Using Python, SQL, ASP.NET and ArcGIS to Process Custom Map Requests

Jeff Nothwehr

National Drought Mitigation Center

University of Nebraska-Lincoln

Overview

- U.S. Drought Monitor background
- Custom map challenges
- Solution
  - How it works
  - Pieces
- Step-by-step through the process
- Improvements

The U.S. Drought Monitor

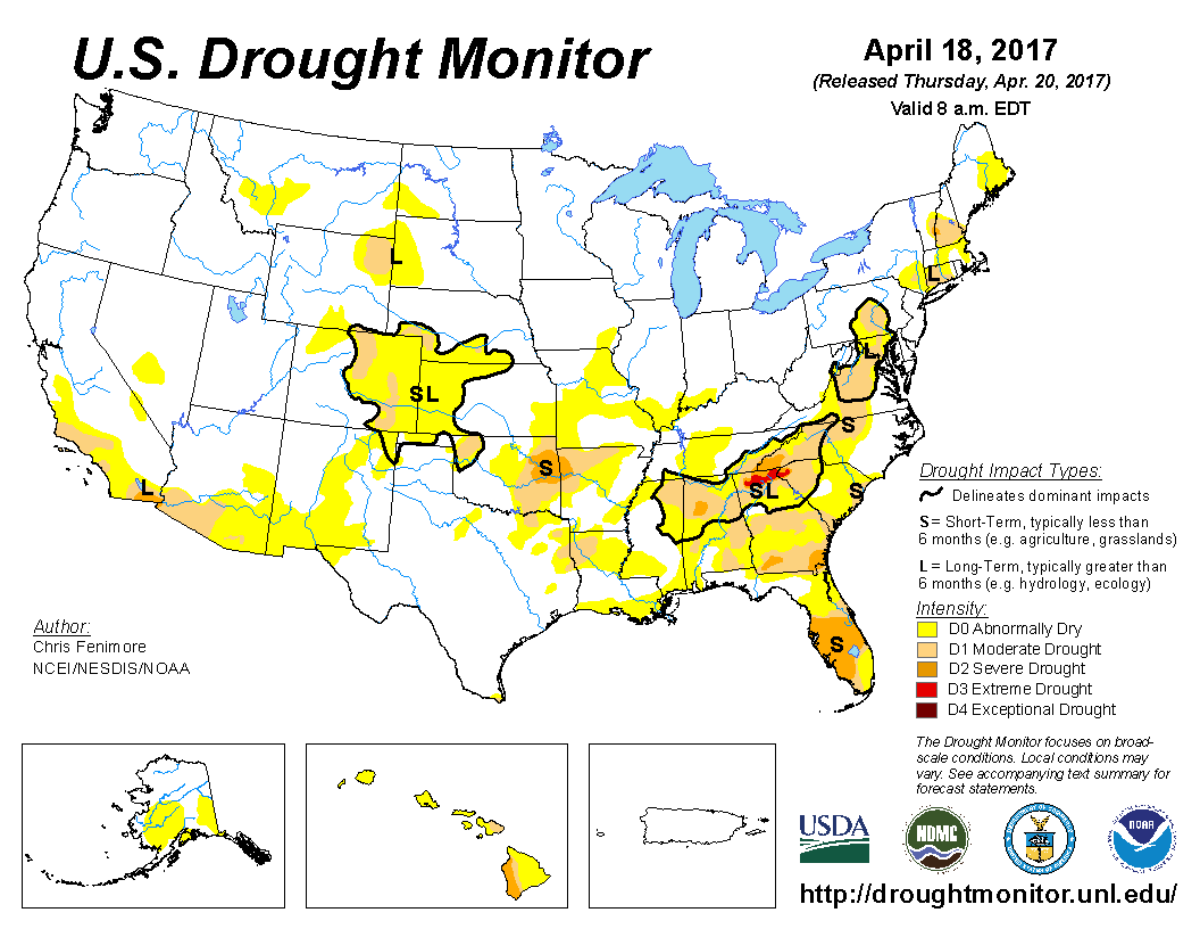
Background Information

U.S. Drought Monitor

- U.S. Map Depicting Drought Conditions

- Covers 50 states and Puerto Rico
  - Soon to be expanded to U.S. Virgin Islands and Pacific possessions

U.S. Drought Monitor



U.S. Drought Monitor

- Produced on a weekly basis
- Data compiled by one author each week
- Author edits shapefiles in ArcMap

U.S. Drought Monitor

- Data are processed by the NDMC on Wednesday afternoon/evening
  - Process currently happens in Python

- Data are released on Thursday morning at 8:30 a.m. Eastern Time

U.S. Drought Monitor

- Almost **3,300** map files produced

- Areas mapped:
  - National
  - State
  - Other areas (regions, 2-digit HUCS, etc.)

