

Soil Dust & Soil Ammonia Call

Update by
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Soil Ammonia

- Soil Ammonia (except fertilized soil)
 - CMU Model ~ could plug in emission factor for ammonia from soil – Question: What factor?
- Issue:
 - Soils (and vegetation) are both a Source AND Sink for Ammonia
 - Vegetation removes ammonia f(temperature, moisture, plant affinity, soil type)

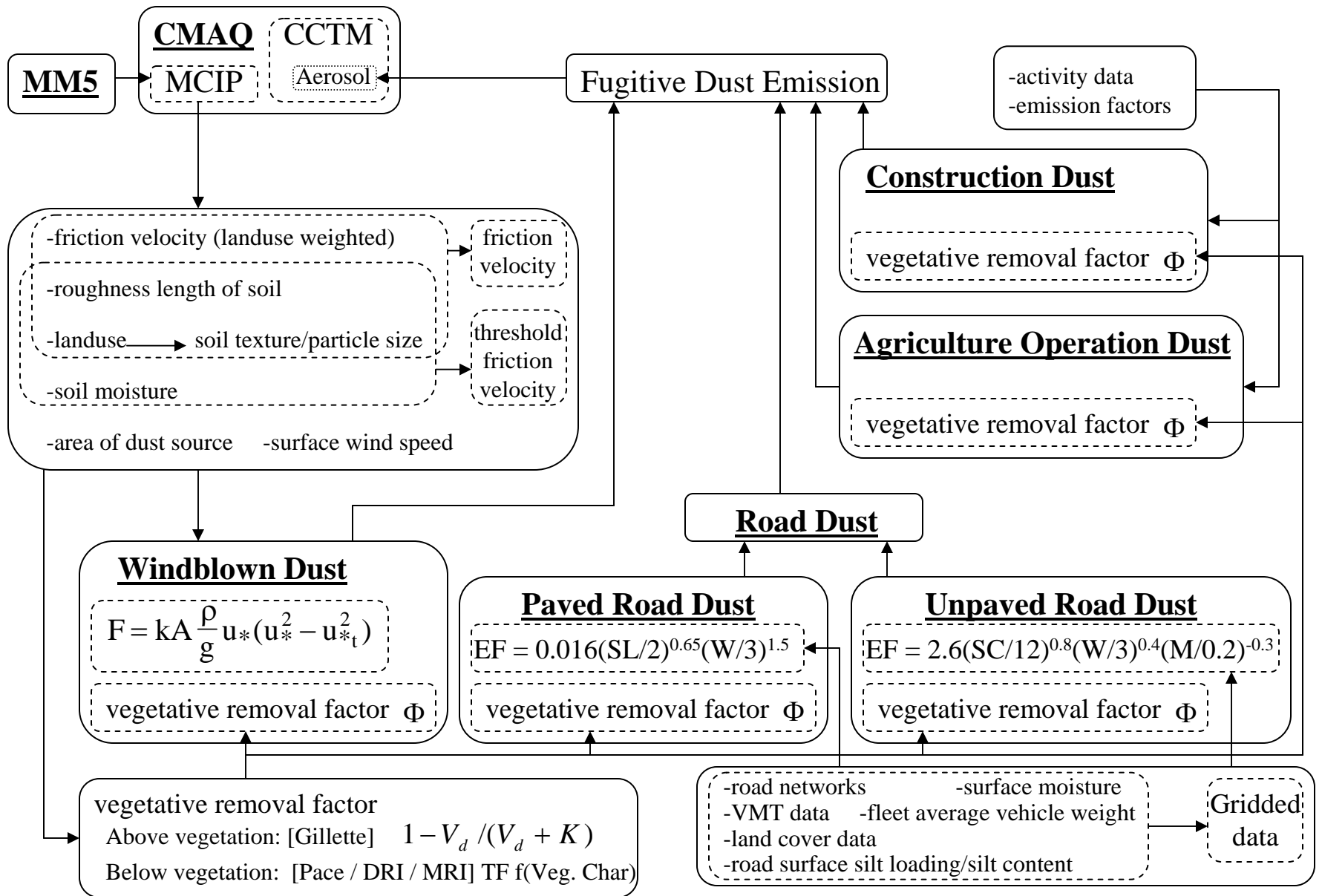
Soil Ammonia

- Science pertaining to Soil & Plant uptake & release of ammonia is not yet ready
- EIIIP funding State of Science paper
 - Bill Benjey (ORD) is task manager
 - Draft report is likely late Spring '03
- Fertilized soil:
 - LADCO: Sonoma Technologies Report
 - EIIIP is funding incorporation of ammonia release feature into CMAQ system

