



Comments of the Colorado Native Plant Society to the Colorado Oil and Gas
Conservation Commission

Docket Number 220800233

December 2, 2022

These Comments are submitted by the Colorado Native Plant Society. The Colorado Native Plant Society (CoNPS) is a statewide nonprofit organization “dedicated to furthering the knowledge, appreciation and conservation of native plants and habitats of Colorado through education, stewardship and advocacy.”

We urge the Commission to grant the petition by WildEarth Guardians, 350 Colorado, Womxn from the Mountain, Physicians for Social Responsibility, The Larimer Alliance, and Sierra Club (‘WEG petition’) for rulemaking on the subject of the cumulative ozone impacts of emissions from Colorado oil and gas facilities.

The focus of these Comments is on the adverse impacts of ozone from oil and gas production on biological resources, including native plant populations.

According to peer-reviewed scientific studies that are quoted below, ozone and ozone precursors produced as a result of operations by oil and gas facilities regulated by COGCC have a well-documented adverse environmental impact on Colorado’s biological resources, including its native plants. A recent overview study shows that ozone also disrupts pollinator networks, which are essential to the continued viability of native plant populations.

As the Commission is aware, native plants, including native grasses, forbs, shrubs and trees, are critical forage for the state’s livestock industry and native wildlife. They are crucial components of the state’s watersheds, holding snowload, preventing erosion, reducing sedimentation, and cleansing polluted water (and air). They are a source of much of the state’s natural beauty, an often taken-for-granted foundation of the state’s recreation industry.

Senate Bill 19-181 explicitly mandates protection of biological resources and air from the adverse impacts of oil and gas operations, saying that the Commission:

SHALL REGULATE OIL AND GAS OPERATIONS IN A REASONABLE MANNER TO PROTECT AND MINIMIZE ADVERSE IMPACTS TO PUBLIC HEALTH, SAFETY, AND WELFARE, THE ENVIRONMENT, AND WILDLIFE RESOURCES AND SHALL PROTECT AGAINST ADVERSE ENVIRONMENTAL IMPACTS ON ANY AIR, WATER, SOIL, OR BIOLOGICAL RESOURCE RESULTING FROM OIL AND GAS OPERATIONS. (CRS 34-60-106 (2.5)(a))

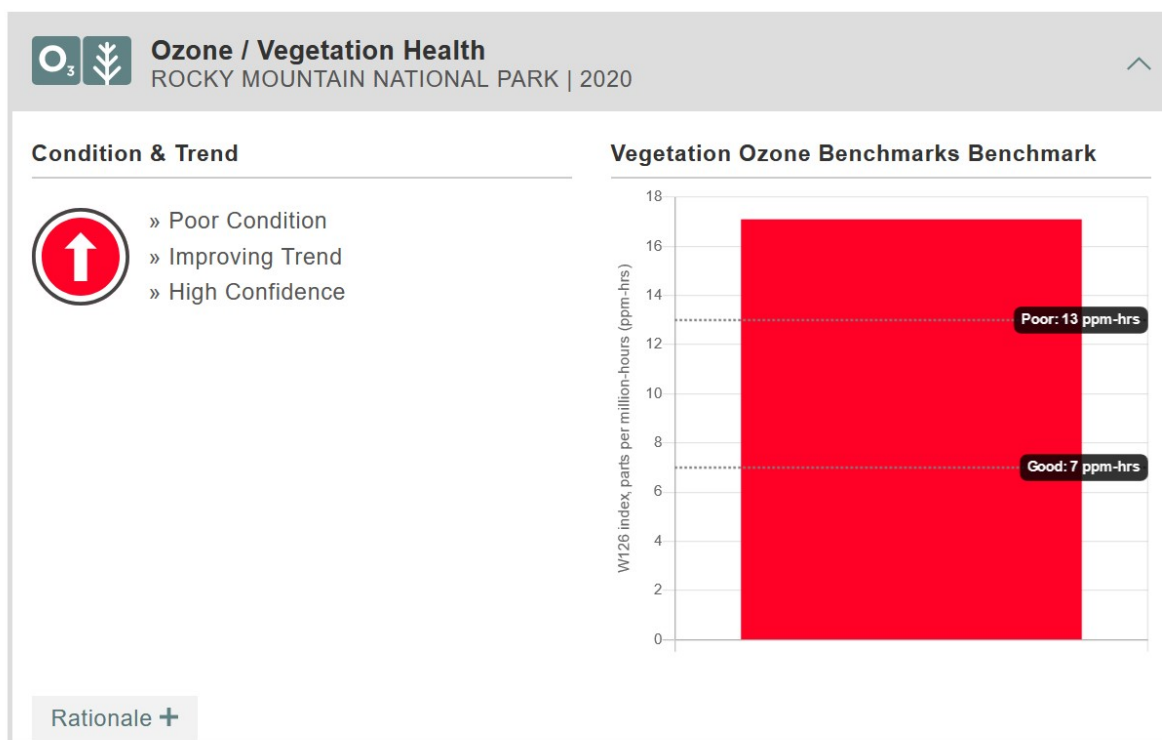
As the sponsors of SB19-181 stated to the Commission:

“We also provided a directive that the COGCC “shall” protect “biological resources” from adverse impacts. [This was] included because our open spaces and wildlife are important though can be overlooked considering conflicts arising in populated areas. The goal of 181 is to ensure we’re prioritizing the health and safety of both the people of Colorado and our environmental resources.” (August 14, 2020 letter from 41 State House and Senate Members to COGCC re Mission Change Rulemaking)

There is a wealth of peer-reviewed studies regarding the impact of ozone on Colorado’s native plant populations that provide support for the WEG petition, and, if the petition is granted, should be considered in the course of rulemaking on cumulative ozone impacts.

For example, research indicates that ozone has had and is having significant adverse impacts on native plants of protected Front Range landscapes, especially Rocky Mountain National Park. These landscapes are in and adjacent to the area which EPA has now designated as being in ‘severe’ noncompliance with national ozone standards.

The National Park Service’s 2020 summary of ozone effects on vegetative health in Rocky Mountain National Park (ROMO) indicates that these effects reflect a “poor condition” for vegetative health:



(Source: [https://www.nps.gov/subjects/air/park-conditions-trends.htm?tabName=summary&parkCode=ROMO¶mCode=Ozone&startYr=2009&endYr=2020&monitoringSite=080690007%20\(AQS\)%20Long%27s%20Peak&timePeriod=Summary](https://www.nps.gov/subjects/air/park-conditions-trends.htm?tabName=summary&parkCode=ROMO¶mCode=Ozone&startYr=2009&endYr=2020&monitoringSite=080690007%20(AQS)%20Long%27s%20Peak&timePeriod=Summary))

In addition, the scientific literature also has found that sites in northwest Colorado - Dinosaur and Rangely - have ozone concentrations that sometimes exceed the 70 ppb standard. Ozone is not just a problem for the Front Range, and the Commission should carefully examine ozone impacts due to oil and gas facilities in non-Front Range areas of the State, as well.

We have provided below several studies for the Commission's consideration that support the connection between ozone and damage to native plant biologic resources, including research which ties elevated ozone levels in areas with significant native plant populations (such as Rocky Mountain National Park) to origins in oil and gas production.

Thank you for your consideration of these Comments and the literature cited below.

Respectfully,

Brad Klafehn
Conservation Committee
Colorado Native Plant Society

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Katherine B. Benedict, et al. *Volatile organic compounds and ozone in Rocky Mountain National Park during FRAPPÉ*, Atmos. Chem. Phys., 19, 499–521, 2019, <https://doi.org/10.5194/acp-19-499-2019>. (“Rocky Mountain National Park is a Class I area that is afforded the highest level of air quality protection. Nevertheless, O₃ mixing ratios can reach levels that negatively impact vegetation and human health, particularly for older adults and people who are active outdoors...Light alkanes measured at ROMO [Rocky Mountain National Park], markers for oil and gas production, were significantly elevated relative to background levels and at times reached mixing ratios measured in some oil and gas source regions during upslope events...Management practices aimed at reducing high O₃ levels at the park thus cannot focus on controlling a single source, but instead must take a broader approach to focus on reductions in the traditional sources as well as these new sources. Recent work by Zhou et al. (2019) suggests that emission reductions of both volatile organic compounds and nitrogen oxides (NO_x) could lead to effective O₃ mitigation in the Intermountain West. Additionally, identifying periods of stratospheric O₃ influence should also be a priority when assessing which high-O₃ episodes can be mitigated through emissions control.”)

