Agricultural Burning Activity Data in the WRAP Region

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Presented by:

Paula G. Fields

ERG, Inc.

Sacramento, CA

ERG

WRAP Project: Non-Burning Management Alternatives

- Task 1: Crop Production and Agricultural Burning Activity for 1996
  - Develop county-level statistics for crops grown (acres)
  - Develop county-level residues burned (tons)
  - Include entire WRAP region (15 states)
  - Year = 1996
  - Determine days, months, seasons of burning

Agricultural Crop Data: Objectives

- Provide information on total residues by crop at the county level:

$$\textit{Acres Harvested} \times \textit{Residue Loading Factor} = \textit{Total Residue}$$

- Use to disaggregate state-level burn data to the county level
- Use to verify anecdotal information related to burning residues

Agricultural Crop Data: General Procedure

- Compiled available data by county by crop for each state:
  - NASS formed foundation: 1996, county-level, major crops, electronic format
  - State data used to fill in crops missing in NASS
  - 1997 Ag Census used to fill in remaining crops
- Draft database => Comments => Final database
- Final database => Used in residue calculations

Agricultural Crop Data: Quality Assurance

- Data Quality Objectives:
  - Account for 90% all acres harvested for the top 10 crops in each state, at the county level for 1996
  - Account for 100% of acres harvested for crops burned
  - Acres harvested quantities compare alternative data sources within ± 15%
- 4-Step Process:
  - Reality check: Compared data to Std. Ref. Value
  - Peer review: Checklist and written comments by FEJF, stakeholders
  - Sample calculations: Replication of 1 set of calculations
  - Computerized checks: Electronic methods of checking
  - Independent audit by WRAP/FEJF project manager

Agricultural Burn Data: Objectives

- Provide a basis for assessing non-burning alternatives
- Provide activity data for 1996 emissions inventory:

$$\textit{Acres Burned} \times \textit{Residue Loading Factor} = \textit{Residue Burned}$$

Agricultural Burn Data: General Procedure

- Compiled available data by county by crop:
  - Burn permits: WA, CA/SJV, AZ/Yuma/Pinal
  - Emission inventories: ID, NV, OR, UT
  - Anecdotal information ■
- Calculated % burned *by state* to compare to USDA/AQTF study (1997)
- Calculated % burned *by crop* to gap fill
- Draft database => Comments => Final database
- Final database => Air Sciences for 2018 EI

Agricultural Burn Data: Quality Assurance

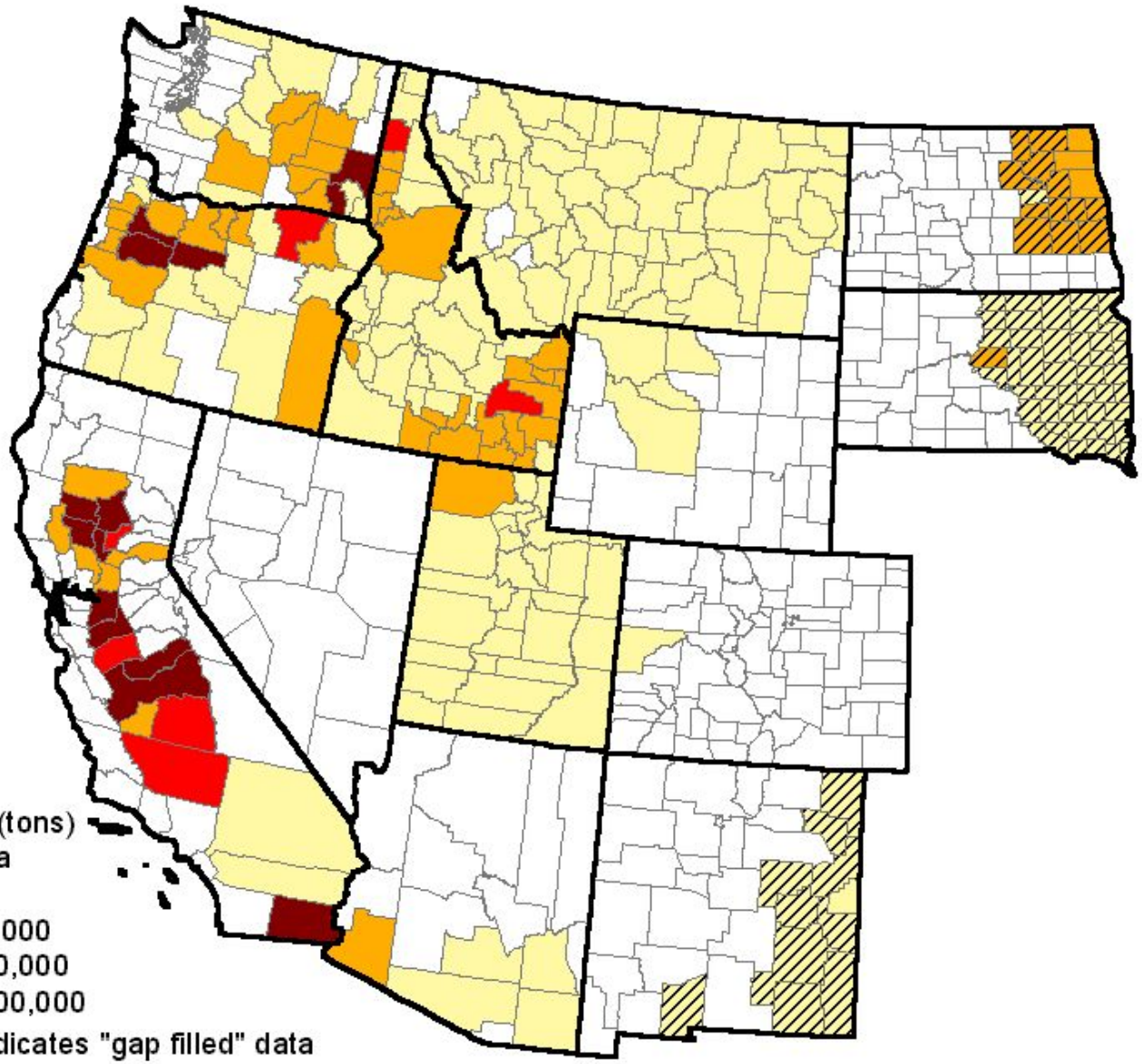
- Data Quality Objectives:
  - Account for 90% all residues actually burned at the county level for 1996 or other years
  - Develop method to estimate residues for areas where data do not exist within ± 25% of peer review estimates
- 4-Step Process:
  - Reality check: Compared data to Std. Ref. Value
  - Extended peer review by FEJF and other stakeholders
  - Sample calculations and computerized checks
  - Independent audit by EI contractor