Custom Map Requests

and the challenge they present

Mapping Challenges

- Large number of maps produced
  - Over **3,200** files
  - Over **1 GB** of data

- Doesn’t seem like a lot but…
  - over **900 weeks** of data

Mapping Challenges

- Limited time to produce maps
  - **16 hours** between final edits and data release

- Process happens during “non-business” hours
  - Between 5 p.m and 7 a.m. Central Time

Mapping Challenges

- Requests for maps of areas that are not part of the process
- Can’t map everything due to the time and resource limitations

Solving the Mapping Conundrum

Available options

Option Number One

- Produce custom map requests manually
  - Time consuming
  - Need to store a number of files (mxds, layers, etc.)
  - Possibility for map inconsistencies

- Basically the potential for **chaos!!!**

Option Number Two

- Add more maps as part of normal process
  - Processing time constraints
  - Disk space constraints
  - Opens the door for more and more requests

Option Number Three

- Create a custom map request tool
  - Allow users to request maps at their convenience
  - Handle processing automatically upon request

We Have a Winner!

(Option number three)

Solution

- On-demand custom map request module/process
  - Maps generated automatically upon user data submission
  - Minimal use of storage space and staff resources

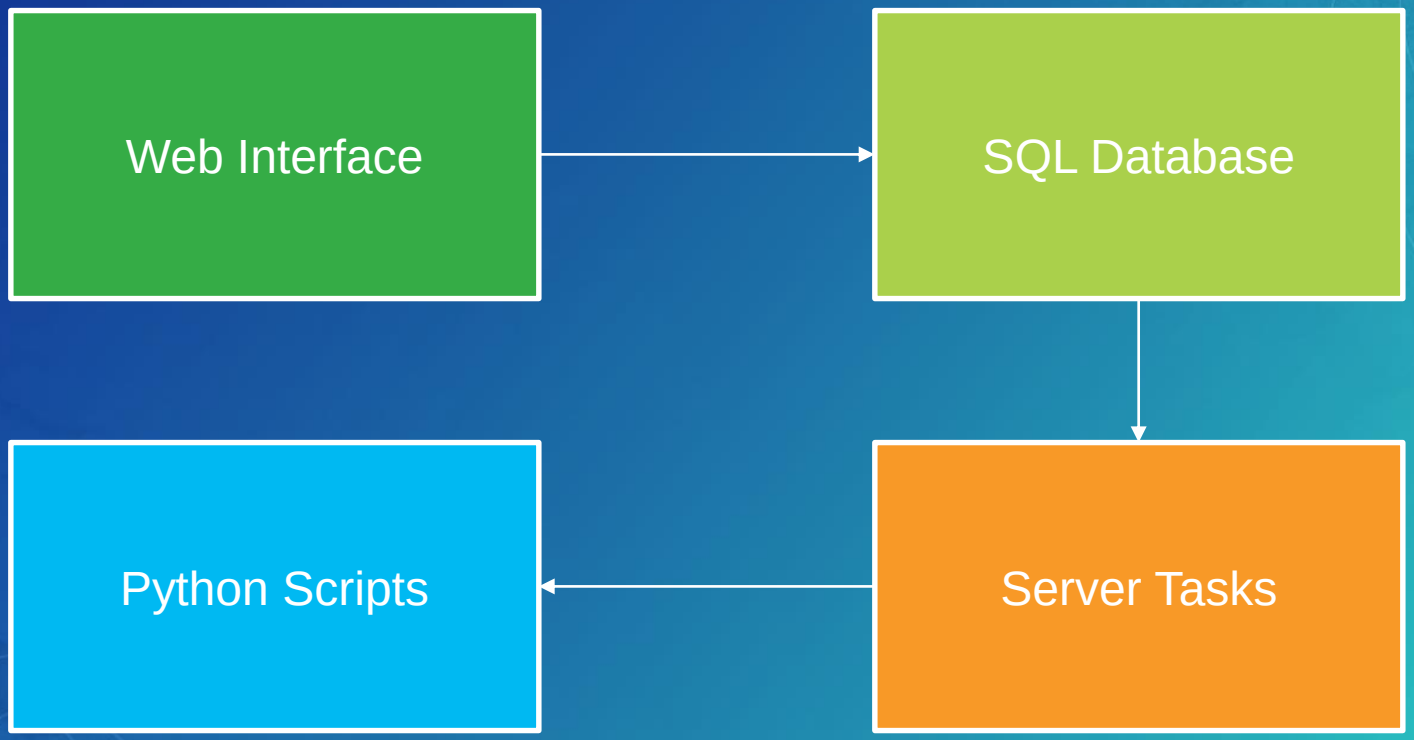
Solution

- Allows users to request maps as needed
  - Can provide maps of areas that are not part of current process
  - Users can specify some map options that are not part of current process

How does it Work?

A look under the hood

How it Works



Web Interface

- ASP.NET page which writes to the SQL database
  - Site built in DNN content management system

