WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Wolf-livestock interaction protocol
Revision date January 3, 2020~~July 18, 2019~~

This protocol describes a variety of proactive measures ~~livestock producers can take~~ to reduce the probability of wolf-livestock conflicts and establishes a framework for Washington Department of Fish and Wildlife's (WDFW; Department) response when conflicts between wolves and livestock occur.

The Department completed its Wolf Conservation and Management Plan in 2011 (Wolf Plan), which provides guidance on the implementation of activities, tools, and actions. This protocol outlines additional measures for implementing the wolf-livestock conflict chapter of the Wolf Plan.

The Director has the authority to deviate from this protocol while remaining within the guidelines of the Wolf Plan. ~~For example, in areas where the wolf population is below the regional component of the statewide wolf recovery objective, the Director may be more conservative. In areas where the wolf population is at or above the regional component of the statewide wolf recovery objective, the Director may be less restrictive (per ESHB 2097).~~

This protocol draws from a diversity of perspectives expressed by people throughout the state for protecting wildlife populations as a public resource and livestock. These values include achieving a sustainable, recovered wolf population; supporting rural ways of life; maintaining livestock production as part of the state's cultural and economic heritage; managing for~~conserving~~ a sustainable prey base; and promoting education and coexistence with wolves. This protocol also serves to provide transparency and accountability regarding WDFW activities and management actions related to wolves.

Section 1. Background and purpose of protocol

Gray wolves are listed as endangered under the federal Endangered Species Act (ESA) of 1973 in the western two-thirds of Washington, and are federally delisted in the eastern-third of the state (Fig. 1). Under Washington State rule, gray wolves are endangered statewide. Under the federal listing status, the U.S. Fish and Wildlife Service (USFWS) is the lead agency for managing wolves in the western two-thirds of Washington, and WDFW has full management authority for wolves in the eastern third (Fig. 1).

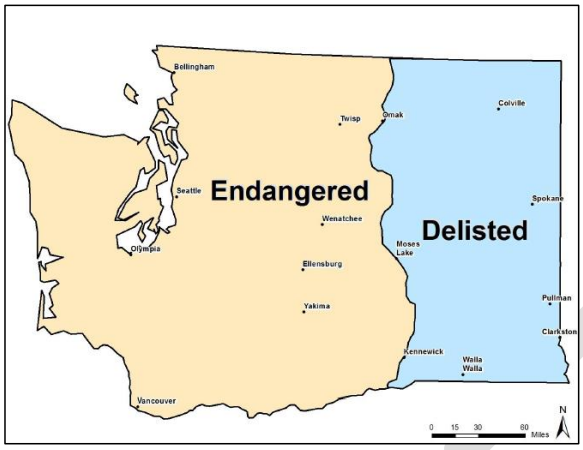

Figure 1. Federal classification of gray wolves in Washington State.

The Department developed a Wolf Plan under the requirements of WAC 220-610-110, which requires that listed species be managed to attain "survival as a free-ranging population" (Section 1.1). This requirement is consistent with the Department's responsibility to manage wildlife in trust for the citizens of Washington. Recovery plans need to include target population objectives, delisting criteria, and an implementation plan for reaching population objectives, "which will promote cooperative management and be sensitive to landowner needs and property rights" (WAC 220-610-110, Sections 11.1.1, 11.1.2, and 11.1.3).

The Wolf Plan was developed with the help of a multi-stakeholder working group and adopted by the Washington Fish and Wildlife Commission in 2011. The Wolf Plan has four goals, in accordance with state law and regulations: 1) recovery of the species, 2) reducing wolf-livestock conflict, 3) addressing interactions between wolves and native ungulates, and 4) promoting coexistence of livestock and wolves and public understanding of wolf management (Wolf Plan, p. 14).

Under the umbrella of the Wolf Plan, this protocol outlines the various tools and actions WDFW uses to reduce wolf-livestock interactions in order to support wolf recovery and maintain long-term coexistence of wolves and livestock. ***The goal of the tools and approaches described in this protocol is ~~to influence/change wolf pack behavior~~ to reduce the potential for recurrent wolf depredations on livestock*** *and removal of wolves* ~~***while continuing to promote wolf recovery***~~. In addition, some tools promote increased human awareness and/or influence livestock behavior to reduce negative interactions between wolves and livestock. The overarching aim of this protocol is coexistence among wolves, livestock, and people. When wolf-livestock conflict does occur, casting blame or stating failure is not productive. Conflict is a reminder that wolf-livestock interactions are a complex challenge, and conflict will never be completely eliminated where wolves and livestock overlap.

At this stage of recovery in Washington, most wolf packs share a portion of their territory with livestock on the rural landscape. WDFW encourages livestock producers in those environments to use proactive deterrence measures to reduce the probability for conflict. If conflict should occur, the Department considers the use of responsive deterrence measures and – within established guidelines – lethal removal of wolves (in areas where wolves are federally delisted) if appropriate deterrence measures have first been taken to ~~attempt to change pack behavior and~~ reduce the potential for recurrent wolf depredations on livestock.

This protocol describes a variety of livestock damage deterrence measures and the expectations for their use. Although no single deterrence measure or combination of measures will guarantee that zero conflict between wolves and livestock occurs, the Department believes careful application of these techniques will help reduce conflict. This protocol also describes the criteria for and implementation of lethal removal of wolves.

Section 2. Definitions

Confirmed wolf depredation refers to any event where there is reasonable physical evidence that a wolf caused the death or injury of livestock. Primary confirmation would include bite marks and associated subcutaneous hemorrhaging and tissue damage, indicating that the wolf attacked a live animal, as opposed to simply feeding on an already dead animal. Spacing between canine tooth punctures, location of bite marks on the carcass, feeding patterns on the carcass, fresh tracks, scat, and hairs rubbed off on fences or brush, and/or eyewitness accounts of the attack may help identify the specific species or individual responsible for the depredation. Wolf predation might also be confirmed in the absence of bite marks and associated hemorrhaging (i.e., if much of the carcass has already been consumed by a predator or scavengers) if there is other physical evidence to provide confirmation. This might include blood spilled or sprayed at a nearby attack site or other evidence of an attack or struggle. There may also be nearby remains of other animals for which there is still sufficient evidence to confirm predation, allowing reasonable inference of confirmed wolf predation on an animal that has been largely consumed.

