Recovery Planning for the Red Wolf

August – September 2021

Workshop Report
December, 2021

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Introduction

The United States Fish and Wildlife Service (Service) has convened a Recovery Team composed of 50 stakeholders (wolf experts, private citizens, wildlife biologists, natural resource managers, zoo biologists, etc.) that is tasked with developing a revised recovery plan for the red wolf (*Canis rufus*). The existing recovery plan was adopted in 1990 and, therefore, is largely out of date while also containing important historical information on the species and its status at the time the plan was adopted.

To accomplish this task, the Service has contracted with the Conservation Planning Specialist Group (CPSG) – part of the Species Survival Commission of the International Union for Conservation of Nature – to facilitate the development of this revised plan and, ultimately, the accompanying detailed Recovery Implementation Strategy. CPSG has a long and successful history of designing and facilitating multi-stakeholder deliberative processes to develop effective conservation plans for threatened and endangered species around the world. Specifically, CPSG has worked with the Service, state and provincial wildlife management agencies, and an array of private stakeholder domains to help develop recovery plans for endangered wildlife in North America. Recent examples include the jaguar, Mexican wolf, Sonoran pronghorn, and whooping crane.

While perhaps more flexible than the standardized methodology required by the Service for recovery planning documents (USFWS 2019), the general approach to conservation planning as practiced by CPSG fits well within the structured framework for identifying meaningful, evidence-based recovery goals, strategies and criteria that defines USFWS recovery plans. This general approach to planning is presented in detail in CPSG's *Species Conservation Planning Principles and Steps* (CPSG 2020). Recent research (Lees et al. 2021) has demonstrated the positive conservation outcomes that can emerge from this structured approach to species conservation planning. In the case of the red wolf, this planning process was conducted over four days, clustered into two fairly distinct stages: two days making up Stage 1 (31 August – 1 September 2021) and another two days making up Stage 2 (14 – 15 September 2021). The 13-day gap between sessions resulted from relatively few Recovery Team members being available for meetings during that period of time.

Summary of the Recovery Planning Workshop Process

The recovery planning workshop process began on 31 August 2021, with 44 (88%) of the 50 recovery team members attending at least a portion of the day's sessions. These meetings were held in the virtual space over Zoom due to travel restrictions brought on by the current coronavirus global pandemic. Following opening remarks by Leo Miranda (Director, Southeast Region, USFWS), Aaron Valenta (Southeast Regional Program Manager, Division of Restoration and Recovery, USFWS) and Emily Weller (Red Wolf Recovery Lead, USFWS), participants were able to move into smaller virtual breakout rooms for a brief social activity, designed to begin building team cohesion and function.

Following the opening activities, Aaron Valenta and Emily Weller gave a detailed presentation on the Service's recovery planning process, emphasizing the new "modular" approach that now breaks the traditional, cumbersome recovery plan process into three distinct parts: Species Status Assessment, Recovery Plan, and Recovery Implementation Strategy. This new approach is designed to facilitate more efficient production of endangered species recovery plans across the Service. As a compliment to this presentation, workshop facilitator Phil Miller presented an overview of CPSG's philosophy and approach to planning and its integration with the Service's framework for recovery planning. CPSG's "One Plan Approach" promoting the development of a coherent and scientifically rigorous conservation plan across both wild (*in situ*) and captive (*ex situ*) populations, with a strong emphasis on key stakeholder identification and engagement, was discussed in the context of its adaptation to the current recovery

planning process for red wolves. The informational component for Day 1 wrapped up with an overview presentation by Emily Weller and Pete Benjamin (Field Supervisor, Raleigh (NC) Ecological Services Field Office, USFWS) on the history of red wolf conservation in the southeast United States and the current status of the declining population on the Albemarle Peninsula in coastal northeastern North Carolina.

The remainder of the workshop's first day featured the identification of key elements of an effective recovery vision for red wolves in the southeast US. A conservation vision as defined by CPSG intends to describe the desired future state of a given species once recovery has been successful. Workshop participants (recovery team members) were randomly assigned to breakout groups under the guidance of workshop co-facilitator Stephanie Winton (CPSG). This activity ultimately led to a small sub-group of volunteers bringing together all the information generated by these groups and drafting a brief but powerful vision statement for recovery of red wolves in the species' historic range. This statement can be found in the next section of this report.

The second day of the workshop process included 42 (84%) of the 50 recovery team members, and was focused first on gaining general agreement on the vision statement generated by the sub-group. After this was accomplished, the participants were distributed according to their own interests among a set of breakout groups that corresponded to a diverse array of themes within the vision statement. The five themes were:

- Population viability / self-sustaining population (both in situ and ex situ)
- Geographic scope / metapopulation connectivity
- Genetic viability / coyote introgression
- Human dimensions (pride; landowner support / trust / engagement)
- Inter-agency cooperation (Federal, state, and local)

The goal of this breakout session was to generate operational definitions of key words or phrases within that statement – words like "viability" or "pride among local communities". In this way, a clear description of the desired end-state of red wolf recovery begins to emerge, with the added benefit of ideally specifying how management authorities are to measure progress toward the long-term goal of recovery. CPSG workshop facilitators introduced a set of online collaboration tools to help participants in their breakout group tasks. The final products of these activities are presented in the main body of this report, with the full sets of information created by each breakout group included as appendices.

Day three of the workshop was held approximately two weeks after the previous session in order to maximize the number of participants that could attend the day-long online session. Forty (80%) of the 50 recovery team members attended this day's session. A primary activity for this day was an analysis of the primary biological threats or factors considered to limit progress towards red wolf recovery. In particular, workshop participants were asked to review the major biological threats outlined in the 2018 USFWS Species Status Assessment (SSA) for the red wolf, and identify important drivers of those threats – those causal factors that serve to initiate the threat or facilitate its continued presence over time. This causal analysis is intended to help recovery team members identify "critical control points" in the system that could be prioritized for targeted management intervention in order to most effectively improve the prospects for species recovery.

The analysis of the "human dimensions" of red wolf endangerment – those perceptions, beliefs, and behaviors that underlie a person's or community's interactions with red wolf populations or their habitat – was of particular interest to workshop participants. Similarly, the challenges around promoting productive collaboration among the various Federal, state, and local governmental agencies were recognized and discussed in some detail in a dedicated working group and among the broader set of

recovery team participants. Although these complex aspects of wildlife conservation are not easily incorporated into the traditional framework of formal recovery planning employed by the US Fish and Wildlife Service (or those of other nations, for that matter), it is increasingly evident that directly addressing these sociological, cultural, and economic challenges is critical to the success of any endangered species recovery effort.

Following the analysis of threats and challenges, the workshop process moved on to developing recovery objectives and criteria. In response to the information presented to this point, and in keeping with the general structure of recovery plans now produced by USFWS, the workshop facilitator drafted a preliminary set of recovery objectives that aligned with the five themes carried through the overall workshop process. These high-level objectives were discussed amongst the full body of participants and ultimately adopted as initial statements for further discussion and consideration by the appropriate working groups. Once the objectives were discussed, the day ended with continued deliberations in working groups with the goal of developing draft recovery criteria. At this point, a sixth working group was formed to address specific needs around the management of the ex situ (captive) population and its proper integration into the overall recovery effort. While a formal recovery criterion focusing on the desired status of the ex situ population may not be considered an appropriate element in a formal recovery plan, as an ex situ population is not typically considered as an element that contributes to species recovery, the discussions in this group were nevertheless important for setting management targets for the population as a key support tool for the wild population in its progress towards recovery.

The fourth and final day of the workshop began with continued discussions on the recovery criteria produced by each group. This was then followed by a lengthy session in which working groups developed a set of recovery actions that were designed to achieve the objective set forth the previous day, and to help satisfy the criteria just developed. Again, in keeping with the updated framework for USFWS recovery planning, the intent was to develop rather high-level actions that do not yet have the detail required (i.e., the activities) to facilitate their completion. However, the action items created by each group clearly outline the various streams of work that are considered key to achieving long-term recovery of the red wolf.

The workshop ended with a brief discussion around the next major phase of recovery planning: the development of an updated population viability analysis (PVA) that explicitly incorporates both the wild (in situ) and the captive (ex situ) population elements and their detailed interactions. Phil Miller from CPSG, who will be leading the PVA effort, presented some basic concepts around this form of quantitative risk assessment and the types of questions that could be explored using the simulation modeling tool that will be used for the analysis. The PVA is expected to begin in earnest in February 2022 and will use the recent population analysis (Faust et al. 2016) as a valuable starting point. The analysis will likely be completed around the end of 2022.

Throughout the recovery planning workshop process, the facilitators worked to ensure that all participants were given an opportunity to present their own viewpoints and perspectives on the very complex issue of red wolf recovery in the southeastern US. An important example of this open environment was a brief presentation early in the workshop process by Wes Seegars (a private landowner and member of the NC Wildlife Resources Commission) on the history of interactions between the Service and landowners in northeastern North Carolina in the context of red wolf management. This presentation was followed by a productive discussion around stakeholder engagement, support and trust in endangered species conservation. Many participants identified this opportunity for dialogue as a key highlight of the overall workshop process – recognizing that listening to and understanding all credible viewpoints is a critical step in building an effective plan for red wolf conservation and recovery in a highly modified landscape.

A standardized workshop survey, slightly modified for the purposes of this recovery planning application, was made available to all participants at the end of the meeting as a way for CPSG and USFWS to assess the immediate impact of the process. A total of 25 participants (50% of the recovery team) completed the survey. Overall, workshop participants responded favorably to the process, with 96% saying they were at least somewhat satisfied with the workshop process, 60% saying they were "Satisfied" or "Very Satisfied", and 40% saying they were "Very Satisfied". The average satisfaction score on this question, defined on a scale from 1 (very unsatisfied) to 7 (very satisfied) was 5.96. In addition, while there was some acknowledgement of gaps in the representation of various stakeholder groups, participants found the process to be successful in introducing new perspectives and ideas to the recovery process, understanding diverse points of view among different stakeholders, and in generating clear guidance on how to move forward with effective recovery efforts for the species. Finally, respondents recognized the added complexity and occasional frustration with conducting this type of meeting in a virtual environment – while at the same time appreciating the workshop facilitators' preparation and attention to process design that ultimately led to a more enjoyable experience and, by extension, a more valuable workshop product.

Developing a Recovery Vision for the Red Wolf

Workshop participants were asked to develop a long-term vision for recovery of the red wolf. This statement is meant to describe the desired future state of the species after recovery has been achieved, and therefore provides a working definition of successful conservation of red wolves in their historic range. In the broad context of successful species conservation planning, the vision should also account for how the species should interact and be valued by local people with which the species interacts.

All participants were given a few minutes to write down what they believed to be key words or phrases that could be included in a vision statement for red wolves. Following this personal reflective time, participants were randomly assorted into six different breakout groups, where they discussed their own ideas and worked together to develop common themes for the recovery vision. Finally, a small group of volunteers (S. Agan, A. Casillas, C. Kendall, A. Shipley, and B. vonHoldt) gathered after workshop day 1 to review each breakout group's product and develop a draft vision statement that incorporated the contributions from all six groups. The draft statement was then presented to the full body of workshop participants at the start of workshop day 2 and was subject to discussions and minor revision by all participants.

