

Applications of the USDA NASS CDL Based Automated Stratification Method for NASS Area Sampling Frames

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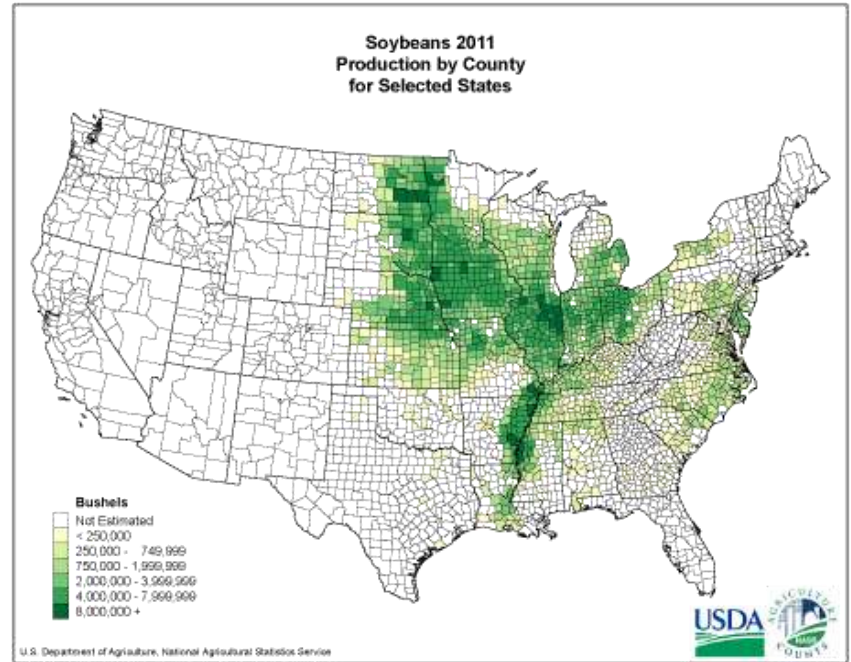


“ . . . providing timely, accurate, and useful statistics in service to U.S. agriculture.”



Importance of Crop Estimates

- NASS's statistical contribution to U.S. agriculture is vital to producers, farm organizations, agribusinesses, lawmakers, and government agencies.
- Farmers and ranchers rely on NASS reports to make production and marketing decisions.



Crop production by acreage county maps produced by NASS can be found at www.nass.usda.gov

What is an Area Sampling Frame?

An **Area Sampling Frames (ASF)** is a geographic area with a known population from which the sample is selected.

Stratification consists of dividing the population into subsets (called strata) within each of which an independent sample is selected.

The ideal ASF has **strata as homogeneous** as possible, i.e. cultivated land use in one strata and non-cultivated land use in another strata.

Stratification has been found to **increase efficiency** (reduce variance) of an estimator compared with Simple Random Sampling alone.



NASS Area Sampling Frames

NASS uses Area Sampling Frames (ASF) for its agricultural surveys.

