Fire Emissions Inventories for Regional Haze Planning in the Western Regional Air Partnership

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Session 12. Agriculture & Ammonia: Managed Burning and Wildfire
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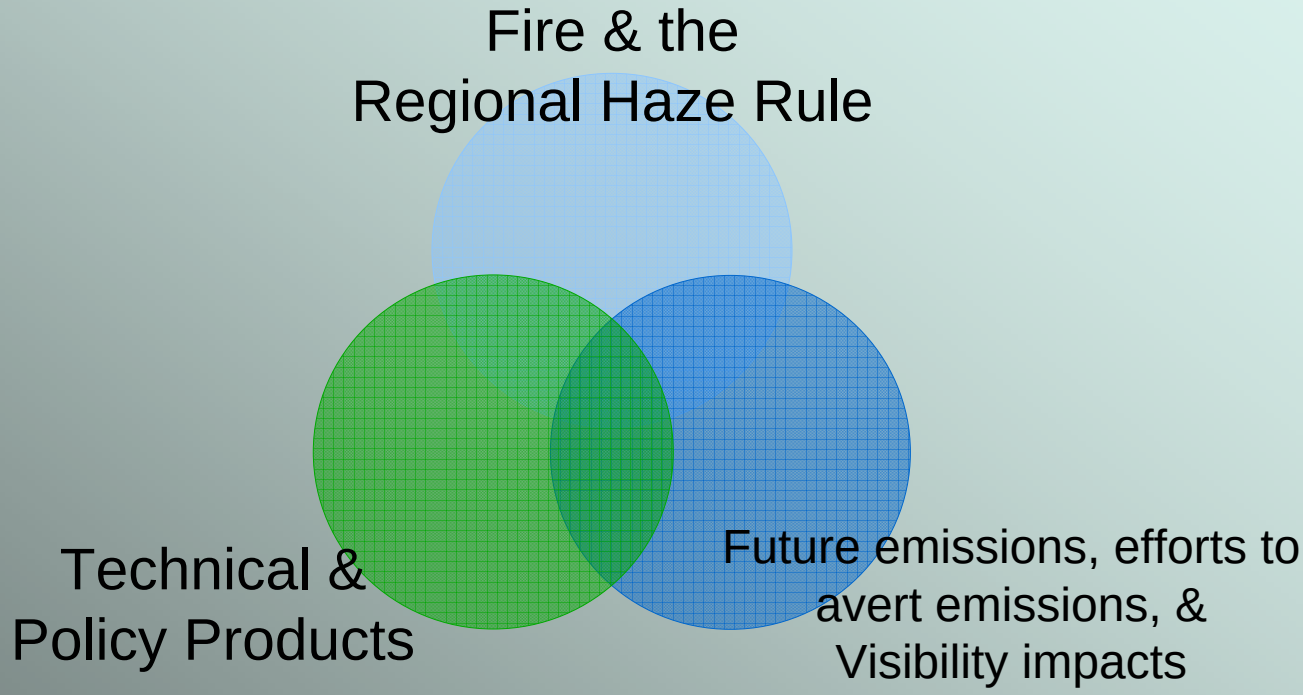
- Previous AQ planning efforts
  - Putting fires at right place at right time
  - Quantifying emissions with confidence
  - Representing fire plumes in modeling analysis
  - Confidence in fire projections

Fire & Regional Haze Planning

- Fire Emissions Inventories are “in the system” on equal footing with other sources in the WRAP’s regional haze planning inventories.
  - Historical – 2002 (model performance)
  - Baseline Period – 2000-2004
  - Projection - 2018

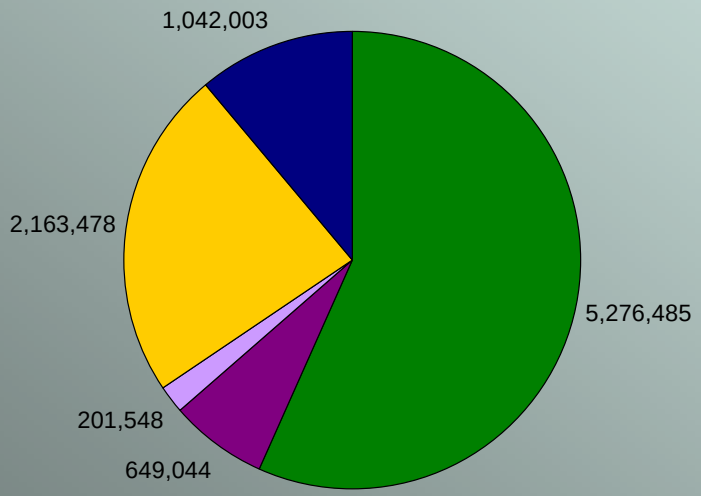


The Big Picture

Fire Emissions Joint Forum's Charge:

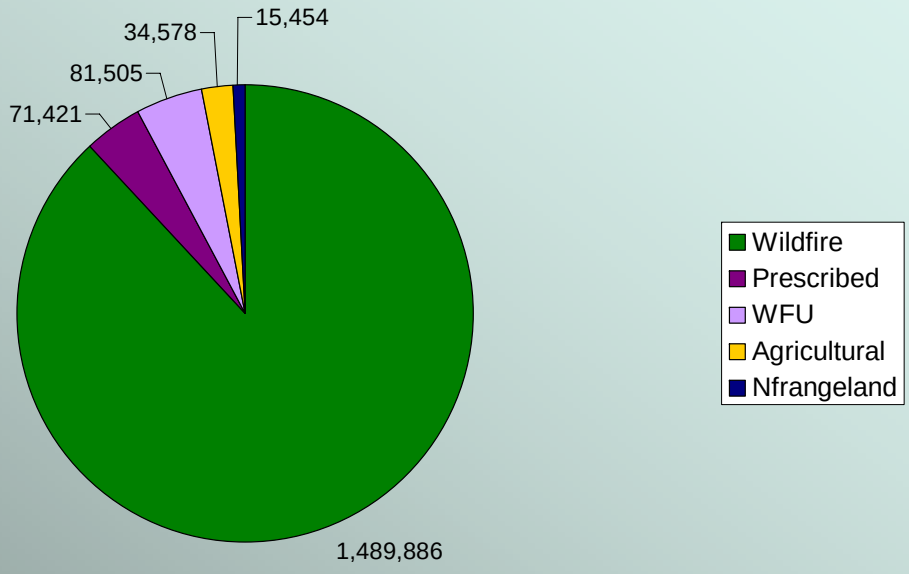
- What are the major sources of fire?
- How (and where) do fire emissions contribute to visibility impairment?
- What sources of fire can/should/must be managed for smoke?
- What can SMPs do to reduce emissions from planned fire events?
- How will the magnitude of manageable sources and measures to avert emissions change in the future?

WRAP 2002 Phase II Fire Emission Inventory
Annual Acres Burned by Fire Type



How many acres?