The final version of the vision statement for red wolf recovery is given below.

> In the future, wild and free red wolves will coexist as multiple sustainable populations across their historic range, where ongoing threats are effectively ameliorated through the public's trust and engagement and aligned policies among all stakeholders. The recovery of the red wolf will provide a strong sense of community ownership, cultural importance, and pride, while promoting local economic growth.

The digital whiteboards used by each breakout group to discuss their key vision elements are reproduced here in Appendix 2.

Defining Success in Red Wolf Recovery

After crafting the vision statement for red wolf recovery, the workshop participants were asked to think more deeply about how to define and measure success in recovering red wolves. For example, what does it mean for red wolf populations to be "sustainable", distributed "across their historic range", and

providing a sense of "pride" among local communities? This exercise served to operationalize the recovery vision so that all Recovery Team members have a better understanding of what success in recovery will look like for the species.
Workshop facilitators identified five thematic areas in which operational definitions of important vision elements could be developed. These thematic areas were:

- Population viability / self-sustaining population (both in situ and ex situ)
- Geographic scope / metapopulation connectivity
- Genetic viability / coyote introgression
- Human dimensions (pride; landowner support / trust / engagement)
- Inter-agency cooperation (Federal, state, and local)

Workshop participants were given the option to choose which breakout group (thematic area) to join. After an initial breakout session of approximately one hour, participants were given the option to switch to another group for a second session so that they could contribute their expertise and perspective to another thematic area.

Key definitions and information from each thematic area are summarized below, with more complete information presented in Appendix 3.

Population viability / self-sustaining population (both in situ and ex situ)

Viable: Red wolves can avoid extinction in the wild given anticipated management, threats, environmental stochasticity, etc. Wild populations have less than 5% risk of extinction over 100 years while maintaining 85% of the captive population's genetic diversity.

Sustainable: Viable and resilient (able to sustain populations in the face of environmental variation and periodic disturbance) without extensive intervention. Extensive intervention is defined as regular/annual releases, placeholder management, etc. Occasional interventions (translocation) may be needed to maintain genetic viability.

Functional: Ecologically functionality as an apex predator with natural biological processes (survival, reproduction, dispersal, etc.) that support population growth and stability (viability).

Effectively mitigated threats: Existing and new threats that impact important population vital rates are addressed and reduced to levels that do not negatively impact population dynamics.

"Intervention": Management interventions such as translocating red wolves.
"Extensive": Regular/annual releases, placeholder management

Questions / discussion during plenary session:

- Is the genetic viability discussed here referring to wild or captive? → Wild populations maintaining 85% of what we have now in captivity
- What happens if go below thresholds? Policy implications? → if don't meet recovery criteria doesn't necessarily affect listing status (depends on definition of threatened and endangered) but may trigger management actions *important to defined benchmarks in this process
- Difference between intervention management schemes vs usual management activities in state

Geographic scope / metapopulation connectivity

Diverse historic range: Suitable areas representing different habitat types within historic range as defined by the Red Wolf Species Status Assessment (SSA).

Multiple populations: At least three sites over a large region that includes a diversity of ecoregions, with human-assisted connectivity a potential reality.

Questions / discussion during plenary session:

- Human assisted connectivity might be needed – natural functional metapopulation dynamics not necessary component of recovery? → depends on scale e.g. can sustain in NC, but not with populations in other states (e.g. NC to TN) e.g. FWS moving grey wolves – not precedent setting decision if need to do for red wolves

Genetic viability and coyote introgression

Genetic viability: Presence of genetic diversity, allelic richness, avoidance of autozygosity (inbreeding and resultant loss of fitness through inbreeding depression), maintain a high level of red wolf ancestry. This is measured by standard population genetic metrics and a panel of genome-wide loci with ancestry informative analyses.

Functional preservation: Maintain an ecologically-functioning phenotypic red wolf across the historic range. The expectation is to conserve the role of the wolf across a diverse landscape. This is measured by a composite profile of an individual's collection of phenotypic and behavioral attributes.

Questions / discussion during plenary session:

- Hybrid vs admixed: hybrid – recent offspring from interspecific matings, 1-2 generations (F1, F2), admix – understand composition of genome, structure of ancestry, more detailed
- Can you avoid admix genome? → yes, can target quantitative info for making decisions
- What does that mean for recovery under ESA? → species definition: look, act, and genetic material of wolves (When NAS issued their finding that red wolf is a species; they also considered behavior and not rely solely on genetic uniqueness.)
- This approach could give us more flexibility for management on landscape level e.g. coyote sterilization work very labor intensive – simplify management and decrease impacts on individual animals
- Clarify: Introgression is not the only thing to be concerned about – not that it doesn't need to be managed for e.g. bring back genetic red wolf ancestry
    - 1993 hybridization event that backcrossed continuously to red wolves
    - Point in time: red wolves filled available habitat – no hybrid litters produced
- Coyote management: pair bonding – small female wolves with coyotes – natural mechanism to segregate from coyotes on landscape – want to get population to autopilot so don't have to worry

Human dimensions (pride; landowner support / trust / engagement)

Public trust: A true partnership that projects honesty, transparency and open communication and helps further red wolf conservation benefitting both red wolves and stakeholders.

Economic development (rather than growth): Red wolves are a catalyst for the enhancement (and not the detriment) of the amount of goods of services (developed) per head of the population over a period of time.

Pride: To achieve, identify with, and celebrate red wolves in the landscape as the only wolf species endemic to the United States.

Cultural importance: Red wolf recovery is reflective of the values, beliefs, and historical significance of the communities in which they coexist.

Engagement: The involvement, participation, and exchange of knowledge with the relevant public in the recovery and conservation efforts of the red wolf for the benefit of the species and the community (stakeholders and / public?)

Stakeholders: A person, agency, or organization that has interest in or is affected by red wolf conservation.

Community ownership: The community influences the recovery and conservation of the species and is involved in the details and outcomes of the process.

Measures of success include: The diversity and magnitude of stakeholders who attend (respond, comment, review, etc.), participation in "Prey for the Pack" program, positive communications / interactions between FWS and landowners, number of public and private partnerships (increasing) over time, % of community members who feel the NR agencies responsible for red wolf recovery are worthy of trust.

Inter-agency cooperation

Alignment of agencies: interagency field teams, united agency marketing, strategic communications, relationship building - landowner liaison team with different partners (landowners can choose who to work with, but team is united), interagency policy dream team (start on softer items), as the cast of characters rotates catch them up and continue communications, other partners for support on projects/issues - directed by interagency team, compilation of stakeholder groups support, have a landowner representative (who is a tough sell) on interagency team.

Questions / discussion during plenary session:

- Did you talk about policy implementation? → Yes, important that state and federal policy align while respecting boundaries and mandates
- Scale – field to top policy within and among agencies – need to work throughout to be effective

Threats and Challenges to Red Wolf Recovery

The Species Status Assessment (SSA) for the red wolf (USFWS 2018) listed the following factors that are thought to influence the viability of the species in the wild:

- **Anthropogenic mortality**
  - **Shooting (intentional, unintentional)**
  - **Vehicle collision**
  - **Management mortality**
  - **Poisoning**
  - **Suspected illegal activity**
- **Coyote introgression**
- **Small population size and associated inbreeding depression**
- Disease and parasites
- Fire
- Hurricanes and storms
- Sea-level rise
- Public perceptions
- Carcass use, dumping, and use of agricultural areas
- Development

Those factors highlighted in bold type –anthropogenic mortality, coyote introgression, and small population size – are specifically identified in the SSA as the primary threats to red wolf persistence.

With this list as key background information, workshop participants were asked to deepen the collective understanding around the drivers of these threat factors, in other words, those activities or conditions that facilitate the existence of the immediate threats. This work was conducted using the same theme-based working group structure used in the immediately preceding activity focused in operationalizing the recovery vision. Each working group was instructed to review the list of limiting factors presented in the SSA, to identify any new biological threats that were not part of that assessment, and to then identify the underlying drivers or causes of the threat factors. The workshop facilitator introduced the participants to the "Rule of 5 Whys", a common process in problem analysis of iteratively asking the question as a way of seeking the root cause of a given threat.

Figures 1 through 5 on the following pages are graphical representations of the information generateed by each of the working groups. These graphics are intended as summaries of the extensive body of information assessed in working group sessions. For the complete set of information assembled by each group, please refer to Appendix 4.

In addition to understanding the more traditional logical flow of biological processes that lead to population vulnerability, this simplified graphical process of threat analysis is particularly valuable in uncovering an array of human perceptions, beliefs and behaviors that contribute to population decline and increased risk of population or species extinction. This information is critical to the subsequent process of identifying meaningful actions designed to mitigate threats to persistence.

Figure 1. Threats and challenges to red wolf recovery as identified by the Population Viability – Self-Sustaining Population (In Situ / Ex Situ) working group. Numbers in small yellow circles refer to analogous portions of threat diagrams on the following pages.