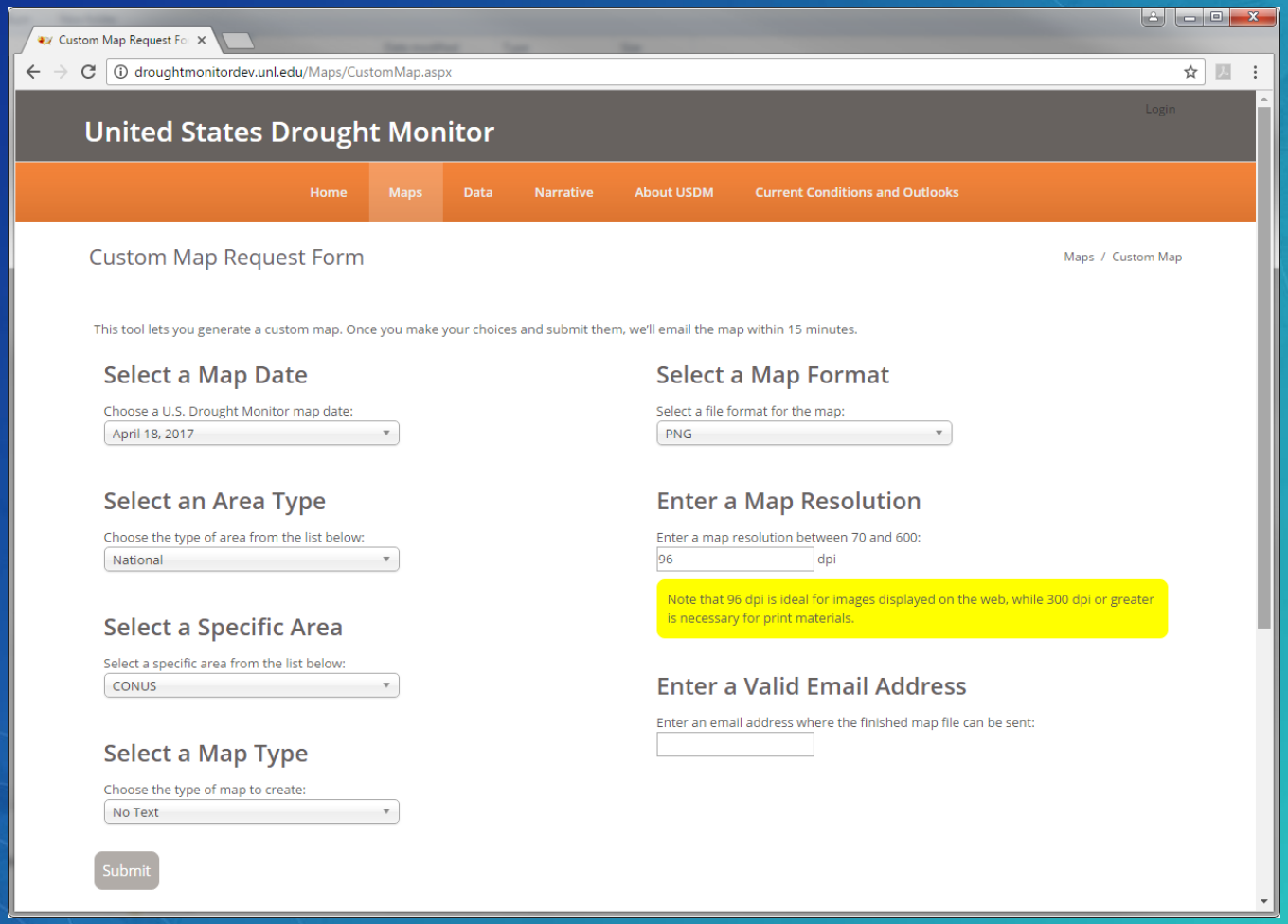
Web Interface

- Multiple selection options
  - Area
  - Map Type
  - File Format
  - Resolution (if applicable)

Web Interface

- User submits a valid email address
- Request is written in the SQL database as a new record

Web Interface



SQL Database

- Table inside the USDM database to handle requests

SQL Database

	customMapReqId	areaType	specArea	mapType	mapFormat	mapRes	emailAddress	mapSent	dmReleaseId	fileName
1	1	urban	16264	text	png	96	jnothwehr2@unl.edu	1	869	20151208_16264_text.png
2	2	urban	49933	text	png	100	jnothwehr2@unl.edu	1	931	20170214_49933_text.png
3	3	national	total	usdm	pdf	0	jnothwehr2@unl.edu	1	936	20170321_total_usdm.pdf
4	4	fema	4	text	pdf	0	jnothwehr2@unl.edu	1	937	20170328_4_text.pdf
5	5	huc4	1101	trd	pdf	0	jnothwehr2@unl.edu	1	937	20170328_1101_trd.pdf
6	6	huc4	0714	trd	pdf	0	jnothwehr2@unl.edu	1	938	20170404_0714_trd.pdf
7	7	huc4	1806	text	pdf	0	jnothwehr2@unl.edu	1	869	20151208_1806_text.pdf
8	8	county	48237	date	png	96	jnothwehr2@unl.edu	1	936	20170321_48237_date.png
9	9	fema	7	text	png	96	jnothwehr2@unl.edu	1	294	20050215_7_text.png
10	10	huc4	1810	trd	pdf	0	jnothwehr2@unl.edu	1	938	20170404_1810_trd.pdf
11	11	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
12	12	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
13	13	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
14	14	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
15	15	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
16	16	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
