Getting started with GeMS, part 2

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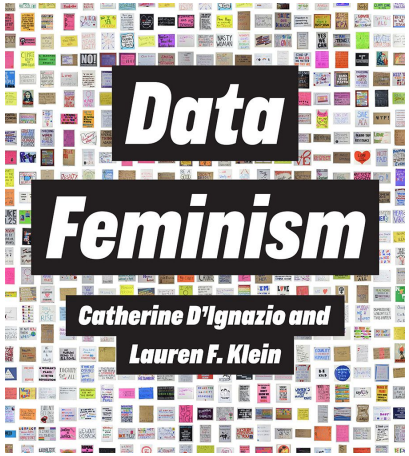
Digital Mapping Techniques
June 9, 2020
https://ngmdb.usgs.gov/Info/dmt/

github.com/wgnhs/gems

Wisconsin Geological
and Natural History Survey
DIVISION OF EXTENSION
UNIVERSITY OF WISCONSIN–MADISON

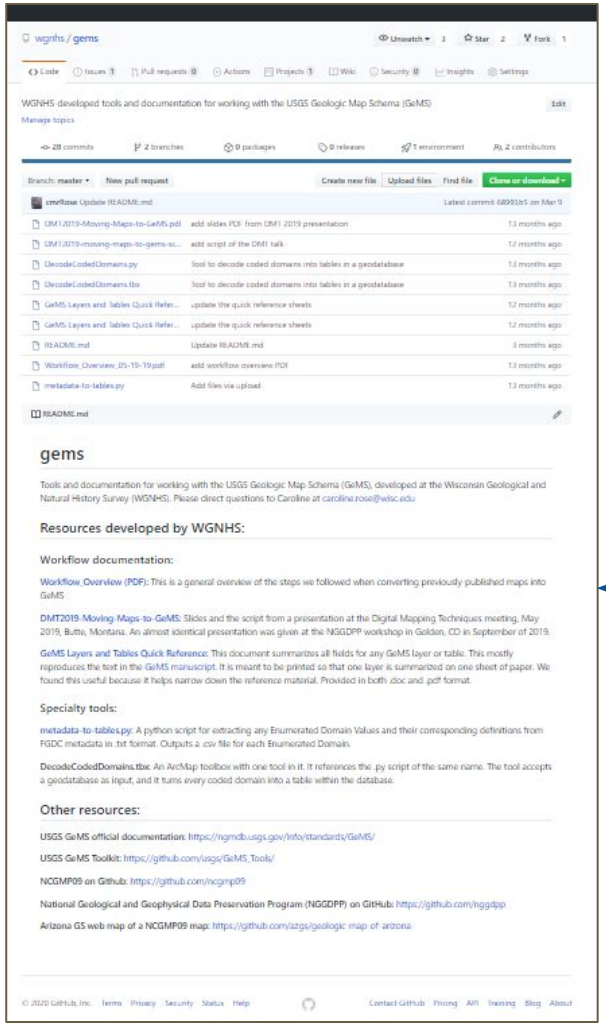


MIT Press, 2020

Datafeminism.io

Reading Group: videos and notes

Relates data visualization to feminist work on race, class, gender, and other aspects.



wgnhs / gems

WGNHS developed tools and documentation for working with the USGS Geologic Map Schema (GeMS)

gems

Tools and documentation for working with the USGS Geologic Map Schema (GeMS), developed at the Wisconsin Geological and Natural History Survey (WGNHS). Please direct questions to Caroline at caroline.rose@wisc.edu

Resources developed by WGNHS:

Workflow documentation:

Workflow_Overview (PDF): This is a general overview of the steps we followed when converting previously published maps into GeMS

DMT2019-Moving-Maps-to-GeMS: Slides and the script from a presentation at the Digital Mapping Techniques meeting, May 2019, Butte, Montana. An almost identical presentation was given at the NGGDPP workshop in Golden, CO in September of 2019.

GeMS Layers and Tables Quick Reference: This document summarizes all fields for any GeMS layer or table. This mostly reproduces the text in the GeMS manuscript. It is meant to be printed so that one layer is summarized on one sheet of paper. We found this useful because it helps narrow down the reference material. Provided in both .doc and .pdf format.

