

# USING Remote Sensing and GIS to Detect and Characterize Smoke Emissions

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## **I. SUMMARY**

This project would assess the feasibility of developing an automated procedure using satellite mounted sensors and GIS databases to detect and quantify smoke from agricultural burning and/or forest fires on a regional scale.

## **II. PROJECTED USE**

The projected use for this data is the development of smoke emission inventories for use in regional haze modeling in the support of State Implementation Plans.

## **III. PRELIMINARY INVESTIGATION**

- A. Research previous investigations into this area.
- B. Satellite mounted remote sensing platforms would be assessed as to their capabilities to detect fire, smoke, and charred areas. Suitable platforms would then be ranked as to coverage, frequency of data availability, and data cost.
- C. GIS databases would be assessed as to their capabilities to characterize vegetation. Suitable databases would be ranked as to coverage, data quality, cost, and ability to be integrated into a programming environment.
- D. Computational environments would be assessed as to their ability to address large data sets, stability, robustness, etc.

## **IV. DEVELOPMENT OF SOFTWARE TOOLS**

- A. A suite of spectral signatures would be acquired and/or developed corresponding to fire, smoke, and charred areas in various forest and agriculture environments.
- B. A computer program would be developed that would be capable of:
  - 1. Importing the satellite data stream, and processing the satellite data using the spectral signatures library.
  - 2. Querying the GIS databases to determine the type and amount of vegetation (fuel) that was burned, and estimating the burn efficiency.

## **V. METHODOLOGY**

- A. The GIS databases would be queried in order to exclude certain areas, such as desert areas, water bodies, urban areas, etc. from consideration.
- B. The satellite data coverage from the remaining areas would be imported into the computer program. This data stream would then be searched for the specific spectral signals corresponding to fire, smoke, and charred areas in various forest and agricultural environments. When a burned area is identified from the spectral signatures, the program would:
  - 1. Estimate the burn efficiency.
  - 2. Query the GIS databases to determine the type and amounts of fuels burned.
  - 3. Make baseline "bound the problem" calculations of smoke emissions.
  - 4. Record the emission data in a database.

## **VI. PILOT PROJECT ASSESSMENT**

In order to prove the concept, a pilot project will be developed. The goal of the pilot project will be to assess the ability of the system to automatically quantify smoke emissions from several homogeneous and heterogeneous environments. This could include sugar cane field burning, predominantly single species forest fires (e.g., Douglas fir), and mixed species forest fires. The areas studied will be limited in size in order to facilitate ground truthing using conventional techniques.