17	17	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
18	18	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	324	20050913_106_text.pdf
19	19	fema	6	text	pdf	0	jnothwehr2@unl.edu	1	938	20170404_6_text.pdf

SQL Database

- Several columns hold map parameters
  - Area type
  - Area ID number
  - Map type
  - Map resolution

SQL Database

- Email address stored
- Map file name recorded
  - Combination of date and map parameters
- Parameter to indicate whether or not map has been emailed

Python Script: Mapping

- Script handles the mapping process
  - Uses parameters from the data request
- Creates map to a folder on the server

Python Script: Mapping

- Searches database for records that have no file name listed
  - Creates a map for each record
  - Uses parameters submitted to the database to create the map
  - Writes the filename to the database
  - Exports the map to a folder on a server

Python Script: Email

- Second script handles the email
  - Sends a canned email response with the newly created map as an attachment

Python Script: Email

- Script checks the database for records that have parameter value of 0
  - Locates the file name listed for each record
  - Sends the automated email to the address listed in the record
  - Attaches the map file to the email

Server Scheduled Tasks

- Two scheduled tasks run every 15 minutes
  - First task runs the mapping script
  - Second task runs the email script

Other Pieces

- MXD files containing map templates
  - Used by the Python Scripts
  - Same MXDs that are used the regular production process