This definition is from the Department's Wolf Plan. In practice, 96 percent of the confirmed wolf depredations (over a~~in the last~~ three year~~s~~ period) ~~have~~ included hemorrhaging as the factor that led to that determination. The Department will continue to use evidence of hemorrhaging (along with other supporting factors) for determination of a confirmed wolf depredation (see **Section 5** for more information on factors). Only trained WDFW staff make the final determination in depredation investigations.

Depredation means any death or injury of livestock caused by a carnivore.

Dispersal generally refers to the natural movement of an animal from one area to another area outside its natal territory.

Event refers to the wolf-livestock conflict incident that results in one or more injured or dead livestock. For depredations on large livestock (i.e., cattle, horses, mules, and donkeys), each depredated livestock equals one "event," unless there is evidence in the investigation that supports multiple livestock in one event (e.g., physical proximity of livestock, reconstructive evidence). For depredations on small livestock (i.e., sheep, pigs, llamas, goats, and alpacas) there may be one or more livestock in one depredation event.

Guarding and herding dogs are also included in the definition of small livestock if, based on the investigation by Department staff, the dog was actively guarding or herding its assigned livestock herd when it was killed by one or more wolves. The same is true for guarding and herding dogs injured by wolves, provided there was one or more confirmed wolf depredations to the other livestock species in the assigned herd, indicating that the dog's injury was part of a pattern of depredations in the assigned herd.

Incremental removal refers to a period of active wolf removal (or attempt to remove wolves) followed by a period of evaluation. If, during this evaluation period, wolf depredations continue, the Department may resume removal of additional wolves from the pack as part of the continuation of a series of periods of active removal and periods of evaluation.

Livestock means cattle, pigs, horses, mules, sheep, llamas, goats, donkeys, alpacas, guarding animals, and herding dogs (this definition is derived from the Wolf Plan and WAC 220-440-020).

Proactive deterrence measure refers to an action taken to discourage wolf depredation that has been in place long enough prior to a confirmed wolf depredation that the local WDFW Wildlife Conflict Specialist can be confident that it had time to be effective. In most situations, the measures will have been in place for at least one week. The WDFW Wildlife Conflict Specialist and the livestock producer will determine which techniques are best suited for the specific livestock operation and have the best chance to reduce the likelihood of wolf depredations on livestock.

Probable wolf depredation means there is sufficient evidence to suggest that the cause of death or injury to livestock was a wolf, but not enough evidence to clearly confirm that the depredation could only be caused by a wolf. A number of factors can help in reaching a conclusion, including (1) recently confirmed predation by wolves in the same or nearby area, and (2) evidence (e.g., telemetry monitoring data, sightings, howling, fresh tracks, etc.) to suggest that wolves may have been in the area when the depredation occurred. These factors, and possibly others, will be considered in the investigator's best professional judgment.

This definition is from the Wolf Plan. In probable wolf depredations, WDFW's practice in conducting investigations is such that there is a reasonably high likelihood that the depredation was caused by a wolf, but evidence of hemorrhaging was lacking (see **Section 5** for an explanation of all the factors that influence making a probable determination and how these are distinguished from non-wolf predation or non-predation causes of death). Only trained WDFW staff make the final determination in depredation investigations.

Responsive deterrence measure means a deterrent measure put into place after a confirmed or probable wolf depredation has occurred. The WDFW Wildlife Conflict Specialist and the livestock producer will determine which techniques are best suited for the specific livestock operation and have the best chance to reduce the likelihood of future depredations.

Wildlife Conflict Specialists are WDFW staff members who are responsible for working with local livestock producers to implement deterrence measures designed to reduce the probability of wolf-livestock conflict. Wildlife Conflict Specialists are the primary contact and staff that respond to and conduct depredation investigations.

Section 3. Expectations for deterrence measures

The Wolf Plan states that "any wolf-livestock management program should manage conflicts in a way that gives livestock owners experiencing losses the tools to minimize losses" without jeopardizing recovery efforts (Wolf Plan, p. 85.) The Wolf Plan then instructs the Department to work with livestock owners to incorporate non-lethal deterrence strategies (e.g., range riders, electric fladry) into their business practices (specific strategies are discussed in **Section 4**). Minimizing wolf-livestock conflicts involves identifying the factors that increase risk to livestock and adaptive management at a local scale (Hanley et al. 2018b).

The Department envisions a future where livestock producers and their communities work individually and collaboratively to reduce the potential for wolf-livestock conflict, develop innovative solutions, and advance efforts to coexist with wolves while preserving the economic viability and character of Washington's agricultural communities. To facilitate that vision, experience shows the best approach for expanded use of voluntary proactive deterrence measures is fostering relationships between independent producers and local Wildlife Conflict Specialists, and building receptivity through respectful mutual learning and collaboration. Research also supports the proposition that individuals who feel autonomous and competent are more likely to support and participate in conservation activities (Decaro and Stokes 2008, Dedeurwaerdere et al. 2016).

WDFW's role is to:

- Implement the Wolf Plan to ensure recovery of wolves in Washington State and reduce wolf-livestock conflict;
- Manage for an ungulate prey base at or near the objectives outlined in the Game Management Plan or appropriate herd plans;
- Collaborate with livestock producers on the implementation of deterrence measures;
- Provide information on wolf behavior, pack dynamics, population status, etc.;
- Foster mutual learning to build knowledge, trust, and respect;
- Support and promote expansion of use of deterrence measures that follow best management practices and provide high applicability for specific operations and landscapes;
- Facilitate and provide technical assistance to livestock producers and rural communities;

Commented [SJB(1]: In the WAG meeting, we talked about moving this elsewhere in the protocol.

From the primary author, Dr. Hanley:

This suggested sentence clearly states the intention of the previous statement and fits better in that paragraph:

"Non-lethal deterrence strategies will be most effective when selected tools are site-specific (e.g. based on terrain, size of grazing area, proximity to high-use wolf areas... etc.) and implemented adaptively (Hanley et al. 2018b)."

- Provide a compensation program for livestock damages caused by wolves (RCW 77.36);
- Support increased receptivity to best management practices in proactive deterrence measures;
- Provide local communities with interim resources for deterrence measures;
- Recognize that adjusting to wolves on the landscape and expanded use of proactive deterrence measures across all of Washington will be an ongoing process; and
- Communicate regularly with community leaders and elected officials prior to the start of the grazing season to provide an understanding of WDFW's wolf-related management activities and their objectives as they relate to wolf/livestock conflicts that arise during the grazing season (e.g., field response to reported depredations, timing of capture or lethal removal activities, etc.).

