

IN THE MATTER OF CHANGES TO THE ) CAUSE NO. 1R  
RULES AND REGULATIONS OF THE )  
OIL AND GAS CONSERVATION COMMISSION ) DOCKET NO. 200300071  
OF THE STATE OF COLORADO )  
**MISSION CHANGE 200-600 SERIES** ) TYPE: RULEMAKING

**IN THE MATTER OF CHANGES TO THE RULES AND REGULATIONS OF THE OIL &  
GAS CONSERVATION COMMISSION OF THE STATE OF COLORADO.**

**TESTIMONY AND REFERENCE OF DANA BOVE**

**ON BEHALF OF**

**WILDLIFE AND BIOLOGICAL RESOURCES COALITION (WBRC)**

**August 14, 2020**

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**TESTIMONY OF DANA BOVE**

**I. INTRODUCTION AND BACKGROUND**

*Please state your name and address for the record*

My name is Dana Bove, my address is 1935 Tincup Ct in Boulder, Colorado.

*Who is your employer?*

I am retired from the United States Geological Survey (USGS).

I was Research Scientist and Project Leader U.S. Geological Survey, Denver, Colorado (1979 to 2013). Duties: Research scientist and project leader on a wide array of scientific investigation throughout my 34-year career at the USGS. Project work included environmental investigations pertaining to abandoned mine investigations in large Colorado watersheds; mineralogic and environmental studies of large mineralized deposits; geologic quadrangle mapping; and studies of metallic ore genesis and mineralizing processes.

*On whose behalf are you testifying?*

I am testifying on behalf of Front Range Nesting Bald Eagle Studies (FRNBES) and the Wildlife and Biological Resources Coalition (WRBC).

*Dana, please briefly describe your credentials to offer testimony on bald eagle conservation.*

I am President and Chief of Citizen Science Studies: Front Range Nesting Bald Eagle Studies (2015 to present). Duties: I designed an easy-to-follow yet quantitative and robust field methodology that provides objective and quantifiable behavioral and geospatial data for Bald Eagle nests and winter roosts. I lead a team of up to 15 volunteers; 3 staff members, and various contract workers.

Front Range Nesting Bald Eagle Studies (“FRNBES”) is a Colorado based nonprofit 501(c)(3) organization dedicated to the study and conservation of nesting and winter roosting bald eagles in the northern Colorado Front Range. FRNBES accomplishes its mission through scientific research on eagles; mitigation of electrical and collision hazards near eagle nests; the gathering, publication, and dissemination of data to federal, state, local agencies, and the public; legal advocacy to counter proposed actions that will adversely impact eagles; and through public education.

*Has FRNBES worked on oil and gas issues with regard to nesting eagles on the Front Range?*

Since 2015, most of the bald eagle nests and roosts in our studies, especially those in Weld County, have been impacted by multiple phases of oil and gas development. The principal goal of FRNBES is to study

the natural behavior of eagles, and utilizing our quantitative methodology, we can evaluate if there are significant changes that vary from an established baseline in response to any types of input, including anthropogenic activity from oil and gas development.

## **II. PURPOSE AND SUMMARY OF TESTIMONY**

### ***What is the purpose of your testimony?***

The purpose of my testimony is to present an overview of FRNBES' and WBRC's evaluation of the COGCC's proposed rules, focusing on bald eagle populations and habitat; and illustrate issues we identified through our research. A comprehensive rules framework is needed that applies to all aspects of oil and gas operations and all infrastructure at all stages of the development process: from initial exploration activities through permitting, drilling, post-drilling Operations and Maintenance (O&M) activities through final Plugging and Abandonment (P&A). Currently, too many activities and too much ancillary infrastructure outside the main permitting processes is significantly impacting priority wildlife species and habitat.

### ***Can you summarize the main points of your testimony?***

One, a cradle to grave approach is needed for protecting bald eagles, wildlife habitat and healthy ecosystems.

Two, initial siting is critically important, and avoidance of priority habitat is far and away the best strategy.

Three, much existing infrastructure including wellpads, access roads, and pipelines have been poorly sited too close to important habitat such as nests and communal roosts. This underlines the importance of involving the public and CPW to achieve wildlife protections at these sites for post-drilling operations up to and including plugging and abandonment.