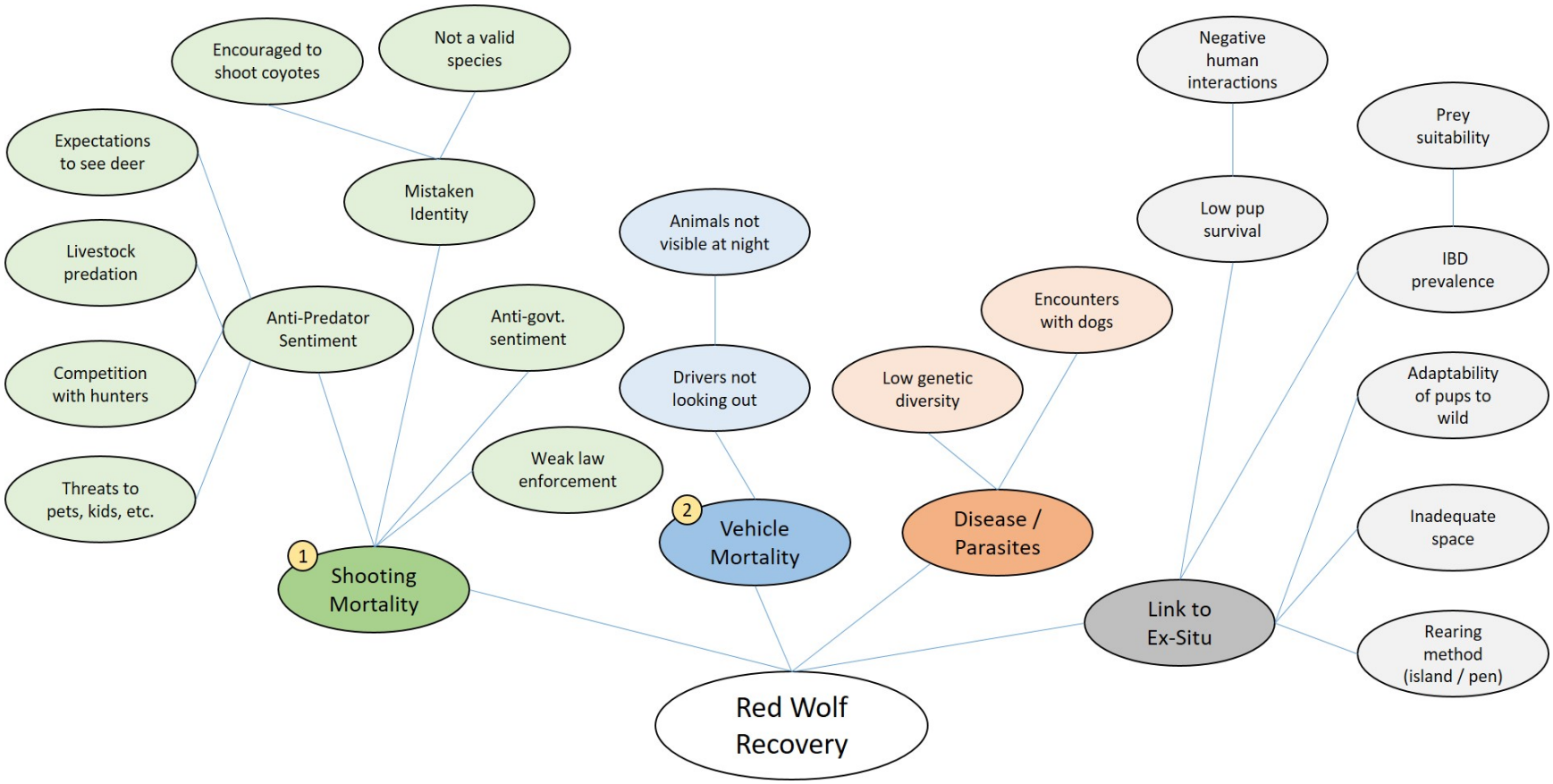


Figure 2. Threats and challenges to red wolf recovery as identified by the Geographic Scope / Metapopulaion Connectivity working group. Numbers in small yellow circles refer to analogous portions of threat diagrams on the following pages.

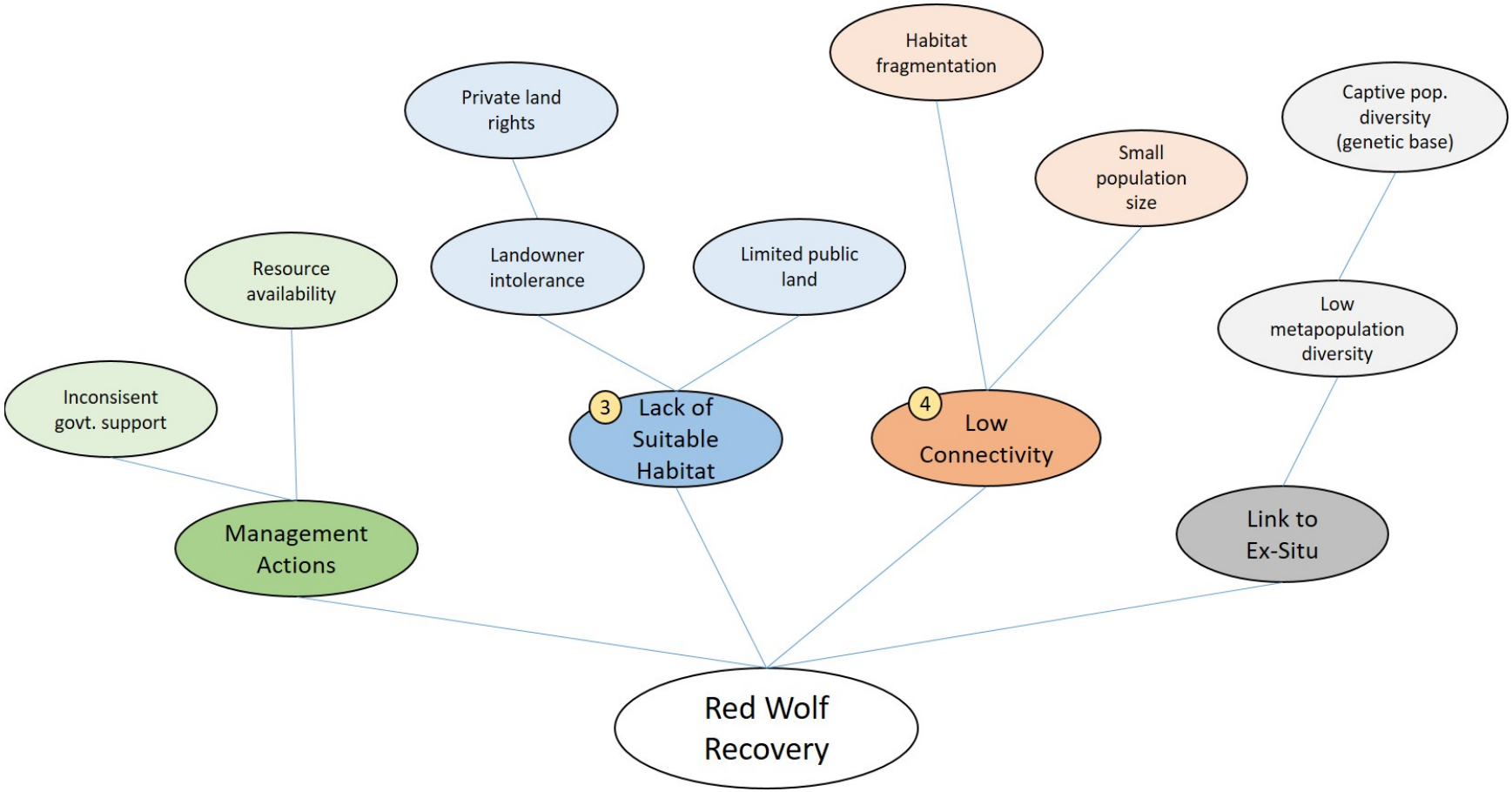


Figure 3. Threats and challenges to red wolf recovery as identified by the Genetic Viabiity and Introgression working group. Numbers in small yellow circles refer to analogous portions of threat diagrams on preceding pages.

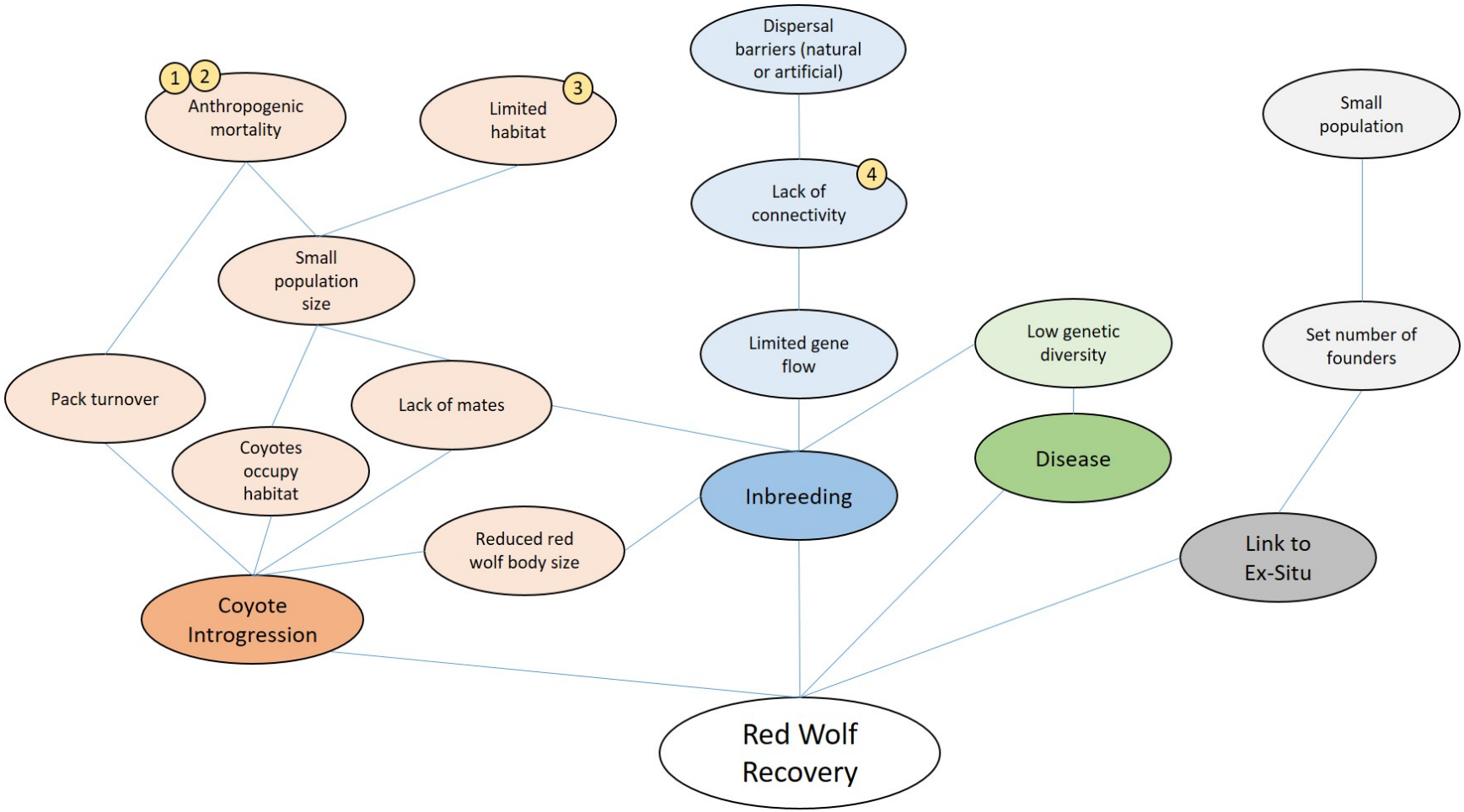


Figure 4a. Threats and challenges to red wolf recovery as identified by the Human Dimensions working group: Shooting mortality. Numbers in small yellow circles refer to analogous portions of threat diagrams on preceding pages.

