

**Changes in
cultivated
cropland land
in Iowa**

Andreea L.
Erciulescu

CEAP

Data

Des Moines
River
Watershed

Crop
codes/classes

Results

Conclusions

STAT 585X - Final Project

Changes in cultivated cropland in CEAP

Andreea L. Erciulescu

April 30, 2014

Conservation Effects Assessment Project (CEAP)

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Data

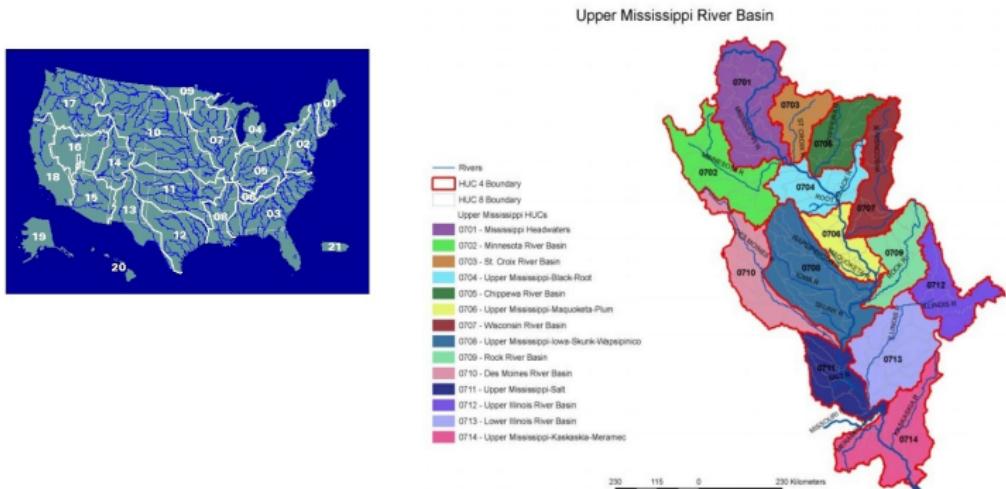
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- Series of surveys intended to quantify environmental effects of conservation practices and programs by hydrologic unit codes (HUCs)



- Local concerns regarding the existence of nitrates in drinking water, particularly in Des Moines

CEAP study data and project goal

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- CEAP sample is a set of cultivated cropland points
- Center for Survey Statistics and Methodology (CSSM) study data: 2003-2007
- Frame designed in 2003

The question of interest: Do changes in land characteristics over time match the CEAP survey design and data collection?

Publicly available data

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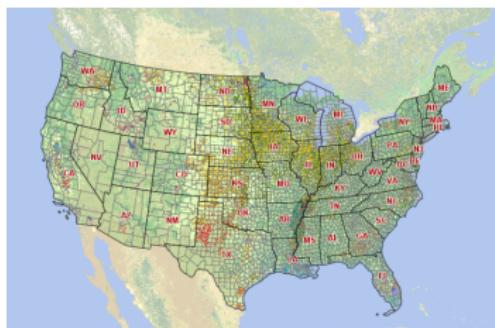
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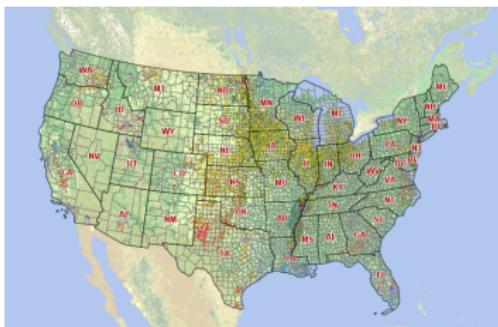
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USDA NASS Cropland Data Layer - category codes, class names, and colors. Consistent and standardized for all states and all years.

The 1987-2013 CDL were revised and re-released in January 2014 to better represent pasture and grass-related categories. A new category named Grass/Pasture code (176) replaces the following historical CDL categories: Pasture/Grazing (code 83), Grassland/Hay/Grass (code 171), and Pasture/Grass (code 181). This was done to eliminate confusion among these similar land cover types which were not always classified definitively consistent from state to state or year to year and frequently had poor classification accuracies. This follows the recording of the entire CDL archive in January 2012 to better align the historical CDLs with the current product. For a detailed list of the category name and code changes, please visit the Frequently Asked Questions (FAQs) section at <http://www.nass.usda.gov/research/Cropland/Surveys/>.