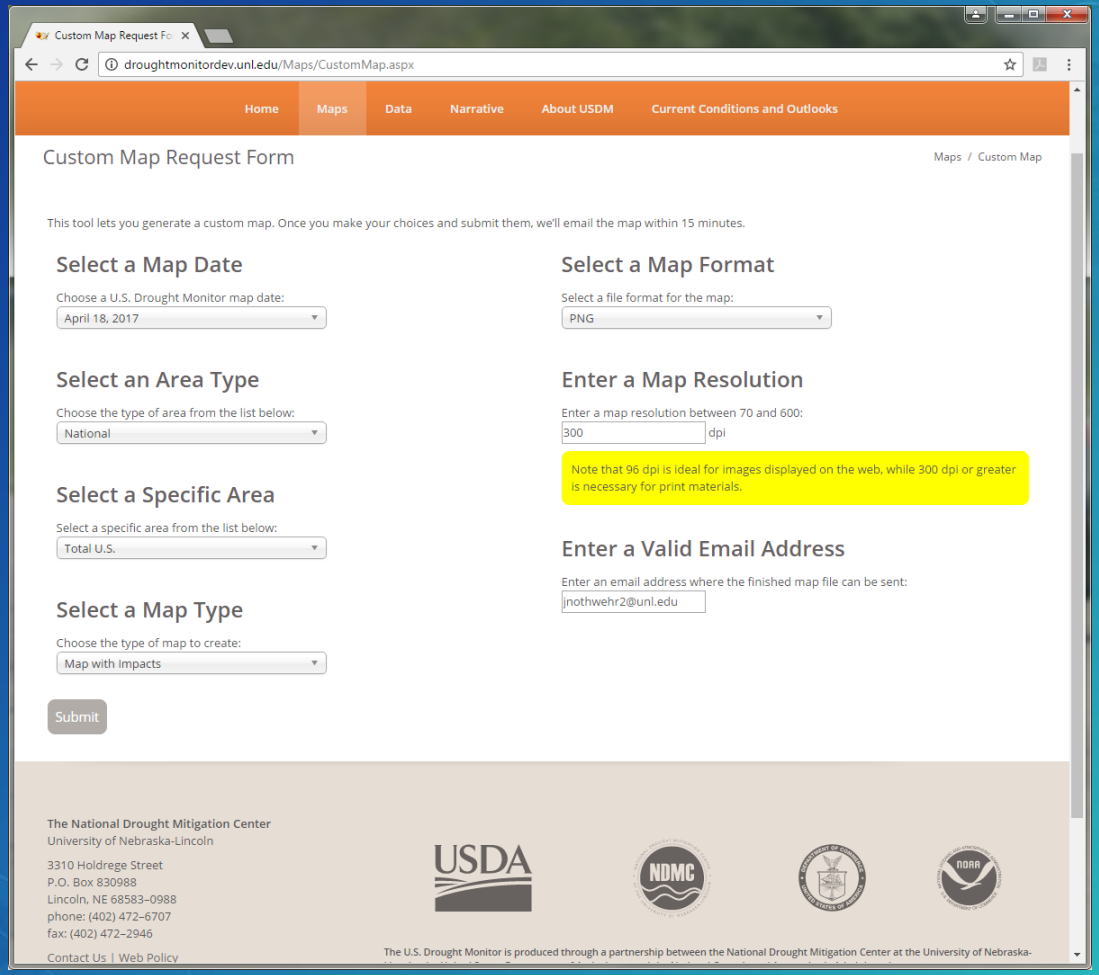
Other Pieces

- Layer files with symbology for maps
- Accessible location on the sever for map storage