Residue Loading Factors

Fuel Type	Residue Loading (tons/acre)	Source
Barley	1.7	AP-42
Hay	0.8	AP-42
Wheat (spring, irrigated)	4.0	Sharkoff, 2002 (CO only)
Wheat	1.5	Shaver, 2002 (NM only)
Wheat	1.9	AP-42
Orchard prunings, unspecified.	1.7	AP-42
Orchard removal, unspecified	15.0	Jenkins, 2002
Apple	2.3	AP-42
Apple	0.8-1.0	Beyer, 2002 (CA only)
Seeds, KBG and unspecified	2.0	IDEQ, 2001
CRP	2.6	AP-42 (grasslands)
Ditches, fenceline	1.6	Gabrielson, 2002 (AZ only)
Ditches, fenceline	0.75	Goodrich, 2002 (UT only)
Ditches, fenceline	3.2	AP-42 (weeds)

WRAP
FEJF-ETT

Agricultural Burning Activity



Legend

Residue Loading (tons)
- 0 or No Data
- 1 - 10,000
- 10,000 - 50,000
- 50,000 - 100,000
- 100,000 - 300,000

Crosshatching indicates "gap filled" data

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For the Western Regional Air Partnership - Fire Emissions Joint Forum

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Comparison to USDA/AQTF

Crop	WRAP Task 1 for 1996/various years	USDA/AQTF for 1992/various years	Comments
Sugarcane	70% residues burned	100% residues burned	Different years, methods
Orchard crops	21% residues burned in the West	5% residues burned across the US, 1997	Expected increased activity in the West
Rice	51% residues burned in the West/CA	25% in CA, 1997 19% in the US	Different years, burning phase-down
Small grains	14% OR, 1996 13% ID, 1996 6% WA, 1999 3% in the West	15% in Pacific NW, 1997 10% in the US	PacNW comparable WRAP<USDA for average due to small amounts in CO, MT, ND, SD
Grass seed	5% WA 53% OR 72% ID 44% in the West	0% WA 50% OR 100% ID 50% rest of US	Comparable between studies