Four, cumulative impacts are a major threat to the health of bald eagles and supporting ecosystems. This includes other forms of development and climate change. Direct, indirect and cumulative impacts stem from factors including direct habitat loss and disturbance, habitat fragmentation, noise, lighting, access and overall encroachment and increased human disturbance.

## **IV. TESTIMONY**

### ***The rules propose to apply cumulative impacts analysis to priority habitats including bald eagle habitat. Is that a good thing?***

The specific examples from our studies that I provide in this testimony focus heavily upon our documentation of cumulative and repetitive impacts related to oil and gas and other anthropogenic activities on nesting and roosting bald eagles. Not only do I provide examples of the numerous types and specific instances of these disturbances, but also include detailed descriptions and data demonstrating how these activities negatively impact nesting and roosting eagles.

In FRNBES interaction with state and federal agencies, as well as other land managers, we continually emphasize the need for developers and individuals to abide by established buffers for eagles, such as CPW's 2008 eagle recommendations. FRNBES believes that these established ¼ mile and seasonal ½ mile buffers are the best way to prevent federally prohibited "take" or molestation of eagles as defined under the Bald and Golden Eagle Protection Act (BGEPA).

***Do you support the proposals for alternative location analysis for proposed locations?***

Yes. Alternative location analysis or ALA goes to the core of protecting habitat and populations of eagles and other species. For proposed new operations, ALA allows avoiding habitat by safe distances informed by science and on-the-ground knowledge. We have seen many examples in Weld County where the lack of ALA resulted in siting wellpads, access roads and pipelines too close to nests, roosts, streams, wetland areas and other important habitat.

***What about existing locations where a legacy well location may have been drilled within ¼ or ½ mile of a bald eagle nest. Have you encountered situations where this has disturbed eagles and habitat?***

Yes, on multiple occasions, as described in case studies below.

***FRNBES is proposing that both CPW and the public have the chance to comment on all sundry notices and other notices going to proposed post-drilling activities by operators in bald eagle habitat. Why is this important?***

This is important because all application decisions by COGCC need to rely on the best available scientific data. FRNBES expertise is specifically focused on bald eagles and nesting golden eagles in the northern Front Range. Thus, we can provide critical information when it comes to decisionmaking that could impact these eagles and their habitat. For instance, each nesting bald eagle pair have their own unique behaviors and circumstances pertaining to near-nest resources on which they depend. Land use decisions, especially when considering the large-scale impact of multi-well oil and gas drilling, need to account for these critical details in order to protect wildlife as mandated by SB19-181.

***WBRC is supporting a comprehensive rulemaking framework that ensures activities or infrastructure doesn't "fall through the cracks". Please explain why this is important based on your direct experience monitoring eagles and oil and gas activity near habitat.***

I'll cite a specific example of critical rulemaking infrastructure that has fallen all through cracks and will likely have enormous consequences. My example below examines cumulative oil and gas activity which appears to have resulted in the apparent cumulative demise of the Middle Roost.

If the new rules are not based on the best scientific data including crucial information submitted by the public, oil and gas will continue to be the death of roosts like the Middle Roost: If periodic visits (such as oil well maintenance work) are requested and required within the buffer zone after development, activity should be restricted to the period between 1000 and 1400 hours from November 15 to March 15.

Workover rigs and that level of activity absolutely must be scheduled outside seasonal wildlife closures to protect priority habitat. Allowing workover rigs during sensitive periods on the claim of "routine

maintenance” can cause levels of disturbance that severely stress bald eagles and can contribute to nest abandonment or reproductive failure.

***What about flowlines and pipelines? Have you observed operations that affect eagle conservation related to transportation of oil and gas from well locations?***

Flowlines and pipelines can impact habitat and wildlife as much as drilling during construction and maintenance activities. Examples are provided below.

***Draft Rule 1202.c(1)(G) provides that HPH subject to the rule would include “Bald Eagle (within 0.25 miles of an active nest)”. In your opinion, is this an adequate protection for active nests?***

No.

FRNBES unpublished data on four nests in our studies document that these nesting eagles derive up to 52 percent of their prey from within ½ mile of their nest, especially during incubation and brooding young. The dominant prey source for most of the bald eagle nests we study are prairie dogs. With Colorado being the 5th fastest growing state human in the country, with five of the fastest growing counties in the northern Front Range, wildlife habitat, especially for nesting bald eagles (with near nest territories averaging 2-3 km<sup>2</sup>), needs to be protected. In addition, land managers have not paid attention to the needs of juvenile bald eagles during the 6 to 8 week post-fledge period when they are wholly dependent upon their parents. During this incredibly vulnerable time period, juvenile eagles extensively utilize their near nest territory and foraging grounds that extend more than ½ mile from the nest tree. In addition, adding electrical hazards and other hazardous infrastructure as close to ¼ mile or less to nest trees only increase the already high likelihood of mortality during the post-fledge dependence period. Habitat within ½ mile for these reasons is critical to protect.