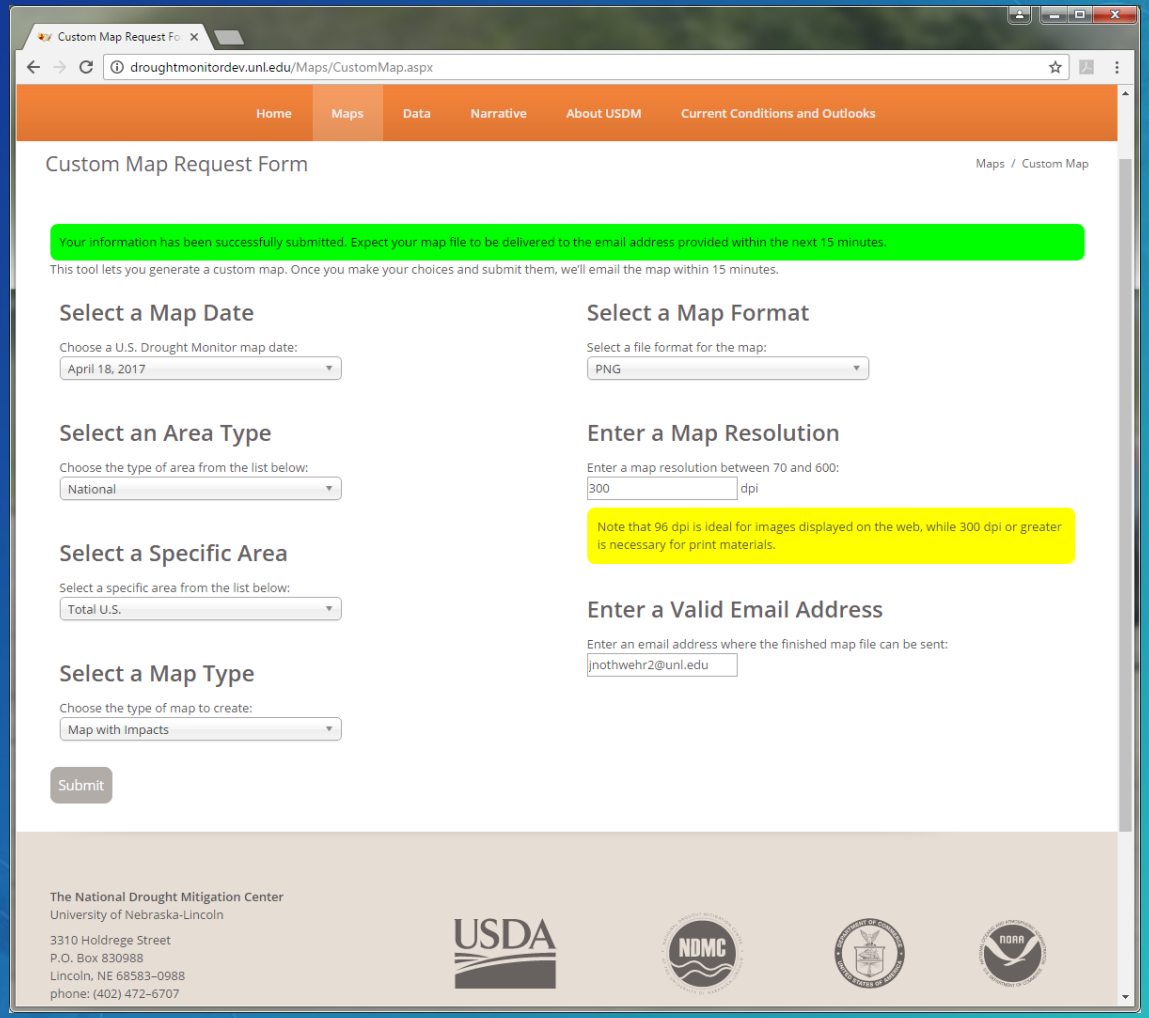
Step by Step Example

The process from start to finish

Submit my Information



Submit my Information



Record Added to Database

	customMapReqId	areaType	specArea	mapType	mapFormat	mapRes	emailAddress	mapSent	dmReleaseId	fileName
7	7	huc4	1806	text	pdf	0	jnothwehr2@unl.edu	1	869	20151208_1806_text.pdf
8	8	county	48237	date	png	96	jnothwehr2@unl.edu	1	936	20170321_48237_date.png
9	9	fema	7	text	png	96	jnothwehr2@unl.edu	1	294	20050215_7_text.png
10	10	huc4	1810	trd	pdf	0	jnothwehr2@unl.edu	1	938	20170404_1810_trd.pdf
11	11	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
12	12	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
13	13	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
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17	17	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
18	18	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	324	20050913_106_text.pdf
19	19	fema	6	text	pdf	0	jnothwehr2@unl.edu	1	938	20170404_6_text.pdf
20	20	national	total	usdm	png	300	jnothwehr2@unl.edu	0	940	NULL