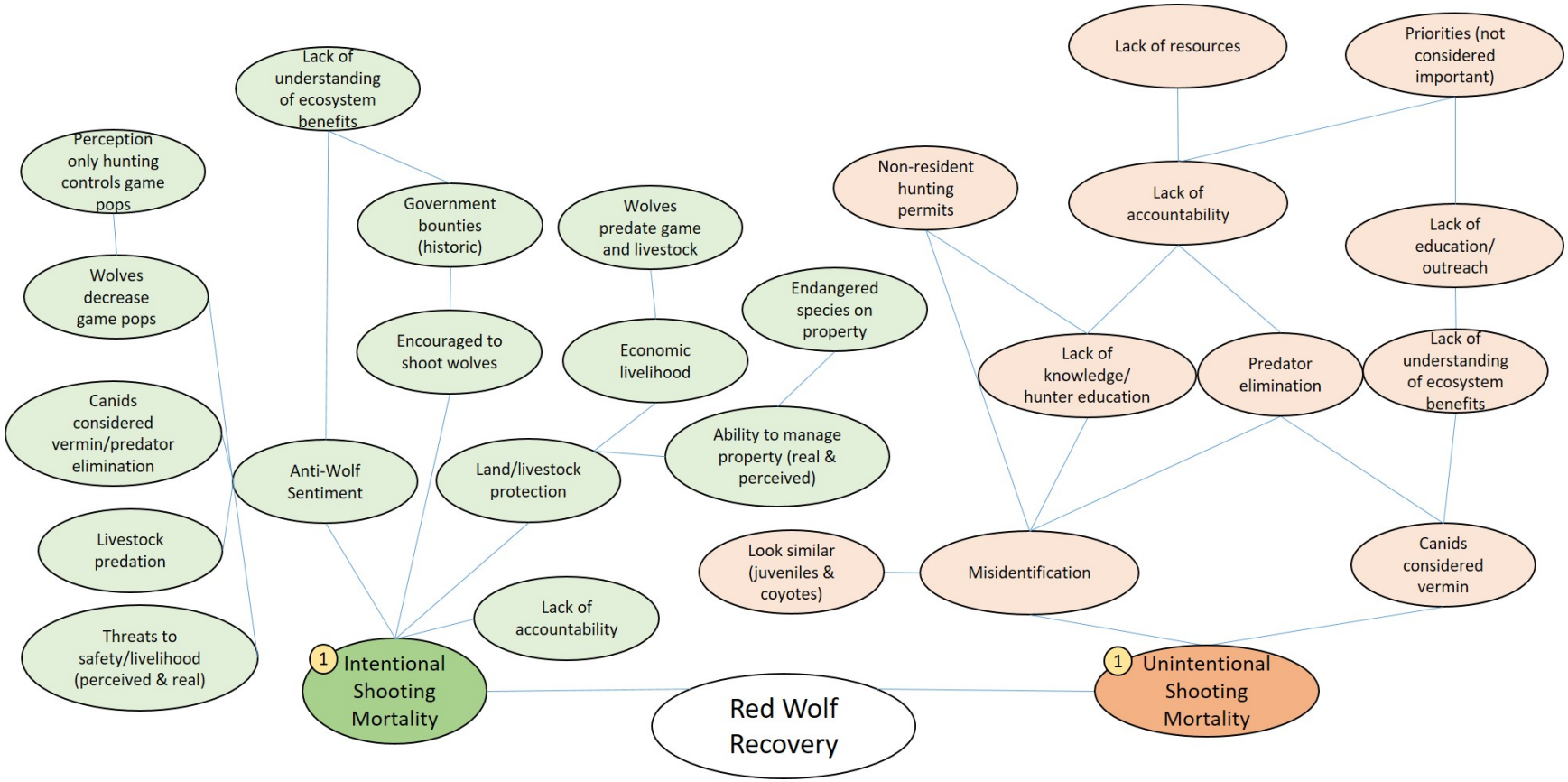


Figure 4b. Threats and challenges to red wolf recovery as identified by the Human Dimensions working group: Vehicle collision mortality. Numbers in small yellow circles refer to analogous portions of threat diagrams on preceding pages.

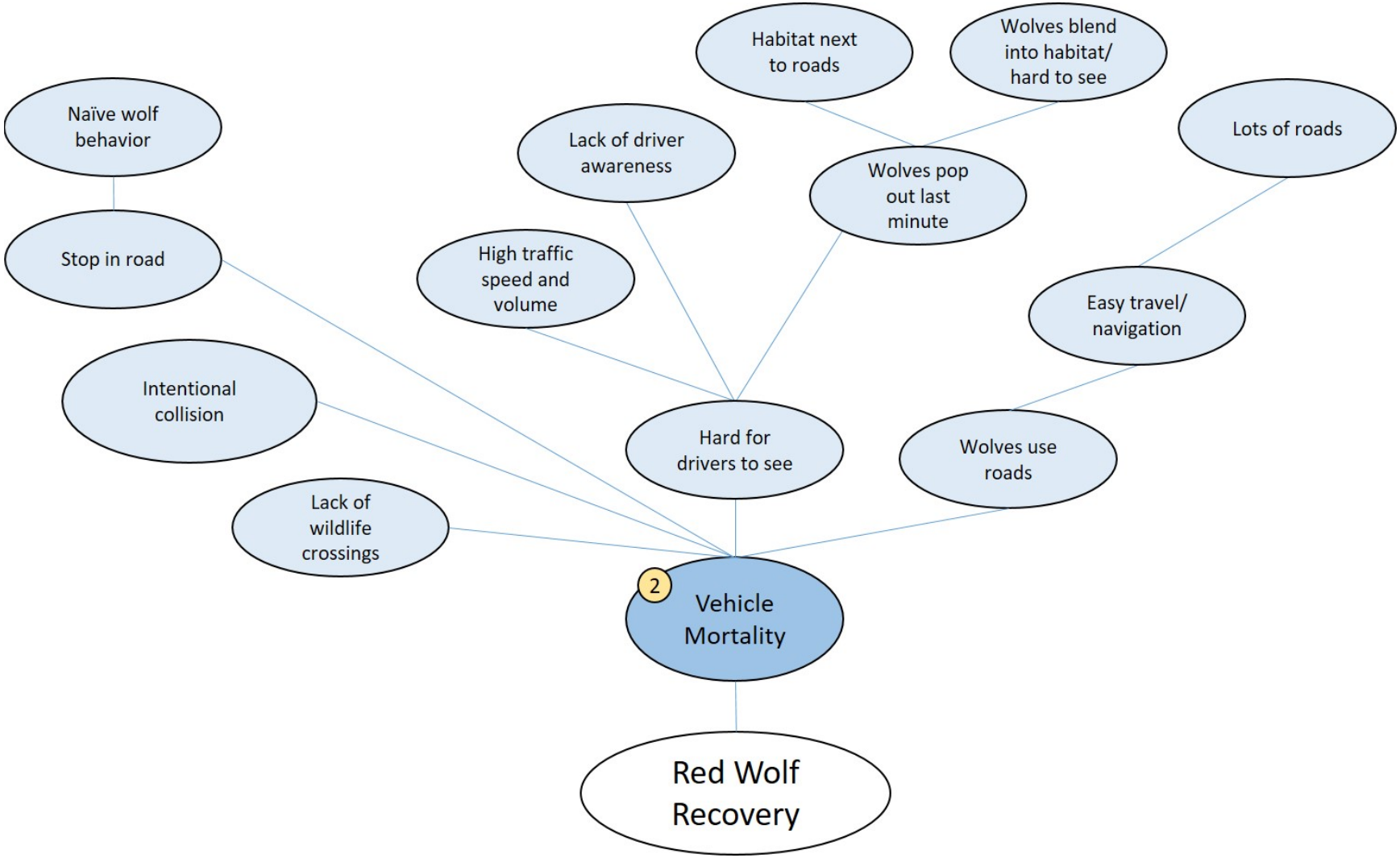


Figure 4c. Threats and challenges to red wolf recovery as identified by the Human Dimensions working group: Negative public perceptions of red wolves. Numbers in small yellow circles refer to analogous portions of threat diagrams on the following pages.