Within this context, livestock producers are expected to proactively implement at least two deterrence measures with concurrence from the local WDFW Wildlife Conflict Specialist. The Department's expectation is that livestock producers and the Wildlife Conflict Specialist work in collaboration to identify and plan the proactive deployment of the best suited deterrence measures specific to the grazing site; Wildlife Conflict Specialists are available throughout the year to work with livestock producers. The proactive deterrence measures must be in place a sufficient amount of time prior to a wolf depredation. The WDFW Wildlife Conflict Specialist will carefully consider the amount of time necessary for deterrence measures to have had an opportunity to be effective. In most situations, the measures will have been in place for at least one week. Several example deterrence measures with associated expectations for deployment are listed in **Section 4**.

Following a confirmed or probable wolf depredation, the Wildlife Conflict Specialist will work with the livestock producer to assess the local on-the-ground conditions and risk to determine which responsive deterrence measures should be employed (i.e., which techniques are best suited for the specific livestock operation, have the best chance to reduce the likelihood of future depredations, and are the most feasible). The Wildlife Conflict Specialists will guide or facilitate the implementation of the responsive deterrence measures by increasing the frequency of engagement with the affected producer(s), deploying additional deterrence measures, and coordinating with producers and other government agencies. The Wildlife Conflict Specialist will evaluate the timing of de-escalation or lengthier deployment of responsive deterrence measures contingent upon wolf behavior, pack size, pack structure, landscape conditions and the proximity of livestock. Wildlife Conflict Specialists will attempt to manage the use of responsive deterrence measures consistently across packs and regions of the state.

Influencing pack behavior to reduce the potential for recurrent depredations is challenging, especially on allotment-type operations (whether public or private) where livestock are dispersed on large landscapes that overlap with a wolf pack territory. In these situations, the Department recommends regular range riding around livestock to monitor livestock behavior and identify signs of wolf-livestock conflict. Additionally, regular human presence (including sheep herders, livestock producer employees and family members) around livestock aids in early detection of sick or injured livestock. As such, WDFW (along with individual producers and community-based organizations) is working to help facilitate range

riding through cost-sharing on private property and contracted range riders on public allotments as a proactive deterrence measure in priority areas. This effort is intended to accomplish the following:

- Build receptivity and encourage regular range riding around livestock;
- Improve and facilitate opportunities for increased and improved technical capacity in range riding;
- Secure and provide resources (financial and technical), as available, to bolster individual and collective efforts of strategic, applicable, and best practices in deterrence measures (per ESHB 2097); and
- Provide range rider training opportunities to encourage consistency in application.

Section 4. Example deterrence measures

This section provides common deterrence measures used to reduce the potential for wolf depredations on livestock. It was developed from a review of the scientific literature on these or other deterrence measures. The literature review can be found on the Department's website at https://wdfw.wa.gov/species-habitats/at-risk/species-recovery/gray-wolf/conflict-prevention (Western Wildlife Outreach 2014).

The tools best suited for a particular livestock operation will depend on many factors associated with the operation, such as the species of livestock, number of livestock, terrain, landscape conditions, and time of year.

The Department's expectation is that livestock producers and the Wildlife Conflict Specialist will work in collaboration to identify and plan the proactive deployment of the best suited deterrence measures specific to the grazing site. Wildlife Conflict Specialists are available throughout the year to work with livestock producers so the measures can be implemented a sufficient amount of time prior to when a wolf depredation is more likely to occur. In most situations, the measures will have been in place for at least one week. Also, there may be strategies on the timing and duration of particular deterrence measures, or deterrence measures may be periodically changed or varied to increase their effectiveness.

The efficacy of some of these deterrence measures is not limited to influencing the behavior of wolves. Depending on how the deterrence measures are deployed, they may also influence the behavior of livestock and further reduce the potential for recurrent depredations (Miller et al. 2016, Van Eeden, et al. 2017, Hanley et al. 2018b).

- Avoiding den and rendezvous sites
    - Identify areas of concentrated wolf sign that might be an indication of an active den or rendezvous site.
    - Work with Wildlife Conflict Specialists prior to grazing season to evaluate the potential for overlap and develop a plan to avoid these areas if the current or potential grazing area overlaps with active den or rendezvous sites.
    - Work with WDFW and the appropriate land management organization to seek time-based and/or geographical separation of livestock and wolves, such as alternative grazing areas, change in route, or delayed turn-out dates if possible.

- Increase vigilance and time spent guarding livestock in pastures with active den and rendezvous sites in the vicinity.
- Incorporate strategies to reduce the likelihood of a depredation based on the specific circumstance of the situation (e.g., use of range riders to move grazing livestock out of the high risk areas, place watering sites or mineral blocks to localize livestock to a desired area away from active and known denning or rendezvous sites).

- Monitoring livestock (either range riding on large pastures/allotments or human presence on small pastures)
  - Range riding (range riding occurs on large grazing pastures where regular monitoring of livestock is needed)
    i. Proactively monitor and protect livestock through working at least weekly with the livestock producer and WDFW staff.
       1. Watch for changes in livestock behavior, condition, and reproductive status; note any interactions with cattle and pertinent details (e.g., agitation, single or grouped livestock, cows with tight bags).
       2. If practical and feasible, remove sick or injured livestock from pastures within a wolf territory.
       3. Notify the livestock owner and/or WDFW of any dead livestock immediately.
       4. Manage livestock distribution to optimize herd and human deterrence, and monitoring capability while minimizing wolf-livestock conflict (e.g., small groupings).
    ii. Managing grazing rotations, monitoring livestock behavior, locating missing livestock, removing injured or sick livestock, and watching for carnivore activity around livestock.
    iii. Range riding is providing consistent monitoring of livestock, particularly throughout the grazing season when cattle and sheep are out on open range.
    iv. Work with the local WDFW Wildlife Conflict Specialist to prioritize range riding effort to cover the grazing areas and the number of livestock as effectively as possible.
    v. WDFW contracted range rider activity will be tracked using a GPS.
    vi. Range riders and sheep herders who sign a sensitive-data sharing agreement may monitor the location of radio-collared wolves so as to move or better protect livestock.
    vii. Range riding is intended to monitor and protect livestock. Following wolves or other carnivores reduces this ability.