Mapping Script Runs

	customMapReqId	areaType	specArea	mapType	mapFormat	mapRes	emailAddress	mapSent	dmReleaseId	fileName
7	7	huc4	1806	text	pdf	0	jnothwehr2@unl.edu	1	869	20151208_1806_text.pdf
8	8	county	48237	date	png	96	jnothwehr2@unl.edu	1	936	20170321_48237_date.png
9	9	fema	7	text	png	96	jnothwehr2@unl.edu	1	294	20050215_7_text.png
10	10	huc4	1810	trd	pdf	0	jnothwehr2@unl.edu	1	938	20170404_1810_trd.pdf
11	11	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
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16	16	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	932	20170221_106_text.pdf
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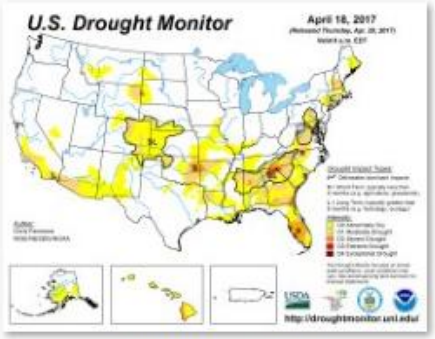
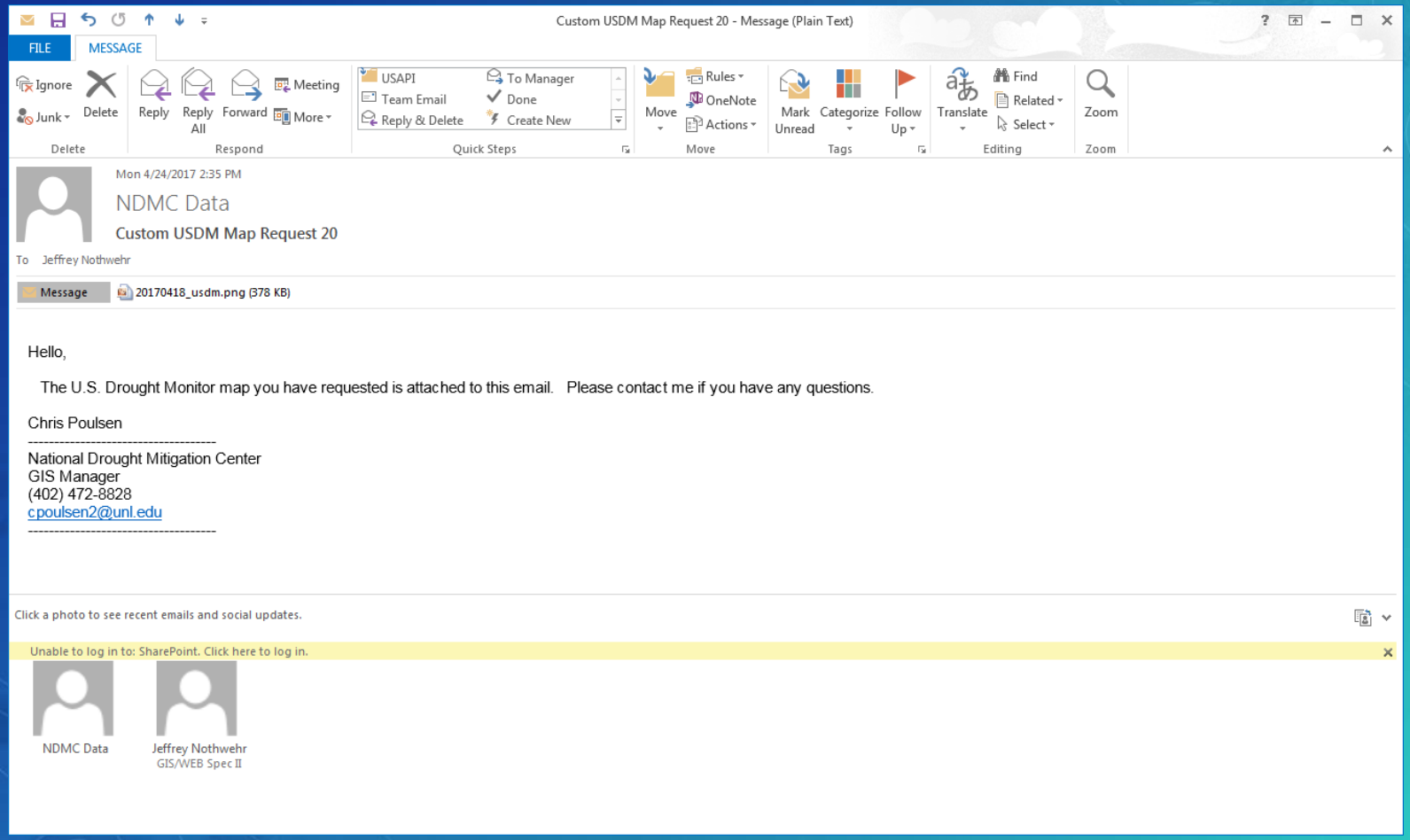
18	18	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	324	20050913_106_text.pdf
19	19	fema	6	text	pdf	0	jnothwehr2@unl.edu	1	938	20170404_6_text.pdf
20	20	national	total	usdm	png	300	jnothwehr2@unl.edu	0	940	20170418_usdm.png