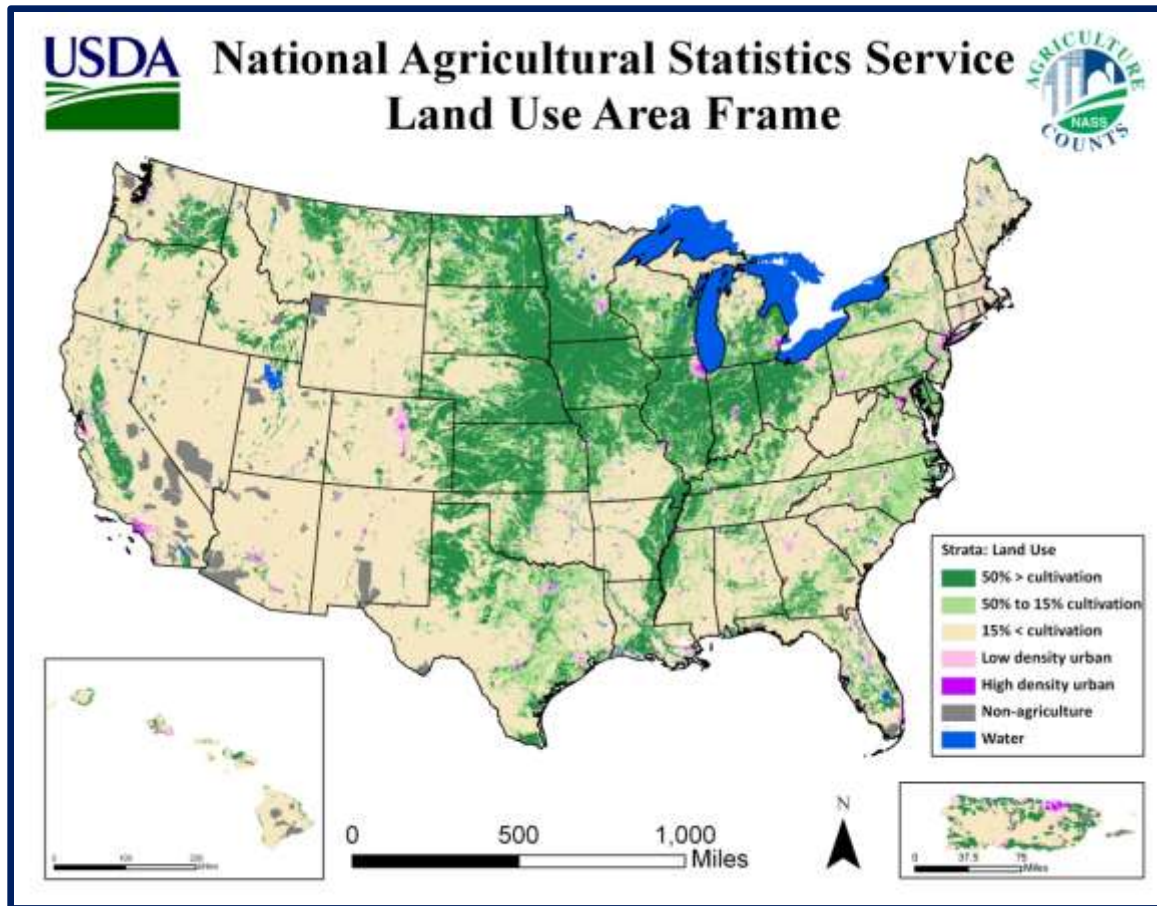
NASS's ASF is based on **stratification of land use** in the U.S. defined by percent cultivated land use.

The NASS ASF is multipurpose and **two** comprehensive surveys are primarily conducted:

- The **June Area Survey (JAS)**, which is conducted the first two weeks of June annually.
- The **Census of Agriculture**, which is conducted every five years in conjunction with the June Area Survey.



The NASS Area Sampling Frame



Area Frame Section (AFS) - The NASS ASF has been developed by Area Frame Section staff since 1954 using visual interpretation of aerial photography, and later 30m resolution Landsat TM data (Davies, 2009).

The NASS Cropland Data Layer products have been used in recent years to aid in stratification analysis (Boryan, 2013).

NASS Background



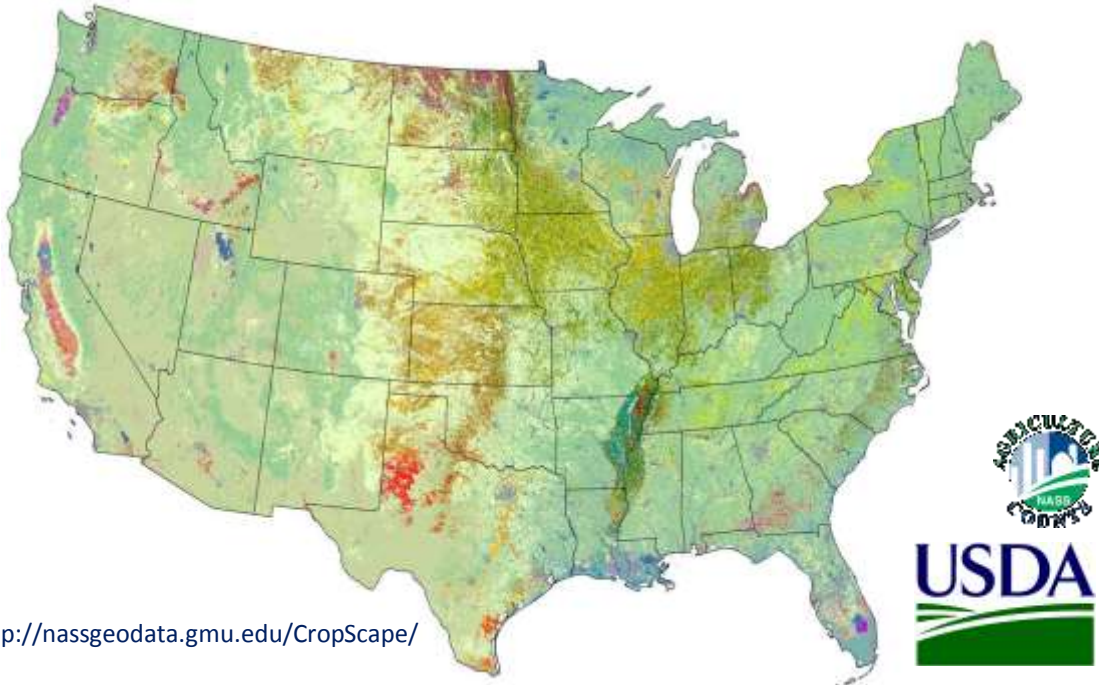
National Agricultural Statistics Service (NASS) is an agency within the United States Department of Agriculture (USDA).