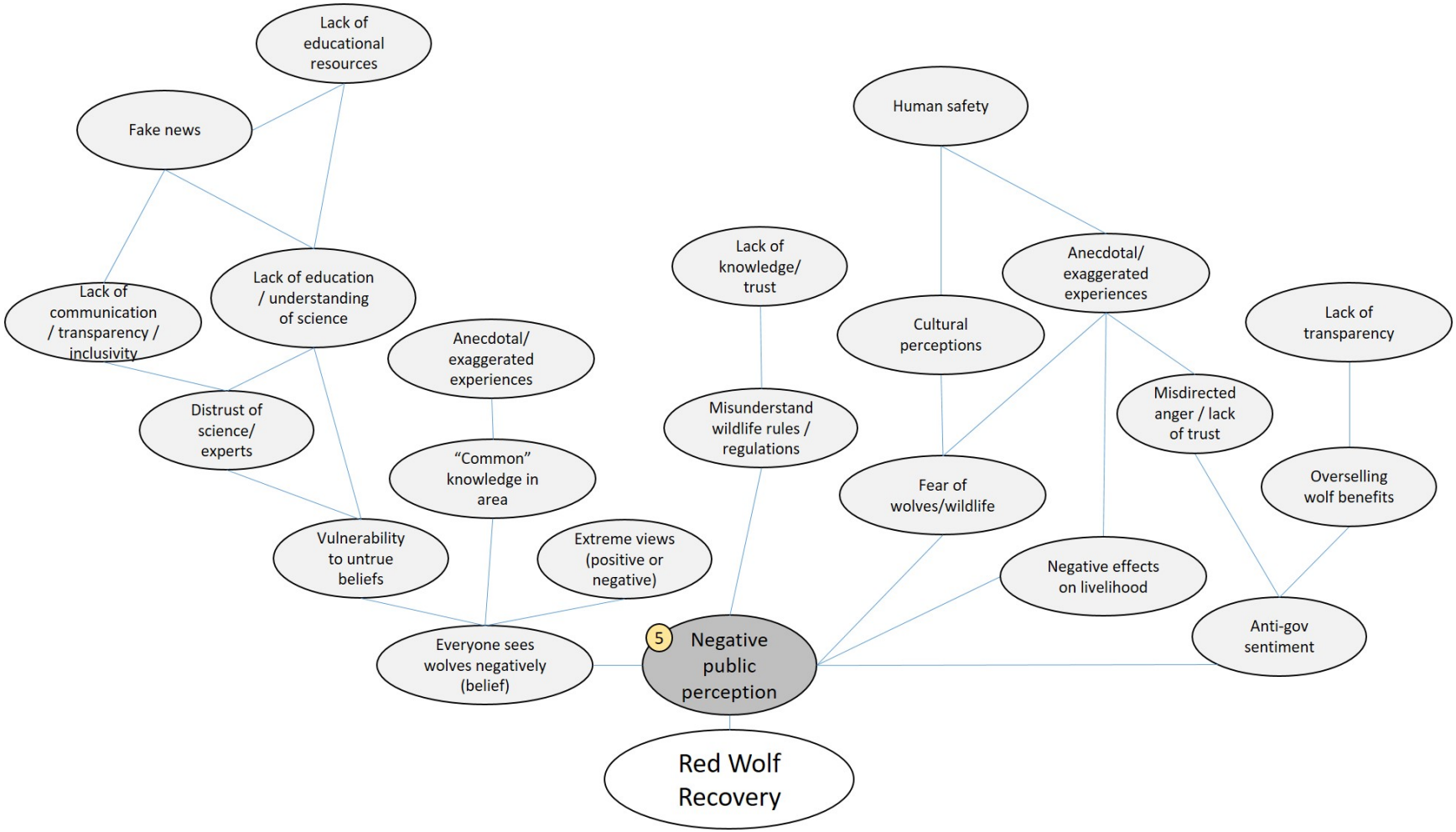
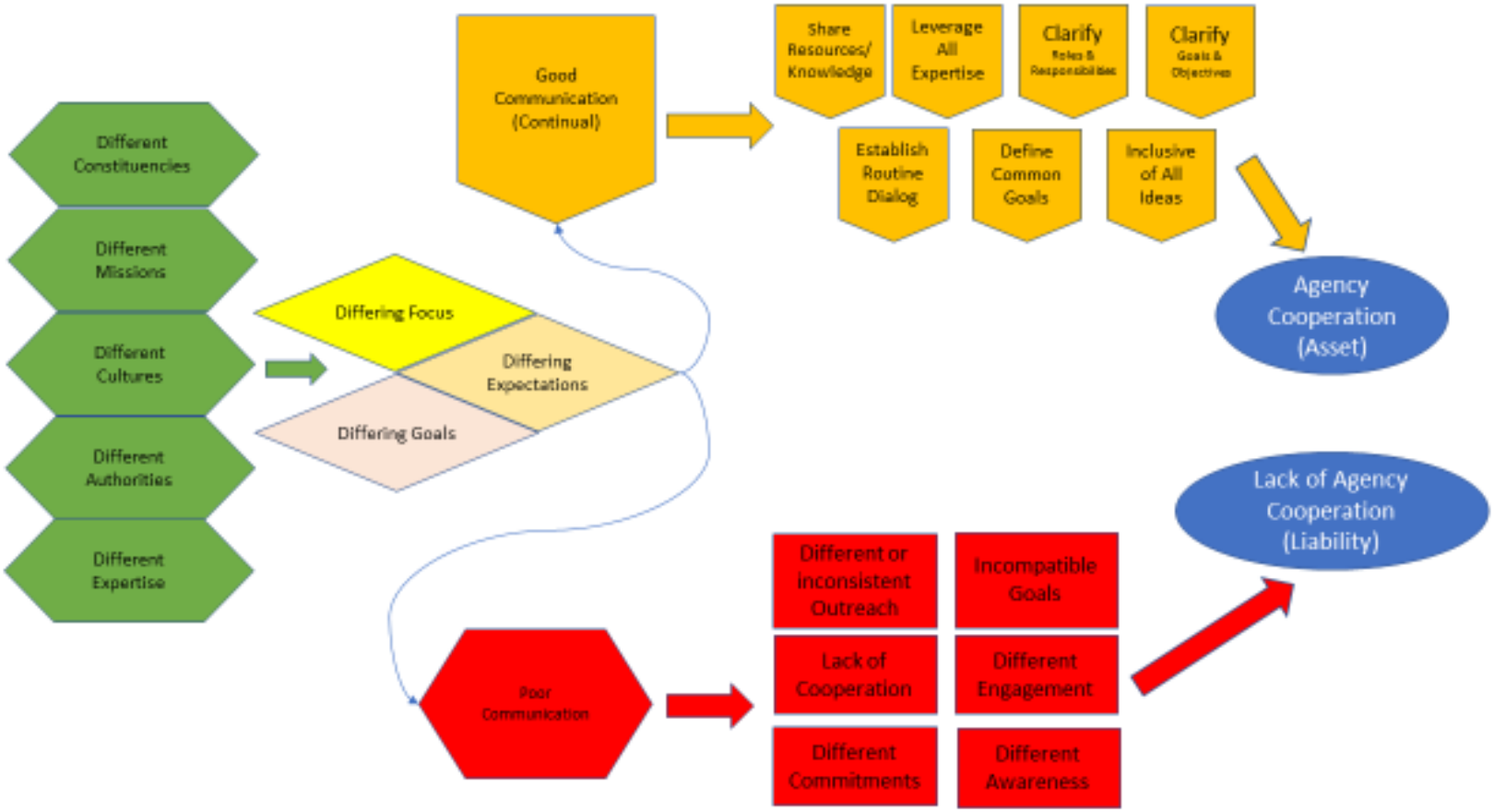


Figure 5. Threats and challenges to red wolf recovery as identified by the Inter-Agency Cooperation working group,and opportunities for mitigating those challenges. The diagram shows how inherent differences in mission, authority, constituencies and culture can influence agency goals, expectations and focus regarding red wolf recovery and how communication (good or poor) can mitigate or exacerbate those differences leading to either cooperation or cooperation challenges among agencies. [Note: Multiple factors affect cooperation among agencies, and the purpose of this diagram is not to imply that effective communication will always lead to full agreement among agencies on a given topic]



Recovery Objectives

Based on the information presented to this point by workshop participants (the Recovery Team), the overall workshop process facilitator drafted a set of preliminary objectives for red wolf recovery that incorporated key concepts from each of the five themes defining the working group topics within the workshop. Moreover, the objective statements were drafted in a manner that was consistent with the level of detail included in recovery plans currently produced by the U.S. Fish and Wildlife Service under their revised recovery planning framework (e.g., USFWS 2019).

The draft objectives were presented to the workshop participants and revised in response to suggestions made during plenary discussion. The final statements are presented below.

1. Reduce threats within each wild population unit to a level that will increase their demographic and genetic viability and resiliency.
2. Establish multiple self-sustaining populations of wild and free red wolf across the species' historic range, creating a functional metapopulation structure that is maintained either through natural dispersal or through assisted movements of individuals (translocation).
3. Maintain an ecologically functional phenotypic red wolf metapopulation on the landscape through minimizing negative interactions with closely-related canids (e.g., introgression with and mate monopolization with coyotes).
4. Increase the ex situ red wolf conservation effort in order to improve that population's capacity to support viable populations in the wild.
5. Empower the diverse stakeholder community to engage in collaborative conservation activities that promote red wolf recovery, while also acknowledging and supporting the broader needs of those communities.
6. Facilitate productive collaboration between State and federal agencies on recovery actions that satisfy recovery goals while fostering cooperation and relationships with stakeholders including communities in recovery areas.

These objective then become the basis for developing recovery criteria and actions as described in the following sections.

Recovery Criteria and Actions

The delisting criteria and recovery actions outlined below are organized according to the working groups that created them. This method for organizing information generated at the workshop will not be replicated in the draft recovery plan to follow, but is retained here for clarity of presentation.

Note that, at this point in the workshop, a new working group was formed to specifically address issue with managing the ex situ (captive) red wolf population and properly integrating it into the broader process of wild population recovery. In addition, the reader should recognize that while achieving the criteria and actions identified by the Human Dimensions and Inter-Agency Cooperation working groups may be critical in ultimately recovering the red wolf, the information produced by these groups does not lend itself to being incorporated into the structure of a traditional endangered species recovery plan that is focused on the biological needs of the focal species. Therefore, the bulk of the material in this section that was produced by these two groups will be included in the Recovery Implementation Strategy to follow from the recovery plan.

Working Group: Population Viability / Self-Sustaining Population (In Situ, Ex Situ)
(Aaron Valenta, Art Beyer, Brian Flock, Duke Rankin, Eric Gese, Jay Butfiloski, Mark Ruder, Mike Gillikin, Pat Gwin, Ryan Nordsven, and List Faust)

Delisting Criteria

1. Reduce the impacts of threats to the population to the point that mortality and fecundity rates result in stable or increasing growth rate (lambda equal to or greater than 1.0 over a XX-year running average).
2. Populations have the genetic integrity to persist and adapt with only occasional transfer of animals for management purposes; Populations are no longer reliant on annual releases from the SSP population.
3. Genetic management based on the best available science maintains or increases genetic diversity [and phenotypic expression and behavior?].
4. Intact packs and wolf/wolf breeding pairs hold core recovery territory against coyotes.

Recovery Actions

Overarching actions:

Use an adaptive management framework to implement actions and evaluate outcomes of management strategies

Use a population viability analysis (PVA) process to identify initial targets for each population in the Recovery Implementation Strategy

Specific actions:

1.1 Monitor cause-specific mortality
1.2 Monitor key population demographic rates (fecundity, mortality) and population size to estimate population growth rate
1.3 Monitor disease threats through targeted surveillance programs
1.4 Establish strategies (i.e. outreach, incentive programs, highway interventions, law enforcement programs) to target specific anthropogenic threats with different stakeholders
1.5 Establish post-delisting monitoring and management programs to maintain populations

2.1 Monitor genetic diversity in each population
2.2 Establish post-delisting monitoring and management actions to maintain genetic integrity

3.1 Use established and new techniques to minimize coyote introgression
3.2 Integrate less represented lineages into populations based on the best available science

4.1 Use established and new techniques to minimize coyote/wolf breeding
4.2 Monitor spatial ecology, i.e. territory size, pack composition, and percent occupancy of recovery areas

Other notes from this working group

- The population minimum size, target mortality and fecundity rates, etc. will need to be defined in the Recovery Implementation Strategy (RIS)
- translocations: “occasional” defined in RIS
- Genetics criteria:
  - (addressed in coyote introgression group?)
  - goal is both avoiding coyote introgression + potential for integration of TX red wolf genomes
- Intact packs criteria:

  - (addressed in coyote group?)
  - PHVA modeling group -- what is tipping point that is a stable population that can withstand territorial introgression from coyotes
- number of breeding pairs (wolf/wolf), number of litters -- this is what is monitored on the ground, good indicators?
- goal was to create measurable criteria, but not boxed into something that is outdated as best available science changes (i.e. PHVA showing a % of extinction)
- Increase numbers of individuals

Working Group: Captive Population
(Chris Lasher, Corinne Kendall, Sarah Long, Natalie Davis, Nucharin Songsasen)

Delisting Criteria [Note: This statement is unlikely to be directly incorporated into the upcoming recovery plan as a delisting criterion, as captive populations do not by themselves contribute to endangered species recovery. Nevertheless, this statement is included here as a written record of the product of this group and their recognition of the importance that ex situ population management will continue to play in the ongoing recovery effort for the red wolf.]

1. Increase the SSP population to a level sufficient for it to remain demographically strong and retain a higher gene diversity with increased probability of retaining 80% GD for 125 years while carrying out releases [Justification: Based on 2016 PVA (Faust et al. 2016), 400 animals was needed to ensure 88.5% probability of maintaining 80% genetic diversity.]

Recovery Actions

1.1 Secure spaces to increase total population of ex situ red wolves to achieve a level sufficient to remain demographically strong and retain a higher gene diversity with increased probability of retaining 80% GD for 125 years [Justification: Based on 2016 PVA (Faust et al. 2016), 400 animals was needed to ensure 88.5% probability of maintaining 80% genetic diversity.] (Priority 1)

1.2 Ensure ex situ population can support genetic and demographic sustainability of metapopulation by (Priority 1):
- providing sufficient and behaviorally competent individuals for adult releases;
- cross-fostering;
- gamete rescue;
- assisted reproduction;
- housing problem or threatened individuals.

