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***Use of Remotely-Sensed Data in the
Development and
Improvement of Emission Inventories***

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Remote Sensing Data: General Uses

- Development of refined land use data
- Bottom-up EI development
- Development of activity data for open burning source categories (*see new EPA Report*)
- Development of information for refining biogenic emission estimates (e.g. monthly/seasonal allocation)
- Miscellaneous uses (*e.g. quality assurance*)

Development of Refined Land Use Data

Important wherever area estimates are used to quantify or spatially-allocate emissions:

Example – Wind-Blown Dust:

$$PM_{10} \text{ (tons/yr)} = EF_i \times Area_i \times T$$

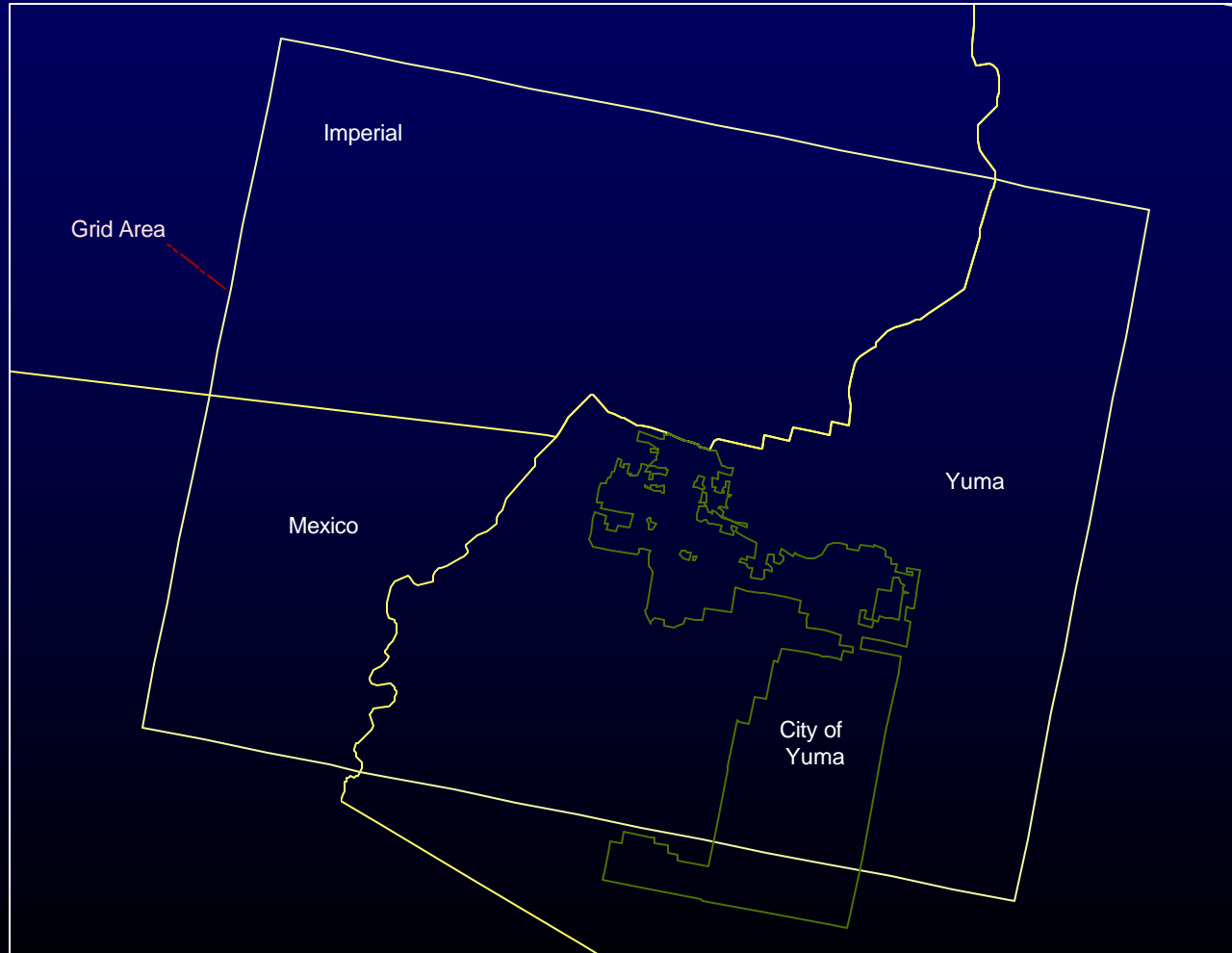
where:

EF_i = emission factor for land use i (tons/acre-hour);

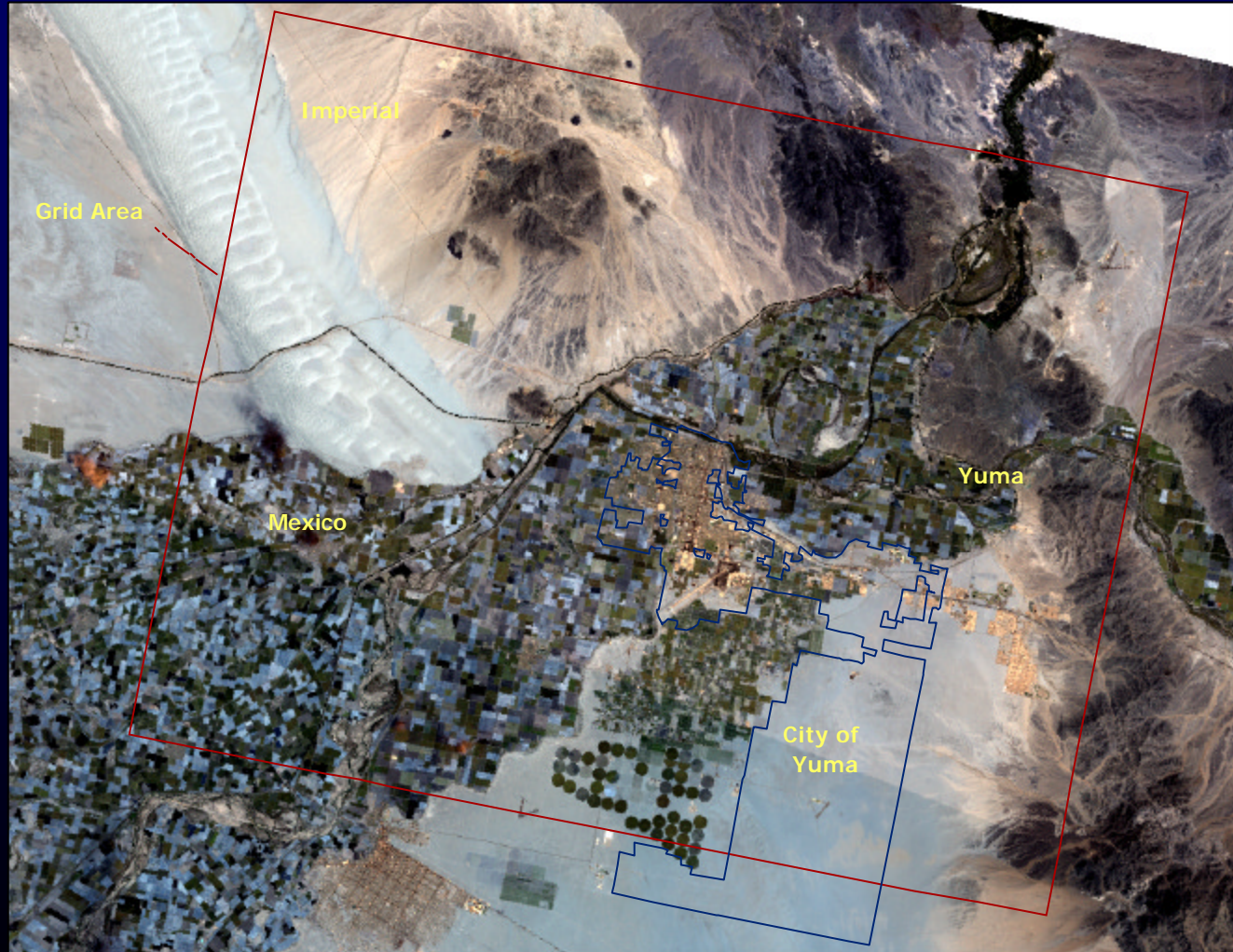
Area = area of erodible land use i (acres);

T = time (number of hours above the wind speed threshold for land use i).