***Why does WRBC emphasize avoidance?***

Avoiding priority habitat through informed siting decisions is the best protection for wildlife. Avoidance of priority habitat needs to be respected for the rules to have any meaning. That means denying locations within priority habitat including habitat on private lands. Just like public health needs to be protected by adequate setbacks without exceptions for drilling near neighborhoods or schools, the same applies for eagle nests and roosts and other priority habitat.

***Before we get to case studies, can you describe FRNBES methodology with regard to compiling and processing field data?***

FRNBES had developed a simple, objective and quantitative methodology that is utilized during all our study sessions, regardless of the presence of anthropogenic disturbance. All FRNBES data entry is rigorously reviewed by in-house Quality Assurance/Quality Control protocol (QA/QC); the data is stored in an “R” database system; and prior to analysis, undergoes additional QA/QC by contracted biometricians. This methodology allows the quantitative comparison of baseline or pre-development eagle behavior to that coincident with encroachment. Unfortunately, most observational studies of eagles—with respect to any potential anthropogenic disturbance--only considers immediacy of reaction to that stimulus. While our studies document that bald eagles often react immediately to human encroachment and disturbance, displacement from critical habitat (nests, winter roosts, and common perches), due to

cumulative and repeated disturbances is also a significant issue. Careful comparative studies with established baseline information, such as that employed in the FRNBES methodology are critical in order to document such displacement.

***What’s your overall take on oil and gas development impacts to bald eagles and habitat?***

Since 2015, Front Range Eagle Studies (FRNBES) has documented numerous bald eagle nest and roost disturbances related to all phases of oil and gas and ancillary development. Examples include all activity pertaining to multi-well, non-conventional oil and gas drilling; “offsite flowline” or pipeline construction for conveyance of oil, gas; produced water from well-pad to hub; downhole operations on vertical wells in preparation for offset horizontal drilling; plugging and abandonment of vertical wells; routine maintenance work on tank batteries and wells; and pumping of injection water from ponds to nearby well-pads. WBRC emphasizes that a “cradle-to-grave” approach to permitting and all subsequent operations are essential to realizing statutory protections under the Oil and Gas Act.

***I understand your first “Case Study” is for the Middle Boulder Creek Communal Roost ?***

Yes. The Middle Roost is an example of how multiple types of permitted and ancillary oil and gas encroached on and disturbed a bald eagle winter communal roost

First, I’ll describe the ecological significance of the Middle Roost.

Bald eagles are highly social and non-breeding individuals utilize winter communal roosts that form around important feeding sites. Communal roosts are often strategically located around profitable food sources (Hansen et al. 1980, Keister et al. 1987, Grubb et al. 1989, Wilson and Gessaman 2003) and may be established and disbanded in response to availability of these resources (Steenhof 1976, Grubb 1984, Keister et al. 1987). Proposed benefits to non-breeding eagles utilizing communal roosts include a reduction in the cost of thermoregulation, a decrease in the likelihood predation, either through safety in numbers or improved predator detection, and access to information about the location of food or other resources. Studies by Watts and Turrin (2017) indicate that communal roosts play a more significant and complex role in the eagle life cycle than previously understood, and recommend 800-meter buffers for protection.

The Middle Boulder Creek Winter Roost (Middle Roost) is a part of a roost network, with three discrete roost areas that are near evenly dispersed along a 4-mile stream corridor (Exhibit 1). The Middle Roost comprises four nearby stands of adjacent trees, which collectively comprise an area about 0.7 by 0.4 miles (Exhibit 1). The most utilized of these three roost areas is located near the confluence of Boulder and St. Vrain Creeks (Confluence Roost); the collective roosting area at the Confluence Roost also measures about 0.7 by 0.4 miles. Field studies by FRNBES indicate an integral connectivity between all three of these three local roost areas. FRNBES has extensive documentation of nonbreeding bald eagles moving northeast along the Boulder Creek corridor near dusk. Dependent upon prey conditions, some eagles remain at the southernmost roost (South Roost), whereas others leap-frog from one or two prominent cottonwood trees just northeast of the South Roost, and then move further northeast along the creek. Prior to the winter of 2019, up to 23 bald eagles would gather some nights at the Middle Roost, whereas others paused there briefly, only to continue northeast—along with those that by-passed the Middle Roost—to the larger Confluence Roost.

