

Ozone on Mt. Lemmon

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Latitude: 32° 26' 28" N, Longitude: 110° 47' 26" W, Altitude: 2754 meters / 9033 feet

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Background

- San Bernardino Mountains 1950s – Ponderosa and Jeffrey pines most sensitive to “X-disease” (ultimately identified as ozone damage).
- Foliar damage observed at 50-60 ppb (24 h mean; May-September).
- Reduced tree vigor and ecosystem effects at >100ppb.
- Injured trees susceptible to pests and disease (bark beetles, root rot) and drought, leading to premature mortality.

Ozone Injury Symptomology



Figure 1—Healthy ponderosa pine needles are shown on the right one-third of the photo compared to chlorotic mottle caused by ozone injury that gradually increases in intensity on the left.

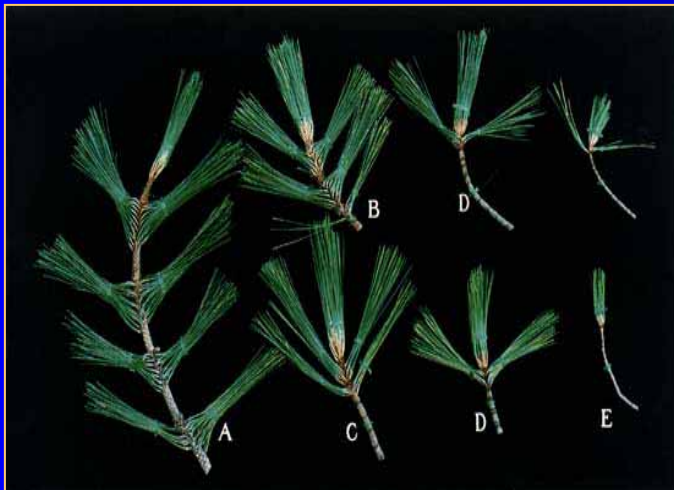


Figure 2—Progression of ozone injury on ponderosa pine.

- A)** Healthy branch (5 annual whorls; little chlorotic mottle near tips of whorls 4 and 5).
- B)** Four annual whorls with chlorotic mottle on whorls 3 and 4.
- C)** Considerable mottle on whorl 3; small amount on whorl 2.
- D)** [upper] Slight mottle on whorl 2. [lower] Severe chronic ozone injury on whorl 1.
- E)** [upper and lower] Most severe injury - only current year's needles remain; shorter; >30 percent mottle.

K. Stolte, Symptomology of Ozone Injury to Pine Foliage, General Technical Report PSW-GTR-155-Web, USFS 1996

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Arizona Data

Tucson Ozone 8-h Mean (2003)

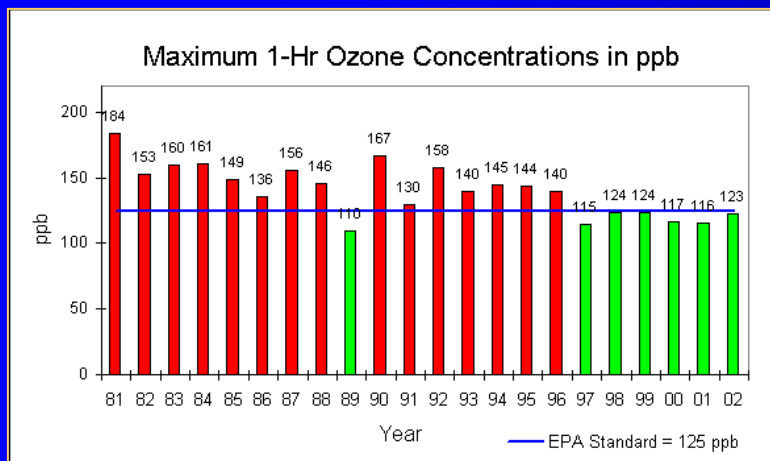
Site	1 st Maximum	2 nd Maximum	3 rd Maximum	4 th Maximum
Downtown	.071	.069	.069	.068
22 nd / Craycroft	.078	.075	.074	.073
Saguaro National Park, East ²	.087	.084	.080	.078
Fairgrounds	.077	.072	.071	.070
Tangerine	.078	.076	.074	.074
Children's Park	.080	.080	.079	.076
Rose Elementary ³	.072	.070	.066	.066
Coachline ³	.072	.068	.067	.064
Green Valley ³	.077	.070	.070	.068

