Integrating Landsat 7, 8 and Sentinel 2 data in improving crop type identification and area estimation

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General approach to land-cover and land-use change mapping and area estimation

1. Land-cover / land-use change maps for stratification
2. Probability-based sampling and reference data collection
3. Unbiased area estimation from sample
4. Sample-based area as constraint for final map
2015 soybean stratification and sample

2009-2014 CDL as 2015 stratifier

Population strata
- High
- Low
- Medium
- Very low
- Sample blocks (n=70)
2015 soybean stratification and sample

2009-2014 CDL as 2015 stratifier

Population strata
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Sample blocks (n=70)
Soybean area estimate from field sample: 341,000 km², derived in early September, 2 months ahead of harvest.

USDA NASS 2015 June survey: 344,000 km²

USDA NASS 2016 January estimate: 334,000 km²

1.0 % lower than 2015 June survey but 1.9 % higher than 2016 January estimate.
Cloud-free Landsat image composites

R: max near-infrared
G: min shortwave infrared (~1.6μm)
B: min red

500 Km

Overall Accuracy (SE) = 86 (2) %

2017 soybean and corn stratification and sample

2011-2016 CDL as 2017 stratifier

Map showing the distribution of soybean and corn cover across the United States, with different colors indicating high, medium, and low cover. Sample block locations are also marked (n=90).
High stratum block near Lexington, NE

Field sample (n=20)
High stratum block near Lexington, NE
High stratum block near Lexington, NE

6-15-2017
Sentinel 2A

R-g-b of nir-swir-swir
High stratum block near Lexington, NE

7-25-2017
Sentinel 2A

R-g-b of nir-swir-swir
High stratum block near Lexington, NE

8-14-2017
Sentinel 2A

R-g-b of nir-swir-swir
High stratum block near Lexington, NE

8-21-2017
Sentinel 2A

R-g-b of nir-swir-swir
High stratum block near Lexington, NE

8-31-2017
Landsat 8

R-g-b of nir-swir-swir
High stratum block near Lexington, NE
Soybean stratification (20-km by 20-km blocks)
Soybean sample blocks (n = 25 x 3)
Classify sample blocks using field data as training

High stratum block in central Mato Grosso
Classify sample blocks using field data as training

High stratum block in central Mato Grosso

All Landsat and Sentinel 2 images in growing season
Classify sample blocks using field data as training

High stratum block in central Mato Grosso

- Soybean
- Non-soybean
- Validation data
Mapping global crop type is a challenge due to a variety of cropping systems, field sizes and management practices.

Field validation is critical. Satellite-based maps can be used as an efficient indicator for allocating field sample. Two-stage cluster sampling is efficient for minimizing costs.

Developed method can derive unbiased area estimate within growing season and map crop type at national-to-continental scales with high accuracy.
Thank you!

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