In sum, the Middle Roost area is about 0.7 by 0.4 miles in size, and mature cottonwood trees in the roost are used by 20 or more bald eagles primarily from the months of November thru April. The roosts area includes or is adjacent to prey habitat including several ponds for fishing and upland terrane with mammals such as prairie dogs and rabbits.

Now I'll describe FRNBES roost counts and the history of encroachment by various ancillary oil and gas operations.

In 2017, FRNBES observed the Middle Roost during the months of February, March, April, September, October and December, and recorded ten dawn/dusk counts. Total bald eagle counts ranged from 0 to 23 per observation during that time period (Exhibit 2; Exhibit 3a and 3b).

On December 5, 2017 I counted twenty-one bald eagles in the morning at the roost. We observed many of these eagles flushing the roost site (i.e., temporarily abandoning the site due to disturbance) upon arrival of oil and gas work trucks nearby. The observed disturbance was oil and gas workers accessing the area.

A large work-over drill rig and workers were present approximately 250 meters south of the core of the Middle Roost on about December 24, 2017 (Exhibit 2; #1). The rig remained in the area until middle January 2018. Dawn and dusk roost counts ranged from 0 to 3 from December 19, 2017 through January 17, 2018, which was the last winter count for that year.

Another oil and gas work-over rig set up on October 2, 2018, this time less than 100 meters from the communal roost core (Exhibit 2; #2). The drill rig remained through November 12, 2018. Backhoe activity beneath the core of the Middle Roost was observed from November 17 through November 21, 2018 (Exhibit 2; #3). At a time when early winter communal roost activity can commence, total bald eagle counts were zero for four dawn/dusk sessions.

After the backhoe activity ceased, non-breeding bald eagles again began to utilize the Middle Roost area on November 26, 2018 when 1 immature eagle was observed. Dawn/dusk counts increased to 4 eagles on November 29, and further to 13 and 11 eagles on December 1 and December 3, respectively (Exhibit 2). On December 4, 2018, while a FRNBES researcher was observing the roost, several heavy equipment trucks (related to an oil and gas pipeline project by Extraction Oil and Gas) drove down the dirt road north of the roost (Exhibit 2; #4). Approximately five minutes later, four eagles grouped together at the site began "vocalizing" before leaving and flying north. Several days later (December 8 to December 12), there were no eagles roosting at dusk at the site, again coinciding with heavy equipment and lights related to oil and gas pipeline construction directly west of the roost area (Exhibit 2; #4).

Pipeline or other construction activity was no longer present near the Middle Roost site December 19, 2018, when 3 immature eagles were counted at dusk. Counts of 4 and 8 eagles were documented on December 24 and 26, respectively. On December 26, 2018, several vehicles and a backhoe (oil and gas related work) were observed near the eastern section of the communal roost area near dusk, and at one point a FRNBES observer noted several immature eagles flushing from the roost trees nearby, and flying north (Exhibit 2; # 5). Roost counts at dusk again fell to zero on December 31, 2018, which was followed by 3 eagles counted on January 5, 2019, and zero again until a month later. On February 5, 2019, 9 eagles were counted prior to sunrise in the southern-most extent of the Middle Roost. This was after construction had again ceased.

An assortment of oil and gas activities were conducted near the Middle Roost from June 3, 2019 through March 13, 2020 (Exhibit 2; #6 to #9), the latter date marking the end of our winter dusk/dawn roost counts.

The earliest of these activities included construction on the Crestone multi-well Dreamweaver pad on about June 20, 2019. Sound walls were completed near the end of July 2019 (Exhibit 2; #6). The COGCC approved the Dreamweaver application on or around September 21, 2018, without any disclosure or determination by either the operator or the COGCC that the proposed location was within 1/3 mile and direct line of sight of the active bald eagle winter roost site at the Middle Roost. CPW's Recommended Buffer Zones and Seasonal Restrictions for Colorado Raptors (2008) at that time listed the following measures to avoid adverse impacts to bald eagle winter roost sites:

**Winter Night Roost:** No human encroachment from November 15 through March 15 within ¼ mile radius of an active winter night roost (see 'Definitions' below) if there is no direct line of sight between the roost and the encroachment activities. No human encroachment from November 15 through March 15 within ½ mile radius of an active winter night roost if there is a direct line of sight between the roost and the encroachment activities. If periodic visits (such as oil well maintenance work) are required within the buffer zone after development, activity should be restricted to the period between 1000 and 1400 hours from November 15 to March 15.