Robert C Musselman, Korfmacher, John L. *Ozone in remote areas of the Southern Rocky Mountains*, Atmospheric Environment 82 (2014) 383-390. <https://doi.org/10.1016/j.atmosenv.2013.10.051>. (“Ozone is the most widespread phytotoxic air pollutant, causing injury to vegetation foliage and yield loss to crops and native vegetation in the US and Europe (US EPA, 2006, 2013). Vegetation is particularly sensitive to higher concentration levels of O₃ (Musselman et al., 2006; US EPA, 2013). Ozone is taken up into leaves through stomata and causes necrosis to plant tissue. The mechanisms of O₃ impact on plant tissue have been recently reviewed (US EPA, 2013). Cumulative O₃ exposure and leaf tissue injury can result in reduced growth. Reductions in growth can damage plants by reducing yield (Musselman et al., 2006). In addition, plants stressed from O₃ injury are more susceptible to damage from insects, diseases, and drought (US EPA, 2006, 2013)...Year-round and seasonal observations of O₃ patterns indicate consistencies demonstrated by data shown in Figs. 3-6 for 2009 and 2011. Most sites had an 8-h average value that exceeded 75 or 70 ppb (when

springtime data were available), even in years where O₃ values were lower (2009 compared to 2011). . . . Several of the monitoring sites (Bell Ranch, Wilson, Sunlight, Silt-Colbran, Flat Tops, Ripple Creek Pass, and Briggsdale [Pawnee National Grasslands]) are close to or downwind from oil and gas development. All of these sites had 8-h O₃ concentrations greater than 70 ppb (Supplementary Tables S1 and S2). . . . our data suggest that exceedance of the NAAQS for O₃ may occur in many remote high elevation areas of the Southern Rocky Mountains, and compliance with the current primary and proposed secondary O₃ standard may be difficult to achieve. . . . Even though the number of areas with potential for exceeding NAAQS is a concern, much of the O₃ that contributed to the exceedance was not peak, but mid-level concentrations. The lack of nighttime scavenging of O₃ at remote high elevation sites allow for the large number of mid-level concentration values that can be accumulated into the summation of the W126 value, as evidenced by the high 24-h and nighttime W126 values. . . . Yet the persistence exposure of plants to mid-level O₃ at night should not be discounted, since stomata of many native plants are partially open at night when detoxification potential is lower, and O₃ can delay stomatal closing allowing additional uptake. Plant energy is expended to detoxify O₃ or to produce additional antioxidants. Even though this response may difficult to quantify there is increased potential for tissue injury or plant damage and nighttime O₃ uptake should not be ignored for plants already growing under stress at high elevation.”)

U.S. Environmental Protection Agency. 2013. *Integrated Science Assessment for Ozone and Related Photochemical Oxidants*, 2013. EPA/600/R-10/076F (“A large body of scientific evidence spanning more than 60 years clearly shows effects on vegetation due to ozone exposure. Decades of research on many plant species confirm effects on visible foliar injury, plant growth, reproduction and yield. The use of visible foliar injury to identify phytotoxic levels of ozone is an established and widely used methodology. There are robust exposure-response functions for reduced growth and yield (i.e., from carefully controlled experimental conditions, involving multiple concentrations and based on multiple studies) for about a dozen important tree species and a dozen major commodity crop species. Newer evidence supports a role for ozone in tree mortality and shifts in community composition of forest tree and grassland species.” (Executive Summary, 17-18) “At the leaf level, ozone uptake produces reactive oxygen species that affect cellular function (Section 8.1.3 and Figure 8-2). Reduced photosynthesis, altered carbon allocation, and impaired stomatal function lead to observable responses in plants. Observed vegetation responses to ozone include visible foliar injury (Section IS.5.1.1), and whole-plant level responses (Section IS.5.1.2), which encompass reduction in aboveground and belowground growth, reproduction and yield. Plant-fauna linkages affected by ozone include herbivores that feed on ozone-damaged vegetation and interactions of ozone with compounds emitted by plants that can alter attraction of pollinators to plants (Section IS.5.1.3). (Executive Summary, 10)