1.3 Maintain support for management and coordination of Studbook and ex situ population (Priority 1)

1.4 Increase the reproductive success of ex situ pairs to 25% producing a litter (19% to 25%) [Justification: Based on 2016 PVA (Faust et al. 2016), this was considered realistic but desirable for genetic and demographic diversity.] (Prority 2)
- Increased breeding in SSP (through more breeding pairs or higher success of breeding pairs) will retain more gene diversity and slow the increase of inbreeding and associated effects (e.g., decreased litter size in SSP, increased infant mortality in NENC, birth sex ratio changes)

1.5 Improve existing and develop new reproductive technology for assisted breeding to enhance and maintain genetic diversity (Priority 2)

1.6 Assess and address infant and reproductive age individual trauma-related mortality to identify areas of husbandry that can be improved (Priority 2)

1.7 Assess and address genetic and other diseases impacting the ex situ populations to improve husbandry practices (Priority 2)
1.8 Secure pre-release sites where adult ex situ red wolves can be conditioned for life in the wild (Priority 3)
1.9 Utilize ex situ populations to increase awareness, engagement, and support for red wolf conservation (Priority 3)

Working Group: Geographic Scope / Metapopulation Connectivity
(Joe Madison, Joey Hinton, Nicole Lorenz)

Delisting Criteria

1. Three or more wild populations over large regions within the red wolf's historic range.
2. Each wild population achieves an abundance in which minimum manaement is needed for human-caused mortality and coyote introgression.
3. The extent of each wild population allows red wolves to live out their lives (born, disperse, die of natural causes and serve their ecological role in the NEP).
4. Multiple NEPs are established, with human-assisted dispersal and/or translocations permitted.

(Note: important to maintain the current NEP located in North Carolina as one of the desired wild populations)

Recovery Actions

1.1 Complete updated PVA to identify number and sizes of populations needed.
1.2 Complete human dimension and habitat assessments to identify a group of sites across the historic range that represent diverse ecoregions.
1.3 Collaborate on state, tribal and other federal agency support in potential reintroduction sites.
1.4 Reintroduction of red wolves to the wild to areas based on the above actions.

2.1 Establish an adaptive management plan separately for each population based on the best available science (Include monitoring, genetic fitness, inbreeding depression, etc.).
2.2 Establish sufficient breeding pairs for each population.
2.3 Ensure prey base is adequate initially and managed over time to support the population.

3.1 Establish programs that address predator/prey interactions and adequate habitat such as Prey for the Pack, Pay for Presence, etc.

4.1 Establish methodology for determining movements between populations (captive and wild)

Working Group: Genetic Viability and Introgession
(Jen Adams, Bridgett vonHoldt, Ryan Nordsven, Ben Sacks, Tom Risch, Kristin Brzeski)

Delisting Criteria

1. There are at least X wild, free-ranging red wolf populations in the species' historic range.
2. Referencing the SSP and NCNEP studies, we want to maintain that:
    a. A minimum of X% of individuals in every wild free-ranging red wolf population is above 1 standard deviation below the average body size (e.g. weight, morphometrics) of the reference red wolves from SSP and NCNEP, with sex and aged- corrected. [Activity: wildlife cameras]

   b. Sympatric coyote densities have significantly declined and maintain smaller home ranges due to the presence of the wild, free-ranging red wolf population. The rationale is linked to the significantly larger amount of space-use by red wolves relative to sympatric coyotes, the exclusion of coyotes, and the incorporation of local ecological resources. [Activity: radio collar and camera data; non-invasive sampling]
3. X% of the SSP genetic diversity is translocated in the wild, free-ranging red wolf populations, monitor inbreeding values, and retain the option to translocate genetic diversity of wild populations back into SPP (w.r.t. genetic divergence). [Activity: genetics; translocations]
4. Integration of newly discovered and ancestral/historical genetic diversity. [Activity: genetics; translocations]
5. More criteria are expected as we fill in our knowledge gap to incorporate as we learn more about ancestral genetics, ancestry, body size variation, etc. and reclassify with increasing information.

<u>Recovery Actions</u>

1. Identify suitable/intact/contiguous available red wolf habitat.
2. Prepare the introduction site to ensure the success of all released red wolves
   a. Activity: Sterilize local coyotes; Survey genetic diversity, ancestry, morphometrics, and demography of existing canid population; Determine maximum number of animals that can be released
3. Establish a soft-release design that maximizes the success of introduced red wolves across their historic range with respect to ecological function, phenotype, group cohesion and inbreeding avoidance
   a. Activity: Introduce individuals from SSP to NCNEP and new sites. [Side note: goal to rebuild/revive the NCNEP population; possibly function as a future source for future translocations and cross-fostering]
   b. Activity: When possible, prioritize larger-sized red wolves to support the ecological function, exclusion of coyotes, conspecific reproduction, and space-use.
   c. Activity: Utilize both genetic and pedigree information to select family groups for release that minimize the inter-group relatedness (for inbreeding avoidance)
4. Establish and maintain successful long-term stable breeding pairs.
   a. Activity: Propagation semi-wild sites to help transition between environments.
   b. Activity: Broken breeding pairs (loss of mate) are translocated to an acclimation site, encouraged to form a new pair bond prior to a release to the introduction site.
5. Monitor genetic diversity, inbreeding, and admixture (introgression) of all populations
   a. Activity: Annual genetic testing and surveillance of red wolves and local canids
6. Identify, prioritize, and archive biomaterials (biological information) for the inclusion and exchange of genetic variation that is not represented in the SSP for integration into any of the wild, free-ranging red wolf populations (or if lost or not currently present into the SSP).
   a. Activity: Annual genetic testing and surveillance of red wolves and canids from the red wolf historic range.
   b. Activity: Through the discovery of new founders that could be introduced into the wild, free-ranging red wolf populations and the SSP; Selective breeding of individuals (i.e. intercross) with high red wolf ancestry content to establish new genomic variation of historic or newly discovered variation.
   c. Activity: Consider new technologies of improved breeding strategies and enhanced artificial means of conserving genomic content for individuals who do not reproduce by natural means; establish and maintain a biobank archive of various tissue types.

Working Group: Human Dimensions
(Angelina Casillas, Amy Johnson, Jay Butfiloski, Wes Seegars, David Clegg, Becky Gwynn, Amielle DeWan, Duke Rankin, Kim Wheeler, Emily Weller, Regina Mossotti, Lauren Toivonen, Suzanne Agan)

Delisting Criteria

1. Human-induced mortality: Anthropogenic mortality does not hinder sustainable growth within the red wolf population.
2. Community input: Diverse stakeholders, including the community, participate through communication and engagement, therefore influencing red wolf conservation through collaborative planning and adaptive management.
3. Public perception: Informational programs are established in areas of reintroduction sites.

Recovery Actions

Unintentional mortality:

1.1 Consistent and long term public informational resources for identification and presence of red wolves (e.g. signage)

1.2 Conduct research on captive-released vs. wild-born wolves to understand behavioral differences (e.g. vehicle crossings, seasonal behaviors)

Intentional mortality:

1.3 Increase accountability for people who are found liable for intentional killing of red wolves

1.4 Agency alignment of consequences for red wolf mortalities (determine who holds prosecutorial authority)

2.1 Ensure inclusiveness of participating stakeholders: Identify ambassadors representative of entire stakeholder community to help guide decision making and conversations (hunters, tribal reps, landowners, farmers, local government, educators, administrators, small business owners, etc.).

2.2 Create opportunities for resource sharing and exchange (e.g. information hubs, lesson plans, red wolf representatives attend public events, school field trips).

3.1 Generate informational products that raise awareness and garner support for red wolf conservation at local and regional levels.

a. Establish an activity/interactive reporting platform (positive and negative) for landowners/general public (or human-wolf interaction)
b. Create an incentive program to promote acceptance around the presence of red wolves
c. Survey of stakeholders in potential recovery areas?

Notes

Fourth delisting criterion not used now, but retained for future reference:

Economic growth within community: Communities surrounding red wolf recovery areas demonstrate increased economic growth as a result of red wolf recovery activities

Working Group: Inter-Agency Cooperation
(Kelly Davis, Andrea Shipley, Pete Benjamin, Liz Rutledge, Dave Holdermann, Robert Wayne, with ediorial assistance provided by Colleen Offenbuttel)

Roadmap Development Criteria

1. A management plan is developed and periodically updated by the principal agencies (state wildlife agencies and USFWS).
2. Biannual meetings between the principal agencies (state wildlife agencies and USFWS) are coordinated regularly.
3. Inter-agency cooperation is put in place to create a supportive and realistic set of human perceptions of red wolves and the wolf reintroduction program.

Delisting Criterion

4. State wildlife agencies actively cooperate in managing for persistent red wolf populations.

Cooperation Criteria

5. State and federal wildlife agencies develop a grassroots approach to relationshi interactions.
6. Education and other strategic communication products are developed.

Recovery Actions

1.1 Create a mutually developed, signed 5-year management plan between sate and federal agencies that enables the achievement of other population criteria for success.
   a. Identify specific geographic areas, relationships and actions that will be taken by each agency and specify the necessary resources.
   b. The management plan would be revised in coordination with the 5-year cycle of the USFWS species status assessment review process.
   c. The aproach would be tailored to the local landscape and encourage stakeholder engagement and inclusion at the local level.

2.1 Facilitate frequent coordination between the state wildlife agency and USFWS regarding planning, field actions, and exigencies of either wolves or interactions between humans and large sympatric canids.

2.2 Schedule biannual meetings between the state wildlife agency and the USFWS to review recovery progress and to address important recovery issues (e.g., conflicts, adaptive-tactical measures, etc.)

3.1 Create an MOU between agencies to take strategic steps to create public support amongst local recovery area stakeholders (this is the umbrella of principles)

3.2 Review any applicable agreements for any appropriate changes that need to be made.

3.3 Create landowner liaison, law enforcement and public relations teams

3.4 Engage strategically with wildlife advocacy groups to reduce current and potential litigation events

3.5 Engage with hunting, trapping and wildlife conservation organizations to promote transparency, collaboration and partnerships.

3.6 Develop a law enforcement roadmap for strategic interactions with local stakeholders and law enforcement.

4.1 USFWS offers post-delisting monitoring period assistance to state wildlife agencies.

4.2 Develop state rules for long-term population viability.

4.3 Develop rules for creating regulated hunting seasons using the PVA as a basis for making science-based and biologically sound management decisions to inform the percent of harvest that is biologically sustainable in both short- and long-term horizons.

5.1 Involve state and federal agency personnel in local events where there can be personal interaction with landowners and other stakeholders.
5.2 Create flexibility among agencies in working with particular stakeholders in a transparent and coordinated manner.
5.3 Develop value-added programs for recovery area landowners.
5.4 Develop programs that would benefit local commnities (e.g., cleaning canals, invasive vegatation control, etc.)