Drilling at the completed Dreamweaver site was roughly coincident with two other significant oil and gas-related operations: 1) a workover drilling rig began operating within about 100 meters of the Middle Roost core on about November, 2, 2019, and remained until around December 12, 2019 (Exhibit 2; #8), and 2) water pumping operations at the core of the Middle Roost to supply water for a multi-well pad to the west were in place through most of November, 2019 (Exhibit 2; #7). These operations, which included multiple trucks and workers, were also conducted at night and facilitated by bright lighting.

FRNBES conducted 36 dawn/dusk roost counts from November 2, 2019 to March 3, 2020 that spanned convergence of the multiple oil and gas activities described above (Exhibit 2; #6 to #9). We counted bald eagles on only 4 of those observation periods from November 30 to December 6, 2019. Zero eagles were counted for the remaining 32 dawn/dusk sessions.

#### ***What do you conclude based on observations of and data collected at the Middle Roost site?***

The obvious conclusions from this data and our observation are that human encroachment from various oil and gas activities in close proximity to the Middle Roost can have immediate impacts and long term impacts on bald eagle usage of this ecologically important roost site. Moreover, the convergence of significant oil and gas activities from late 2019 into March 2020 coincide with an alarming decrease and then absence of eagles at the Middle Roost through the remaining 2020 roost season. Consistent with extensive observations and monitoring data collected by FRNBES, drilling operations and a myriad of other oil and gas-related disturbances in the vicinity of the Middle Boulder Creek Winter Roost are resulting in direct, indirect, and cumulative effects on bald eagles that regularly used this roost site.

#### ***What about activities near active bald eagle nests?***

Similar concerns as for the Middle Roost extend to oil and gas projects that encroach upon and negatively impact nesting bald eagles and their critical habitat. We documented workover drilling projects (downhole work from surface locations) and encroachment on Bald Eagle Nests near Boulder Creek in western Weld County (Exhibit 4).

FRNBES sent a detailed list of 13 oil and gas workover drilling operations that operated since late 2016 proximal to eastern Boulder Creek to Greg Deranleau, Environmental Manager at COGCC (Exhibit 5). The purpose of the March 20, 2020 communication was to request details on the purpose, nature and scope of each of these operations. As shown in Exhibit 4, many of these operations were within CPW's recommended ¼ to ½ mile seasonal buffers around active bald eagle nests. Mr. Deranleau kindly responded on April 2, 2020 with a summary of 40 such site projects in the requested area, with the earliest of these commencing in December 2017:

- Out of those 40 projects, 28 were “downhole” operations on vertical wells.
- 12 of the “downhole” projects consisted of well preparation for offset horizontal drilling.
- 4 were production workovers (including well maintenance and repair)
- 12 projects pertained to plugging and abandonment of existing vertical wells.

This documents regular and frequent post-drilling activities within recommended buffers for active nests. It points out the need for public notice and comment on these activities to determine whether they should be allowed or denied during the proposed periods, and, if allowed, what Conditions of Approval and Best Management Practices should be required. Seasonal restrictions can avoid impacts during sensitive periods including reproduction and fledging. COAs and BMPs can minimize or mitigate impacts from noise, lighting and access. Rules 423 and 424 need to impose the highest, most protective noise and lighting standards for priority habitat including active bald eagle nests.

***What about flowlines and pipelines construction projects that might impact bald eagles and habitat?***

Offsite-flowline projects that include pipelines that carry produced water, oil, and gas from well pad to hub are perhaps one of the most disruptive phases of oil and gas development with regard to wildlife. Multi-well pads often require these construction projects for the installation of these offsite flowlines.

Two such pipeline projects, each lasting nearly two months, were conducted from October 28, 2018 through the beginning of October 2019, both in close proximity the Boulder Creek bald eagle nest in western Weld County (Exhibit 6 and 7). Pipeline activity during the first of these projects also encroached upon the Middle Boulder Creek Communal bald eagle roost, as discussed above.