With the mission...

The National Agricultural Statistics Service provides timely, accurate, and useful statistics in service to U.S. agriculture.

Other NASS Geospatial Products

2012 National Cropland Data Layer



<http://nassgeodata.gmu.edu/CropScope/>

Released Jan. 31, 2013
National 30m Product



Spatial Analysis Research Section (SARS) -

NASS related use of remotely sensed and other spatially referenced information for forecasting, estimation, and data presentation. SARS began producing individual state Cropland Data Layers (CDL) in 1997 and the program was expanded nationally in 2008.



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2012 Cropland Data Layer Inputs

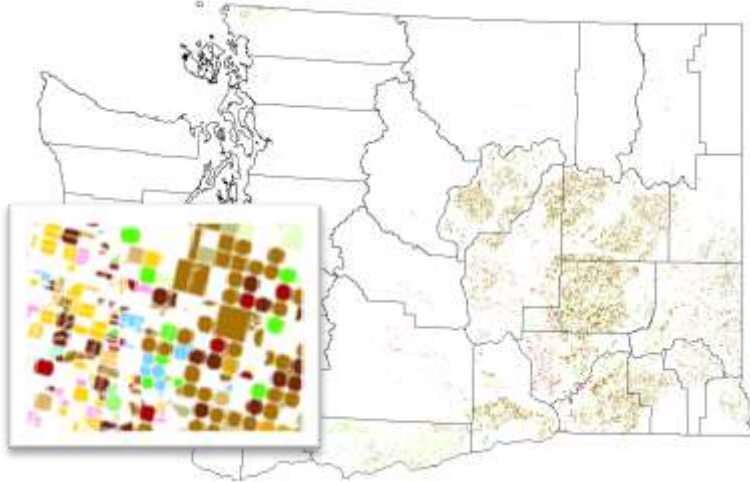