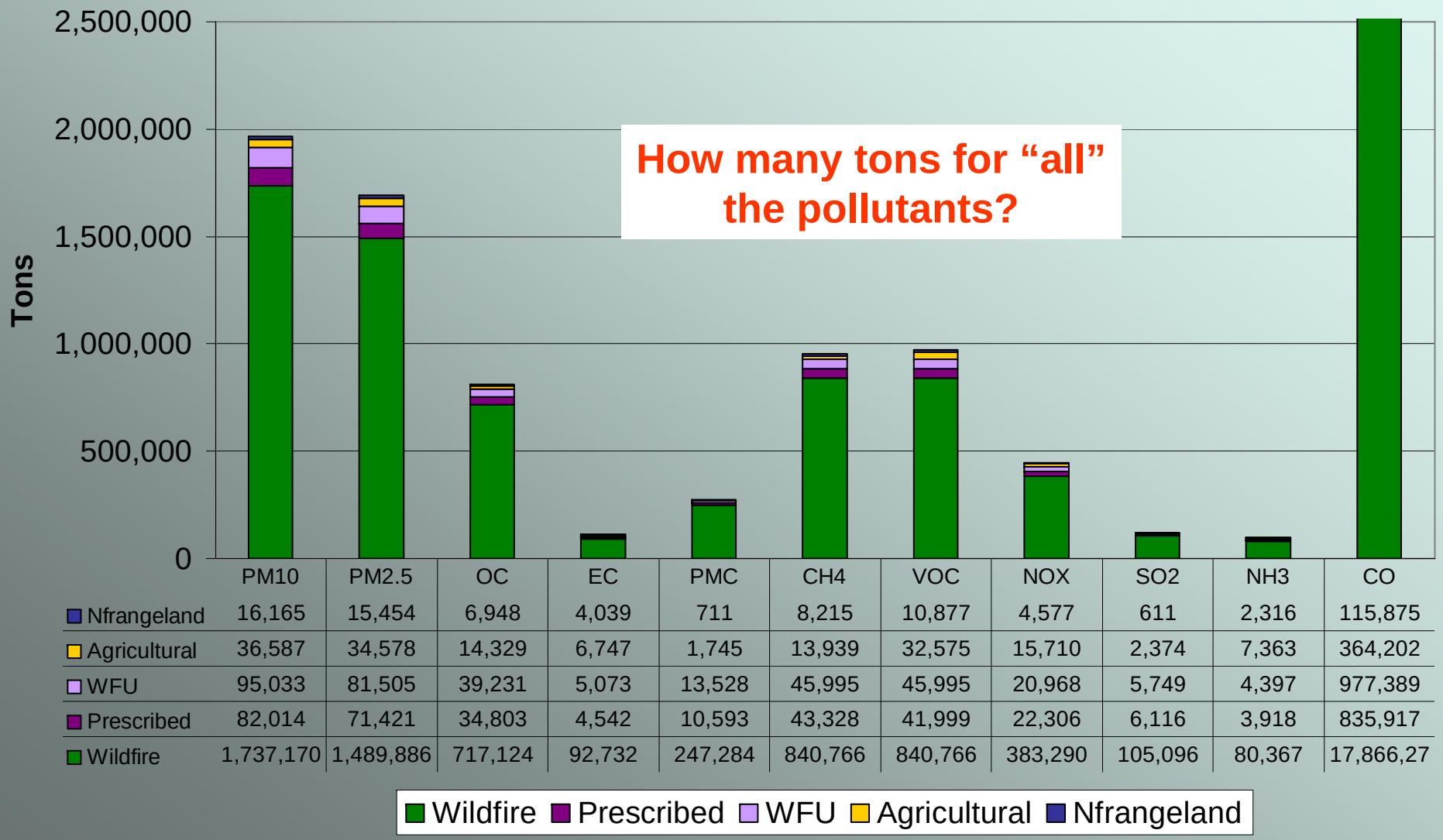
WRAP 2002 Phase II Fire Emission Inventory
Annual $PM_{2.5}$ Emissions by Fire Type (tons)



How many tons PM2.5?

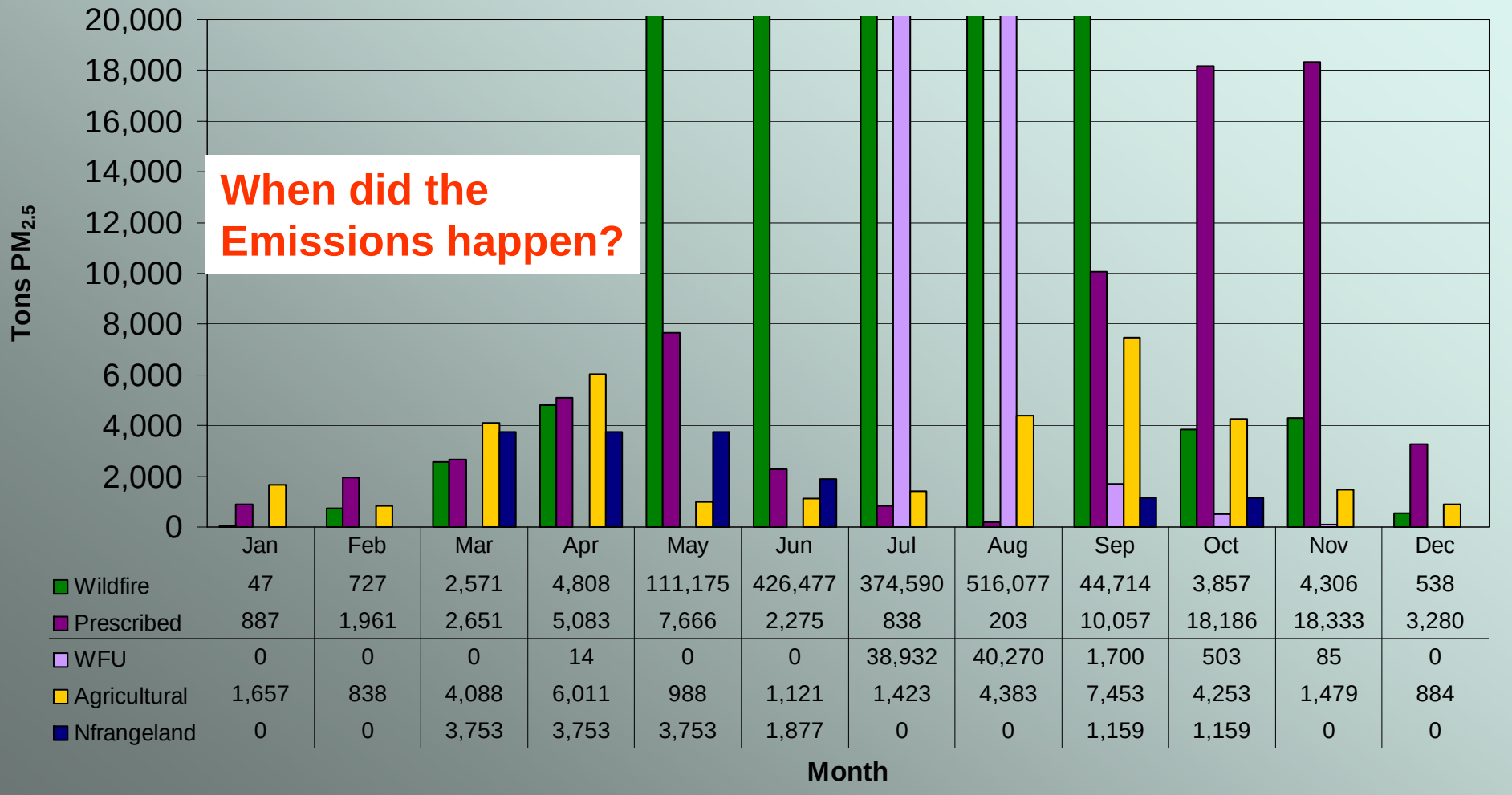
Historical EI (2002)

WRAP 2002 Phase II Fire Emission Inventory
Annual Region-Wide Emissions (tons)