  - Human presence (human presence occurs on smaller pastures or calving areas, typically on private property, during times of increased livestock vulnerability [e.g., lambing, calving, injured livestock in a pen])
    i. Increased and regular human presence (e.g., ranch employees, family members, or sheep herders) to protect livestock by patrolling the vicinity occupied by livestock on a daily or near-daily basis.
    ii. Individuals providing regular human presence communicate frequently with the livestock producer and WDFW about issues including livestock depredations, grazing rotations, and wolf activity.

Commented [SJB(2]: Waiting on language from range riding group.

iii. Monitors livestock, protects calving/lambing areas, and uses scare devices to deter wolves from approaching livestock.
i. If practical and feasible, establish calving or lambing areas away from areas occupied by wolves and/or in pastures near ranch houses to provide for easier and more frequent livestock checks and intervention, when necessary.
ii. Use protective fencing, fladry, or sheds around calving or lambing areas.
iii. Keep the area clean of livestock carcasses.
iv. Human presence is intended to monitor livestock not follow wolves or other carnivores.

- Using scare devices
  - Coordinate with WDFW to develop a hazing strategy to frighten wolves away from livestock. This might include installing light and noise devices, such as propane cannons, lights, radio-activated guard (RAG) systems that alert the range rider/herder to the presence of wolves by emitting flashing lights and loud sounds when a radio-collared wolf approaches the area.

- Guardian or herding dogs
  - Guardian dogs are used to alert on-site personnel (herders or range riders) of predator presence and to protect livestock.
  - Specific dog breeds and training are required to have effective livestock guardian and herding dogs.
  - Guardian dogs and herding dogs are used in conjunction with daily human presence.
  - For sheep, guardian dogs and herding dogs may live with the herd to provide protection 24 hours a day, seven days a week.
  - Guarding and herding dog owners are trained in effective use of dogs specific to wolf-livestock situations.

- Strategic carcass sanitation

The objective of carcass sanitation is to prevent wolves from being attracted to livestock carcasses in areas frequented by livestock (corral, salt areas, calving pens, etc.) to reduce the potential for wolf-livestock interactions. As such, sanitation is targeted at areas around active and adjacent pastures in close proximity to livestock. Producers (or their family and/or employees) are expected to remove or secure their own livestock carcasses in a timely manner. Example ways to remove or secure carcasses include:

  - Create a temporary carcass disposal site on a grazing pasture that is secured so as to not be an attractant.
  - Use fladry or electrified turbofladry around a carcass until it decomposes or until it can be removed from the area. Work with WDFW to determine the best approach for using fladry. The "attractant" aspect of a carcass is largely scent-based, and fladry around a carcass will not prevent wolves from being attracted to the site.
  - Bury or burn the carcass consistent with state law, county or city ordinances, and the land management agency's guidelines.
  - Work with WDFW to create a permanent carcass disposal site on private property.

- Use predator-resistant fencing as a permanent barrier around a boneyard or carcass pit on private property.
- Develop a composting site consistent with state law, county, and city ordinances.

- Permanent and portable fencing (fladry, electrified turbofladry, calf panels)
  - Use predator-resistant or electric fencing as a permanent or temporary barrier to confine livestock and deter predators.
  - Create night pens under open grazing conditions.
  - Confine a sick or injured animal until it can be transported off range.
  - Confine calves born on an allotment under a fall calving operation.
  - Use fladry or electrified turbofladry around livestock as a temporary deterrent to wolves.
  - Protect a carcass until a depredation investigation can be conducted.

- Delay turnout to forested/upland grazing pastures
  - Turnout when livestock calves reach at least 200 lbs. (e.g., early calving so calves are older and heavier at turn-out).
  - Turnout after wild ungulates are born (approximately mid-June).

- WDFW pack monitoring

Deploying radio collars on wolves helps monitor their activity. Deploying collars on wolves is not always feasible due to a wide range of circumstances such as weather, season, pack behavior, and trap shyness, among many others. Generally, uncollared packs can only be collared through trapping. Trapping efforts are limited to the spring and summer months to reduce chances of temperature-related injury to captured wolves and the potential for trap failure (e.g., freezing). New packs detected outside of these periods will be monitored and collaring will be attempted once feasible. Once packs are collared, they can be supplemented with additional collars or have aging collars replaced using a helicopter during winter if terrain and snow conditions allow.

Deploying a collar will be a high priority for WDFW when feasible in the following circumstances:

- When monitoring wolf movements in areas with ongoing research.
- When monitoring the recolonization of wolves into new areas not previously occupied.
- When packs have a history of interactions with livestock.
- Following the first livestock depredation by an uncollared pack.

- ~~Deploying a radio collar will be a high priority for WDFW following the first depredation by an uncollared pack whenever feasible.~~

Commented [MD(3]: Draft language from small group that worked on this following last WAG meeting

Section 5. Proactive communication

Coordination with landowner

Coordination between livestock producer and landowner on potential steps to reduce the likelihood of wolf-livestock conflict, such as:

- Timing of turn-out.
- Grazing areas and restricted areas.
- Pasture/allotment rotation.
- Sanitation.
- Water and mineral block sites.
- And other annual allotment plan instructions related to wolf-livestock interactions.

Section 6. Depredation investigations

Suspected wolf depredations on livestock are reported to the WDFW by the livestock owner (or their family members or employees), local law enforcement, or by other local entities. Department staff responds to these reports typically within 24 hours. The reported incident site is treated as a "crime scene" to preserve the physical evidence. The investigation is conducted by a two-person WDFW team (in most situations) with training and experience in wolf depredation investigations. WDFW may coordinate with local law enforcement (as agreed upon with local law enforcement agencies) to be present at the investigation to facilitate mutual learning. In areas where wolves are listed under the ESA, WDFW will coordinate with the USFWS on the findings from depredation investigations and seek agreement on the determination of the investigation. WDFW may seek input from other non-WDFW experts. However, the final determination of the investigation will be made by the WDFW staff members who conducted the investigation.