CMAQ Dust Emissions Module

Objectives

- Develop a fugitive dust algorithm within CMAQ modeling system:
 - establish consistent database of resource info (soil map, land use, vegetation cover, moisture, precipitation, windspeed) for making emission estimates w/in CMAQ modeling system.
 - demonstrate proof-of-concept of emission models for wind erosion and other dust sources,
- Evaluate the capability of CMAQ for dust emission modeling, assess the sensitivity, and identify key uncertainties for improvement.
- Implement, test & release modular code to perform dust inventory functions w/in the CMAQ system.

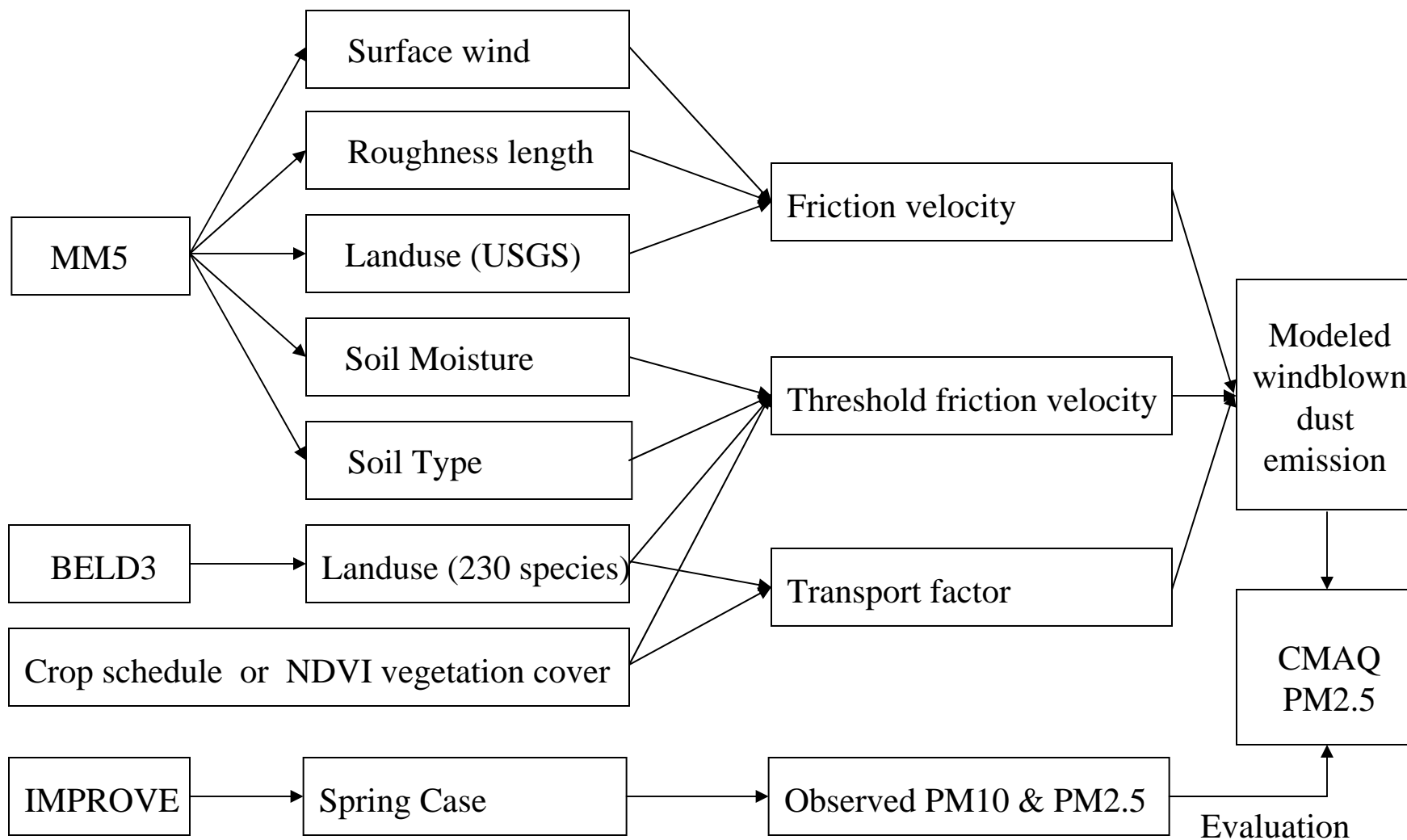


Schematic flow of fugitive dust emission modeling

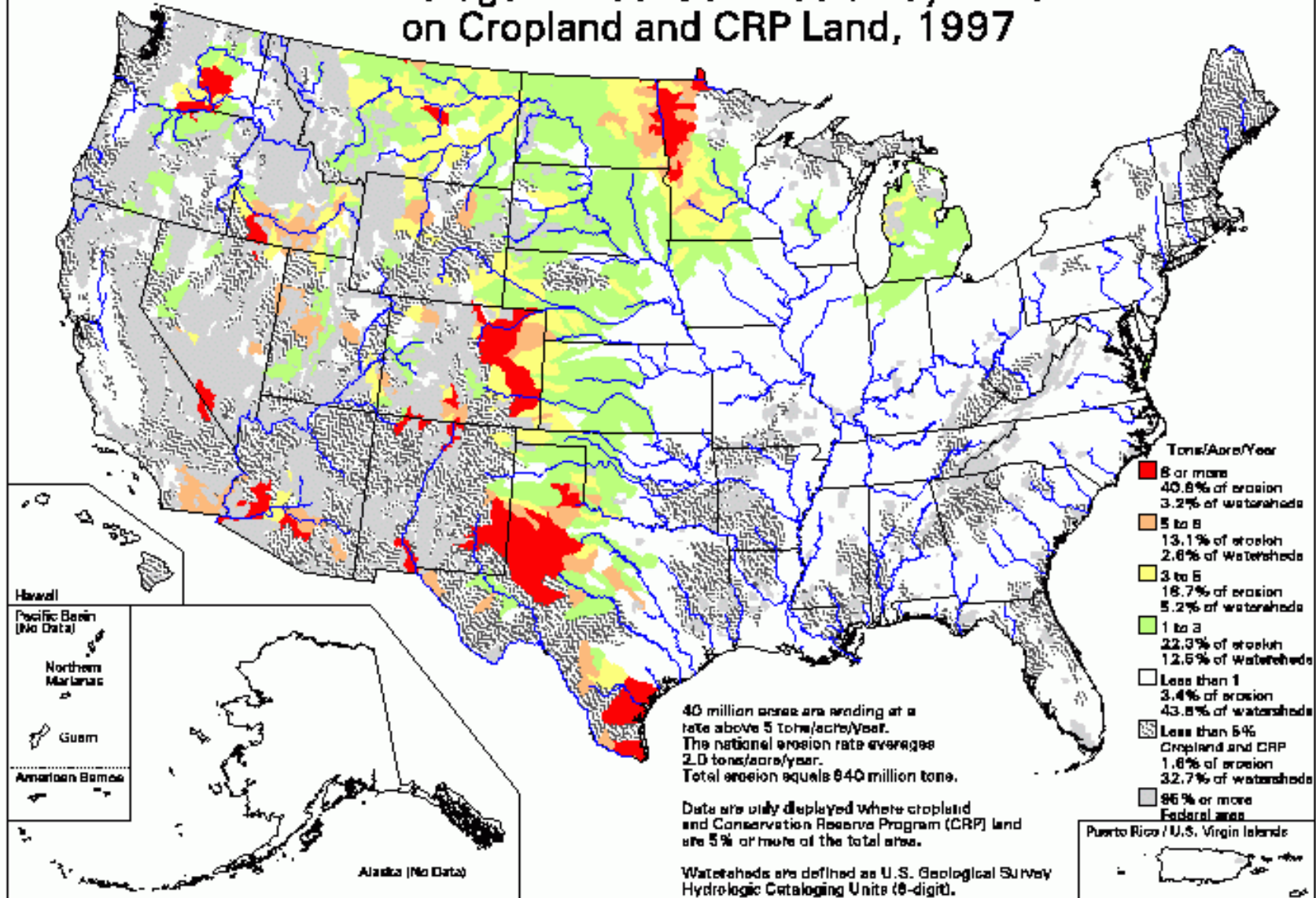
Progress to date – Wind Erosion

- Preliminary windblown dust emission and dust removal algorithms has been implemented into CMAQ system.
 - Applying local scale dust emission model into regional scale air quality model requires detail information on vegetation distribution and soil properties due to their highly heterogeneous characteristics.
 - The threshold friction velocity, which is highly sensitive to soil texture and landuse is the most sensitive source in dust emission modeling.
 - Continue sensitivity testing to evaluate Draxler et al & other potentially useful approaches to Wind Erosion estimation.
 - Refine Draxler, based on initial results
 - Begin work on other dust categories (e.g., assemble databases & algorithms, code, test)