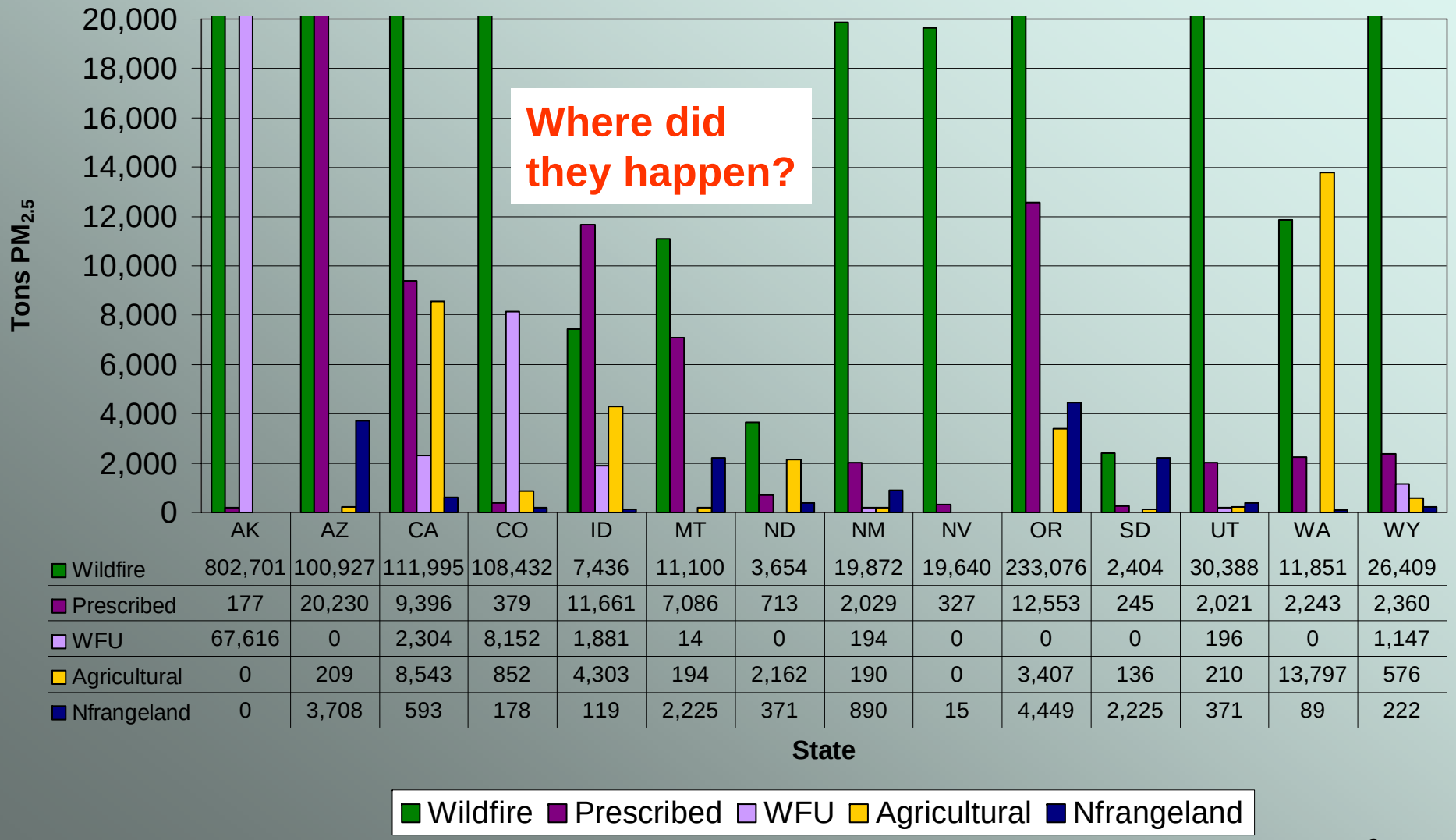
	PM10	PM2.5	OC	EC	PMC	CH4	VOC	NOX	SO2	NH3	CO
Nfrangeland	16,165	15,454	6,948	4,039	711	8,215	10,877	4,577	611	2,316	115,875
Agricultural	36,587	34,578	14,329	6,747	1,745	13,939	32,575	15,710	2,374	7,363	364,202
WFU	95,033	81,505	39,231	5,073	13,528	45,995	45,995	20,968	5,749	4,397	977,389
Prescribed	82,014	71,421	34,803	4,542	10,593	43,328	41,999	22,306	6,116	3,918	835,917
Wildfire	1,737,170	1,489,886	717,124	92,732	247,284	840,766	840,766	383,290	105,096	80,367	17,866,27

WRAP 2002 Phase II Fire Emission Inventory
$PM_{2.5}$ Emissions (tons) Temporal Distribution (month)

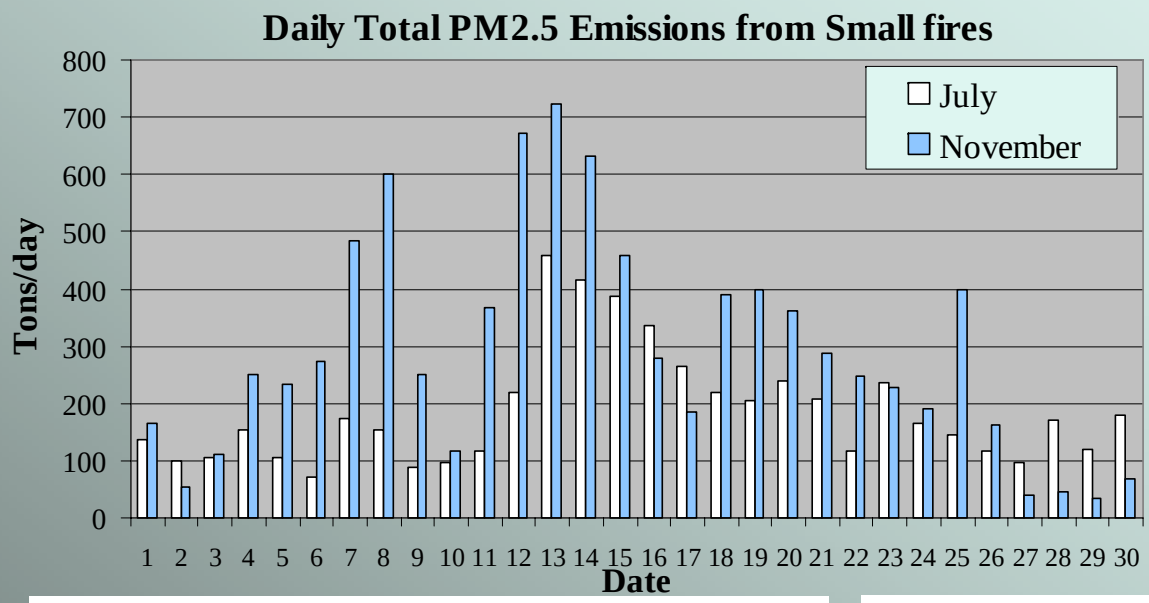


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wildfire	47	727	2,571	4,808	111,175	426,477	374,590	516,077	44,714	3,857	4,306	538
Prescribed	887	1,961	2,651	5,083	7,666	2,275	838	203	10,057	18,186	18,333	3,280
WFU	0	0	0	14	0	0	38,932	40,270	1,700	503	85	0
Agricultural	1,657	838	4,088	6,011	988	1,121	1,423	4,383	7,453	4,253	1,479	884
Nfrangeland	0	0	3,753	3,753	3,753	1,877	0	0	1,159	1,159	0	0

WRAP 2002 Phase II Fire Emission Inventory
Annual $PM_{2.5}$ Emissions (tons) Spatial Distribution (state)



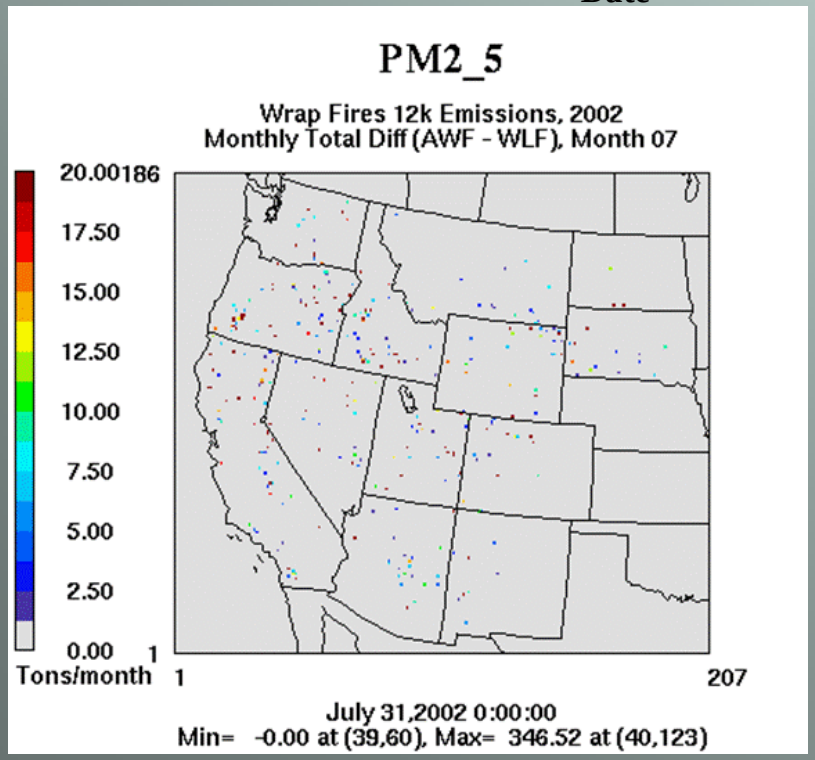
	AK	AZ	CA	CO	ID	MT	ND	NM	NV	OR	SD	UT	WA	WY
Wildfire	802,701	100,927	111,995	108,432	7,436	11,100	3,654	19,872	19,640	233,076	2,404	30,388	11,851	26,409
Prescribed	177	20,230	9,396	379	11,661	7,086	713	2,029	327	12,553	245	2,021	2,243	2,360
WFU	67,616	0	2,304	8,152	1,881	14	0	194	0	0	0	196	0	1,147
Agricultural	0	209	8,543	852	4,303	194	2,162	190	0	3,407	136	210	13,797	576
Nfrangeland	0	3,708	593	178	119	2,225	371	890	15	4,449	2,225	371	89	222