Specialty tools:

metadata-to-tables.py: A python script for extracting any Enumerated Domain Values and their corresponding definitions from FGDC metadata in .txt format. Outputs a .csv file for each Enumerated Domain.

DecodeCodedDomains.tbx: An ArcMap toolbox with one tool in it. It references the .py script of the same name. The tool accepts a geodatabase as input, and it turns every coded domain into a table within the database.

Other resources:

USGS GeMS official documentation: https://ngmdb.usgs.gov/Info/standards/GeMS/

USGS GeMS Toolkit: https://github.com/usgs/GeMS_Tools/

NCGMP09 on Github: https://github.com/ncgmp09

National Geological and Geophysical Data Preservation Program (NGGDPP) on GitHub: https://github.com/nggdpp

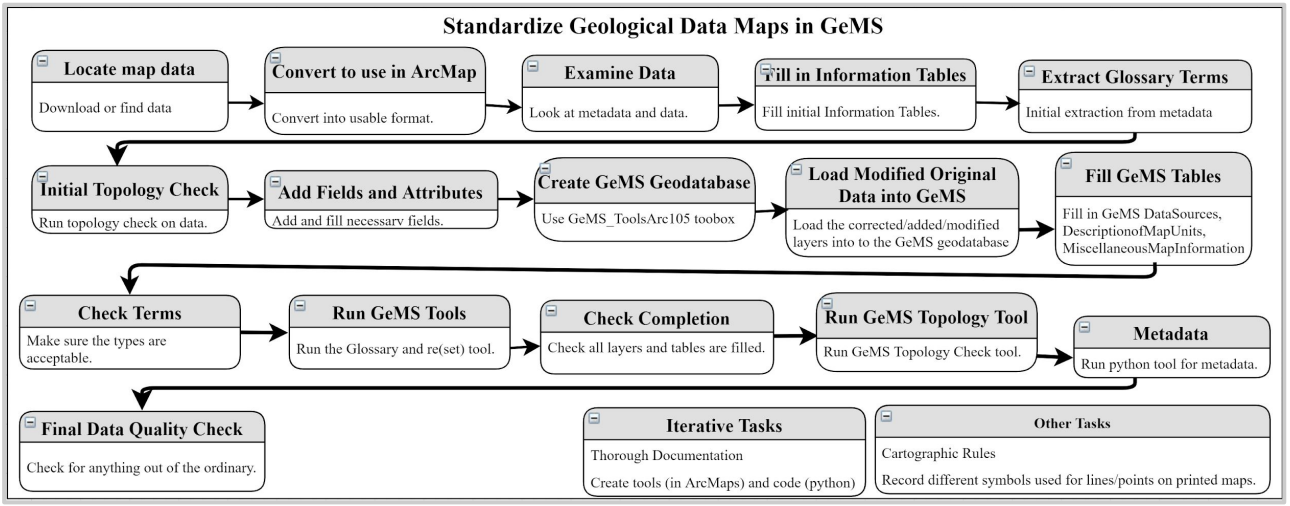
Arizona GS web map of a NCGMP09 map: https://github.com/azgs/geologic-map-of-arizona

github.com/ wgnhs/gems

Summary of resources

Workflow Overview

(PDF on github)



Workflow Step	Basic Steps	Tools/Scripts/Templates
Locate Data	• Create folders to house initial data, edited data, and eventually GeMS data. • Download from WGNHS website or • Find in past project folders	
Convert to use in ArcMaps	If in .E00 format: • Use conversion tool • Create a new file geodatabase (with correct spatial information) and within that create a new feature dataset. • Import the converted shapefiles into the geodatabase/feature dataset.	• Import from E00 (Conversion) (tool) • Create new File Geodatabase • Create new Feature Dataset
	If already in a geodatabase: • Create a new file geodatabase (with correct spatial information) and within that create a new feature dataset. • Import the other geodatabase files into the geodatabase/feature dataset.	• Create new File Geodatabase • Create new Feature Dataset
Examine Data	• Extract metadata from larger metadata txt (if necessary). • Write down the initial data type in the progress table.	• Run in-house extract from metadata script
	• Fill in tables	• Templates:

MAP SYMBOLS → master glossary

Abandoned beaches and wave-cut bluffs.