Yuma Arizona PM_{10} Study Area



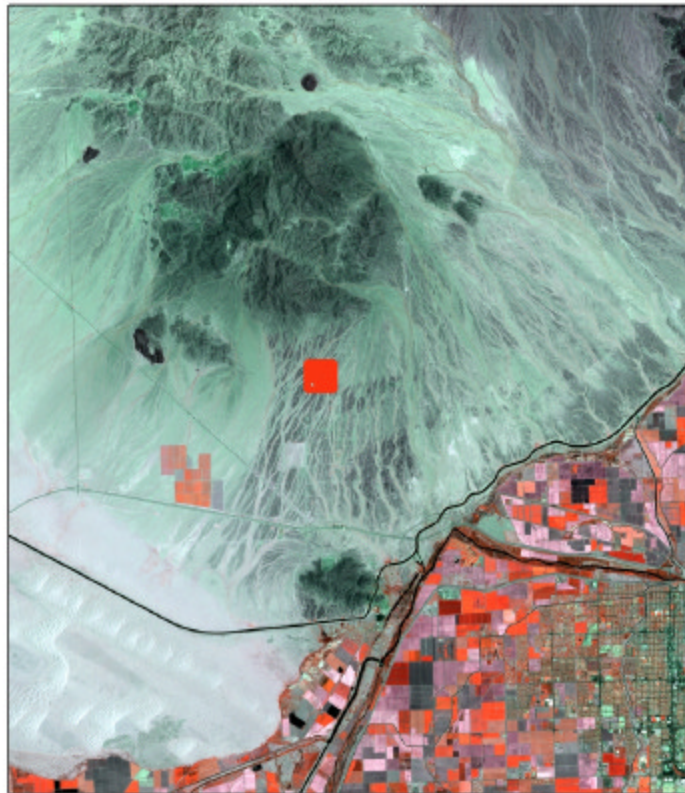
15-Meter LANDSAT Image



Quantifying Erodible Areas

Alluvial Channels - Yuma Study

Alluvial Information estimated using a Landsat Satellite Image



15 meter Landsat Satellite Image fall 2001

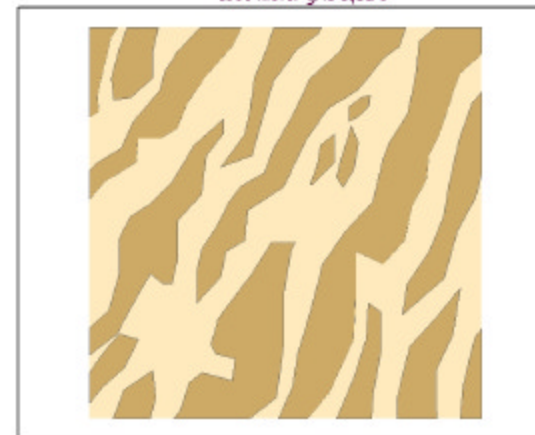
AREA	CLASS_ID
8122.25541	3
31271.812189	2
19308.71024	3
20800.18114	2
348836.205	2
26124.181561	3
82226.82625	2
118322.82625	3
128123.710203	2
31730.88401	3
3305.812189	3
33178.15625	3
4200.89825	3
38165.40025	3
67867.32010	3
24703.71825	3
19047.40025	3
88232.42189	3
9177.8125	3
8382.0125	3

Legend

CLASS_ID

- Sand, Silt, Alluvial Material **51% of area**
- Desert Pavement **49% of area**