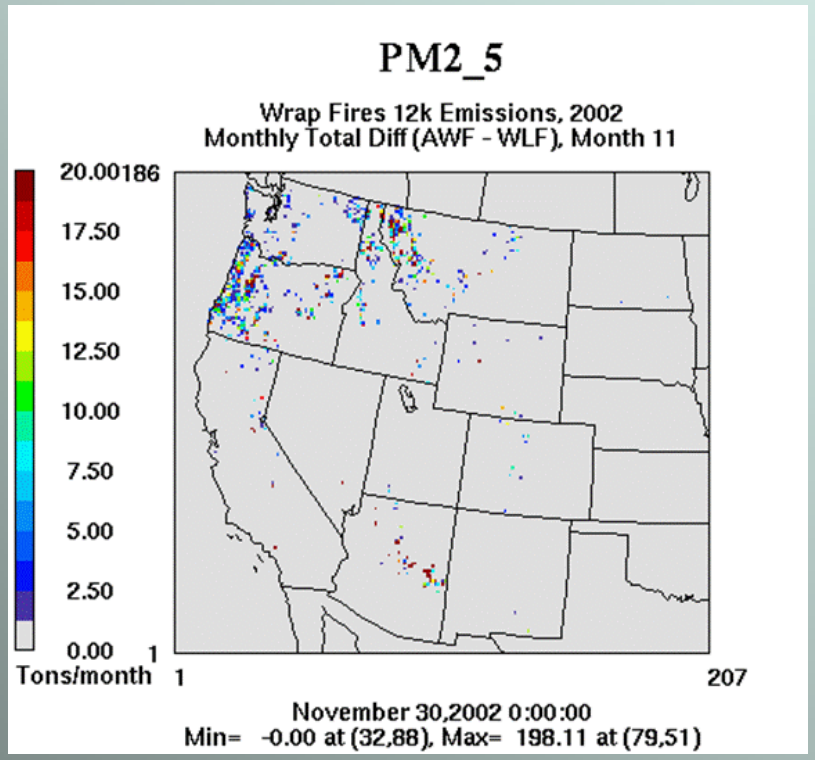


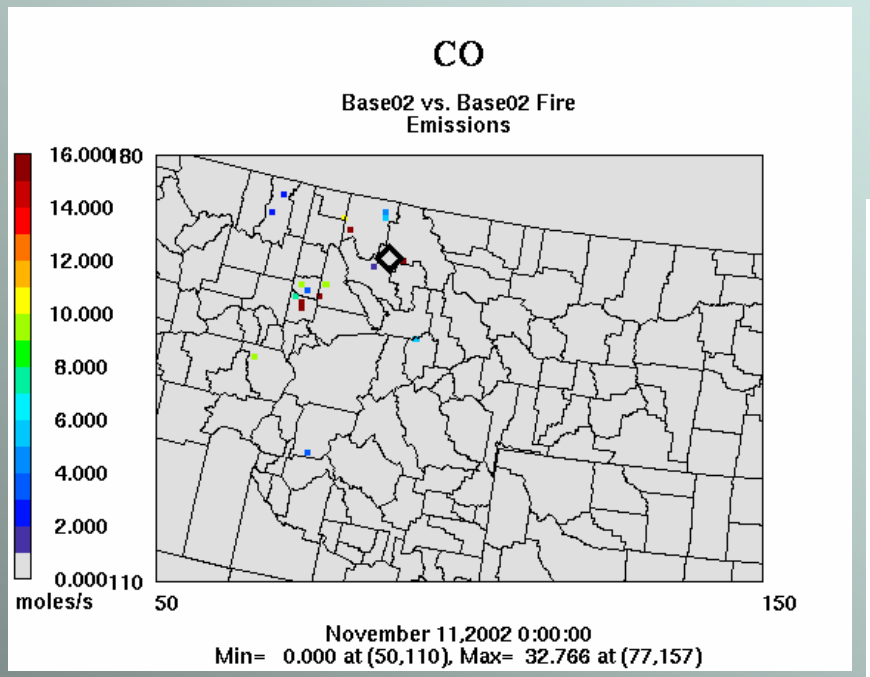
Do small Fires Matter?