Windblown Dust Model



Average Annual Soil Erosion by Wind on Cropland and CRP Land, 1997



U.S. Department of Agriculture
Natural Resources Conservation Service
Resource Assessment Division
Washington DC December 2000

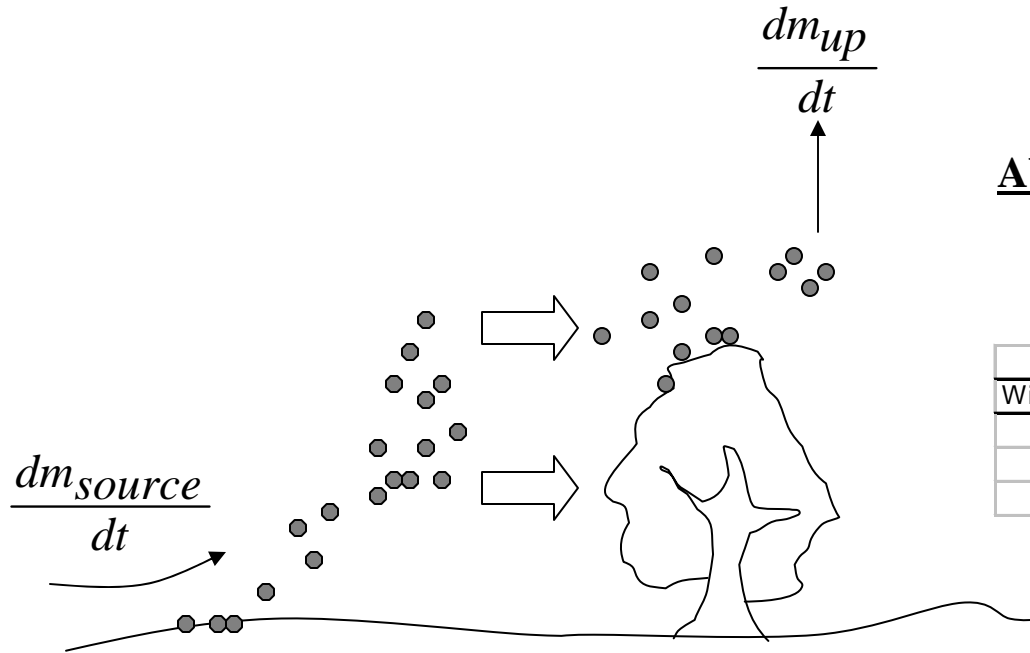
Map ID: m5086
For proper interpretation, see Explanation of Analysis for this map at our web site. Search for "USDABOTL" to locate our map index.

Data Source: 1987 National Resources Inventory
Revised December 2000

Progress to date - Removal

- Preliminary Dust Removal approach has been incorporated into CMAQ
 - Incorporate biweekly vegetation cover maps from AVHRR satellite data to supplement the current maps (based on the BELD3 vegetation databases) ~ *incorporates “greenup”*.
 - Adapt and apply a model by Raupach et al. (2001) to improve the estimation of dust removal inside and below the vegetative canopy. Thus, the transport fraction will be a function of more detailed canopy properties (leaf area index, optical porosity, canopy height, etc.) and wind speed.
 - Begin work on other dust categories (e.g., assemble databases & algorithms, code, test)

Dust Removal by Nearby Vegetation



Above canopy $\Phi = \frac{\frac{dm_{up}}{dt}}{\frac{dm_{source}}{dt}} = \frac{V_d}{V_d + K}$
 (Gillette 2001)