Kohut, Robert & Flanagan Pritz, Colleen & Cheatham, Jim & Porter, Ellen. (2012). *Foliar Ozone Injury on Cutleaf Coneflower at Rocky Mountain National Park, Colorado*. Western North American Naturalist. 72. 32-42. 10.2307/41718311. (“Surveys for foliar ozone injury on cutleaf coneflower, spreading dogbane, and quaking aspen were conducted in Rocky Mountain National Park, Colorado, from 2006 through 2010. Foliar injury in the form of ozone stipple was found on coneflower each year. The incidence of injured plants on sites with injury ranged from 5% to 100%. The severity of injury on affected foliage was generally <4% but occurred on some leaves at a level greater than 12% in 3 years and in 1 year on 1 plant at a level >75%. No foliar ozone injury was found on spreading dogbane or quaking aspen in any year of the survey. This is the first documentation of ozone injury on vegetation in Rocky Mountain National Park. While

ozone has long been a concern in the Colorado Front Range, spreading urbanization and oil and gas development are leading to increased levels of ozone in many areas in the Rocky Mountain region. Air monitoring data indicate that ozone exposures are exceeding injury thresholds in several locations and suggest that assessments of foliar ozone injury should be conducted on ozone-sensitive plant species in riparian and moist communities in those areas.”)

Oriane Rollin, et al., (2022). *Effects of ozone air pollution on crop pollinators and pollination*. *Global Environmental Change* 75, 102529. 10.1016/j.gloenvcha.2022.102529 (“Human driven environmental changes increase the concentrations of polluting reactive compounds in the troposphere, such as ozone and nitrogen oxides. These changes lead to biodiversity losses and alter plant physiology and plant-pollinator interactions, essential for pollination services, with potential consequences for agricultural production....As expected, ozone levels were negatively correlated to crop pollination. Recent studies have estimated that global agricultural losses due to high ozone levels totalled 79–121 million metric tons in 2000 with global economic losses ranging from \$11 to \$26 billion and predicted increases of between \$17 and \$35 billion annually by 2030. Such effects may be partly related to a reduction in pollen germination. Our results suggest that changes in pollination by insects (due to changes in flower visitation patterns) may also play an important role [citations removed]. The negative relationship between ozone pollution and flower visitor abundance could be due to changes in plant-pollinator communication and flower attractiveness affecting crop pollinator foraging behaviour. Previous studies have shown that ozone induces changes in availability of floral resources by modifying flowering time and number of flowers, with some plant species being particularly sensitive. Ozone also alters pollinator decision-making, modifying and reducing the volatile floral scents and damaging pollinators olfactory organs [citations removed]”).

IN REVIEW: Ying Zhou, Huiting Mao, and Barkley C. Sive. (2019). *Decadal Trends and Variability in Intermountain West Surface Ozone Near Oil and Gas Extraction Fields*. *Atmospheric Chemistry and Physics Discussions*, <https://doi.org/10.5194/acp-2019-164> (“The decadal (2005 – 2015) mean of the A4DM8HA reached or exceeded 70 ppbv, the current NAAQS, at three sites, DINO (82.7 ppbv), RANG (72.7 ppbv), and ROMO (75.1 ppbv). (P. 8)...DINO, RANG, and MEEK are located within the Uintah-Piceance Basin O&NG fields. Increased emissions, most likely from a 68% rise in natural gas production over 2005 – 2015 in the Uintah Basin, together with snow cover (Edwards et al. 2014; Section xx), could have contributed to very high A4DM8HA O₃ at DINO and RANG. (P. 11)...current emission inventories underestimated VOC emissions from O&NG productions by a factor of 2 or more (Pétron et al., 2014). (P. 23)