Satellite Imagery – Landsat



Satellite Imagery – Deimos & UK2



Farm Service Agency: Common Land Unit

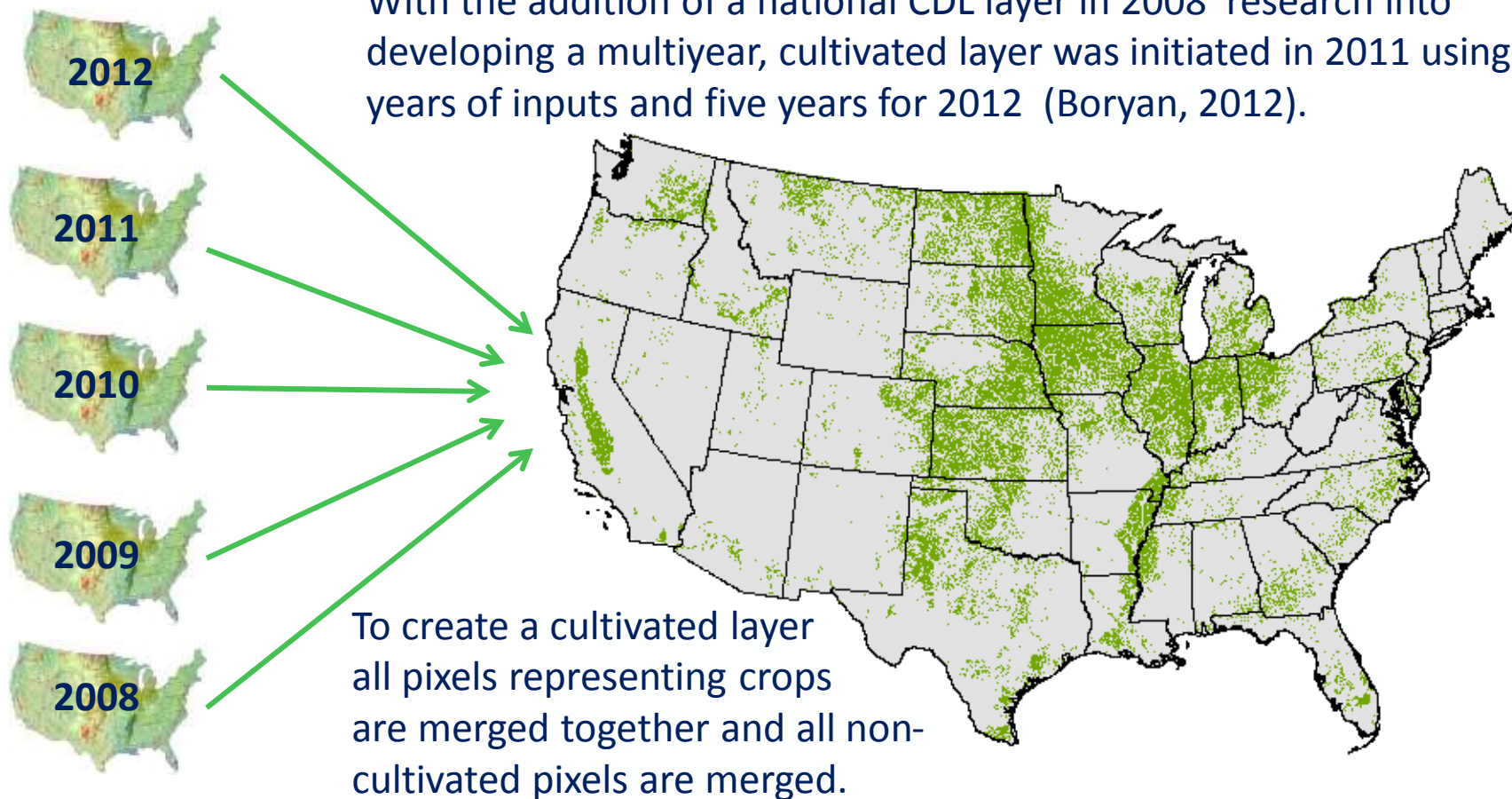


2006 NLCD & Derivative products



The NASS 2012 Cultivated Layer created from 2008-2012 CDL data

With the addition of a national CDL layer in 2008 research into developing a multiyear, cultivated layer was initiated in 2011 using four years of inputs and five years for 2012 (Boryan, 2012).

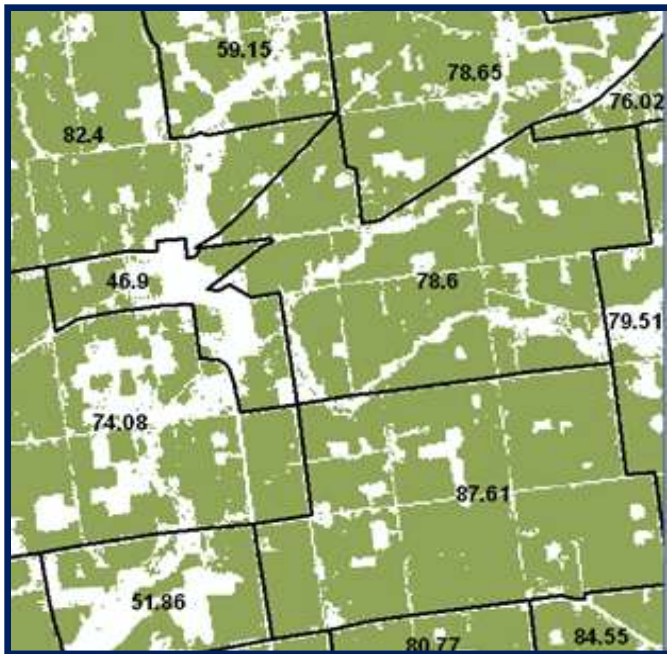


Applications for use of the Cultivated Layer with the Area Sampling Frame

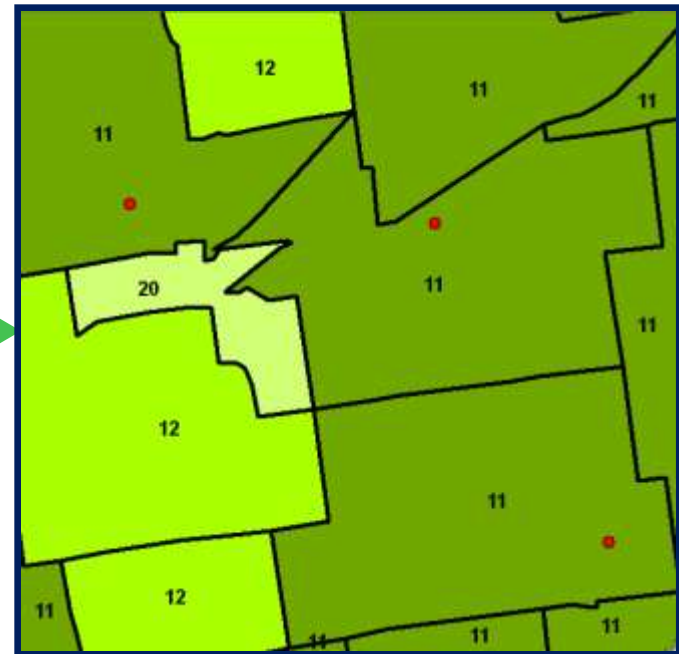
NASS has begun implementing the CDL automated stratification method into NASS Area Frame in **two major applications** (Boryan, 2013).