Codes Current Class Names	Old Class Names	Summary of Revision(s)	RGB values for Erdilescu Imagery	RGB values for SRI ArcGIS
1 Alfalfa	alfalfa		255 252 0	255 252 0
2 Cotton	cotton		0 168 230	0 168 230
3 Rice	rice		255 238 0	255 238 0
4 Sugarcane	sugarcane		0 115 0	0 115 0
5 Soybeans	soybeans		38 115 0	38 115 0
6 Sunflower	sunflower		255 255 0	255 255 0
7			0 0 0	0 0 0
8			0 0 0	0 0 0
10 Peanut	peanut		0 0 0	0 0 0
11 Tobacco	tobacco		332 168 0	332 168 0
12 Sweet Corn	sweet corn		0 175 75	0 175 75
13 Pepp or Chn Corn	pepp or chn corn		224 164 0	224 164 0
14 Mint	mint		224 166 0	224 166 0
15			0 0 0	0 0 0
16			0 0 0	0 0 0

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State of Iowa Census Tracts - Current/ACS13 - Data as of January 1, 2013

MTFCC	OID	GEOID	STATE	COUNTY	TRACT	BASENAME	NAME	LSADC	FUNCSTAT	AREALAND	AREAWATER	UR	CENTLAT	CENTLON	INTPTLAT	INTPTLON	RGB values for Erdoes Imagine			RGB values for ESRI ArcGIS		
																	Red	Green	Blue	Red	Green	Blue
G5020	20790328763043	19001960100	19	001	960100	9601	Census Tract 9601	CT	S	707919439	1124009		+41.4204490	-094.4773809	+41.426701	-094.4754745	255	212	0	0	0	0
G5020	20790328763062	19001960200	19	001	960200	9602	Census Tract 9602	CT	S	666068268	1098841		+41.2402687	-094.4593481	+41.2403358	-094.4634803	38	38	0	0	0	0
G5020	20790328763079	19001960300	19	001	960300	9603	Census Tract 9603	CT	S	100416467	375146		+41.2975066	-094.5025203	+41.2964752	-094.5071226	168	230	0	0	0	0
G5020	20790155900148	19003950100	19	003	950100	9501	Census Tract 9501	CT	S	879308484	4856978		+41.0477119	-094.6732029	+41.0509146	-094.6680804	238	238	0	0	0	0
G5020	20790155900144	19003950200	19	003	950200	9502	Census Tract 9502	CT	S	217392267	496426		+40.9528920	-094.8044597	+40.9482672	-094.8079792	135	0	0	0	0	0
G5020	20790692090375	19005960100	19	005	960100	9601	Census Tract 9601	CT	S	335670054	27231318		+43.3462135	-091.2527640	+43.3464049	-091.2617941	255	0	0	0	0	0
G5020	20790692090405	19005960200	19	005	960200	9602	Census Tract 9602	CT	S	565553312	4317593		+43.3904626	-091.4718223	+43.3971626	-091.4741746	175	0	0	0	0	0
G5020	20790692090415	19005960300	19	005	960300	9603	Census Tract 9603	CT	S	30642913	0		+43.2661236	-091.4897803	+43.2661236	-091.4897803	144	0	0	0	0	0
G5020	20790692090408	19005960400	19	005	960400	9604	Census Tract 9604	CT	S	461476608	19446349		+43.1691456	-091.2844084	+43.1749656	-091.2911688	212	212	0	0	0	0
G5020	20790692090412	19005960500	19	005	960500	9605	Census Tract 9605	CT	S	261910488	0		+43.1793670	-091.5066694	+43.1793670	-091.5066694	175	0	0	0	0	0
G5020	20790163918232	19007950100	19	007	950100	9501	Census Tract 9501	CT	S	408767657	1915051		+40.7889139	-092.7383996	+40.7873507	-092.7433917	168	0	0	0	0	0
G5020	20790143727285	19007950200	19	007	950200	9502	Census Tract 9502	CT	S	315828978	46040082		+40.8244243	-092.9710960	+40.8272750	-092.9636956	255	212	0	0	0	0



Crop Data Layer (CDL)

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- Tagged Image File (.tif) Format
- pixel counts for different categories of cropland - codes
- download Iowa and years 2003-2007, approx. 750,000 KB

Working off of U: drive wasn't a good idea...

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[CyFiles] Your CyFiles is 96% Full Mac X

IT Services <its@iastate.edu> to me Mar 15

This is an automated notification to inform you that you are nearing your CyFiles quota. You are currently using 4.83 GB of 5.00 GB or 96% of your total space. If your usage reaches 100% you will no longer be able to save new files or modify existing files until you increase your quota or delete files.