Here I will describe pipeline projects in the context of the impacts and encroachment on the Boulder Creek nesting bald eagles. The first of project included large-scale construction with heavy equipment and multiple workers within 0.15 miles of the Boulder Creek (Exhibit 6). The work was conducted in October through December 2018, at a time when CPW's (2008) eagle buffer recommendations advised ½ mile distance from an eagle nest. In addition, the pipeline corridor passed directly beneath several of the nesting eagles' most utilized hunting and fishing perches. FRNBES data comparing eagle usage previous to and during the project demonstrate that these important hunting and foraging areas were abandoned during the construction (Exhibit 8).

Occidental conducted a nearly identical pipeline installation at this exact locality 7 months later, commencing on about July 20, 2019 (Exhibit 9). This large construction project was conducted as close as ¼ mile from the Boulder Creek nest and coincided with the critical 6 to 8 week time period when juvenile fledglings were utilizing this same area, and still fully dependent upon their parents' care.

Not only did this project once again discount CPW's recommendations to avoid disturbance of nesting eagles, but demonstrated the lack of good planning, as it duplicated Extraction's pipeline installation only seven months earlier (Exhibit 9 and 10). Better planning at higher levels can reduce impacts by providing

for coordination of infrastructure projects including shared pipeline corridors located to avoid and minimize adverse impacts and timed to reduce the duration and intensity of disturbances. Multiple operators in a field need to better coordinate and the Commission needs to require such coordination through permitting and other levers. Geographic Area Planning under Rule 513 as supported by WBRC is one important planning tool. All operators, agencies and public and private stakeholders need to be involved for informed decisions that respect the protections in the Act.

Operations such as those documented above are no less potentially harmful to protected wildlife than are larger permitted, multi-well operations. It is essential that all post-drilling operations are subject to public notice and comment and to Colorado Parks and Wildlife (“CPW”) review to ensure that needed protections for wildlife and biological resources are applied to such operations. The “cradle-to-grave” approach to permitting and subsequent operations is essential to realizing the statutory protections under the Oil and Gas Act.

This also points out the need for landscape scale planning that looks at all related facilities and infrastructure that can adversely impact and displace wildlife. Pipeline routes are just like access roads and wellpads: they need to avoid priority habitat to minimize adverse impacts. Analyzing alternative locations and allowing public comment on the cumulative impacts of proposed operations in the 300 series are necessary for COGCC to meet its requirement of protecting wildlife and habitat.

***Why is it important that all proposed activities are subject to scientific review and public comment?***

Certain ancillary operations such as those documented above have not always required COGCC permitting or been subject to public comment in the past. But they are no less potentially harmful to protected wildlife than are larger permitted, multi-well operations. It is essential that all post-drilling operations are subject to public notice and comment and to Colorado Parks and Wildlife (“CPW”) review to ensure that needed protections for wildlife and biological resources are applied to such operations. The “cradle-to-grave” approach to permitting and subsequent operations is essential to realizing the statutory protections under the Act.

On Rule 404: Form 4 Sundry Notices, WBRC recommends additional language that requires any operations not otherwise permitted or covered by the rules be subject to a sundry notice if the operation has the potential to impact public health, safety, the environment, wildlife or biological resources. For instance, permitting requirements need to cover all oil and gas operations as defined in the regulations, that are included in the proposed application, including but not limited to flowline construction associated with oil and gas operations, maintenance activity on flowlines and pipelines, all workover operations, fracturing simulations and temporary shut-ins of wells.

***Does this conclude your testimony?***

Yes.

## **REFERENCES & LITERATURE CITED**

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Stalmaster, and C. W. Serveen, editors. *Proceedings of Washington Bald Eagle Symposium*, Seattle, USA. Keister, G. P. Jr., and R. G. Anthony. 1983. Characteristics of bald eagle communal roosts in the Klamath Basin, Oregon and California. *Journal of Wildlife Management* 47:1072–1079.

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Wilson, R., and J. A. Gessaman. 2003. Two large bald eagle communal winter roosts in Utah. *Journal of Raptor Research* 37:78–83.