- First, NASS operations developed a hybrid approach, a combination of automated and manual stratification. With the automated method being used as a primary stratification method for building state area frames. (Boryan, 2013).
- Second, the automated stratification method is now used by NASS operations as an additional tool to evaluate and determine the order of revisions for state frames (Davies, et al., 2012).

Automated Stratification in NASS Operations



1st use existing Primary Sampling Units (PSUs) boundaries to calculate CDL percent cultivation mean in each polygon.

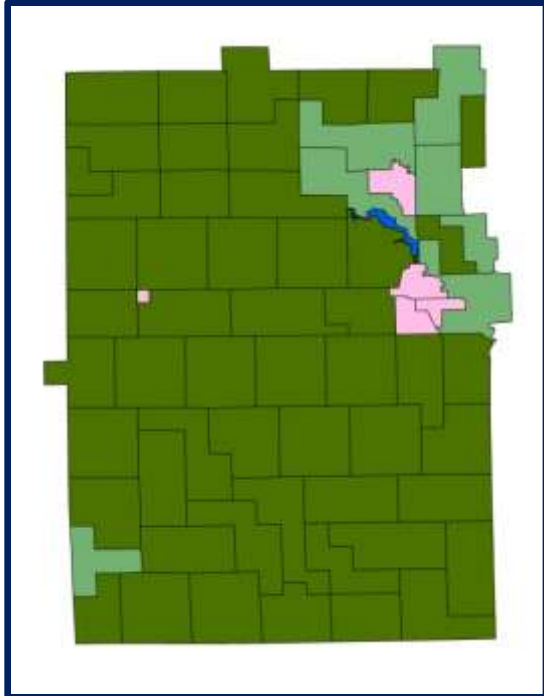


2nd use the CDL percent cultivation mean to automatically re-stratify the PSUs.