1000 meter grid square



Imagery Resolution Issues

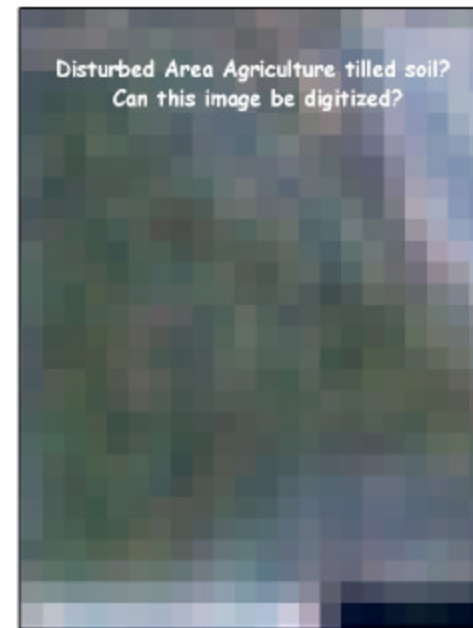
Land Use Classification Using Satellite Images - Disturbed Areas
Scale 1: 2,500



1 - Meter IKONOS Pansharpen image



4 - Meter IKONOS Multispectral image



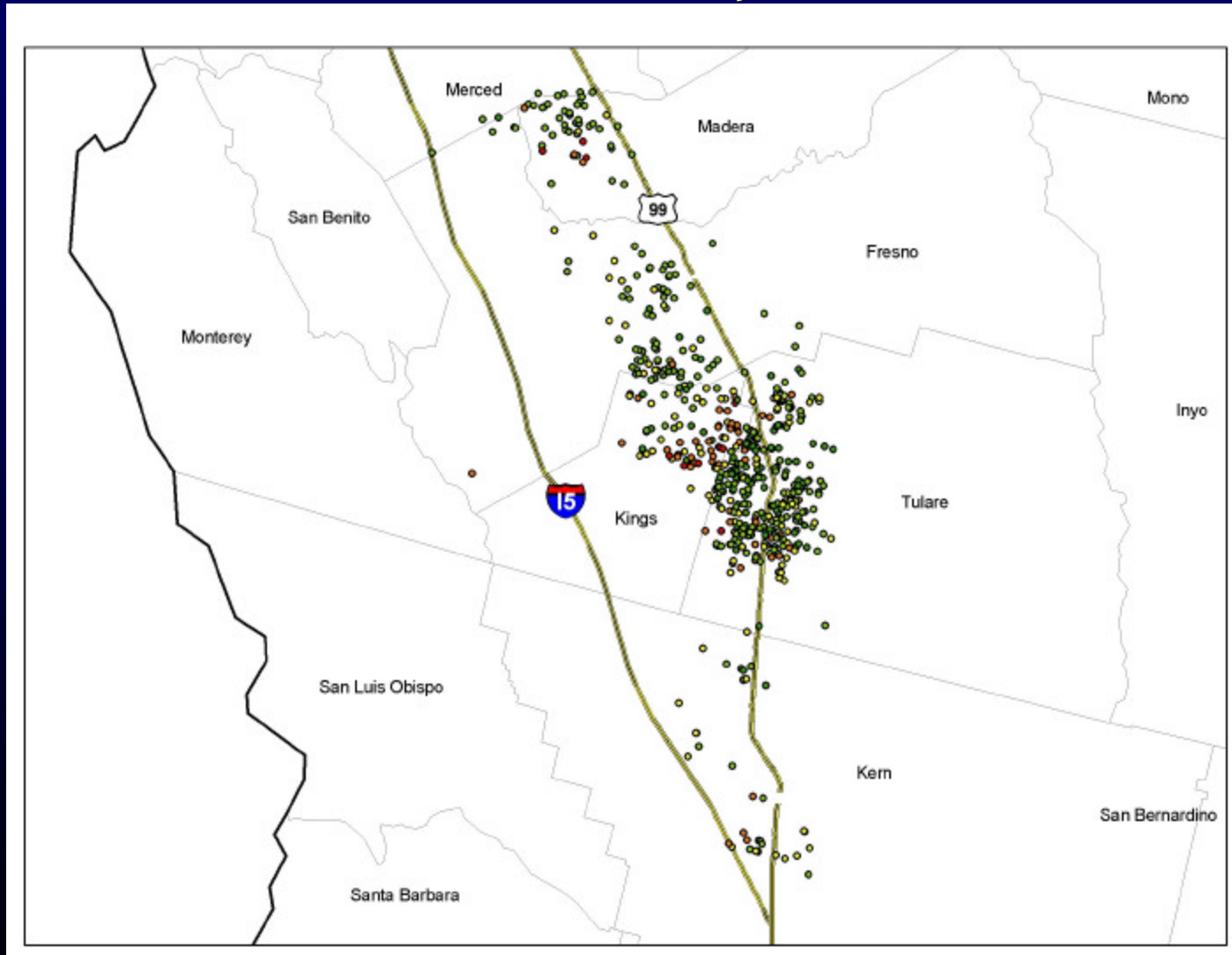
15 - Meter Landsat +7 Pansharpen image

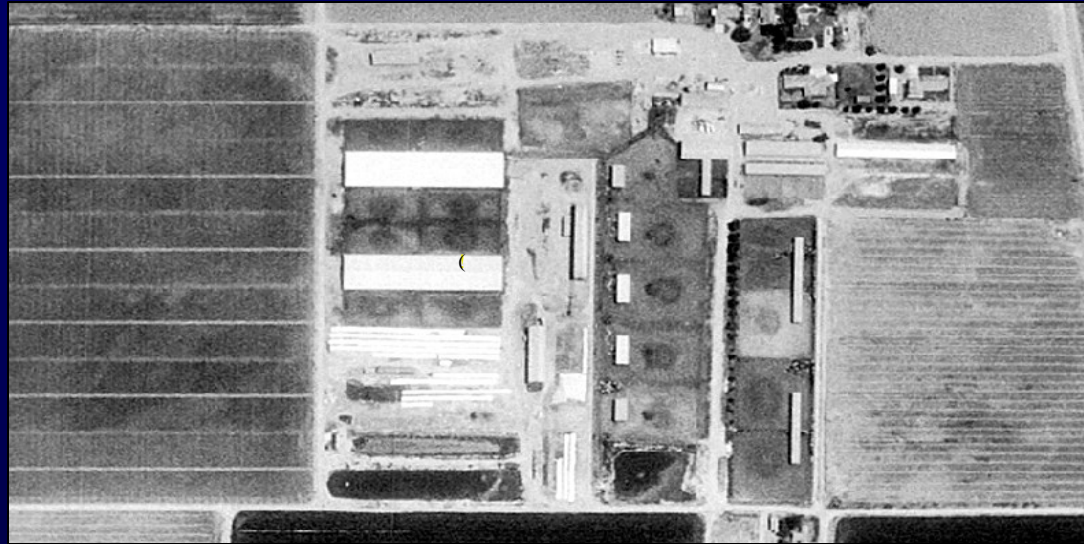
Miscellaneous Uses for Remote Sensing Data

- Spatial Surrogate Refinement
- Micro-Inventories (e.g. around ambient monitors, Class I areas)
- Development or Quality Assurance of Geo-coded point source locations

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So. SJV, CA Dairies





Bottom-Up EI Development

1. Field Identification - In the field, identify and locate land use, roads, and industrial sources contributing to emissions and note these on printouts of the satellite imagery of area of interest.
2. Digitize - In the office, digitize the annotated satellite printouts using GIS and satellite imaging processing software