6.1 Develop intra- and inter-agency education programs for staff at multiple levels.
6.2 Create a written response plan for law enforcement to handle red wolf or other canid issues.
6.3 Ameliorate red wolf issues among local stakeholders.
6.4 Create and distribute stakeholder surveys to monitor trends in perceptions, experiences and attitudes about the recovery program.

Notes / Additional Material

Successful recovery of endangered species depends on engagement with a variety of stakeholders. In particular, many different state and federal agencies have important roles to play in red wolf recovery. While the U.S. Fish and Wildlife Service (USFWS) is primarily responsible for administering the Endangered Species Act, other federal agencies (such as those with large land bases that could serve as centers for red wolf reintroductions) also play important roles. Finally, we emphasize the importance of the role of state wildlife agencies in the recovery of an endangered species, and we believe successful recovery outcomes in large part depend on the development of consensus beween the USFWS and host state wildlife agency(s) regarding recovery objectives, actions, and desired outcomes. We acknowledge the differences in jurisdictional authority and that some inherent differences exist in expertise, constituents, and cultures between the USFWS and states. However, we stress that these differences can be beneficial to the recovery process. Diverse perspectives, values, knowledge, and experiences can be leveraged to generate diverse and novel ideas to overcome obstacles to species recovery.

State agencies play an important role in species recovery, share statutory trust responsibilities for listed species, and recovery success means that management of the species will ultimately be the primary responsibility of the states. Moreover, the regulations for implementing Section 10(j) of the Endangered Species Act (the process through which most predator reintroductions to date have occurred) state (50 CFR 17.81(d)) that: “to the maximum extent practicable, [section 10(j) regulations shall] represent an agreement between the Fish and Wildlife Service, the affected State and Federal agencies and persons holding any interest in land which may be affected by the establishment of an experimental population.”

Given the above and that agencies have some differences in missions, statutory authorities, expertise, cultures, and constituency expectations, it is clear that success of red wolf recovery depends in large part on there being an understanding among all stakeholders, particularly the primary agencies involved, regarding the goals, objectives, and actions of the recovery effort and the roles and responsibilities and expectations of all partners. That said, restoration of federally-listed species, such as the red wolf, has the potential to accentuate the differences among agencies. Reconsiling these differences and finding common ground is a key to successful species reintroduction programs. To be clear, that these differences at times lead to challenges in communication and cooperation is not the fault of any particular agency. All involved agencies share a responsibility to each other and the process, with

the USFWS (has the lead agency responsible for administration of the ESA) having perhaps the lion's share of responsibility for ensuring the concerns and needs of all stakeholders are heard and addressed.

Next Steps in Red Wolf Recovery Planning

As this workshop report is being distributed and the Service's official recovery plan is being drafted, the next phase of red wolf recovery planning is already underway: development of a population viability analysis, or PVA. This analysis will provide crucial insights into the biological, demographic and genetic characteristics of red wolf populations that will meaningfully contribute to recovery of the species across its historic range. Specifically, the PVA can help give guidance on the number of red wolf populations, the abundance of individuals in those populations, and the annual growth rate of each population that, over time, are expected to be demographically and genetically viable. The more precise definitions of viability used in the PVA – metrics like risk of population extinction or decline below a given abundance threshold; likelihood of retaining a given level of population genetic diversity; or maintaining a target level of red wolf ancestry in the presence of coyote introgression – will be based on the definitions of recovery success discussed in this initial workshop process. The Conservation Planning Specialist Group (CPSG) will once again work with the Recovery Team to develop this PVA, with the demographic simulation model used for the analysis to be based on a recent analysis (Faust et al. 2016) that focused on the long-term viability of the *ex situ* (captive) red wolf population in support of wild population recovery. The current PVA effort is expected to be completed in December 2022.

Following the completion of the PVA, the Recovery Team will enter the third and final phase of the project, which involves the develoment of the Recovery Implementation Strategy, or RIS. The Strategy will feature the specification of detailed actions needed for red wolf recovery, based on information assembled in the recovery planning workshop process (described in this report) and on results obtained in the 2022 population viability analysis. Importantly, the RIS will specify the detailed quantitative criteria deemed essential for species recovery. CPSG will work closely with the Service to design and facilitate this final element of the recovery planning project. The RIS is expected to be ready for internal USFWS review by August 2023, and to be made available to the public in early 2024.

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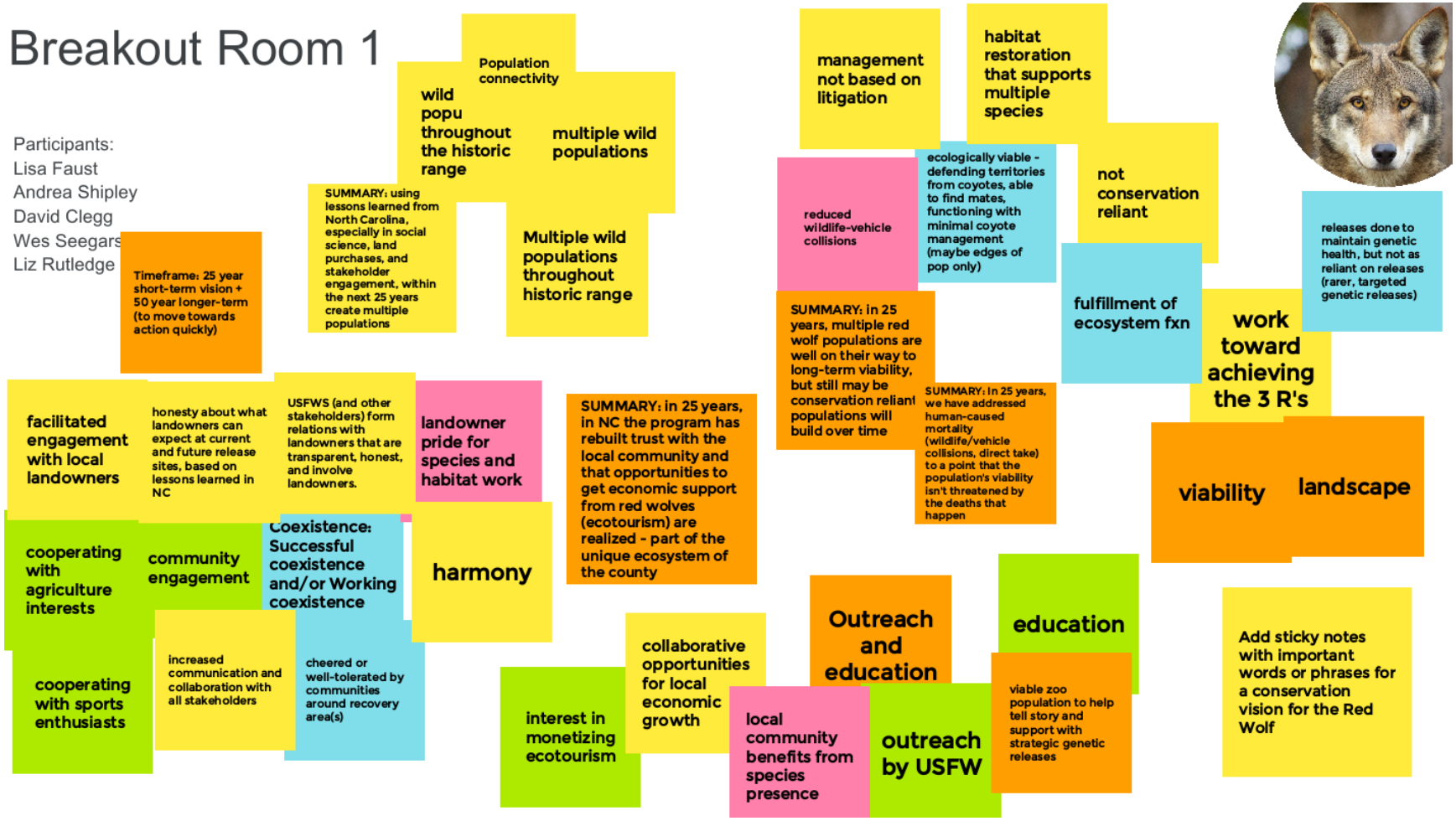
USFWS. 2019. Recovery Planning and Implementation: Fact Sheet. U.S. Fish and Wildlife Service Ecological Services, Falls Church, VA.

Appendix 1.
Workshop Participants

Name	Organization	Day 1	Day 2	Day 3	Day 4
Jennifer Adams	University of Idaho	X	X		X
Suzanne Agan	Kennesaw State University	X		X	
Pete Benjamin	U.S. Fish and Wildlife Service	X	X	X	X
Art Beyer	U.S. Fish and Wildlife Service	X		X	X
Kristin Brzeski	Michigan Technology University	X	X	X	X
Jay Butfiloski	South Carolina Department of Natural Resources	X	X	X	X
Angelina Casillas	Conservation Centers for Species Survival (C2S2)	X	X	X	X
Michael Cherry	Texas A&M University-Kingsville	X	X		X
David Clegg	Tyrrell County, North Carolina	X	X	X	X
Kelly Davis	Hyde County Landowner/ North Carolina Wildlife Resources Commission	X	X	X	X
Natalie Davis	Point Defiance Zoo			X	X
Amielle DeWan	Impact by Design Inc.	X	X		
Lisa Faust	Lincoln Park Zoo	X	X	X	X
Mike Fies	Virginia Department of Wildlife Resources	X	X		
Brian Flock	Tennessee Wildlife Resources Agency	X	X	X	AM
Eric Gese	Utah State University			X	X
Mike Gillikin	Florida Fish and Wildlife Conservation Commission	X	X	X	X
Pat Gwin	Cherokee Nation	X	X	X	X
Becky Gwynn	Virginia Department of Wildlife Resources	X	X	PM	
Becky Harrison	U.S. Fish and Wildlife Service	X	X		
Joey Hinton	Wolf Conservation Center	X	X	X	X
Dave Holderman	Texas Parks and Wildlife	X	X	X	X
Bridgett vonHoldt	Princeton University	X	X	PM	X
Amy Johnson	Smithsonian Conservation Biology Institute	X	X	X	X
Jason Keith	U.S. Fish and Wildlife Service				
Corinne Kendall	North Carolina Zoo	X	X	X	X

