMUa
Source: Lake Tahoe Basin Management Unit
Coverage: LTBMU

Layer: TMUb
Source: Lake Tahoe Basin Management Unit
Coverage: LTBMU

Layer: TMUc
Source: Lake Tahoe Basin Management Unit
Coverage: LTBMU

Layer: TNFa*
Source: Tahoe National Forest
Coverage: Tahoe National Forest

Layer: TNFb
Source: Tahoe National Forest
Coverage: Tahoe National Forest

Layer: UCD
Source: UC Davis
Coverage: Sierra Nevada

Layer: WEIX
Source: USFS Region 5 Range
Coverage: Sierra Nevada

Layer: WIFL
Source: USFS Region 5 Clearinghouse
Coverage: Sierra Nevada

Layer: YOSEa
Source: UC Merced
Coverage: Yosemite National Park

Restricted layer use

Expanded Methods

Sierra Nevada Multi-Source Meadow Polygons Compilation

We used ArcGIS v10 (ESRI, Redlands, CA, USA) for all geoprocessing.

A total of 44 meadows layers were collected from various individuals, agencies, and organizations. Layers varied in number of features and feature topology (i.e., points, lines, and polygons), meadow type (e.g., wet meadow, dry meadow, fen, etc.), extent (local vs. study area wide), method of creation (digitized from aerial photographs, geolocated (i.e., GPS'd), extracted from GIS layers, Feature Analyst), purpose, and accuracy. All layers were examined for completeness, attribution, and spatial precision. High quality data layers were selected for use in the composite data set, and in few cases selected features were extracted to represent restricted spatial extents. In other cases, selected point layers were used to generate representative polygons using high resolution aerial imagery (<= 1 m pixels). We deemed 32 meadows layers suitable for compilation (Compiled Sources Table).

We examined each layer, removed any duplicate features, and assigned a confidence rank based on source, method of creation, representativeness (feature accuracy), and spatial precision. Confidence ranks were assigned as either 1 (low) or 10 (high). Highly ranking layers were often created in the field by trained personnel using survey grade global position system receivers, whereas low ranking layers were often of large extent and high number of polygons (which decreased certainty that each individual polygon was an actual meadow) but whose polygons were generally accurate. All layers were reprojected into the NAD 1983 California Teale Albers coordinate system. Each layer was then rasterized (retaining the confidence rank) and snapped to a 10m digital elevation model of the study area to serve as geographic control. Raster cells representing open water from the National Hydrography Dataset (NHD) were removed, and resulting cells with ranks were summed. Only cells with a summed rank >2 were retained for further processing. A majority filter was run on the resulting remaining cells to reduce boundary heterogeneity, which replaced cell values based on the majority of the eight neighboring cells. Individual meadow polygons were created through a raster to vector conversion that treated all contiguous cells as a single part meadow feature with boundaries smoothed using the Polynomial Approximation with Exponential Kernel (PAEK; ArcGIS) method (20 m tolerance to reduce edge complexity). Polygons with an area less than 0.4 ha (< 1 acre) were removed from the final meadow composite, and lastly all remaining meadow features were assigned a unique identifier and cross-walked to original source layers.

Additional Attributes

Geology: Dominant rock type was attributed to the meadow polygons based on available state geology layers. Using the Identity (Analysis) tool in ArcGIS, the most abundant lithology in the map unit (ROCK_1) was identified for each meadow.

Vegetation: The LANDFIRE dataset was used to attribute generalized vegetation (GROUPVEG) to the meadow polygons.

Soils: SSURGO datasets were compiled for the entirety of the study area. Gaps were filled with compiled STATSGO data. Soil attributes include: COKEY (component key), Kf (soil erodibility factor), Clay_tot_r (representative value of total clay), map unit key (MUKEY), component name (COMP_NAME). Components were assigned based on the soil component with the highest representative value in the map unit in which the meadow was located. For each component, the clay and Kf values from the top-most horizon were assigned to each meadow polygon.

Flow Length: We ran the flow length geoprocessing tool across a state-wide 30m DEM then ran Zonal Statistics for each meadow on that raster. This tool measures the number of cells from each location to the nearest ridgetop. The flow range is the range value from the zonal statistics and reflects the range of distances to ridgetop across the meadow.

Flow Slope: A slope metric utilizing the range of elevation values (the rise) and the Flow Range previously described (the run). Output is effectively Range (Elevation) / Range (Flow Length to ridgetop) for each meadow.

Catchment Area: The approximate area of the upstream catchment exiting through the meadow. This is obtained by taking the highest value of a flow accumulation raster within the meadow and multiplying it by the raster's cell size. Not every meadow uses the same raster for calculations. Most meadows utilized the NHDPlus Version 1 30m Flow accumulation rasters and were automatically assigned to the appropriate raster based on geography. Due to an error in the Honey Lake area, meadows along or very near the Susan Rivers, the North Fork Feather River, and the Sacramento River downstream of the confluence with the Feather River used a separate, less accurate flow accumulation raster we developed from a California-wide 30m DEM.

Euclidean Distance: Using the Euclidean Distance (Spatial Analyst) tool in ArcGIS, the minimum distance to each meadow was calculated for NHD Springs/Seeps, NHD Streams/Rivers, CA lakes, and FS Topographic Transportation.

HGM Type: Assigned based on plot coordinates provided by Dave Weixelman (USFS) for 438 meadows.