Anthony J. Prenni, Katherine B. Benedict, Derek E. Day, Barkley C. Sive, Yong Zhou, Lilly Naimie, Kristi A. Gebhart, Tracy Dombek, Miranda De Boskey, Nicole P. Hyslop, Emily Spencer, Quayle M. Chew, Jeffrey L. Collett Jr. & Bret A. Schichtel (2022) *Wintertime haze and ozone at Dinosaur National Monument*, *Journal of the Air & Waste Management Association*, 72:9, 951-968, DOI: [10.1080/10962247.2022.2048922](https://doi.org/10.1080/10962247.2022.2048922). (“Dinosaur National Monument (DINO) is located near the northeastern edge of the Uinta Basin and often experiences elevated levels of wintertime ground-level ozone. Previous studies have shown that high ozone mixing ratios in the Uinta Basin are driven by elevated levels of volatile organic compounds (VOCs) and nitrogen oxides (NO_x) from regional oil and gas development coupled with temperature inversions and enhanced photochemistry from persistent snow cover....VOC markers indicated that the high levels of observed pollutants in winter were likely from local sources related to oil and gas extraction activities.” (Abstract)

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In seeking to avoid adverse environmental impacts from oil and gas operations on biological resources, COGCC should also factor into its consideration of the WEG petition, and any resulting rulemaking, the fact that the Colorado Natural Heritage Program has designated a number of 'Potential Conservation Areas' in the Front Range nonattainment area. 'Potential Conservation Areas' are areas "delineated to identify the land area that provides habitat and ecological processes upon which a particular species, suite of species, or natural community depends for its continued existence...the boundaries designate ecologically sensitive areas in which land managers may wish to consider how specific activities or land use changes within or near the PCA may affect the biological resources on which the PCA is based."

(http://www.landscape.org/colorado/priorities/cnhp_pca/) PCAs are thus a prime indicator of sensitive biological resources.

The following are a selection of PCAs in the Northern Front Range nonattainment area:

- Pawnee Grassland West: B3, High Biodiversity Significance. "Numerous state vulnerable plant communities in the area include Shortgrass Prairie (*Atriplex canescens*/*Bouteloua gracilis*), Wet Meadows (*Carex nebrascensis* Herbaceous Vegetation), Salt Meadows (*Distichlis spicata* Herbaceous Vegetation), Clustered Sedge Wetland (*Carex praegracilis* Herbaceous Vegetation), and Bulrush (*Schoenoplectus pungens* Herbaceous Vegetation). Dog Parsley, Plains Milkvetch, Mountain Cat's-eye, and Wyoming Feverfew, all state rare plants, have also been recorded from the site....Pawnee Grasslands East and Pawnee Grasslands West represent the highest density of McCown's Longspur in the state and the best place for conservation of this species."

- Fritz Knopf Prairie: B3, High Biodiversity Significance. "An uncommon butterfly, the rhesus skipper, has been recorded from the plant community Great Plains mixed grass prairie (*Bouteloua curtipendula* - *Schizachyrium scoparium* - (*Eriogonum flavum*)). Other communities of conservation priority in the area include coyote willow (*Salix exigua*) / bare ground, wet meadows (*Carex nebrascensis*), scarp woodlands (*Juniperus scopulorum* / *Schizachyrium scoparium*), foothills riparian shrubland (*Prunus virginiana* - (*Prunus americana*)), and snowberry shrubland (*Symphoricarpos occidentalis*)."

- Pawnee Buttes: B2, Very High Biodiversity Significance. "This site supports excellent (A-ranked) and good (B-ranked) occurrences of a globally imperiled (G2/S2) natural community, *Juniperus scopulorum* / *Schizachyrium scoparium*, good (B-ranked) and good to fair (BC-ranked) occurrences of a globally vulnerable (G3/S2) *Schizachyrium scoparium* - *Bouteloua curtipendula* mixed grass prairie and excellent (A-ranked) and fair (C-ranked) occurrences of a state rare (G5/S2) plant, mountain cat's-eye (*Oreocarya cana*)."

There are also at least four Potential Conservation Areas listed on the east side of Rocky Mountain National Park itself:

- Glacier Basin: B2, Very High Biodiversity Significance;
- Moraine Park: B3, High Biodiversity Significance;
- Steep Mountain: B3, High Biodiversity Significance; and
- Eagle Cliff Mountain: B3, High Biodiversity Significance