Automated Stratification in NASS Operations

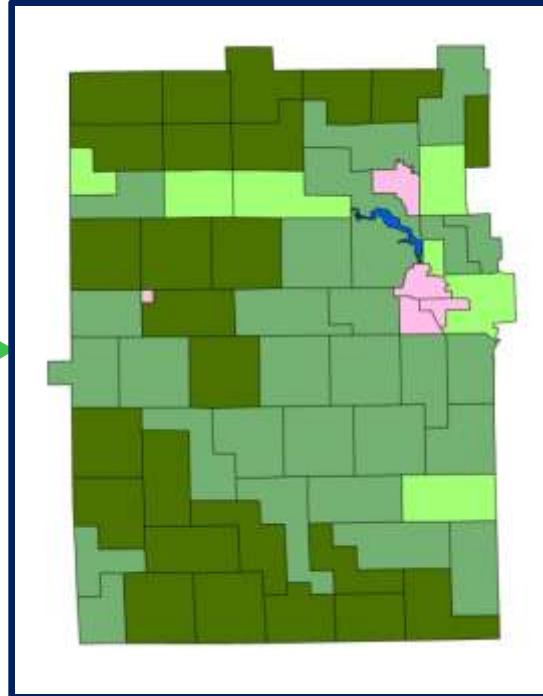


Davison County, South Dakota



Original frame stratification

Davison County, South Dakota



Automated stratification of original frame

Davison County, South Dakota

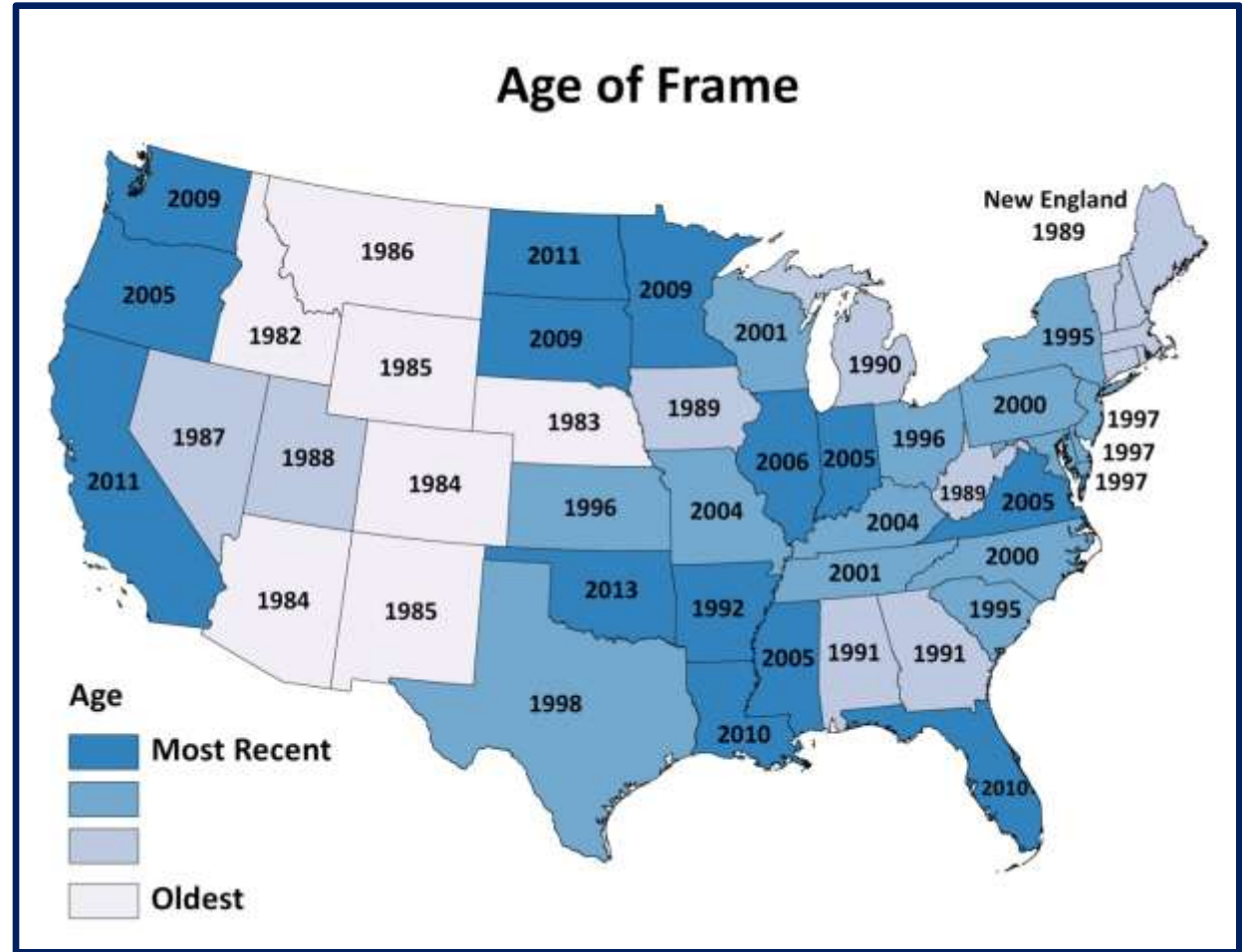


Manual stratification is used to increase strata homogeneity and reduce PSU size in revised frames