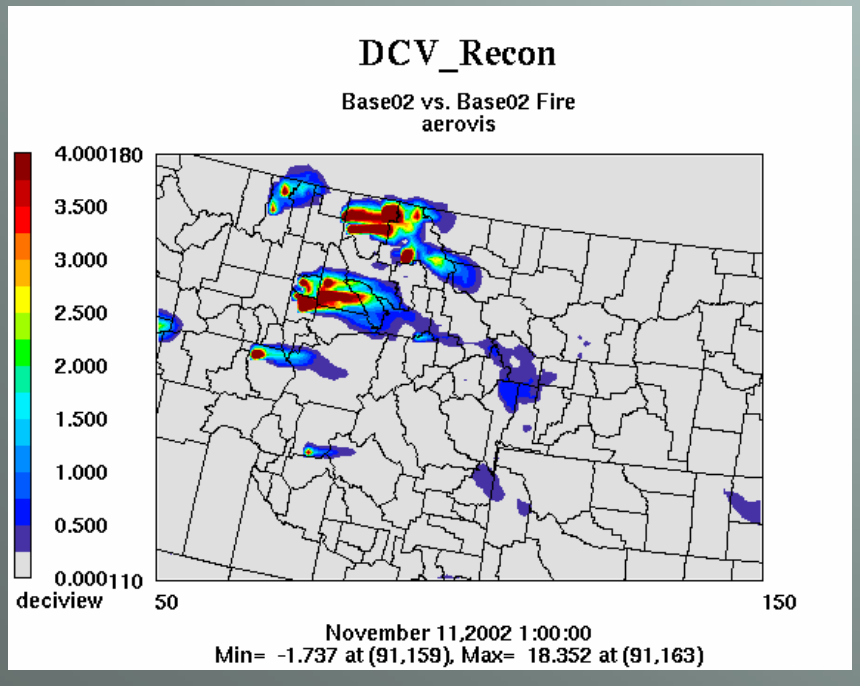
<100 acres in timber

<300 acres in grass

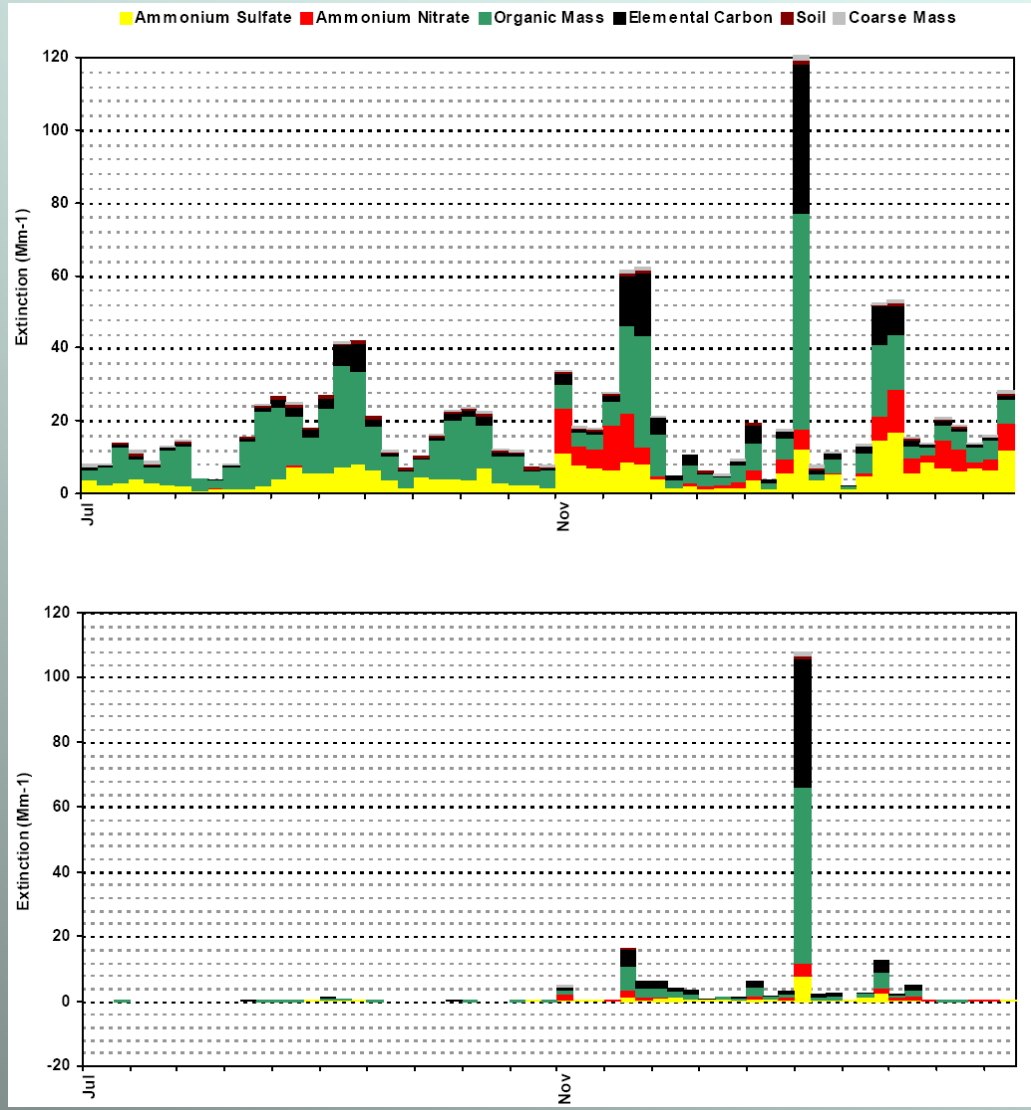




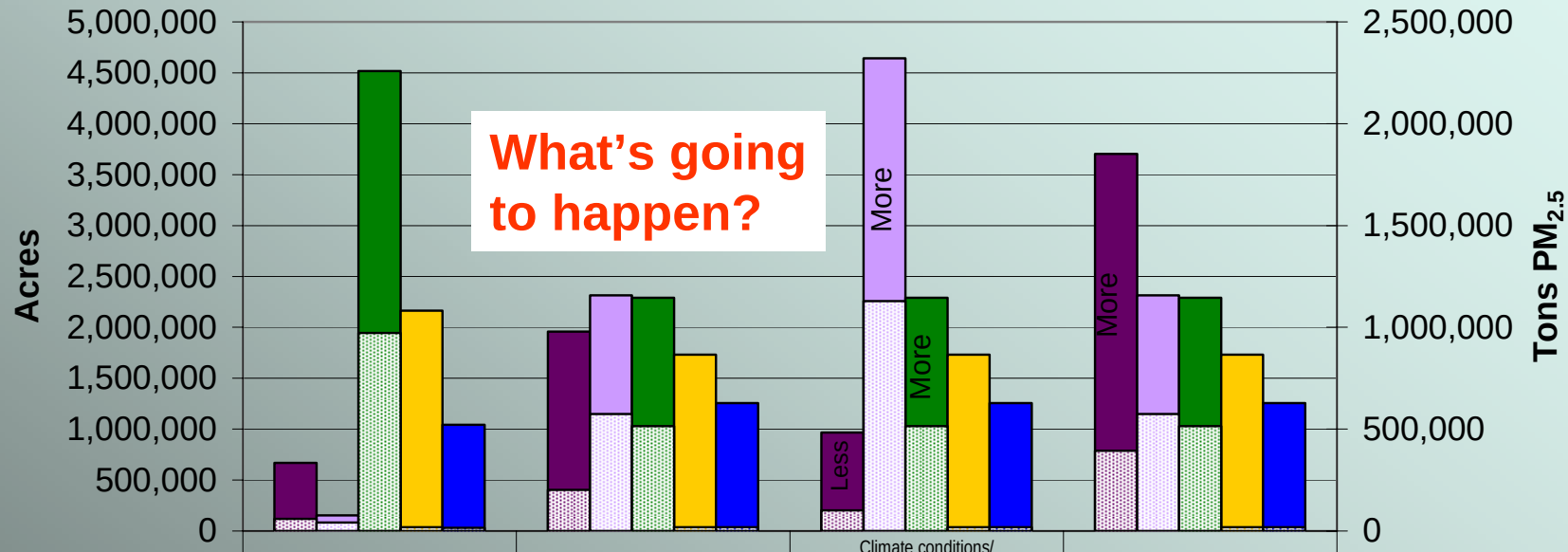




Apparently So!
Flathead, MT



WRAP Phase IV 2018 Fire Projection EI
Source Activity Scenarios Grouped into Air Quality Planning Suites
("Likely" activity and emission scenario choosen unless otherwise noted)



	Baseline Control Case	Base-case	Climate conditions/ resource limited	Max-App of Rx Fire
Prescribed Acres	669,348	1,959,146	966,251	3,704,081
WFU Acres	153,697	2,314,456	4,642,959	2,314,456
Wildfire Acres	4,517,818	2,291,618	2,291,618	2,291,618
Agricultural Acres	2,164,166	1,729,691	1,729,691	1,729,691
NF Rangeland Acres	1,042,003	1,256,106	1,256,106	1,256,106
Prescribed PM2.5	59,687	202,493	100,861	393,391
WFU PM2.5	41,173	574,159	1,128,127	574,159
Wildfire PM2.5	971,490	514,780	514,780	514,780
Agricultural PM2.5	18,816	17,871	17,871	17,871
NF Rangeland PM2.5	15,454	18,630	18,630	18,630

Projection EIs (2018)

Northwest [1]