You can increase your quota by visiting the following site:
<https://www.iastate.edu/cgi-bin/acropolis/user/cyquota>

You can also change your notification settings by visiting this site:
<https://www.iastate.edu/cgi-bin/acropolis/user/cyonth>

Or you can also manage your CyFiles sharing access by visiting this site:
<https://www.iastate.edu/cgi-bin/acropolis/user/cyaccess>

Your CyFiles Information:

Current Usage: 4.83 GB
Current Quota: 5.00 GB
Current Usage Percent: 96%
CyFiles Windows Path: \\cyfiles.iastate.edu\2428andreeae
CyFiles Mac SMB Path: smb://cyfiles.iastate.edu/24/28andreeae

For more information regarding CyFiles go to <http://it.iastate.edu/services/storage/cyfiles>.

For any questions or comments, please contact the IT Services Solution Center at [515-294-4000](tel:515-294-4000) or solution@iastate.edu.

Information Technology Services
195 Durham Center
Iowa State University
solution@iastate.edu
[515-294-4000](tel:515-294-4000)

Processing CDL data

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- *Raster* package, S4 methods
- coordinate reference system (CRS)

```
cdl.ia03 <- raster("data/CDL_2003_19.tif")
cdl.ia04 <- raster("data/CDL_2004_19.tif")
cdl.ia05 <- raster("data/CDL_2005_19.tif")
cdl.ia06 <- raster("data/CDL_2006_19.tif")
cdl.ia07 <- raster("data/CDL_2007_19.tif")
cdl.ia03

## class       : RasterLayer
## dimensions : 11672, 17796, 207714912 (nrow, ncol, ncell)
## resolution : 30, 30  (x, y)
## extent     : -52065, 481815, 1938165, 2288325 (xmin, xmax, ymin, ymax)
## coord. ref. : +proj=aea +lat_1=29.5 +lat_2=45.5 +lat_0=23 +lon_0=-96
## data source : U:\stat585\STAT585X-Project\data\CDL_2003_19.tif
## names       : CDL_2003_19
## values      : 0, 255 (min, max)
```


Processing Census Tigerweb

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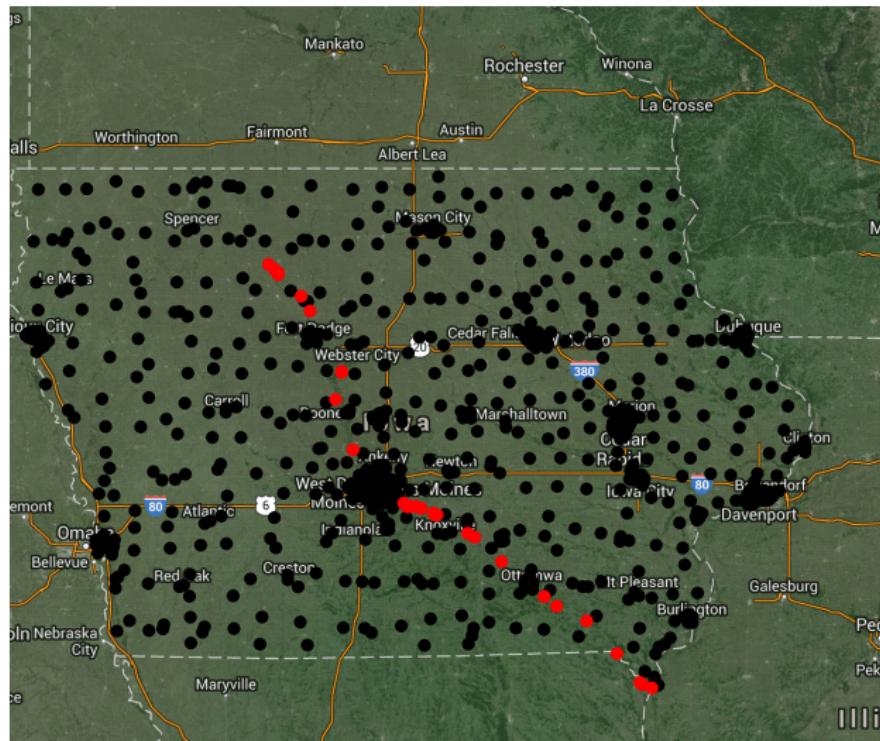
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- XML library
- pull point coordinates for Iowa and for Des Moines river