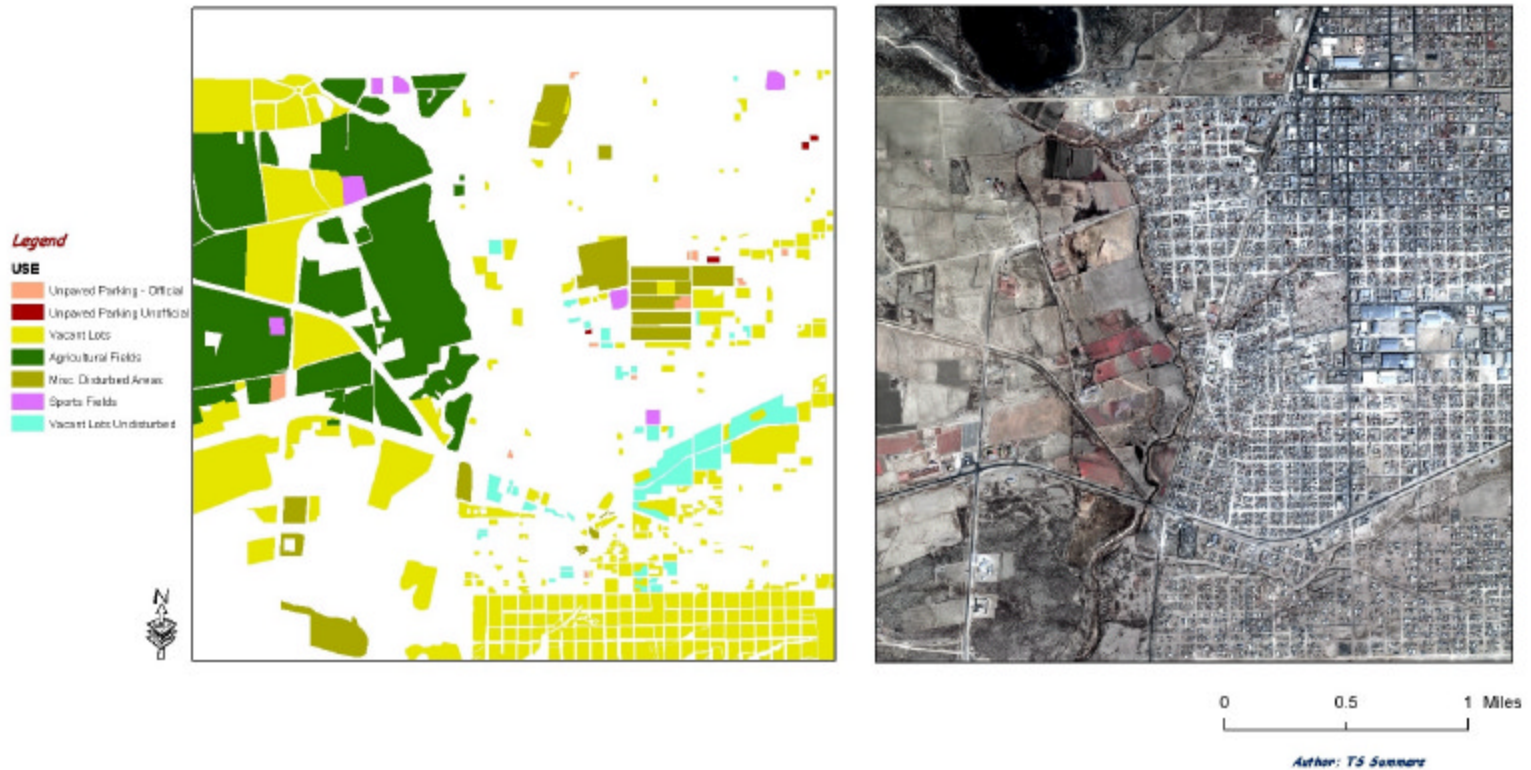
Bottom-Up EI Development

3. Grid - Lay modeling grid over satellite image and calculate spatial area, length, or point location of the emission sources for each grid cell using GIS.
4. Emissions – Calculate and spatially allocate emissions using both survey data and imagery.

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Comparison of Digitized Land Use with Satellite Image

Agua Prieta, Mexico - Landuse (Emission Inventory)



Considerations of Using Remotely-Sensed Data

Match Image Resolution & Cost To EI

- Low Resolution Image (15-meter)
 - ID of general land use (e.g, agriculture)
 - Cost Range: Free to hundreds of dollars
- Medium Resolution Image (4-meter)
 - ID of smaller features (e.g., parking lots)
 - Cost Range: Thousands of dollars
- High Resolution Image (1-meter)
 - ID of very small features (e.g., buildings)
 - Cost Range: Thousands to 10's of thousands of dollars

Considerations of Using Remotely-Sensed Data

Lead Time For Ordering Satellite Imagery

- High resolution images have longer lead time than low resolution images;
- High resolution image collected after customer order;
- Low resolution image, such as LANDSAT, are collected continuously.

Regional Inventory Development

- Start with low level resolution imagery and then identify areas where higher level imagery is needed;
- Identify other organizations with a need for similar imagery to share costs (e.g. water quality agency).