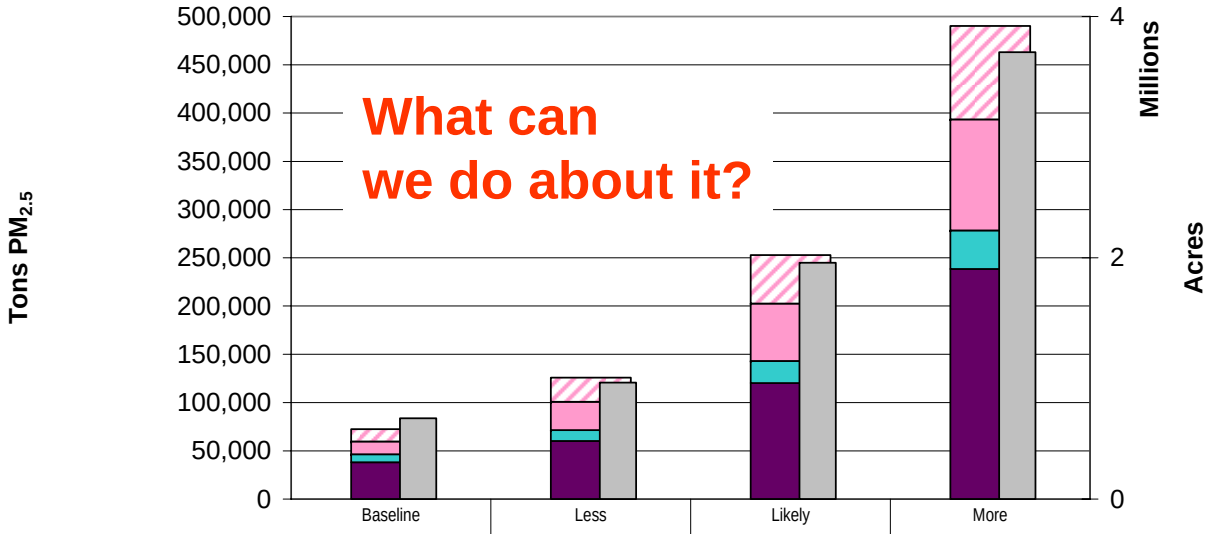
Timber

Fall	40-65%	1,2,4,12,13,17,18,21,22

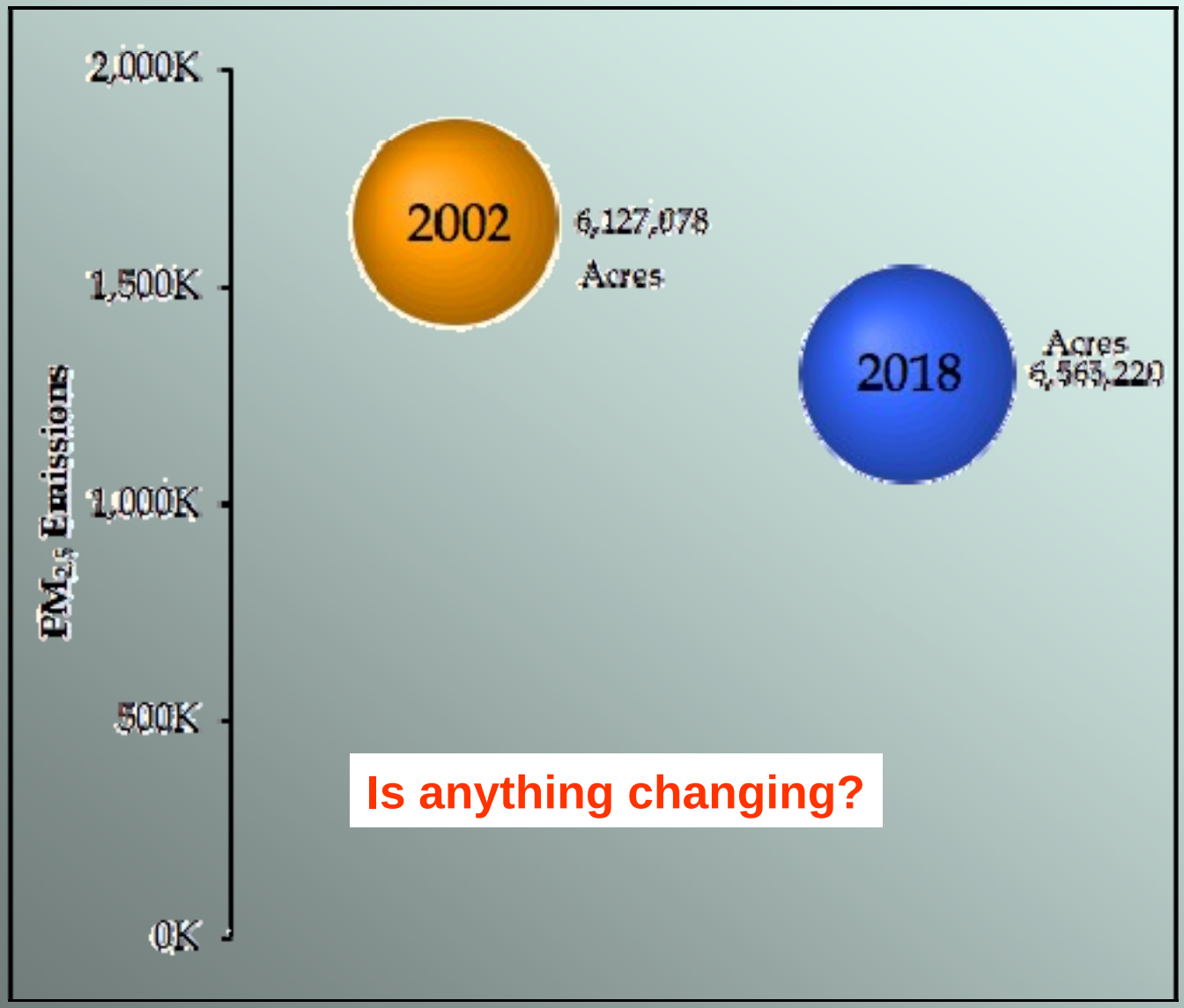
	Emissions Reduction Method	ERT Cat	Definition
1	Pre-Burn Fuel Removal	2	(Mechanical removal.) Includes mechanical removal of logging debirs from clearcuts, onsite chipping of woody material and/or brush for offsite utilization, and mechanical removal of fuels which may or may not be followed by offsite burning in a more controlled environment.
2	Firewood Sales	2	Removal of woody debris using firewood
4	Biomass Utilization (exept for Elect Gen)	2	
12	Isolating Fuels	1	
13	Concentration Burning	1	
17	Burn Before Large Activity Fuels Cure	4	Burning activity-generated fuels within 3-4 drying months of timber harvests to reduce the consumption of large fuels due to residual live fuel moisture.
18	Aerial Ignition/Mass Ignition	6	Ignition techniques to shorten the duration of the smoldering fire and reduce the total amount of fuel consumed.
21	Pile Burning	6	Fuels concentrated into clean and dry piles generate greater heat and burn more efficiently. A greater amount of consumption occurs in the flaming phase and the emission factor is lower. (brush; forest)
22	Air Curtain Incinerator		

