Evidence of Large California Agricultural Soil NO_x Emissions

Almaraz et al. (2018) suggest soil NO_x emissions represent 25-40% of statewide total (20%-30% from agricultural soils)

SCIENCE ADVANCES | RESEARCH ARTICLE

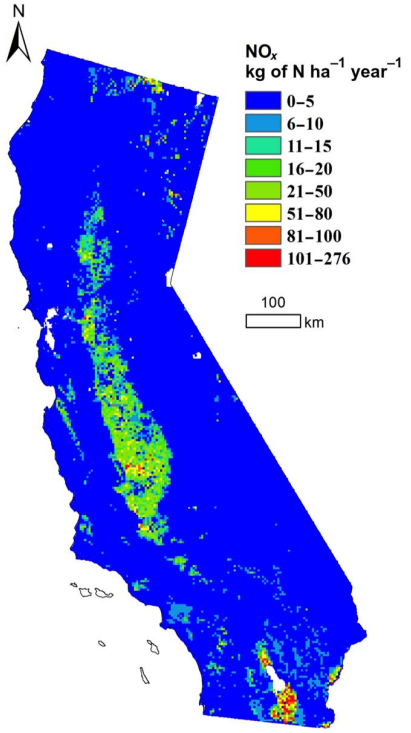
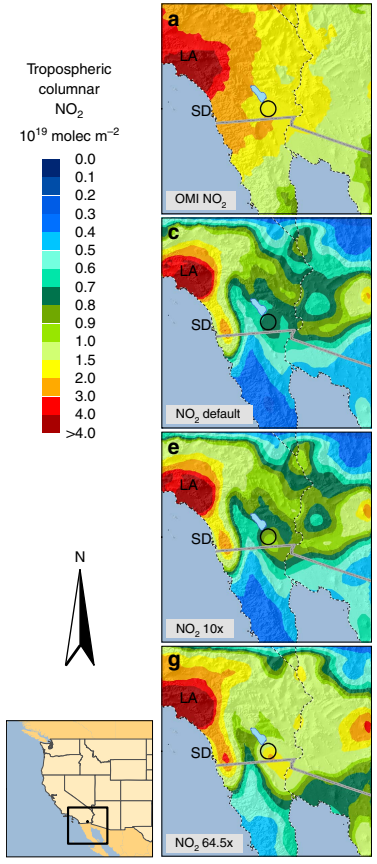
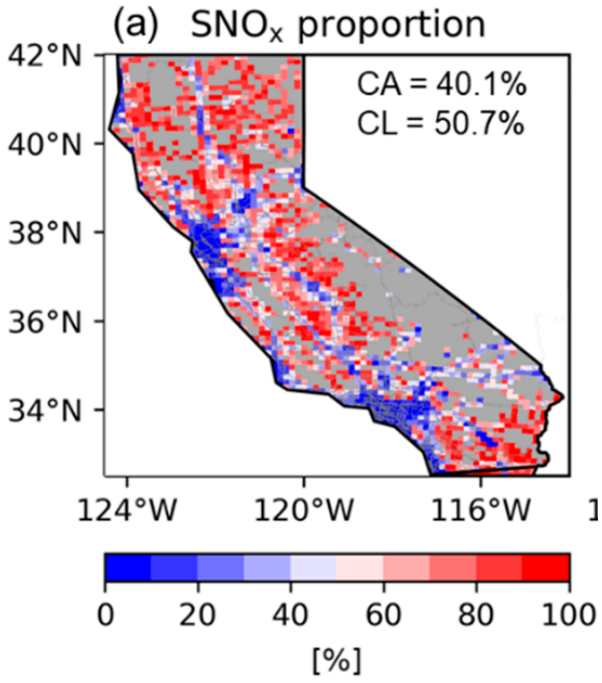


Fig. 2. Estimates of NO_x emissions from California soils (natural and cropland) generated by using stable isotopic modeling and IMAGE model.

Oikawa et al. (2015) suggest models underestimate soil NO_x emissions by 10-65 times in the Imperial Valley



Sha et al. (2021) suggest soil NO_x emissions represent 40% of total emissions (51% of cropland)



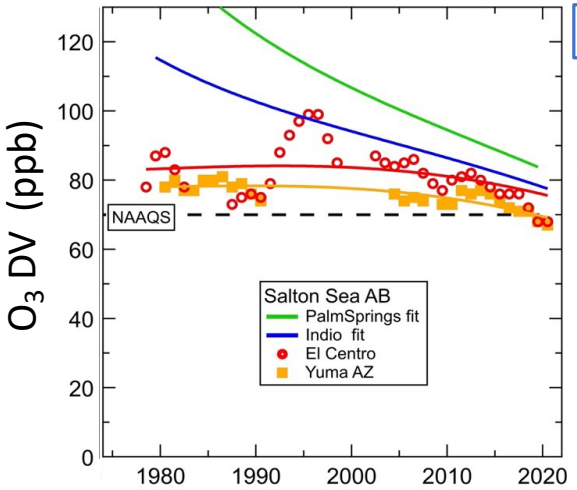
California's NO_x Inventory Appears Anomalous

	California	National (CONUS)		Global
Source ($Tg\ Na^{-1}$)	**CARB (2017)**	**US EPA (2017)**	**GEOS-Chem (Silvern et al., 2019)**	**GEOS-Chem (Hu et al., 2017)**
mobile	0.12	1.53	1.2 (46%)	29.6 (60%)
Other industrial	0.03	1.04	--	--
Lightning	--	--	0.8	6.0
Soils	**0.0024 (1.1%)**	--	**0.45 (18%)**	**9.7 (20%)**
Open Fire	--	--	0.1	3.7
"Natural"	0.013 (7.8%)	0.11 (4%)	1.35 (54%)	19.4 (40%)
Total	0.162	2.69	2.6	49.0

- Almaraz et al. (2018) argue that agricultural soils are anywhere from 20-32% total (+5-9% from natural soils): 25-40% soils
- Guo et al. (2020) ran DNDC soil biogeochemistry model and concluded, "nothing to see here" (1.1% NOx from CA soils)
- Sha et al. (2021) adjusted T-dependence of soil source and estimated 40% of CA NO_x from soils (in July 2018).
- Parrish et al. (2017) shows San Joaquin and Coachella Valleys as having anomalously large background O_3 levels

Long-term Ozone Trends Show Limiting Returns in Many Rural Regions

- Parrish, Derwent, & Faloona (2021) present a synthesis of analyses arguing that the decadal background tropospheric O_3 is convex (~ +5 ppb/decade in 1980's/90's) peaking around 2005 (~ -1 ppb/decade since).
- Using that shape for the background superposed onto an exponential decay due to composite regulatory actions (with a lifetime of ~22 years) a spatial pattern of baseline ('a' parameter) ozone reveals elevated levels in specific places (SJV & Salton Sea basin).
- These regions are where ***agricultural intensity*** and ***wildfire*** impacts (and potentially vertical mixing) are high. (Parrish et al., 2017; Parrish, Faloona, & Derwent, in press).
- See Lieb poster (816, Weds. 5:00) for more on soil NO_x in Salton Sea basin



$$ODV = a + bt + ct^2 + Aexp\{-t/\tau\}$$

Site	a	A	RMSD
Salton Sea AB			
Palm Springs	73 ± 4	34 ± 3	3.4
Indio	73 ± 8	21 ± 6	6.7
El Centro	77 ± 8	7 ± 6	6.4
Yuma AZ	70 ± 3	8 ± 2	2.0