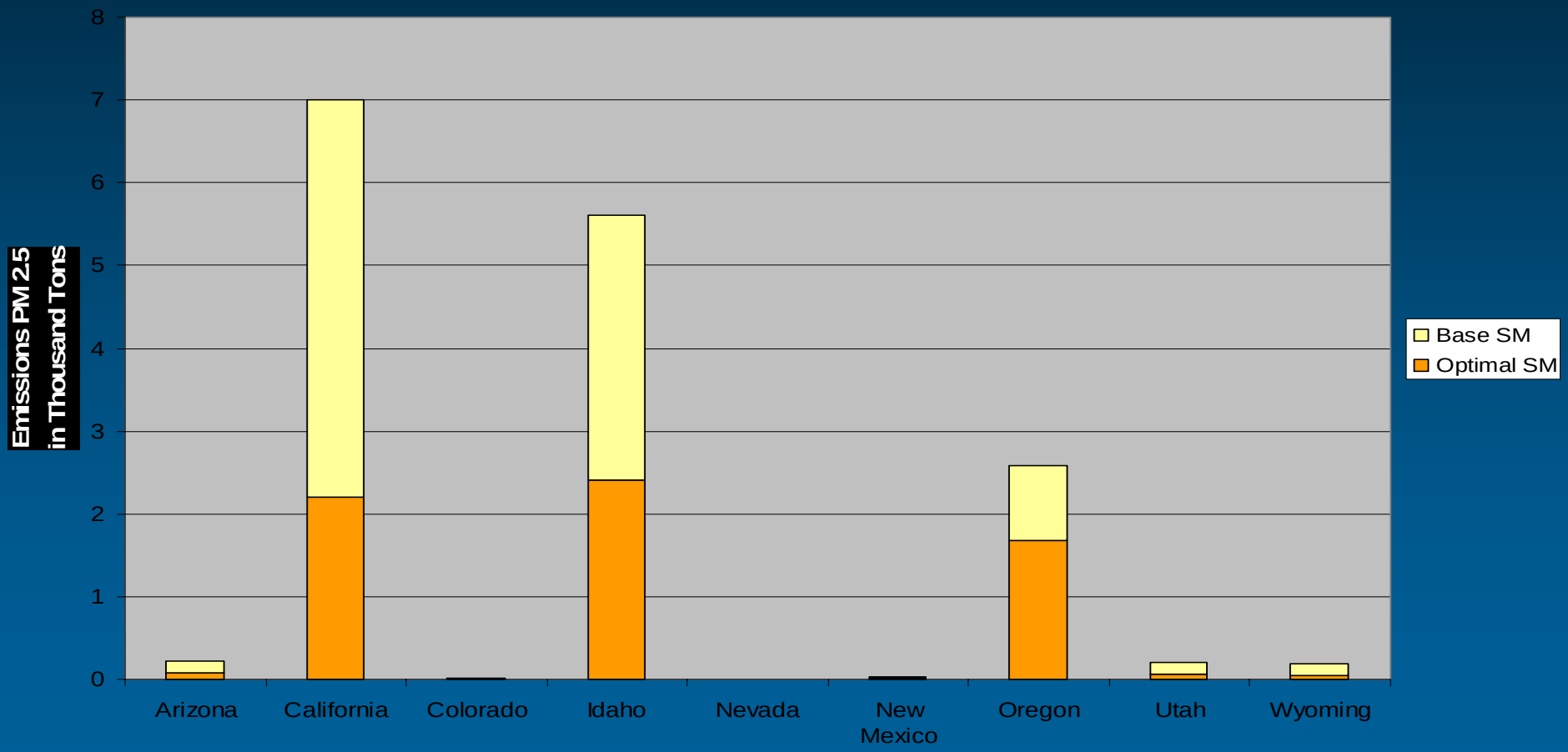
Emissions Methodology: Ag Burning Input Data

- ERG agricultural burning activity data
  - Daily or monthly
  - County
  - Crop-specific residue burned
  - 13-state region (some gap-filled)
- Emissions calculated
  - Crop-specific emission factors (74) from ETT

Activity Data Refinements

- Dataset included aggregated data (e.g., acreage summaries, county-wide & monthly)
  - Daily data (48,000 records) used to statistically derive realistic fire size packets. Aggregated data broken into these realistically sized events.
  - Events allocated to random days within the month except on specific *no-burn* days (holidays, air quality alert days).
  - Events randomly assigned to agricultural land using LCC to identify 1km ag pixels w/in county

2018 Smoke Management Scenario Summary for Agricultural Burning ($PM_{2.5}$)



Emissions Calculations

- For Each Event: RL *x* Emission Factor (Crop)

		Emission Factors in kg/Mg dry weight (zero moisture)					
		1	2	3	4	5	6
Crop_Name	**ERG Crop_Code**	**PM**	**PM10**	**PM2.5**	**EC**	**OC**	**VOC**
almonds	100	4.36	4.30	4.10	1.08	1.85	4.45
apples	110	4.27	4.19	3.98	1.05	1.80	2.47
apricots	120	4.53	4.45	4.22	1.11	1.91	3.47
asparagus	130	16.47	16.20	15.45	4.05	6.97	7.49
avocado	140	14.84	14.57	13.72	3.64	6.26	13.08
barley	150	7.76	7.68	7.43	1.23	3.07	11.67
beans; all dry edible	160	7.86	7.73	7.34	1.93	3.32	8.01
blueberries	170	9.01	8.86	8.47	2.22	3.81	5.96
canola	180	9.01	8.86	8.47	2.22	3.81	5.96
cherries	190	6.31	6.19	5.80	1.55	2.66	4.70
citrus	200	4.25	4.17	3.96	1.04	1.79	4.81
coffee	210	5.58	5.48	5.13	1.37	2.36	4.42

- Different Smoke Management Programs Considered: Base (status quo) and Optimal

Recommended Ag Burning Activity Data Improvements

- Collection of data elements per WRAP Tracking System Policy
  - Date / location / area / crop type / pre-burn fuel loading / type of burn (e.g., heading, backing)
- Centralized data management system (e.g., WRAP EDMS)
- More involvement of the agricultural community in collection and review of activity data
- Refine RL factors to account to variable yields:
  - Geographic variability, nonirrigation/irrigation effects

Thank You!

For more information contact:

www.wrapair.org

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paula.fields@erg.com

916-361-6751