Remote Ozone 8-h Mean (2002)

Table 12: 2002 Ozone Data (in ppm), Eight-Hour Averages

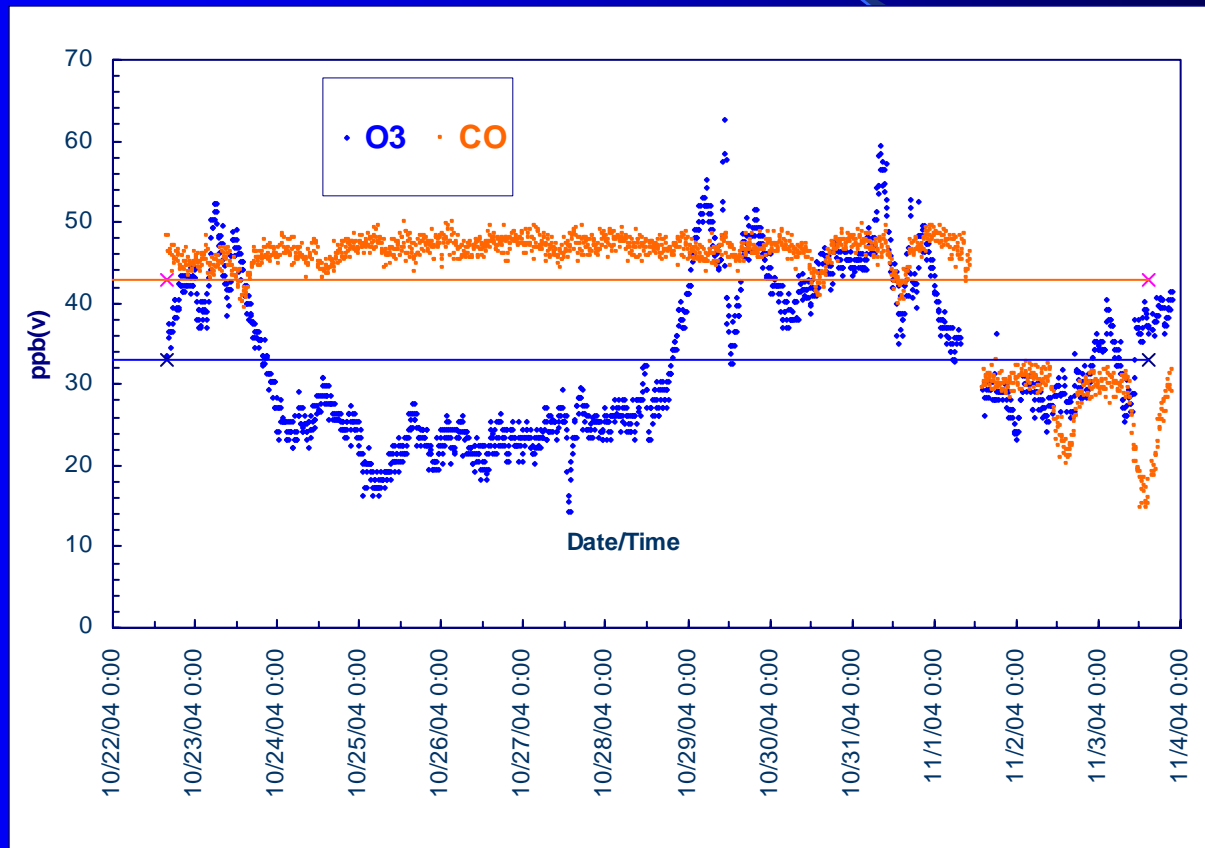
Site or City	Max Value	2nd High	3rd High	4th High	Daily Exceed.	Sample Days
Cochise County						
Chiricahua National Monument	0.077	0.074	0.072	0.069	0	324
Coconino County						
Grand Canyon National Park - Hance Camp	0.081	0.081	0.079	0.079	0	356
Gila County						
Tonto National Monument ⁵ #	0.091	0.088	0.088	0.087	5	149
Maricopa County						
Blue Point	0.091	0.089	0.088	0.086	5	364
Cave Creek ⁵	0.090	0.089	0.088	0.086	4	196