Constructing the sample for the Des Moines river watershed

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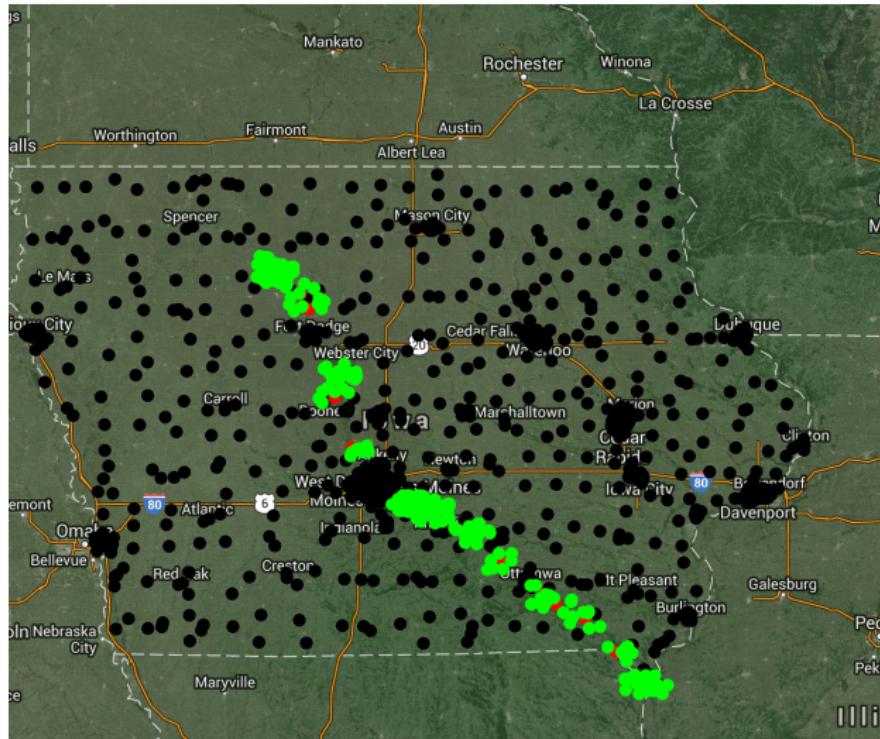
Des Moines River Watershed

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Results

Conclusions

- add noise to each point using *jitter* to mimic CEAP region
- *plyr* package



Extract CDL data for the region

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- *cellFromXY* function to extract the pixel count information from CDL, overlapping the region of interest

```
# get the coordinates in CRS
loc.newcoords <- project(cbind(add.poly.coords[, 2], add.poly.coord
                                proj = "+proj=aea +lat_1=29.5 +lat_2=45.5 +lat_0=23 +lon_0=-96

# gets the values of the pixels
cdl.pts3 <- cdl.ia03[cellFromXY(cdl.ia03, loc.newcoords)]
cdl.pts4 <- cdl.ia04[cellFromXY(cdl.ia04, loc.newcoords)]
cdl.pts5 <- cdl.ia05[cellFromXY(cdl.ia05, loc.newcoords)]
cdl.pts6 <- cdl.ia06[cellFromXY(cdl.ia06, loc.newcoords)]
cdl.pts7 <- cdl.ia07[cellFromXY(cdl.ia07, loc.newcoords)]
table(cdl.pts3)/length(cdl.pts3[-which(is.na(cdl.pts3))]) * 100

## cdl.pts3
##      1      5     25     28     36     61     63     82
## 23.9024 30.7317  1.4634  0.4878  2.4390  6.3415  4.3902  2.4390
##      176
## 23.9024
```

- web scrape code/class data from NASS website
- merge codes and classes

The CODES challenge



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- XML library
- unstructured source code

