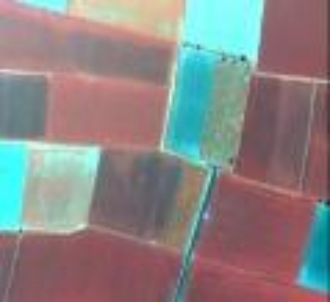

Remote Sensing For Crop Area Estimation: An Overview

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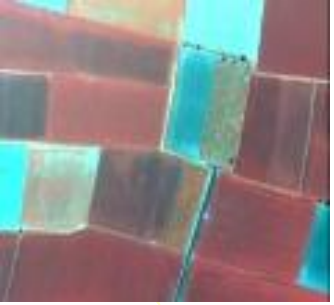
Remote Sensing Approaches to Crop Area Estimation

- Stratification for sampling
  - Efficient, cost effective
- Pixel counting
  - Speed
  - Requires knowledge and devises
- Regression and calibration estimators
  - Efficient, cost effective
  - Require knowledge and devises

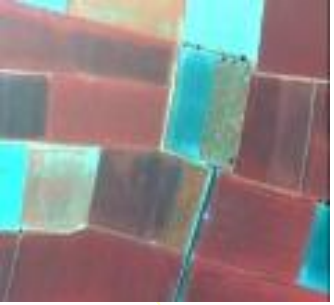


Relative efficiency of the use of remote sensing data at the estimator level, in 2000 (area frame with segments) and in 2002 (point frame)

$$\text{Re}\, l.Ef = \frac{Var\,(\hat{Y}_{ground})}{Var\,(\hat{Y}_{regr})}$$

- Agrit 2004, 2005 and 2006, Empirical Best Linear Unbiased Predictor (EBLUP)
- relative efficiencies for 2005 and 2006 higher than the ones obtained with points in 2002
- but lower than the ones obtained in 2000 with segments

	Area	**Point**
	2000	2002
Durum wheat	2.1	1.1
Soft wheat	2.6	1.2
Barley	1.7	1.0
Colza	1.4	0.9
Maize	6.0	1.1
Sunflower	2.9	1.0
Soy been	8.6	1.2
Sugar beet	7.6	1.0



Remote sensing will be economical if its cost is smaller than the cost of additional segments:

$$(n_1 - n)\,p > R$$

Where:

n **is the original sample size,**

n_1 **is the sample size that allows the ground survey estimate to reach the same precision of the regression estimate**

p **is the unitary variable cost (cost of ground survey, digitisation and quality control),**

R **is the cost of the remote sensing part of the project (image acquisition and processing).**

Remote sensing is cost-effective if the relative efficiencies are higher than:

$$1 + \frac{R}{np}$$

High Resolution Imagery

- As Ground Truth
  - As aid in collecting, or as a replacement
  - If replacing:
    - Photo Interpretation necessary
    - May be biased, wrong
  - In Area Frame
  - In Regression
- Entire Area Coverage
  - Limited area available
  - Disaster, crop disease

Timing analysis

- Stratification for sampling
  - probably a year in advance
  - usable for a long time
- Pixel counting
  - quick but probably biased
  - not repeatable
- Regression and calibration estimators
  - Require independent set of ground data
  - Usually takes longer to obtain estimates

Ground Data

- Administrative Data
  - Field level signup
  - Dynamic
- National Land Cover Database
  - 5-10 yr cycle
  - Non-agric, forests, roads, cities….
- June Area Segments
  - Statistical – stratified sample

Timing example US

- May
  - Winter wheat preliminary
  - Pixel counting, time series of pixel estimates
- June
  - Winter wheat preliminary
  - regression
- August
  - Winter wheat final
  - Row crops
  - regression
- October
  - Row crops final
  - regression