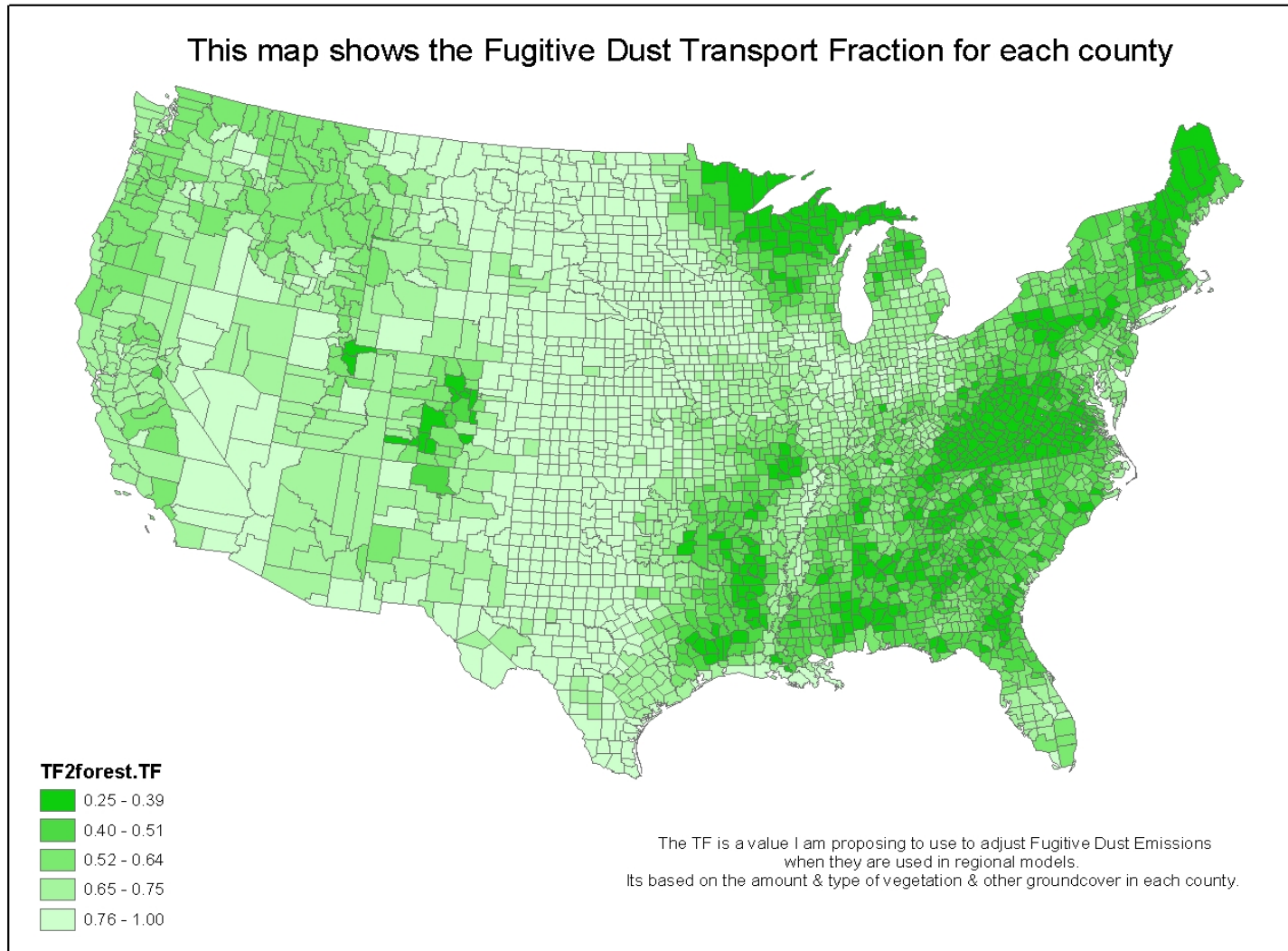
		Vd (m/s)	Slinn 1982	
Wind speed (m/s)	Water	$\gamma=2.0$	$\gamma=3.5$	$\gamma=5.0$
10	0.0051	0.0152	0.0268	0.0382
5	0.0018	0.0056	0.0099	0.0141
1	0.0018	0.0020	0.0021	0.0030

$K=0.08u_*$

Preliminary In and below canopy Transport (Cowherd & Pace 2002)

Landuse	Grass	Agriculture	Forest
Transport Fraction	0.9	0.7	0.05

Transport Fraction for Dust Flux below and into the Canopy



Dust from Unpaved Roads

- VMT
 - Clarke Co NV
 - MRI's work in Kansas
- Silt Content remains an issue
 - Current default database is insufficient
 - More testing or redo of algorithm needed