## ABBREVIATED CURRICULUM VITAE

### SUMMARY OF PROFESSIONAL EXPERIENCE DANA BOVE

#### PUBLICATIONS, MEDIA, OUTREACH AND PUBLIC SPEAKING SUMMARY

To date

- Published more than 93 peer-reviewed scientific papers (some of the most notable publications are referenced at the end of this curriculum vitae).
- Invited to guest speaker on FRNBES eagle studies at more than 20 public presentations.
- Currently writing and assembling several manuscripts for peer-reviewed publication from over 5,000 hours of quantitative studies on nesting and roosting Bald Eagles in the northern Colorado Front Range.

#### EDUCATION AND CERTIFICATIONS

- M.S., Geological Sciences., University of Colorado-Boulder, 1988
- B.A., Geological Sciences and Environmental Studies, University of Colorado-Boulder, 1977

#### POSITIONS

- *President and Chief of Citizen Science Studies:* Front Range Nesting Bald Eagle Studies (2015 to present). *Duties:* I designed an easy-to-follow yet quantitative and robust field methodology that provides objective and quantifiable behavioral and geospatial data for Bald Eagle nests and winter roosts. I lead of team of up to 15 volunteers; 3 staff members, and contract workers. Front Range Nesting Bald Eagle Studies (“FRNBES”) is a Colorado based nonprofit 501(c)(3) organization dedicated to the study and conservation of nesting and winter roosting bald eagles in the northern Colorado Front Range. FRNBES accomplishes its mission through scientific research on eagles; mitigation of electrical and collision hazards near eagle nests; the gathering, publication, and dissemination of data to federal, state, local agencies, and the public; legal advocacy to counter proposed actions that will adversely impact eagles; and through public education.
- *Research Scientist and Project Leader* U.S. Geological Survey, Denver, Colorado (1979 to 2013). *Duties:* Research scientist and project leader on a wide array of scientific investigation throughout my 34-year career at the USGS. Project work included environmental investigations pertaining to abandoned mine investigations in large Colorado watersheds; mineralogic and environmental studies of large mineralized deposits; geologic quadrangle mapping; and studies of metallic ore genesis and mineralizing processes.

#### A FEW SIGNIFICANT PEER-REVIEWED SCIENTIFIC PUBLICATIONS

Published more than 93 peer-reviewed scientific papers

Bove, D.J., Mast, M.A., Dalton, J.B., Wright, W.G., and Yager, D.B., 2007, Major styles of mineralization and hydrothermal alteration and related solid- and aqueous-phase geochemical signatures, Chapter E3 in Church, S.E., von Guerard, Paul, and Finger, S.E., eds., Integrated Investigations of Environmental Effects of Historical Mining in the Animas River Watershed, San Juan County, Colorado: U.S. Geological Survey Professional Paper 1651, p. 160-230.

*My years of expertise in the geology and mineralization of the western San Juan Mountains and experience integrating alteration/mineralization mapping with water quality data were instrumental in these*

*cooperative studies. My research and mapping provided the foundation for studies by the USGS, federal land managers, and other scientists working on AML goals for the Animas River watershed.*

Bove, D.J.; Walton-Day, K.; Kimball, B.A., 2009, The use of fluoride as a natural tracer in water: Examples from the Animas River watershed, San Juan mountains, Silverton, Colorado: *Geochemistry, Exploration, Environment Analysis*, v. p. 125-138.

*This manuscript describes the use of fluoride as a natural tracer in a mineralized watershed, which shows relationships between geologic and hydrologic features and aids in better understanding of the provenance and evolution of the water. The identification of these diagnostic signatures has allowed us to relate changes in water quality over time at a high elevation mine tunnel to plugging of a lower elevation mine tunnel and the subsequent rise of the water table into mineralized areas. We have also used these signatures to fingerprint and trace 13 metal-rich springs and seeps back to several massive tailings piles composed of waste rock associated with these geochemical constituents. These studies and data were utilized by federal land managers and the Animas Stakeholder's group to help in their decision making related to remediation of these situations.*

Bove, D.J., Yager, D.B., Mast, M.A., Dalton, J.B. 2007, Alteration map showing major faults and veins and associated water-quality signatures of the Animas river watershed headwaters near Silverton, southwest Colorado: U. S. Geological Survey, I-Map 2976. 18 p.

*The Animas map and associated pamphlet are key components for understanding the relation between geology and water quality in this highly studied watershed. Rarely can one see a poster or manuscript related to water quality issues in this area without a map derived from this publication. Water chemistry groupings as referenced to alteration type—a signature of the Animas alteration map studies—is now considered one of the most important variables utilized in many of our USGS environmental studies.*

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