Each investigation is unique based on habitat, time of year, and location of the incident. While performing the depredation investigation, WDFW staff use many different factors to determine if a carnivore(s) was involved in the livestock injury or mortality. These factors could include, but are not limited to, documenting the characteristics of or the presence and/or absence of:

1. The disposition and age class of the livestock;
2. The site where the incident occurred;
3. Animal sign (tracks, scat, hair) at the scene, particularly from wild carnivores;
4. Other species of wildlife in the area, particularly other carnivores (collared and uncollared);
5. Sign of a chase and/or struggle (e.g., tracks in substrate, drag marks);
6. Presence of tissue trauma and hemorrhaging with bite wounds;
7. Blood indicating livestock was alive during attack (can include dried or fresh blood);
8. A scattered or buried carcass in the event of a livestock mortality;
9. Evidence of scavenging (indicating the wildlife associated with said scavenging);
10. Wildlife bedding locations near the scene;
11. Witness accounts;
12. Producer accounts;
13. Any evidence of attack or scavenging present on the hide;
14. Bite wounds associated with attack on a live animal versus scavenging;
15. Location of bite wounds; and
16. Presence of broken bones.

Based on the factors and physical evidence documented during the investigation, the Department staff who conducted the investigation make the final determination. In some situations, staff may seek input from individuals or a subset of WDFW staff that did not participate in the investigation. WDFW staff who participated in the investigation may also reach out to non-WDFW experts for further review of the investigation; however, the final determination and rationale will be made by WDFW staff who participated in the investigation.

Once a depredation investigation has been completed (which may take up to 48 hours), the WDFW staff who conducted the investigation make a determination based on classifications from the Wolf Plan. The classification of the final determination includes 1) confirmed wolf depredation, 2) probable wolf depredation, 3) confirmed non-wild wolf depredation, 4) unconfirmed depredation, 5) non-depredation, or 6) unconfirmed cause of injury or death. See **Table 1** and the Department's document, "Livestock injury and mortality investigation: A reference guide for WDFW field personnel" for more information on the investigation process, principles, and factors and physical evidence (online at https://wdfw.wa.gov/publications/01581).

In an investigation, the level of certainty in the determination of the cause of an injury or mortality of livestock is critically important. As such, the Department will include a description of the "factors" that were and/or were not present and how they contributed to the final determination in the written narrative in the depredation investigation report (see **Section 8** for information communicated to the public).

When a determination of "probable wolf depredation" is made, the factors and physical evidence that distinguish it from non-wolf predation and non-predator determinations will be documented. Examples of those distinguishing factors include sign of struggle, blood at the scene, broken branches, trampled grass, or bite marks characteristic of wolves on remaining portions of the carcass (e.g., bite marks on the tail bone). In addition, other factors must be present that allow for a reasonable ability to rule out other predators, such as the pattern of the attack that is more characteristic of wolves than other predators. When factors are absent that allow for the ability to determine if another predator was responsible, or if it cannot be determined whether or not the animal died from non-predation causes, then the incident would be an "unconfirmed depredation" or "unconfirmed cause of injury or death." Alternatively, if evidence suggests another predator, the classification would be "confirmed non-wild wolf depredation," or if it was clear that the animal died from something other than predation, the death would be classified "non-predation." In probable wolf depredations, WDFW's practice in conducting investigations is such that there is a reasonably high likelihood that the depredation was caused by a wolf, but evidence of hemorrhaging is lacking. Also, for one probable wolf depredation to be included in a pattern of confirmed wolf depredations (see **Section 6**), it must be on the same time scale, with similar periods of times between depredations, as the confirmed wolf depredations, and in the same area of overlap of wolves and livestock as the confirmed wolf depredations.

449 Table 1. WDFW classifications for investigation on reported injured or dead livestock.

Classification	Definition from the Wolf Conservation and Management Plan	Principles for determination
Confirmed Wolf Depredation	There is reasonable physical evidence that a wolf caused the death or injury of livestock. Primary confirmation would include bite marks and associated subcutaneous hemorrhaging and tissue damage, indicating that the wolf attacked a live animal, as opposed to simply feeding on an already dead animal. Spacing between canine tooth punctures, location of bite marks on the carcass, feeding patterns on the carcass, fresh tracks, scat, and hairs rubbed off on fences or brush, and/or eyewitness accounts of the attack may help identify the specific species or individual responsible for the depredation. Wolf predation might also be confirmed in the absence of bite marks and associated hemorrhaging (i.e., if much of the carcass has already been consumed by a predator or scavengers) if there is other physical evidence to provide confirmation. This might include blood spilled or sprayed at a nearby attack site or other evidence of an attack or struggle. There may also be nearby remains of other animals for which there is still sufficient evidence to confirm predation, allowing reasonable inference of confirmed wolf predation on an animal that has been largely consumed.	• Multiple factors documented at scene consistent with an attack by a wolf. • Often includes attack signature consistent with a wolf (see https://wdfw.wa.gov/publications/01581) • Includes subcutaneous hemorrhaging. In practice, 96% of the confirmed wolf depredations in the last 3 years have included hemorrhaging as the factor that led to that determination. The Department will continue to use the factor of hemorrhaging (along with other supporting factors) for determinations of confirmed wolf depredation.
Probable Wolf Depredation	There is sufficient evidence to suggest that the cause of death or injury to livestock was a wolf, but not enough evidence to clearly confirm that the depredation could only be caused by a wolf. A number of factors can help in reaching a conclusion, including (1) recently confirmed predation by wolves in the same or nearby area, and (2) evidence (e.g., telemetry monitoring data, sightings, howling, fresh tracks, etc.) to suggest that wolves may have been in the area when the depredation occurred. These factors, and possibly others, will be considered in the investigator's best professional judgment.	• Multiple factors documented at scene consistent with an attack by a wolf. • Physical evidence and factors at scene consistent with "confirmed wolf depredation", except scene is lacking the presence of subcutaneous hemorrhaging. • Factors must be present that allow for a reasonable ability to rule out other predators and non-predation causes of death.
Confirmed Non-Wild Wolf Depredation	There is clear evidence that the depredation was caused by another species (coyote, black bear, cougar, bobcat, domestic dog), a wolf hybrid, or a pet wolf.	• Multiple factors documented at scene consistent with an attack by another wildlife species.