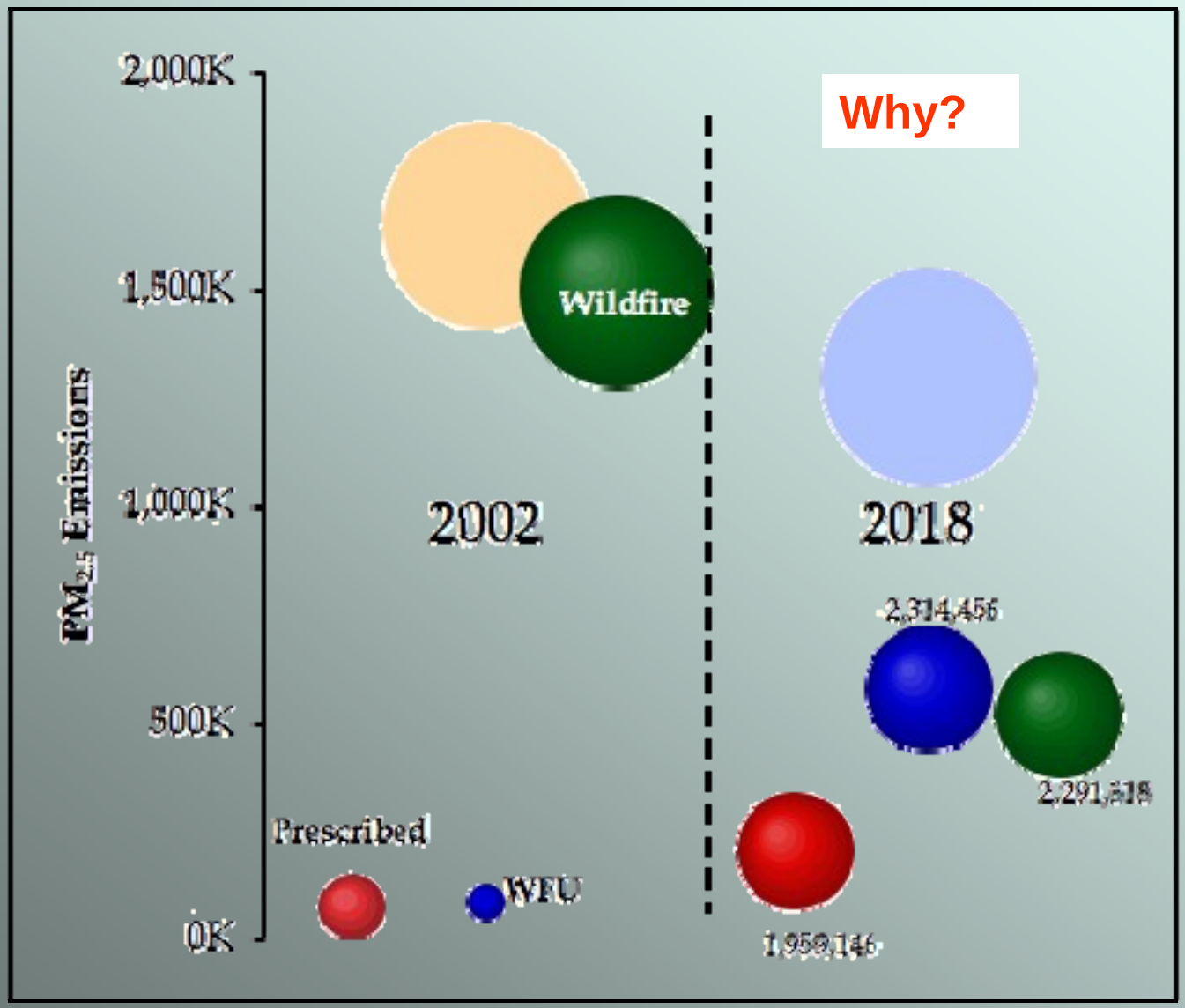
Averting Emissions

WRAP Phase IV 2018 Fire Projection EI
Prescribed Burning: Burn Type (with Alaska)



	Baseline	Less	Likely	More
Averted (ERTs on Broad-ANTH)	12,595	24,978	50,385	96,894
Broadcast - ANTH	13,148	29,413	59,396	114,889
Piled - ANTH	8,318	11,256	22,816	40,080
Broadcast - NAT	38,221	60,192	120,281	238,422
Acres	669,348	966,251	1,959,146	3,704,081


2,000K
1,500K
1,000K
500K
0K
PM2.5 Emissions
2002
6,127,078
Acres
2018
Acres
6,563,220
Is anything changing?


2,000K
1,500K
1,000K
500K
0K
PM2.5 Emissions
2002
2018
Wildfire
Prescribed
WFU
2,314,456
2,291,518
1,959,146

Why?

Two opposing goals?

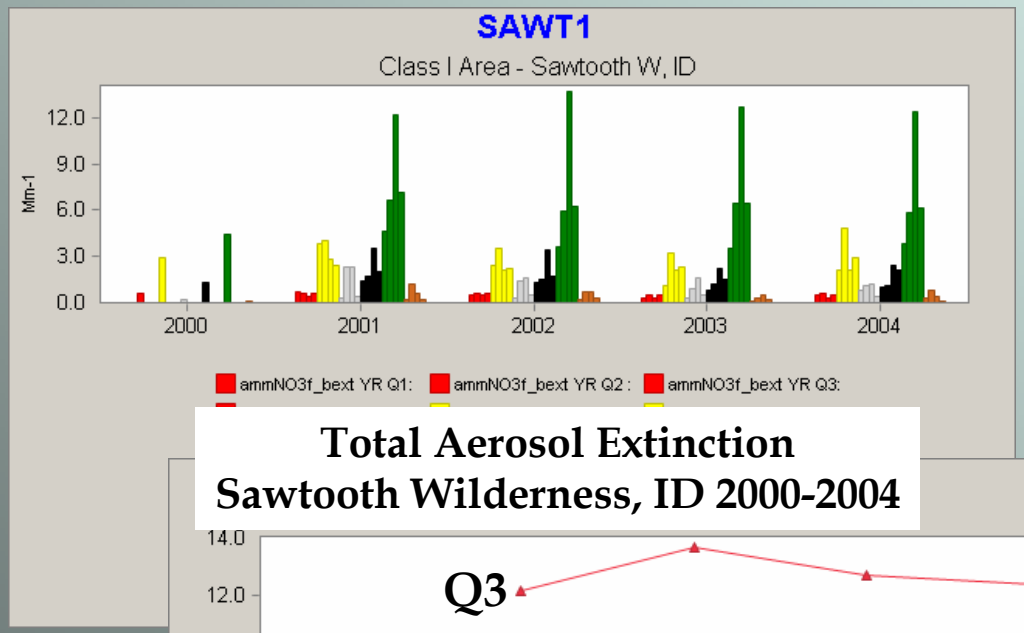
- Federal Land Managers increase prescribed fires to restore ecosystem fire regimes.
- The Regional Haze Rule requires management and reduction of anthropogenic fire emissions.

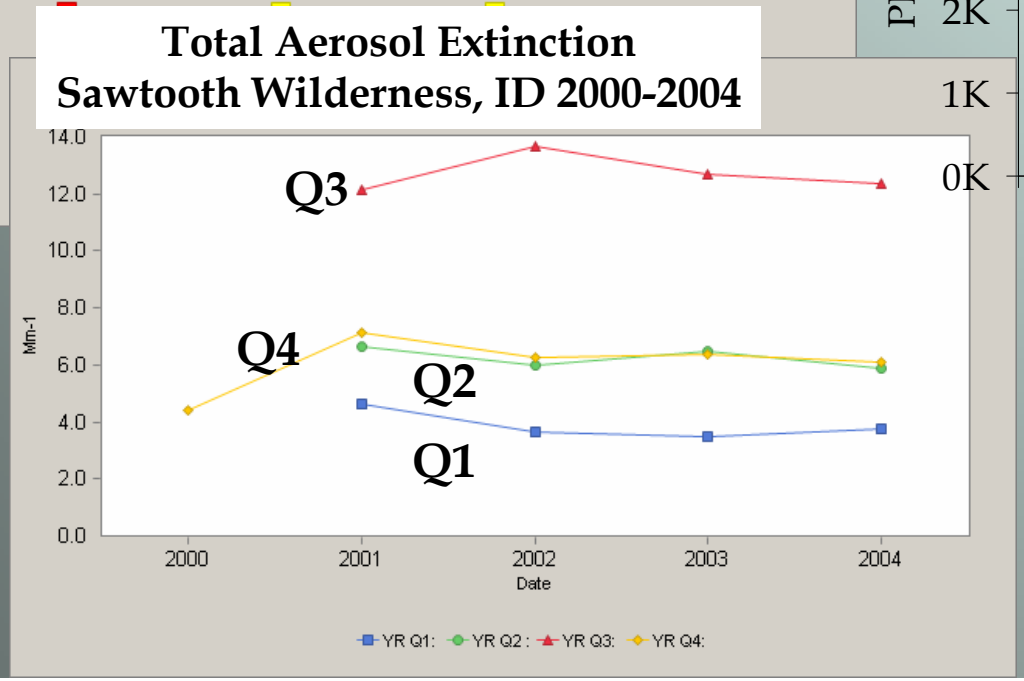
Effective smoke management policy allows land management practices to continue while minimizing the increase in fire emissions over time

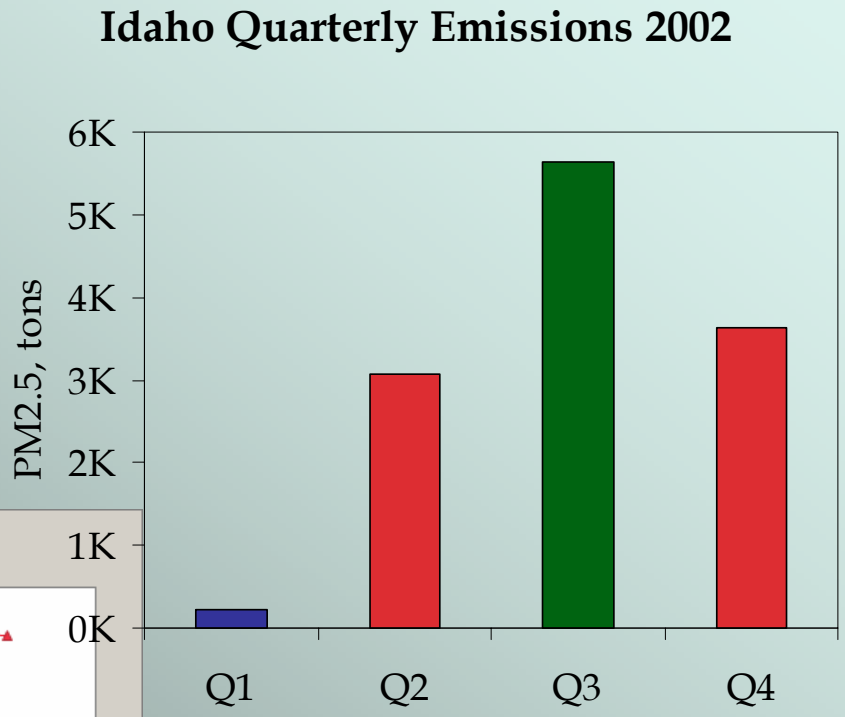
Example Situation – Sawtooth Wilderness

Q: does fire have a major impact on regional haze?