Cutbanks of large abandoned river channels.

Direction of flow of proglacial streams.

Low, narrow drumlins formed during the last glacial advance. ~~Arrowhead indicates direction of glacial movement.~~

High, wide drumlins formed during an earlier glacial episode and only slightly modified during the last glacial episode.

glacial striation

Direction of subglacial scratches on rock surfaces.

Glacial ridges, transverse to ice-movement direction, including ice-thrust masses in map unit gt and small end moraines in map units gu, gc, gg, gm,sg, and p.

Eskers ~~arrowhead point in direction of stream flow.~~

File Home Insert Page Layout Formulas Data Review View Acrobat Tell me what you want to do...

B3 | Modern Stream Sediment

	A	B	C	D
1	**MapUnit**	**Name**	**FullName**	**Age**
2		Modern Sediment		
3	Msu	Modern Stream Sediment	Modern Stream Sediment	Holocene
4	Mbt	Talus	Talus of Barron Quartzite	Holocene
5	Mpm	Organic Sediment	Organic Sediment	Holocene
6		Copper Falls Formation		
7	Csu	Meltwater-Stream Sediment	Meltwater-Stream Sediment of the Copper Falls Formation (Undifferentiated)	Late Pleistocene
8	Css	Eroded Meltwater Stream Sediment	Eroded Meltwater Stream Sediment of the Copper Falls Formation (Undifferentiated)	Late Pleistocene
9		Chetek Member		Late Pleistocene
10	C5su	Meltwater-Stream Sediment of the Chetek Member	Meltwater-Stream Sediment of the Chetek Member of the Copper Falls Formation	Late Pleistocene
11	C5sp	Pitted Meltwater-Stream Sediment of the Chetek Member	Pitted Meltwater-Stream Sediment of the Chetek Member of the Copper Falls Formation	Late Pleistocene
12		Sylvan Lake Member		
13	C4uh	Hummocky Glacial Sediment of the Sylvan Lake Member	Hummocky Glacial Sediment of the Sylvan Lake Member of the Copper Falls Formation	Late Pleistocene
14	C4uu	Glacial Sediment of the Sylvan Lake Member	Glacial Sediment of the Sylvan Lake Member of the Copper Falls Formation	Late Pleistocene
15	C4sp	Pitted Meltwater-Stream Sediment of the Sylvan Lake Member	Pitted Meltwater-Stream Sediment of the Sylvan Lake Member	Late Pleistocene

Initial Topology Check	• Run initial topology check of feature dataset new topology. (Select lines and polygon) • Load rules from template folder (TopologyRules.rul) • In an editor session, open the Error Inspector tool	• Add New>Topology… to feature dataset tool (right click on feature dataset) • Load TopologyRules.rul in New>Topology… tool • Error Inspector tool

	• Go through each error and correct as needed • Save editor session	
	Check line directions: • Check that lines are going the same direction as PDF map • Use long hash right lines for lines that have designs on the side (like cutbanks) and a line with an arrow for lines like drumlins • Flip line where necessary: • 1 line: in editor session click on line until vertices show, right click and select Flip • Multiple lines: select all lines that need to be changed and use the Flip Line (Editing) Tool	• Symbology • Editing Session right click on line > Flip tool • Multiple lines: Flip Line (Editing) tool
	Lines to Points: • Check if any lines need to be changed to points (line to Orientation Points or Direction Points) • Select lines that need to be turned into points and export as its own	• Select by Attributes… (example: Type = 'surface slope of stream plains') • Data > Export Data… • Add Geometry Attributes (Data Management) Tool • Field Calculator for Azimuth in

MapUnitPolys (polygon feature class) required

Fields:

MapUnit	*Short plain-text key (identifier) for the map unit. Example values: "Qal", "Tg", "Kit", "water", "Trc3", etc. Foreign key to DescriptionOfMapUnits table. Null values not permitted—a mapped polygon must have an assigned map unit*
IdentityConfidence	*How confidently is this polygon identified as MapUnit? Value is usually "certain", "questionable", or "unspecified". Null values not permitted. Suggest setting default value to "certain". Values must be defined in Glossary.*
Label	*Determined from the appropriate value of the Label in the DescriptionOfMapUnits table and IdentityConfidence: if IdentityConfidence = "questionable", then append "?" to Label value from the DescriptionOfMapUnits table. Allows for subscripts and special characters. Null values permitted*
Symbol	*References an area fill symbol (background color + optional pattern). Area fill symbols must be defined in an accompanying style file. If Esri Cartographic Representations are used to symbolize map units, the value may be null or blank. Null values permitted*
DataSourceID	*Foreign key to DataSources table, to track provenance of each data element. Null values not permitted*
Notes	*Optional field. Free text for additional information specific to this polygon. Null values permitted*
MapUnitPolys_ID	*Primary key.* Example Values = MUP1, MUP2, MUP3, etc. Values must be unique in database. Null values not permitted

Topology rules:

- Polygons must not overlap
- No gaps between polygons
- Boundaries must be overlain by lines in ContactsAndFaults

Note that not all lines in ContactsAndFaults necessarily bound polygons: polygons separated by concealed contacts or faults may have been merged during construction of the database; also some faults, concealed contacts, and concealed faults may dangle (terminate within polygons) and thus not separate polygons. Note also that open water (lakes, double-line rivers), glaciers, and unmapped areas are polygons, and so must have non-null MapUnit values (e.g., water, glacier, unmapped). Water and glacier areas commonly are not labeled (Label=null).

Quick-reference Sheets

(PDF on github)

MapUnitPolys (polygon feature class) required

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Quick-reference Sheets

(PDF on github)

GeMS is flexible

DECISIONS:

estimating confidence values

terms to use for ‘type’ attributes

represent features as points or as lines

hierarchy key assignment

paragraph style descriptions

how to cite the map

which definitions to use in the Glossary

which layers are best suited for which points

etc.

GeMS is flexible

DECISIONS:

estimating confidence values → Standard list of values

terms to use for 'type' attributes → Draw from master glossary

represent features as points or as lines → New feature classes as needed

hierarchy key assignment

paragraph style descriptions

how to cite the map

which definitions to use in the Glossary

which layers are best suited for which points

etc.

...

- Polk_NCGMP_05-25-16.gdb
  - GeologicMap
    - CartographicLines
    - CartographicPoints
    - ContactsAndFaults
    - DataSourcePolys
    - GeologicLines
    - MapUnitPoints
    - MapUnitPolys
    - OrientationPoints
  - DataSources
  - DescriptionOfMapUnits
  - Glossary

DONE?

Pliestocene

Pleistocence

Pleistoncene

Pleistoecne

Pleistocene & other difficulties

GeMS Fields Checklist + “Validate database” script

Metadata For GeMS Maps - Step by Step in ArcCatalog

Metadata Summary for GeMS Fields + “FGDC CSDGM2 Metadata” script

“GeMS Fields Checklist” (PDF on github)

Glossary (non-spatial table)

	Term	❑ Check paragraphStyles against original map ❑ Terms are in the master glossary ❑ Master glossary has the map listed in the ‘Maps’ column
	Definition	Look for truncated definitions
	DefinitionSourceID	
	❖ SeeAlso	
	TermSrcFld	
	TermSrcFC	
	Glossary_ID	

DataSources (non-spatial table)

	DataSources_ID	Unique and readable abbreviations of the citations
	Source	❑ Cite the entire publication instead of the plate itself. ❑ Citations follow USGS format
	Notes	
	URL	If referencing a past Survey publication, the URL directs to the overall publication, not just the plate.

“Metadata For GeMS Maps - Step by Step in ArcCatalog”

(PDF on github)

ArcCatalog

FGDC metadata

Overview > Citation	Titles	2	Lineage > Source_Information > Source_Citation > Citation_Information
Overview > Citation	FGDC Geospatial Data Presentation Form	1	Citation > Citation Information > Geospatial Data Presentation Form
Overview > Citation	Dates > add a Publication Date	1	Time Period of Content >Time Period Information > Single Date/Time > Calendar Date
Overview > Citation	Series > Name	1	Citation > Citation Information > Series Information > Series Name

Also reference:

The Esri Illustrated Guide to FGDC metadata:

http://desktop.arcgis.com/en/arcmap/10.6/manage-data/metadata/illustrated-guide-to-complete-fgdc-metadata.htm