Phoenix Ozone 1-h Max



Initial Mt. Lemmon Data

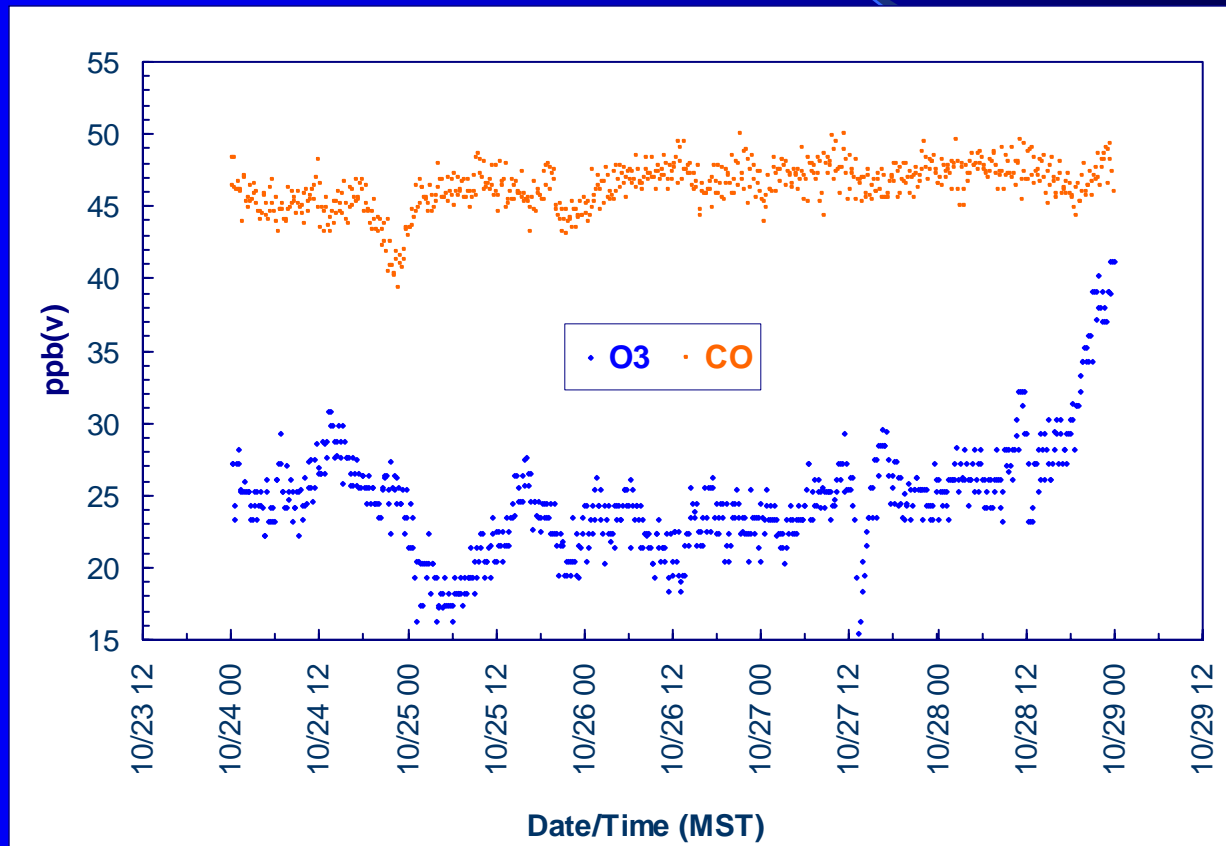
10-minute mean



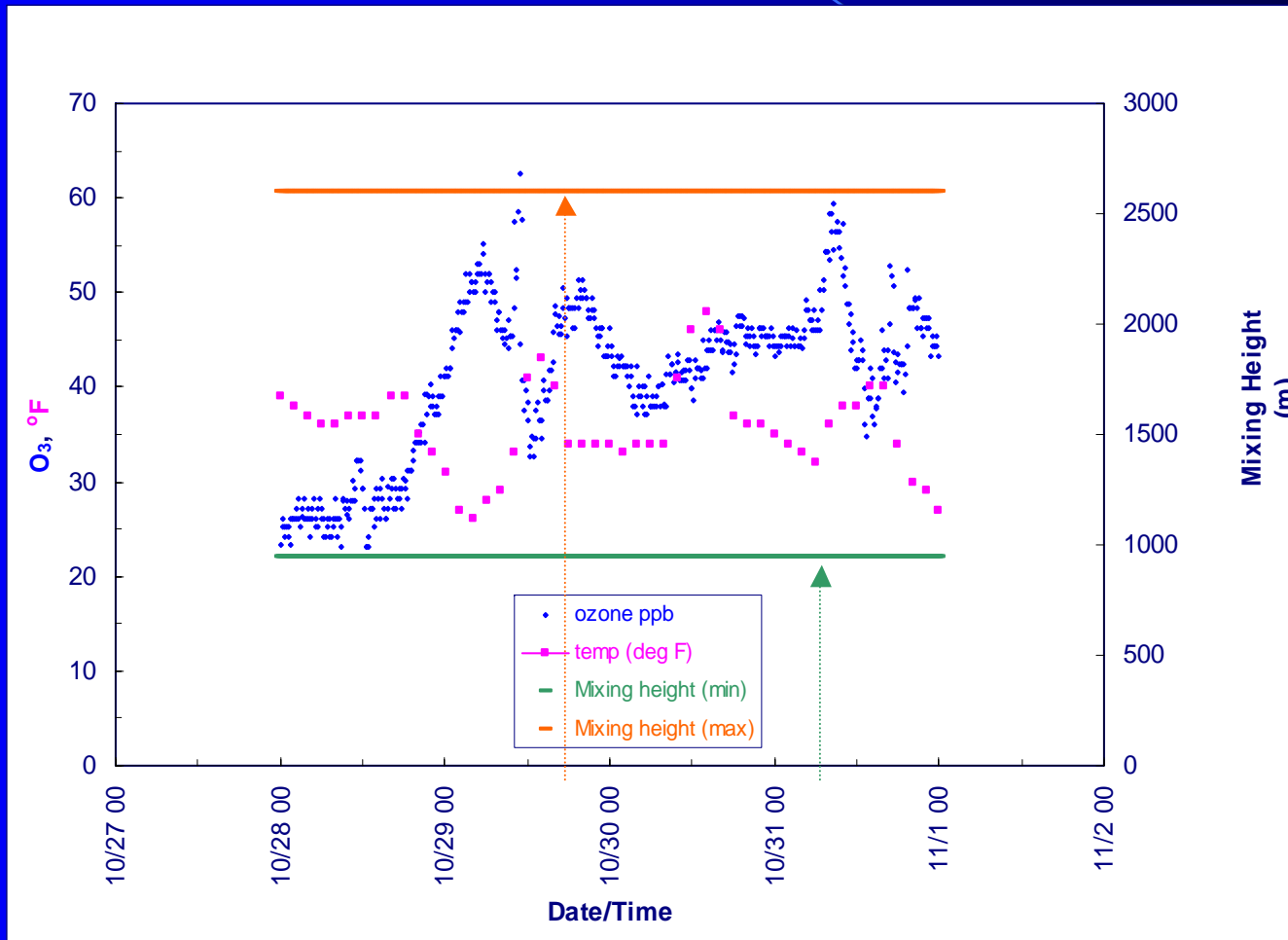
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Diurnal Cycle

10-minute mean



Mixing Height/Temperature



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Ongoing Work

- Install ozone monitor at Palisades
- Analyze
 - Urban impact
 - Vertical distribution
 - Exposure
 - Other pollutants, e.g., HNO_3
 - Temperature
 - Precipitation