		• Often includes attack signature consistent with specific carnivore (see https://wdfw.wa.gov/publications/01581) • Includes subcutaneous hemorrhaging or other factors that provide physical evidence the livestock was alive when attacked by another species.
Unconfirmed Depredation	Any depredation where the predator responsible cannot be determined.	• Single or multiple factors documented at scene consistent with an attack by a predator, but the predator responsible cannot be determined. • May include subcutaneous hemorrhaging (or other factors that provide the same scrutiny of physical evidence the livestock was alive when attacked by a predator). • May include factors from multiple predators (including wolf), but predator responsible for attack cannot be discerned with physical evidence and factors.
Non-Depredation	There is clear evidence that the animal died from or was injured by something other than a predator (e.g. disease, inclement weather, or poisonous plants). This determination may be made even in instances where the carcass was subsequently scavenged by wolves.	• Factors and physical evidence indicating livestock was injured or died from something other than a predator.
Unconfirmed cause of injury or death	There is no clear evidence as to what caused the depredation of the animal.	• There is no clear evidence at the scene as to what caused the injury or death of the livestock.

Section 7. Lethal removal criteria

The Department has the authority under RCW 77.12.240 for the removal or killing of wildlife (including wolves) that is destroying or injuring property, or when it is necessary for wildlife management or research. The Wolf Plan describes two situations when lethal removal may occur: to address wolf-livestock conflict and an at-risk ungulate population when wolf predation is determined to be a primary limiting factor.

The Department's Wolf Plan provides the following guidance and context:

- "Any wolf-livestock management program should manage conflicts in a way that gives livestock owners experiencing losses the tools to minimize losses, while at the same time not harming the recovery or long-term sustainability of wolf populations."
- "Management approaches are based on the status of wolves, ensuring that recovery objectives are met. Non-lethal management techniques will be emphasized throughout the recovery period and beyond….lethal control will be used only as needed after case-specific evaluations are made, with use becoming less restrictive as wolves progress toward delisting."
- "Lethal removal may be used to stop repeated depredations if it is documented that livestock have clearly been killed by wolves, non-lethal methods have been tried but failed to resolve the conflict, depredations are likely to continue, and there is no evidence of intentional feeding or unnatural attraction of wolves by the livestock owner."

The Department considers the use of lethal removal only in areas of the state where the Department has full management authority for wolves. As noted in **Section 1**, USFWS is currently the lead agency for managing wolves in the western two-thirds of the state where they are federally listed as endangered.

Currently, the Eastern Washington recovery region has achieved the regional component of the statewide wolf recovery objective identified in the Wolf Plan. The lethal removal provisions in this guidance currently apply only to the Eastern wolf recovery region.

The purpose of lethal removal is ~~to change pack behavior~~ to reduce the potential for recurrent depredations in the short term while continuing to promote wolf recovery in the long term. The strategy is to attempt to ~~change pack behavior by~~ remov~~eing~~ a minimum but sufficient number of wolves to attempt to disrupt a pattern of repeated livestock depredation. ~~before that behavior is reinforced by additional depredations on livestock.~~

Commented [MD(4]: Attempted to reword this section based on the conversation around the goal statement.

There are a number of variables and complexities related to implementing lethal removal (Brainerd et al. 2008, Borg et al. 2015, Bradley et al. 2015, Decesare et al. 2018, and Hanley et al. 2018a), including the history and pattern of depredations, recovery objectives within a region, estimated pack size (total number, number of adults and pups), the number and timing of depredations, classification of depredations, current year and previous year circumstances, use of deterrence measures (including

appropriateness and timing), time of year, and type of livestock. As such, the Department considers lethal removal on a case-by-case basis, with the Wolf Plan and protocol serving as guiding documents. The Department may consider lethal removal of wolves ~~to attempt to change pack behavior~~ to reduce the potential for recurrent depredations in the short term while continuing to promote wolf recovery in the long term when all the following criteria are met:

1. The Department has documented at least three wolf depredation events within a 30-day rolling window of time, or at least four wolf depredation events within a 10-month rolling window of time; see exceptions below in #6. Stipulations include:

   - At least one of the depredation events is a confirmed wolf kill of livestock.
   - One of the depredation events may be a probable wolf depredation if it is a part of a pattern of confirmed wolf depredations (i.e., the probable wolf depredation is on the same time scale, with similar periods of times between depredations, as the confirmed wolf depredations, and in the same area of overlap of wolves and livestock as the confirmed wolf depredations).
   - Although the Department tracks the total number of depredations, this count is not the only factor used when considering the use of lethal removal.

2. At least two proactive deterrence measures and responsive deterrence measures have been implemented and failed to meet the goal ~~of influencing/changing pack behavior to~~ reduc~~e~~inge ~~the potential for~~ recurrent wolf depredations on livestock. Stipulations include:

   - If proactive deterrence measures are not in place a sufficient amount of time prior to the wolf depredations, the Department will only consider lethal removal at a higher number of wolf depredation events and after deterrence measures have been implemented and failed to resolve the conflict.
   - All regions must include proactive nonlethal deterrents regardless of listing status (per ESHB 2097).
   - Range riding is expected on allotment-type operations where livestock are dispersed on large landscapes that overlap with a wolf pack territory. Range riding could be provided through a variety of sources, such as WDFW, WADA grants, NGOs, or by the livestock producer. Livestock producers should work with the local WDFW Wildlife Conflict Specialist on tailoring range rider duties and efforts to match their livestock operation and grazing landscape (see Section 3)".

3. The Department has documented the use of appropriate deterrence measures and notified the public of wolf activities in a timely manner as outlined in **Section 10**.

4. The lethal removal of wolves is not expected to harm the wolf population's ability to reach recovery objectives statewide or within individual wolf recovery regions. On an annual basis, the Department will assess whether lethal removal of wolves is expected to jeopardize the wolf population's ability to meet recovery criteria both in the recovery region and statewide.

Commented [MD(5]: Per WAG's discussion around this topic, consider adding a statement like…. see highlighted draft language

5. WDFW will consider the implementation of deterrence measures and lethal removal on a case-by-case basis.

Recognizing that breeding pairs are the building blocks of a wolf population and source for dispersal, management approaches for addressing wolf-livestock conflict are based, in part, on the status of wolves within recovery regions and statewide to ensure recovery or long-term sustainability of wolf populations. Lethal removal will be used only as needed after case-specific evaluations are made with use being more conservative in areas below recovery criteria. See appendix G and H in the Wolf Plan and Maletzke et al. 2015 for an analysis of anticipated impacts of periodic wolf removal on the status of wolves within wolf recovery regions and statewide. Under the Wolf Plan and in recognition that wolves are state-listed, the decision to implement lethal removal or not is made by the Director.