“Metadata Summary for GeMS Fields” (PDF on github)

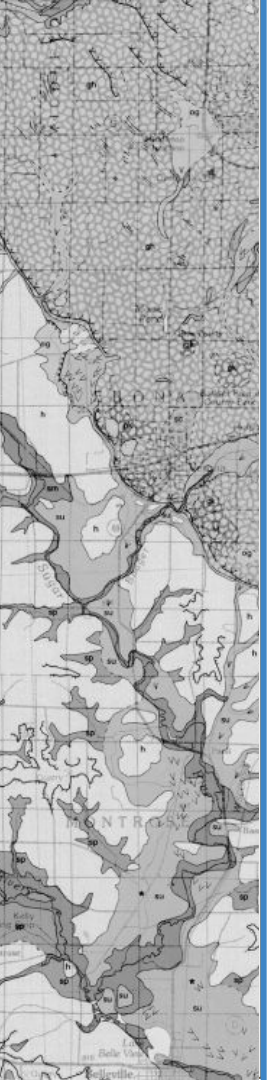
Attribute	Is an Enumerated Domain	Links between Tables / Feature Classes	Appears in Enumerated_Domain_Value_Definition	Appears in Enumerated_Domain_Value_Definition_Source
MapUnitPolys / MapUnit	Yes	Links to DescriptionOfMapUnits / MapUnit		
Any Type field (e.g., in the ContactsAndFaults or GeologicLines feature classes)	Yes	Links to Glossary / Term		
Any Confidence Field (e.g., ExistenceConfidence, IdentityConfidence, etc.)	Yes	Links to Glossary / Term		
Any DataSource Field (e.g., DataSourceID, DefinitionSourceID, DescriptionSourceID, etc.)	Yes	Links to DataSources / DataSources_ID		
DescriptionOfMapUnits / ParagraphStyle	Yes	Links to Glossary / Term		
DescriptionOfMapUnits / GeoMaterial	Yes	Links to GeoMaterialDict / Definition *		
DescriptionOfMapUnits / GeoMaterialConfidence	Yes			
DescriptionOfMapUnits / MapUnit		Yes		
DescriptionOfMapUnits / FullName			Yes	

Metadata summary: MapUnitPolys (polygon feature class) required

Attribute Label:	Attribute Domain Values:
MapUnit	Enumerated Domain: ○ Value drawn from this table. ○ Value_Definition drawn from the “FullName” attribute of the DescriptionofMapUnits table (linked by foreign key “MapUnit”) ○ Value_Definition_Source is “this report, table DescriptionofMapUnits”
IdentityConfidence	Enumerated Domain: ○ Value drawn from this table. ○ Value_Definition drawn from the “Definition” attribute of the Glossary table (linked by foreign key “Term”) ○ Value_Definition_Source drawn from the “Source” attribute of the DataSources table (linked by foreign key “DataSources_ID” connected to the “DefinitionSourceID” in the Glossary table)
Label	Unrepresentable domain
Symbol	Unrepresentable domain
DataSourceID	Enumerated Domain: ○ Value drawn from this table

J. E. g
Attig, ~~John~~ W. and Rawling, J. ~~Elmo~~, III, 2020, Quaternary ~~G~~eology of Oneida County, Wisconsin: Wisconsin Geological and Natural History Survey ~~M507~~, scale 1:100,000.
Map 507

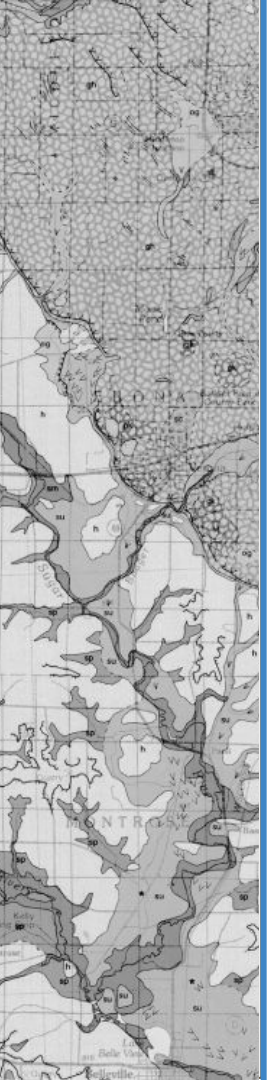
~~http:~~//wgnhs.wisc.edu/pubs~~/m507/~~
https: /000972/