A: 3rd quarter bext is influenced by NAT fire







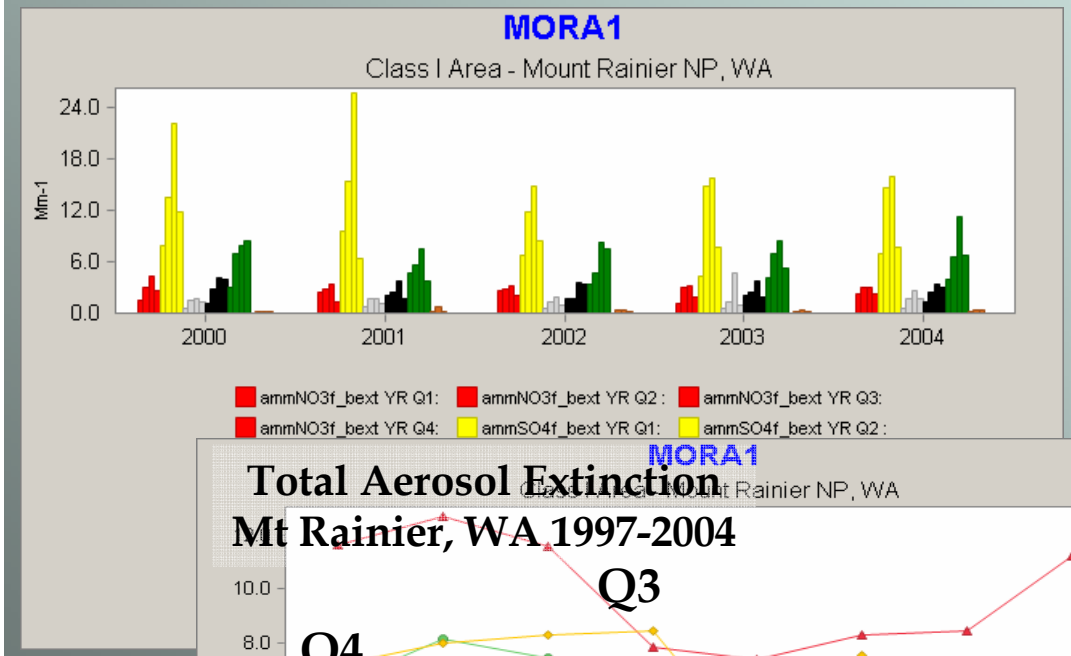
Periods with highest Rx activity

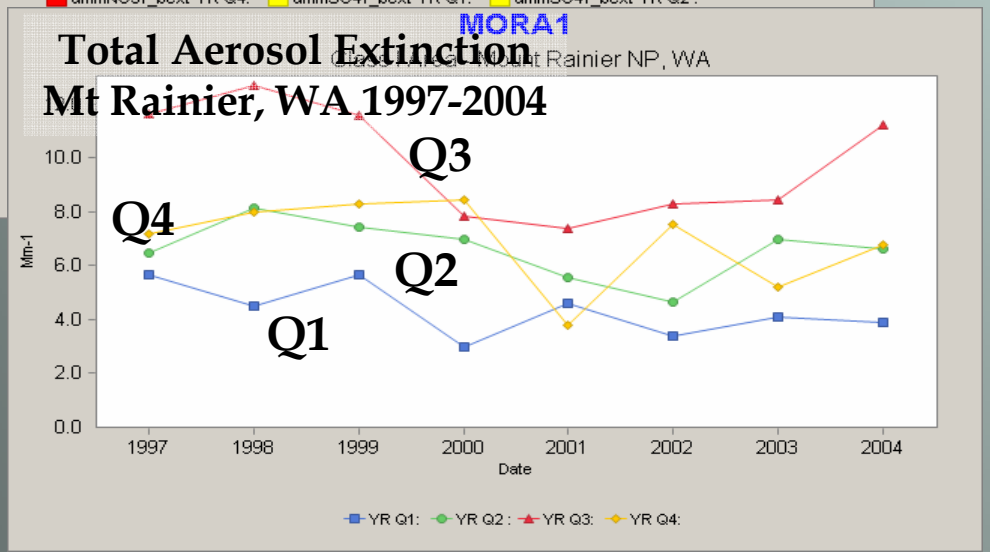
Period with highest wildfire activity

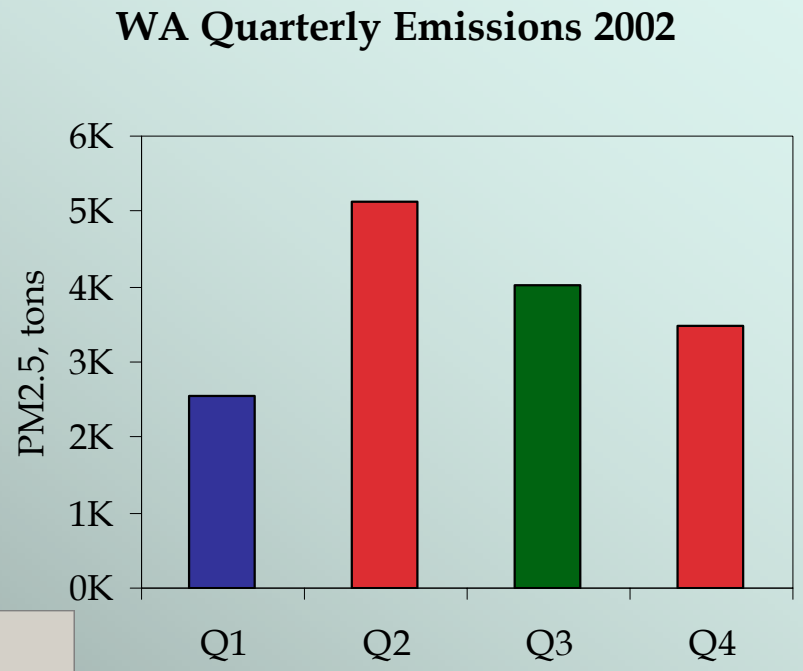
Example Situation – Mt Rainier

Q: can we improve visibility on the worst days by averting emissions from ANTH fire sources?

A: Yes – by averting emissions from Rx activity during the 4th quarter.







Periods with highest Rx activity

Period with highest wildfire activity

WRAP States and Tribes are prepared to do this.

We have policies, guidance, technical tools (TSS, FETS, other), emissions and modeling analyses, language to insert in SIPs/TIPs.

The FEJF & the WRAP have developed policies, guidance, and technical tools to foster State-, Tribal-, and airshed-specific approaches to minimizing smoke impacts in Class I areas.

We get it done by:

- *Knowing what fires are planned and occurring on the landscape.*
- *Determining which fires can and should be considered for measures to avert emissions.*
- *Working together*
  - *with burners to avert emissions*
  - *with other SMPs to make effective burn decisions.*

Tangible Products due to WRAP Fire EIs

- Collaboration among burners & SMP
- Enhanced Smoke Management Plan
- Fire Emissions Tracking System
- Regional Coordination of Smoke Management
- Fire Categorization
- Emission Reduction Techniques
- Annual Emission Goals
- Regional Haze Analyses
- SIP Development

There is more work to do.

- Research & Improvements:
  - Satellite detection of fires for activity data
  - Forecasting/Modeling tools (individual fires)
  - Consumption and emissions models
  - Pollutant Speciation
  - Increase confidence in regional modeling results
    - Plume rise

There is more work to do.

- Implement, Implement, Implement! (ESMP)
- The use of the FETS becomes routine.
- Integrate/Consolidate/Eliminate tools:
  - FETS with TSS
  - Where does the EDMS come in?