Section 8. Implementation of lethal removal of wolves

The objective of lethal removal is to ~~change pack behavior to~~ reduce the potential for recurrent depredations in the short term while continuing to promote wolf recovery in the long term. WDFW's approach is incremental removal, which has periods of active removals or attempts to remove wolves, followed by periods of evaluation.

Periods of an active removal or attempts to actively remove may vary in length of time based on factors such as the number of wolves to remove, the ruggedness of the terrain, the removal method(s) used, and resource availability (e.g., contracted helicopter vendor availability). In most situations, a period of attempting active removal will be two weeks or less. The final removal increment may take longer than two weeks. If no wolves are removed during a period of attempted incremental removal, a period of evaluation will still occur to determine any shifts in the behavior of the pack; the act of attempting to lethally remove wolves may result in meeting the goal of changing the behavior of the pack (Harper et al. 2008). If the final removal increment is not feasible after repeated attempts, WDFW staff will evaluate whether depredations are expected to continue in the near term (e.g., 30 days) based on current overlap between wolves and livestock (see section 7, number 3). If depredations are not expected to continue based on factors such as separation between wolves and livestock (e.g., the end of a grazing season), removal efforts will be discontinued at the discretion of the Director.

Commented [MD(6]: WAG had pending questions on this statement

Commented [MD(7]: New language for WAG to consider from small group following WAG meeting

This protocol recognizes that periods of evaluation are needed to determine if the lethal removal effort has disrupted the pattern of repeated livestock depredation ~~met the goal of changing pack behavior~~. The duration of a period of evaluation will vary in length and is largely based on the depredation behavior of wolves. Generally, the evaluation period corresponds to the 10-month rolling window. If there is a documented wolf depredation(s) after a period of active removal, the Department may initiate another lethal removal action, depending on the estimated date of the depredation incident related to the previous period of active removal. As such, the period of evaluation will typically be a minimum of a week unless the pattern of depredations resumes.

The evaluation period may also serve to allow the pack to regroup and possibly allow the next incremental effort to be more effective. Because wolves quickly learn to avoid aircraft and traps (whether used for capture or lethal removal), the extended use of some methods may reduce their efficacy. During evaluation periods, deterrence measures will be reinstituted.

If the Department initiates the lethal removal of wolves, the first incremental removal action will be to remove or attempt to remove one to two wolves, followed by an evaluation of the situation~~, to see if the goal of changing pack behavior was met.~~ If depredations continue, the Department may remove additional wolves in the subsequent period(s) of active removal. Under an incremental removal approach, WDFW does not explicitly set as a desired outcome of the removal of the entire pack; however, the removal of the entire pack may occur as a result of repeated incremental removals. In instances of a relatively small pack, the loss of the pack could potentially occur in two removal attempts (i.e., removal periods). In packs where the lethal removal of wolves is a concern for the recovery of wolves, the number of wolves to remove may be reduced in number or removals may not occur.

The Department will use methods that lethally remove wolves in a humane manner consistent with state and federal laws (e.g., trap types and sizes, trap check requirements, potential impacts to non-target species, etc.). The objective in terms of methodology is to use the best method available that balances human safety, humaneness to wolves, swift completion of the removal, weather, efficacy, and cost. Likely options include shooting from a helicopter, trapping, and shooting from the ground. Ground-based methods are preferred for conducting lethal removal actions because they involve less risk to human safety and generally lower costs; however, these methods can be ineffective or impossible in some scenarios due to accessibility, difficulty of trapping, etc. A helicopter may be used on an as-needed basis. All methods for removal are consistent with those used by other states and federal jurisdictions. Removal methods are evaluated collaboratively by our wildlife biologists and veterinarian and are consistent with the American Veterinarian Medical Association (AVMA) standards.

Section 9. Chronic conflict zones

Chronic conflict zones are ~~In~~ pack territories where proactive non-lethal deterrents have been implemented, wolf depredations on livestock have occurred, and the Department has lethally removed wolves for two or more consecutive years.

In these zones, WDFW staff will work with affected producers, associated landowners, and land management agencies to attempt to understand the cause of the conflict and to develop an implementation plan for proactive non-lethal deterrents. The plan will be for the annual grazing season and will seek creative alternatives to reduce or eliminate additional loss of livestock and attempt to break the cycle of lethal removal of wolves in these areas. For example, these discussions might be associated with innovations in non-lethal tools or changes in how they are deployed. Another example may be discussions associated with increased understanding of local ungulate and predator abundance and management with an effort to draw connections between various management plans (elk herd plans, deer herd plans, Game Management Plan, and Wolf Plan).

Commented [MD(8]: See draft language (red text and highlighted yellow) per WAG discussion

Chronic conflict zones recognize that repeated livestock loss and wolf removals are likely to cause significant hardship for producers and their animals, as well as their communities, the wolf advocate community, WDFW staff, and wolves. ~~Implementation of this recommendation for coordination between the producer, WDFW staff, and landowners does not direct a specific outcome or requirement other than the commitment to work on creative solutions.~~

If appropriate deterrence measures are not in place a sufficient amount of time prior to wolf depredations, it will be a low priority for the Department to consider lethal removal of wolves. The consideration for lethal removal would likely be associated with:

- A higher number of wolf depredation events (than is outlined in Section 7) and after appropriate deterrence measures have been implemented, or
- If other livestock producers in the same wolf pack area are experiencing wolf depredations and they have deployed appropriate deterrence measures a sufficient amount of time prior to wolf depredations.

In addition to implementation plans, for chronic conflict zones WDFW will work proactively with other interested land managers (e.g., WDFW, DNR, USFS, BLM, private) to plan for reserve grazing areas when it is mutually beneficial for livestock producers, livestock, and wolves. This is particularly important in cases where den and rendezvous sites are expected to occur in or near active livestock grazing areas, in the area of the state where wolves are federally listed and lethal removal of wolves is not an available tool, and/or areas where conflict deterrence measures have been ineffective. An unused plan to utilize reserve grazing areas is not a nonlethal deterrence measure. Actually implementing a plan to use a reserve grazing pasture is considered a nonlethal deterrence measure.