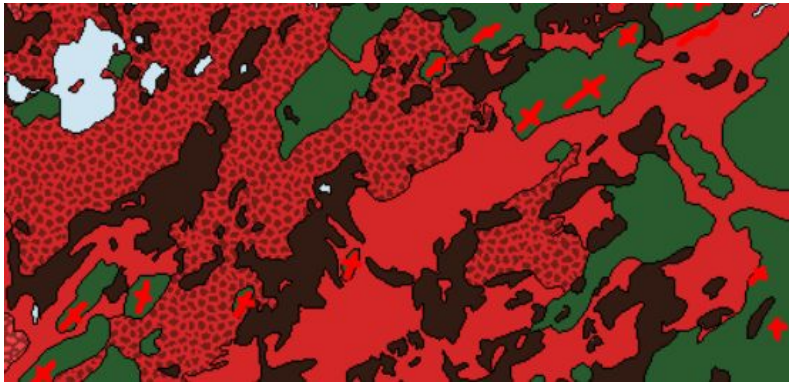
A shift in focus

Support our 500K statewide surficial compilation project

- Cartographic Representations have been helpful for this
- ArcGIS online helps collaborators working remotely



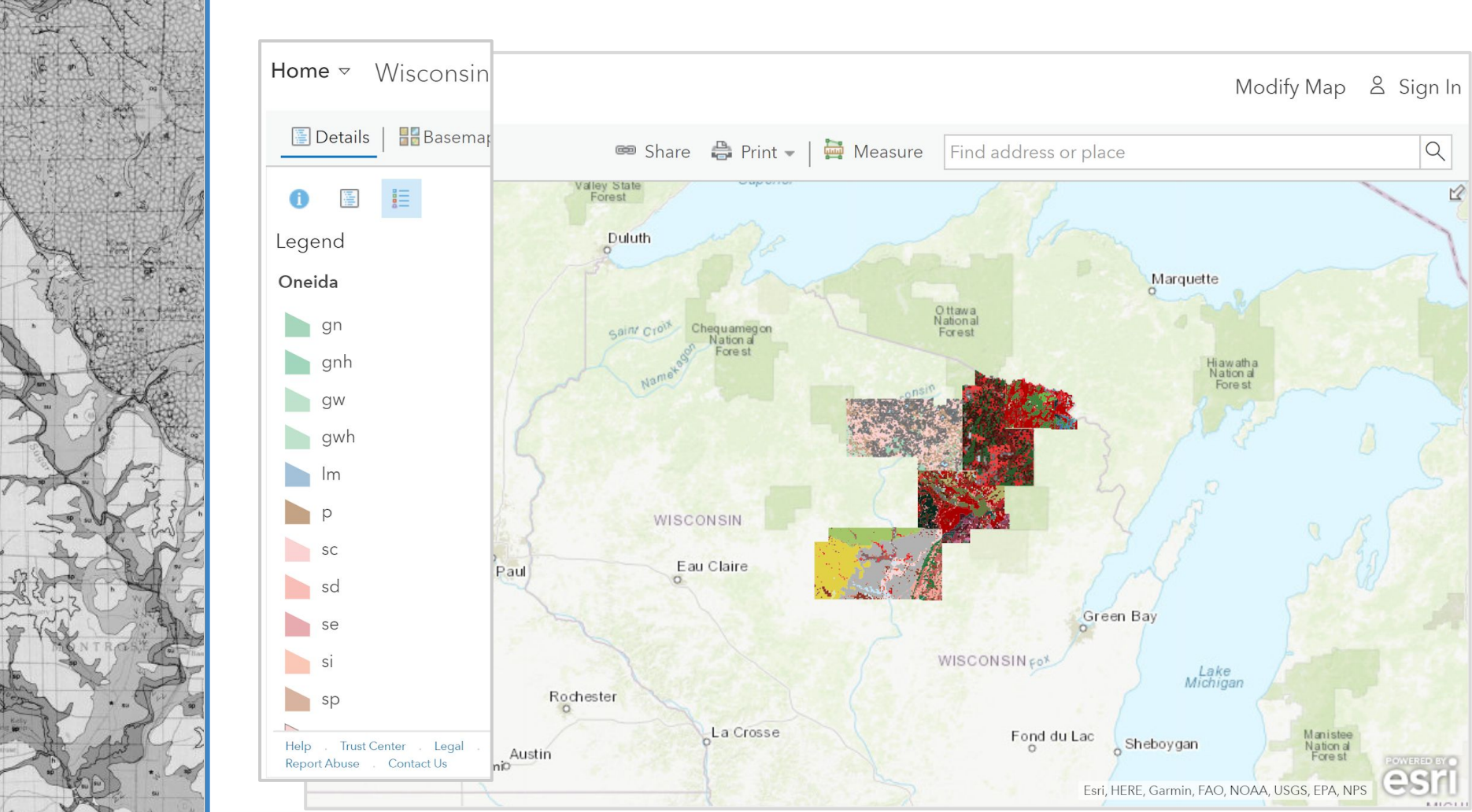
Cartographic Representations

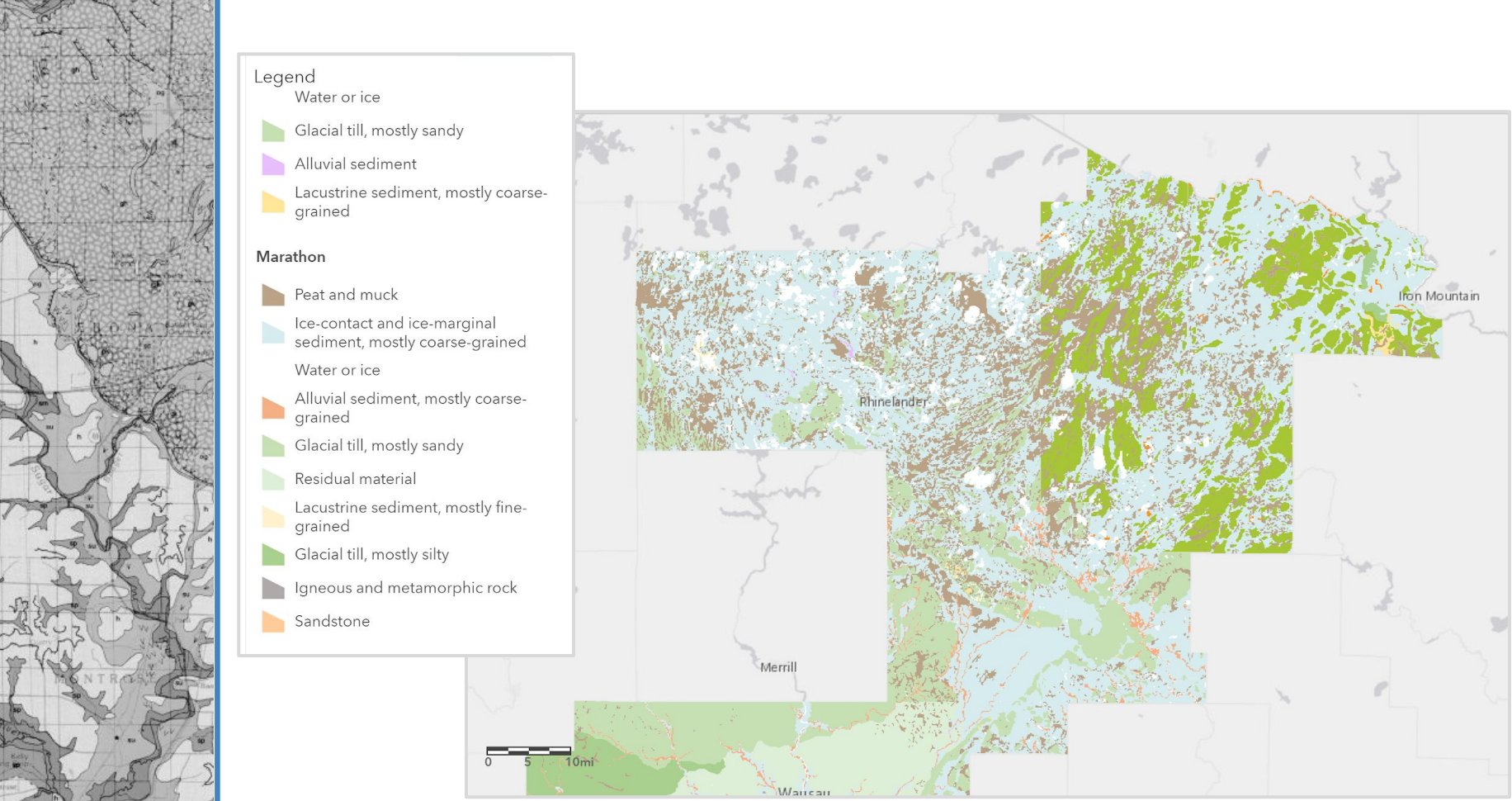


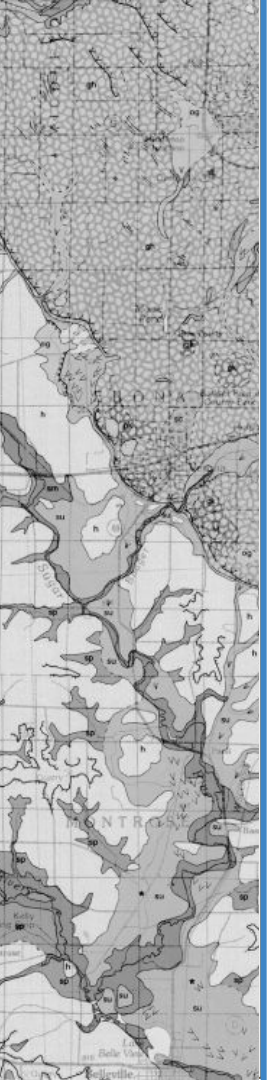
DataSourceID	MapUnitPolys_ID	RuleID
Forest_Pleistocene_Simpkins_1987	MUP1	ts
Forest_Pleistocene_Simpkins_1987	MUP2	p
Forest_Pleistocene_Simpkins_1987	MUP3	sup
Forest_Pleistocene_Simpkins_1987	MUP4	sup
Forest_Pleistocene_Simpkins_1987	MUP5	sup
Forest_Pleistocene_Simpkins_1987	MUP6	ts
Forest_Pleistocene_Simpkins_1987	MUP7	p
Forest_Pleistocene_Simpkins_1987	MUP8	p
Forest_Pleistocene_Simpkins_1987	MUP9	ts