http://view-source:www.nass.usda.gov/research/Cropland/docs/CDL_2013_crosswalk.htm

```

1389 <td class="x111118710" colspan="2">>DB values for ESRI ArcGIS</td>
1390 <td class="x111118710" style="background-color:#cccccc"></td>
1391 </tr>
1392 <tr style="height:21px;">
1393 <td class="x101018710" style="height:21px; background-color:#cccccc"></td>
1394 <td class="x101018710" style="height:21px; background-color:#cccccc"></td>
1395 </tr>
1396 <tr style="height:21px;">
1397 <td class="x112218710" style="border-left:none;">Old class Names</td>
1398 <td class="x112218710" style="border-left:none;">Summary of Revisions</td>
1399 </tr>
1400 <tr style="height:1px;">
1401 <td class="x011018710" style="border-left:none;">Erdas Red</td>
1402 <td class="x011018710" style="border-left:none;">Erdas Green</td>
1403 <td class="x010118710" style="border-left:none;">Erdas Blue</td>
1404 <td class="x110218710" style="border-left:none;">ESRI Red</td>
1405 <td class="x110218710" style="border-left:none;">ESRI Green</td>
1406 <td class="x110218710" style="border-left:none;">ESRI Blue</td>
1407 </tr>
1408 <tr height="10" style="height:15.0pt;">
1409 <td class="x110018710" style="border-left:none; background-color:#cccccc; height:15.0pt;"></td>
1410 <td class="x110018710" style="border-left:none; background-color:#cccccc; height:15.0pt;"></td>
1411 <td class="x110018710" style="border-left:none; background-color:#cccccc; height:15.0pt;"></td>
1412 <td class="x110018710" style="border-left:none; background-color:#cccccc; height:15.0pt;"></td>
1413 <td class="x110018710" style="border-left:none; background-color:#cccccc; height:15.0pt;"></td>
1414 <td class="x110018710" style="border-left:none; background-color:#cccccc; height:15.0pt;"></td>
1415 <td class="x110018710" style="border-left:none; background-color:#cccccc; height:15.0pt;"></td>
1416 <td class="x110018710" style="border-left:none; background-color:#cccccc; height:15.0pt;"></td>
1417 <td class="x110018710" style="border-left:none; background-color:#cccccc; height:15.0pt;"></td>
1418 <td class="x110018710" style="border-left:none; background-color:#cccccc; height:15.0pt;"></td>
1419 <td class="x110018710" style="border-left:none; background-color:#cccccc; height:15.0pt;"></td>
1420 <td class="x110018710" style="border-left:none; background-color:#cccccc; height:15.0pt;"></td>
1421 </tr>
1422 <tr style="height:21px; align-height:15.0pt;">
1423 <td class="x110018710" align="right" style="border-left:none;">21</td>
1424 <td class="x110018710" align="right" style="border-left:none;">10</td>
1425 <td class="x110018710" align="right" style="border-left:none;">13</td>
1426 <td class="x110018710" align="right" style="border-left:none;">11</td>
1427 <td class="x110018710" align="right" style="border-left:none;">13</td>
1428 <td class="x110018710" align="right" style="border-left:none;">8</td>
1429 </tr>

```

- list of unequal length elements

Total	2003	2004	2005	2006	2007
21	10	13	11	13	8

Table: Number of crop classes by year

- similar crop classes, *Developed* and *Developed/Low Intensity* or *Developed/Open Space*

The CODES challenge defeated

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- matching the existent crop classes and adding the missing ones for each year
- using regular expressions: *grep*, *identical*
- debugging
- sorting by crop classes

Results

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Crop Class	2003	2004	2005	2006	2007
Alfalfa	2.439	2.9268	1.4634	2.439	NA
Christmas Trees	NA	0.4878	0.4878	NA	NA
Clouds/No Data	NA	0.9756	NA	NA	NA
Corn	23.9024	28.7805	25.3659	27.3171	27.8049
Deciduous Forest	NA	NA	NA	14.6341	12.6829
Developed	2.439	2.9268	1.9512	NA	NA
Developed/Low Intensity	NA	NA	NA	0.4878	NA
Developed/Open Space	NA	NA	NA	3.9024	9.7561
Fallow/Idle Cropland	6.3415	2.9268	2.9268	1.9512	NA
Forest	4.3902	11.2195	13.6585	NA	NA
Grass/Pasture	23.9024	19.5122	21.4634	16.0976	22.439
Herbaceous Wetlands	NA	NA	NA	0.9756	0.9756
Mixed Forest	NA	NA	NA	0.4878	NA
Nonag/Undefined	NA	0.4878	1.4634	NA	NA
Oats	0.4878	0.4878	NA	0.4878	NA
Open Water	NA	NA	NA	4.3902	5.3659
Other Crops	NA	NA	0.4878	NA	NA
Other Small Grains	1.4634	1.9512	NA	NA	NA
Soybeans	30.7317	22.439	26.3415	25.3659	18.0488
Water	3.9024	4.878	4.3902	NA	NA
Woody Wetlands	NA	NA	NA	1.4634	2.9268

Table: Proportion of land by crop class, by year.

Conclusions

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- Data processing
 - different data types/sources
 - large spatial, image data
 - coordinates in different measurement systems
 - regular expressions

The following conclusions hold only for the region we have described in the previous section. Whether they still hold for the real CEAP data needs future investigation.

- Results
 - missing crop classes for all/some the years
 - missing records in some years
 - changes in crops over the years
 - possible frame coverage problem

Future work

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- analyze changes in the real CEAP data
- investigate CDL data as source of covariates
- shiny application

The end...

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Thank you for your attention!
Questions?