20170418_usdm.png

Email Sent


Custom USDM Map Request 20 - Message (Plain Text)
FILE
MESSAGE
Ignore
Junk
Delete
Reply
Reply All
Forward
Meeting
More
USAPI
Team Email
Reply & Delete
To Manager
Done
Create New
Move
Rules
OneNote
Actions
Mark Unread
Categorize
Follow Up
Translate
Find
Related
Select
Zoom
Delete
Respond
Quick Steps
Move
Tags
Editing
Zoom
Mon 4/24/2017 2:35 PM
NDMC Data
Custom USDM Map Request 20
To Jeffrey Nothwehr
Message
20170418_usdm.png (378 KB)
Hello,
The U.S. Drought Monitor map you have requested is attached to this email. Please contact me if you have any questions.
Chris Poulsen

National Drought Mitigation Center
GIS Manager
(402) 472-8828
cpoulsen2@unl.edu

Click a photo to see recent emails and social updates.
Unable to log in to: SharePoint. Click here to log in.
NDMC Data
Jeffrey Nothwehr
GIS/WEB Spec II

Database Updated

	customMapReqId	areaType	specArea	mapType	mapFormat	mapRes	emailAddress	mapSent	dmReleaseId	fileName
7	7	huc4	1806	text	pdf	0	jnothwehr2@unl.edu	1	869	20151208_1806_text.pdf
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18	18	climdiv	106	text	pdf	0	cpoulsen2@unl.edu	1	324	20050913_106_text.pdf
19	19	fema	6	text	pdf	0	jnothwehr2@unl.edu	1	938	20170404_6_text.pdf
20	20	national	total	usdm	png	300	jnothwehr2@unl.edu	1	940	20170418_usdm.png

Improvements

and other potential changes

Potential Improvements

- More error checking
  - Check validity of email
  - Captcha or some other spam prevention

Potential Improvements

- Process to clean up map files after they are sent
  - Delete files in order to save space

Do it Yourself

Tips and tricks

Web Form

- Any type of web form should work
- Need to be able to write to a database
- Indicate that user’s email will not be shared with anyone else

SQL Database

- Use Boolean variables to record when events happen
  - Used to determine that map has been emailed in this example

Python Scripts

- Used **pyodbc** to write to database
  - Free add in which must be installed
  - Simple way to interact with databases

Python Scripts

- Make sure scripts successfully change check variables
  - Prevent tasks from running endlessly
  - Prevents duplicate emails to users

Python Scripts

- Use **“try”** and **“except”** statements to handle errors
- Set up an email script to alert someone if errors occur

Scheduled Tasks

- Can run at longer or shorter intervals
  - 15 minutes used in this example
- Indicate to users how much wait time is possible

Other

- Make sure your symbology layers have a **valid data source**
  - Layers with a missing data source won’t work

Other

- As with anything, test thoroughly before deploying
  - Don’t want maps with errors going to users

Questions?

Contact:

jnothwehr2@unl.edu