-The representation is stored within geodatabase.

-The map features are drawn by rule.


Home
Wisconsin
Modify Map
Sign In
Details
Basemap
Share
Print
Measure
Find address or place
Legend
Oneida
gn
gnh
gw
gwh
lm
p
sc
sd
se
si
sp
Help
Trust Center
Legal
Report Abuse
Contact Us
Duluth
Marquette
Ottawa National Forest
Chequamegon National Forest
Hiawatha National Forest
WISCONSIN
Eau Claire
Green Bay
WISCONSIN
Lake Michigan
Rochester
La Crosse
Austin
Fond du Lac
Sheboygan
Manistee National Forest
Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS
POWERED BY esri


Legend
Water or ice
Glacial till, mostly sandy
Alluvial sediment
Lacustrine sediment, mostly coarse-grained
Marathon
Peat and muck
Ice-contact and ice-marginal sediment, mostly coarse-grained
Water or ice
Alluvial sediment, mostly coarse-grained
Glacial till, mostly sandy
Residual material
Lacustrine sediment, mostly fine-grained
Glacial till, mostly silty
Igneous and metamorphic rock
Sandstone
Iron Mountain
Rhinelander
Merrill
Wausau
0
5
10mi



More thoughts: Will it be helpful to combine our many “master” datasets?

- Master glossary (*.xls*)
- Master data sources
- List of maps and their status (*Trello board*)
- Points, lines, polygons
- List of formal names and links to GeoLex (*Google sheets*)
- List of links to maps in NGMDB (*Google sheets*)

Let me know if you have done this!

github.com/wgnhs/gems

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&

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Wisconsin Geological and Natural History Survey