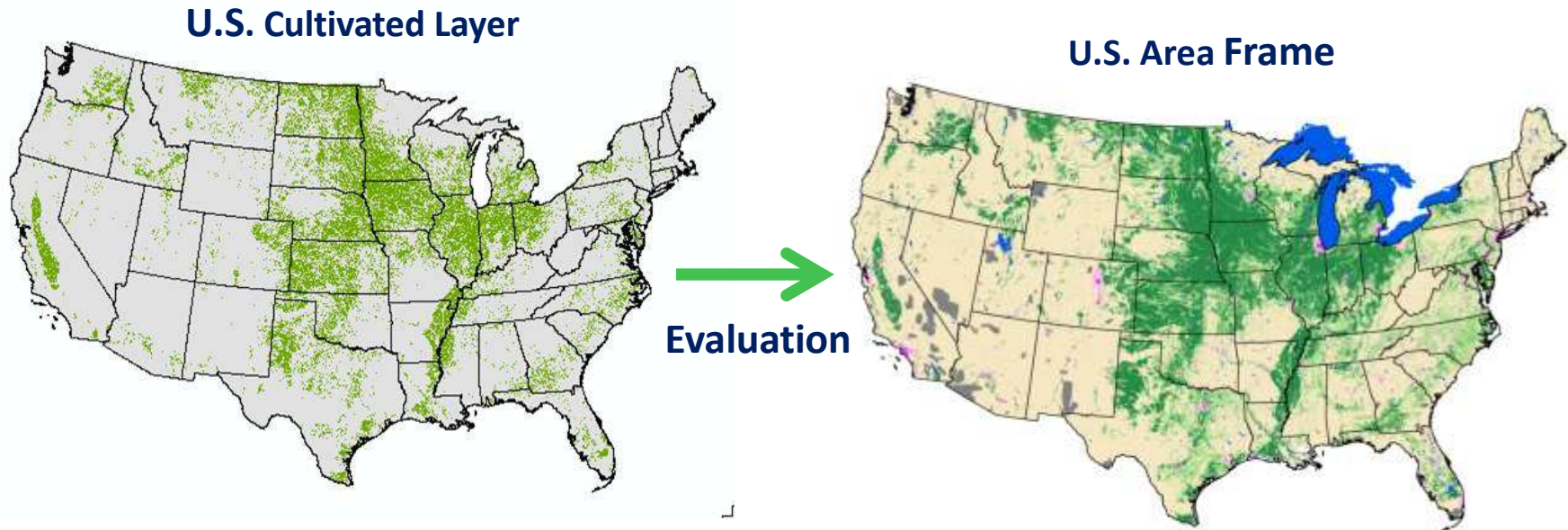
Area Sampling Frame Condition

In the past, NASS ASF were constructed once every 20-30 years using the manual stratification methods.

To evaluate frame condition these metrics were used for analysis: frame age, coefficients of variation (CVs), percent of frame segments meeting stratum definition (frame performance) and contribution of the state to US agriculture were the primary criteria used to determine the order of state frame revisions (Boryan, 2013).



Automated Stratification in NASS Operations



AFS staff are now using the automated stratification procedure as an additional tool to objectively measure the degree of improvement in frame performance that can be expected by using the CDL data (Boryan, 2013).

Automated Stratification in NASS Operations

With the addition of automated stratification more frame revisions can now occur at a higher frequency of 4 to 5 state ASF being revised a year. Reducing frame age.

This analysis is performed using the CDL automated method and the June Area Survey data as validation. By comparing CDL based stratification results to the current year's JAS survey data, the "potential" improvement expected from building a new frame using the CDL data can be computed (Boryan, 2013).

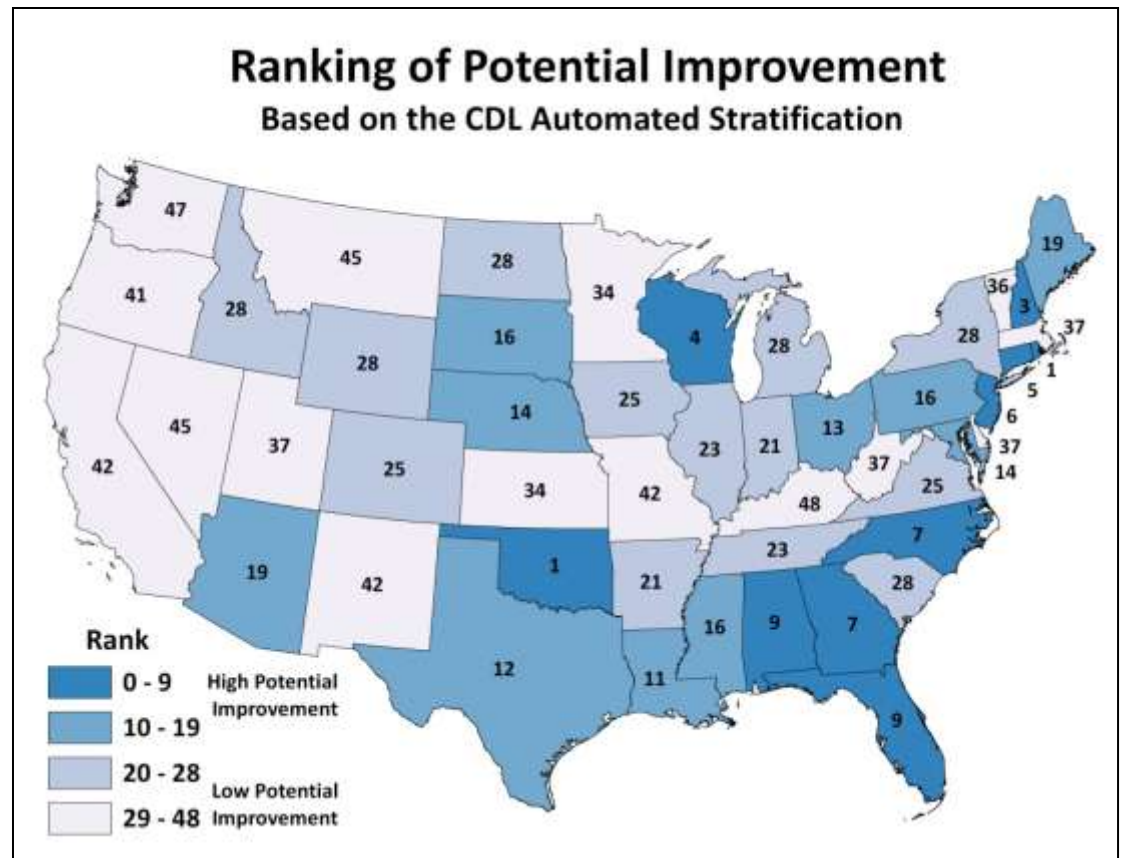
CDL evaluation limitations:

- Land Cover (CDL) versus Land Use (ASF)



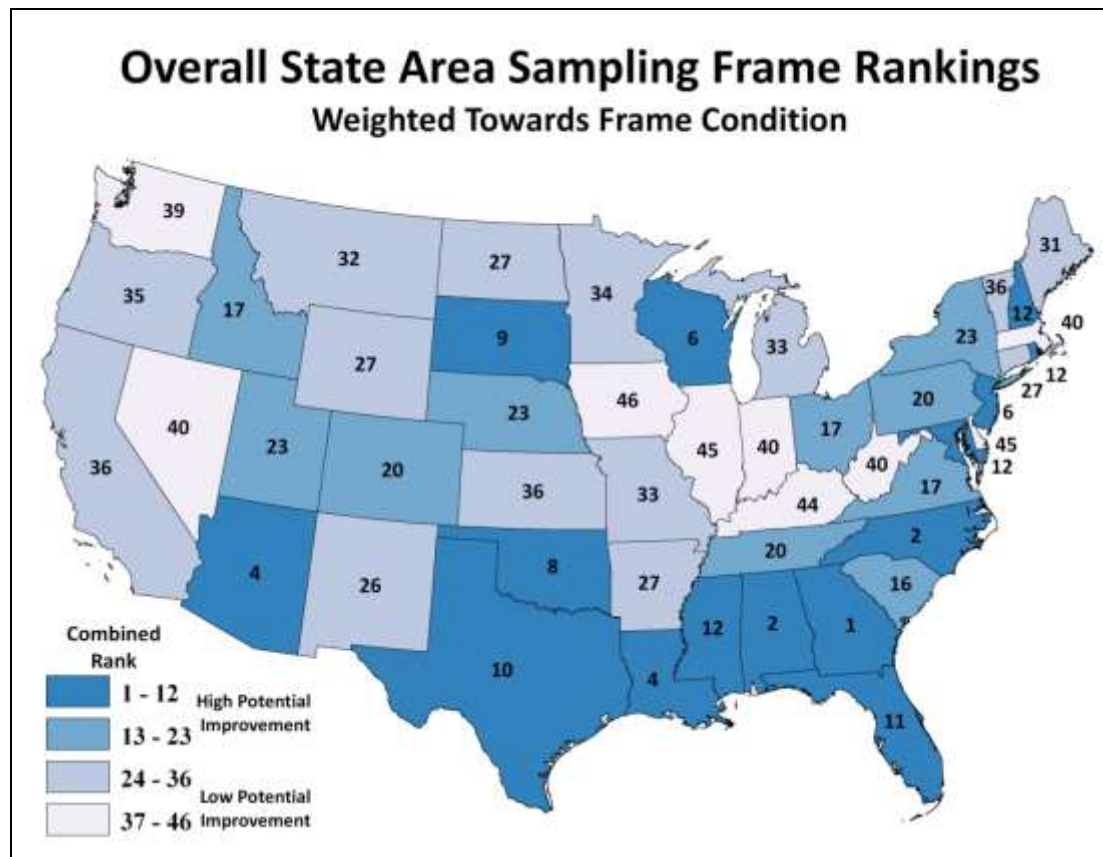
Automated Stratification in NASS Operations

From this evaluation state frames are ranked from a low to high potential for improvement. This method helps NASS objectively determine the optimal order to conduct Area Frame updates (Davies *et al.*, 2012).



Area Sampling Frame Condition Rankings

Potential for improvement rankings are given a 1/3 weight. While the previous statistical metrics of frame age, coefficients of variation (CVs), percent of frame segments meeting stratum definition (frame performance) are given 2/3 weight. The states are then ranked from 1 “Highest Potential Improvement” to 46 “Low Potential Improvement.” This method helps NASS objectively determine the optimal order to conduct Area Frame updates (Davies *et al.*, 2012).



References

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Questions?



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