Commented [MD(9]: Draft language for discussion… #1 is consistent with existing language in the 2017 protocol. #2 is a new concept.

Section 10. Communication with public

The Department will notify the public when a confirmed or probable wolf depredation occurs. The notice will include the date the depredation occurred, the name of the wolf pack, what proactive and responsive deterrence measures are deployed (including when they were deployed and information on how the Department assessed the suitability of the measures), and the rationale for the Department's classification of the depredation (i.e., confirmed or probable). This information will be provided in narrative form for each reported wolf depredation and posted on the Department's website. In addition to notifying the public about wolf depredations, the Department will also notify the public when a wolf pack has met the criteria for consideration of lethal removal and will include the Director's decision to remove or not remove wolves along with the rationale for that decision. This notice will occur prior to any lethal removal action.

The Department will provide a monthly update about ongoing activities related to wolf conservation and management. These updates will be posted on the Department's website and will include items such as:

- Known wolf occurrence areas (i.e., packs and non-dispersing lone wolves wearing an active radio collar) including updates to wolf pack maps on the WDFW website.
- Wolf collaring activities.
- Known wolf mortalities.
- WDFW field staff wolf-related work activities.
- WDFW outreach and information, including visual media of wolf related activities and wolves in Washington.
- Relevant information on wolf ecology, terms used, and coexistence measures.
- WDFW activities related to implementation of deterrence measures.
- A narrative of all reported wolf livestock depredation investigations.
- For a wolf pack with confirmed or probable wolf depredations, a narrative about the chronology of events including details about which proactive and responsive deterrence measures were deployed.
- WDFW annual wolf report and other wolf related reports or WDFW wolf publications.

To ensure the safety of livestock producers, members of the public, and WDFW personnel, the Department will identify the pack in which the removal will occur, but will not disclose the specific location of the removal, the number of wolves to remove, days of operation, or the method of removal until the end of the grazing season. Once a removal operation has begun, the Department will update the public weekly on the number of wolves removed. Department will provide a final update to the public on any lethal removal action after the operation has concluded. A final report on lethal removal operations will be included in the Department's Annual Wolf Conservation and Management Report.

All wolf related notices and updates will be available on the Department's website at https://wdfw.wa.gov/species-habitats/at-risk/species-recovery/gray-wolf/updates. Any member of the public can request to be notified by email about new updates by signing up for email notifications at https://wdfw.wa.gov/about/lists.

Section 11. Literature Cited

Brainerd S. M., H. Andren, E. E. Bangs, E. H. Bradley, J. A. Fontaine, W. Hall, Y. Iliopoulos, M. D. Jimenez, E. A. Jozwiak, O. Liberg, C. M. Mack, T. J. Meier, C. C. Niemeyer, H. C. Pedersen, H. Sand, R. N. Schultz, D. W. Smith, P. Wabakken, and A. P. Wydeven. 2008. The effects of breeder loss on wolves. The Journal of Wildlife Management 72(1):89-98.

Borg B. L., S. M. Brainerd, T. J. Meier, and L. R. Prugh. 2015. Impacts of breeder loss on social structure, reproduction and population growth in a social canid. Journal of Animal Ecology 84:177-187.

678 Bradley E. H., H. S. Robinson, E. E. Bangs, K. Kunkel, M. D. Jimenez, J. A. Gude, and T. Grimm. Effects of
679 wolf removal on livestock depredation recurrence and wolf recovery in Montana, Idaho, and
680 Wyoming. 2015. The Journal of Wildlife Management 79(8):1337-1346.

681 DeCesare, N. J., S. M. Wilson, E. H. Bradley, J. A. Gude, R. M. Inman, N. J. Lance, K. Laudon, A. A. Nelson,
682 M. S. Ross, and T. D. Smucker. 2018. Wolf-livestock conflict and the effects of wolf management.
683 The Journal of Wildlife Management 82(4):711-722.

684 DeCaro, D. and Stokes, M., 2008. Social-psychological principles of community-based conservation and
685 conservancy motivation: attaining goals within an autonomy-supportive environment.
686 Conservation Biology, 22(6):1443-1451.

687 Dedeurwaerdere, T., Admiraal, J., Beringer, A., Bonaiuto, F., Cicero, L., Fernandez-Wulff, P., Hagens, J.,
688 Hiedanpää, J., Knights, P., Molinario, E. and Melindi-Ghidi, P., 2016. Combining internal and
689 external motivations in multi-actor governance arrangements for biodiversity and ecosystem
690 services. Environmental Science & Policy, 58, pp.1-10.

691 Harper et al. 2008. Effectiveness of Lethal, Directed Wolf Depredation Control in Minnesota. Journal of
692 Wildlife Management. 72(3):778-784

693 Hanley, Z. L., H. S. Cooley, B. T. Maletzke, R. B. Wielgus. 2018a. Forcasting cattle depredation risk by
694 recolonizing gray wolves. Wildlife Biology. 1

695 Hanley, Z. L., H. S. Cooley, B. T. Maletzke, R. B. Wielgus. 2018b. Cattle depredation risk by gray wolves on
696 grazing allotments in Washington. Global Ecology and Conservation. (16) 2018.

697 Maletzke, B. T., R. B. Wielgus, D. J. Pierce, D. A. Martorello, D. W. Stinson. 2015. A meta-population
698 model to predict occurrence and recovery of wolves. Journal of Wildlife Management
699 80(2):368-376.

700 Miller J. R. B., K. J. Stoner, M. R. Cejtin, T. K. Meyer, A. D. Middleton, O. J. Schmitz. 2016. Effectiveness of
701 contemporary techniques for reducing livestock depredations by large carnivores. Wildlife
702 Society Bulletin 40(4):806-815.

703 Van Eeden, L. M., M. S. Crowther, C. R. Dickman, D. W. Macdonald, W. J. Ripple, E. G. Ritchie, and T. M.
704 Newsome. 2018. Managing conflict between large carnivores and livestock. Conservation
705 Biology 32(1):26-34.

706 Western Wildlife Outreach. 2014. Wolf-livestock nonlethal conflict avoidance: a review of the
707 literature. Online http://westernwildlife.org/gray-wolf-outreach-project/western-wildlife-
708 outreach-people-wolves-livestock-coexistence-project/.