Name	Organization	Day 1	Day 2	Day 3	Day 4
Chris Lasher	North Carolina Zoo	X	X	X	X
Sarah Long	Independent Consultant	X	X	X	X
Nicole Lorenz	Louisiana Department of Wildlife and Fisheries			X	
Joe Madison	U.S. Fish and Wildlife Service	X	X	X	X
Phil Miller	Conservation Planning Specialist Group	X	X	X	X
Leigh Mitchell	Upper Mattaponi Tribe	X	X		
Regina Mossotti	Endangered Wolf Center	X	X	X	X
Ryan Nordsven	U.S. Fish and Wildlife Service	X	X	X	X
Colleen Olfenbuttel	North Carolina Wildlife Resources Commission	X			PM
Mike Phillips	Turner Endangered Species Fund	X	X	X	
Kaleigh Pollak	Monacan Indian Nation	X	X		
Duke Rankin	U.S. Department of Agriculture Forest Service	X	X	X	X
Tom Risch	Arkansas State University	X	X	X	X
Mark Ruder	University of Georgia	X	X	X	X
Liz Rutledge	North Carolina Wildlife Federation	X	X	X	X
Ben Sacks	University of California, Davis	X	X	X	X
Wes Seegars	Hyde County Landowner/ North Carolina Wildlife Resources Commission	X	X	X	X
Andrea Shipley	North Carolina Wildlife Resources Commission	X	X	X	X
Nucharin Songsasen	Smithsonian Conservation Biology Institute	X	X	X	X
Lauren Toivonen	U.S. Fish and Wildlife Service	X	X	X	X
Aaron Valenta	U.S. Fish and Wildlife Service	X	X	X	X
Will Waddell	Point Defiance Zoo (Retired)		X		PM
Robert Wayne	North Carolina Wildlife Resources Commission			X	X
Emily Weller	U.S. Fish and Wildlife Service	X	X	X	X
Kim Wheeler	Red Wolf Coalition	X	X	X	X
Stephanie Winton	Conservation Planning Specialist Group – Canada	X	X	X	X

Appendix 2.
Breakout Group Digital Whiteboards for Visioning Exercise



Appendix 2. (Continued)
Breakout Group Digital Whiteboards for Visioning Exercise

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Breakout Group Digital Whiteboards for Visioning Exercise

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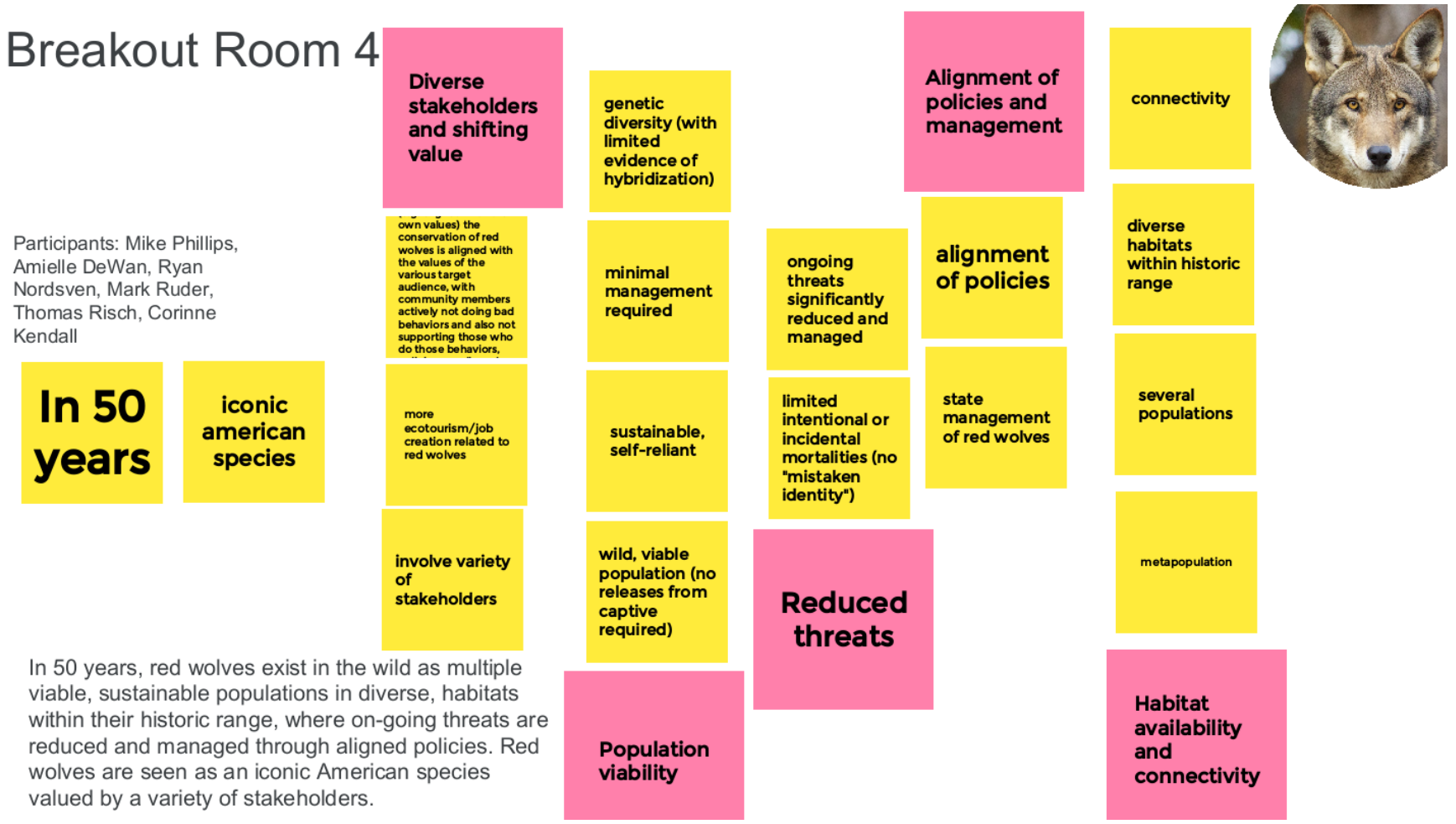
Breakout Group Digital Whiteboards for Visioning Exercise



Appendix 2. (Continued)
Breakout Group Digital Whiteboards for Visioning Exercise

Appendix 2. (Continued)
Breakout Group Digital Whiteboards for Visioning Exercise

Breakout Room 6

Participants:
Chris Lasher, Jennifer Adams, Pete Benjamin, Dave Holderman, Amy Johnson, Duke Rankin, Aaron Valenta

Notetaker: Aaron
Facilitator: Duke Rankin
Presenter: Amy
Timer: Jennifer

Group Representation:
University, State/Federal, Researchers, NGO's, Zoos, practitioners,

Time Frame? 25 years, 50 years?

- Community ownership
- Support and input at the landowner, hunter, community, state and federal levels
- Incorporation of human dimensions
- Tolerance
- Coexistence
- Awareness
- Collaboration
- Diverse perspectives
- Connectivity (dispersal opportunities)
- Genetic diversity within each distinct population
- Multiple recovery areas that are ecologically distributed across the historic range
- Active research and monitoring
- Restored ecosystem function
- Vibrant core population
- Genetically Diverse
- Expanded SSP to support multiple recovery areas

Appendix 3.
Breakout Group Digital Whiteboards for Defining Success in Recovery (Operationalizing the Vision)

Key element: Population Viability/Self-Sustaining Population (In Situ, Ex Situ)

Working group members:

Mike Phillips
Aaron Valenta-Note taker
Michael Cherry
Nuch Songsasen
Will Waddel
Corrine Kendall

Chris Lasher
Lisa Faust- presenter
Becky Harrison-facilitator
Mark Ruder
Brian Flock
Mike Gillikin
Pat Gwin

Group 2:
Will Waddell
Regina Mossotti
Pat Gwin
Sarah Long
Nuch Songsasen
Ryan Nordsven
Joey Hinton
Becky Bartel Harrison
Michael Cherry

Instructions:
1. Identify appropriate words or phrases related to this key element that are included in the vision statement or are derived from the statement.
2. Discuss how you would specifically define those terms, particularly in terms of how you would measure progress towards achieving the desired state in the quest for red wolf recovery. Be as specific as you can be where appropriate.
3. Create draft definitions of those terms for review by the Recovery Team.

Key Words:
Viable: Red wolves can avoid extinction in the wild given anticipated management, threats, environmental stochasticity, etc. Wild populations have less than 5% risk of extinction over 100 years while maintaining 85% of the captive population's genetic diversity. **Needs more work/thought: this will require multiple populations to avoid risk to the overall species.

Sustainable: viable and resilient (able to sustain populations in the face of environmental variation and periodic disturance) without extensive intervention. Extensive intervention is defined as regular/annual releases, placeholder management, etc. Occasional interventions (translocation) may be needed to maintain genetic viability.

Functional: Ecologically functionality as an apex predator with natural biological processes (survival, reproduction, dispersal, etc.) that support population growth and stability (viability).

Effectively mitigated threats: existing and new threats that impact important population vital rates are addressed and reduced to levels that do not negatively impact population dynamics

"Intervention": Mgmt interventions such as translocating red wolves.
"Extensive": regular/annual releases, placeholder management
A thought: Intervention may be a positive mgmt need. For example, the need to remove /relocate problem wolves or those that pose a risk. Interventions as separate from chronic/typical management once delisting has been achieved are compatible with viable/sustainable

Appendix 3. (Continued)
Breakout Group Digital Whiteboards for Defining Success in Recovery (Operationalizing the Vision)

Key element: Geographic Scope / Metapopulation Connectivity

Working group members:
Joe Madison (FWS)
Joey Hinton (WCC) - presenter
Mike Fies (VDWR) - notetaker
Sarah Long (consultant, population biologist)
Dave Holdermann (TX Parks and Wildlife)
Kaleigh Pollak (Monacan Indian Nation)

Group 2
Corinne Kendall
Jay Butfiloski
Mike Phillips
Mike Fies
Joey Hinton

Instructions:
1. Identify appropriate words or phrases related to this key element that are included in the vision statement or are derived from the statement.
2. Discuss how you would specifically define those terms, particularly in terms of how you would measure progress towards achieving the desired state in the quest for red wolf recovery. Be as specific as you can be where appropriate.
3. Create draft definitions of those terms for review by the Recovery Team.

Diverse historic range

Suitable areas within historic range as defined by SSA

Federal land to anchor project

Diverse = different habitat types among restoration areas

Multiple populations

Multiple = 3 or more sites

Large region that includes a diversity of ecoregions

Human assisted connectivity might be needed

Viable populations

Viable = ability to persist

Will state wildlife agencies be in it for the long haul?

Sustainable populations

Geographically distributed to reduce risk from natural disasters (i.e. hurricanes)

Ideally connected populations, but may not be possible initially.

Most likely will always be conservation reliant

Secure landscape

Secure = lives entire life in landscape, can reproduce, safely disperse

Sociologically secure

Functional

Ecologically functional with regard to serving role in ecosystem

... red wolves will exist freely as multiple, viable, sustainable, functional populations across their diverse historic range ...

Functional not needed? Multiple, viable, sustainable = functional?

Appendix 3. (Continued)
Breakout Group Digital Whiteboards for Defining Success in Recovery (Operationalizing the Vision)

Key element: Genetic Viability and Introgression

Working group members:
Jen Adams (timekeeping)
Bridgett vonHoldt (notes)
Ryan Nordsven (rnd 1)
Ben Sacks (presenter)
Tom Risch
Kristin Brzeski (facilitate)

Chris Lasher (round 2)

Maintain a phenotypic and genotypic red wolf on the landscape

Instructions:
1. Identify appropriate words or phrases related to this key element that are included in the vision statement or are derived from the statement.
2. Discuss how you would specifically define those terms, particularly in terms of how you would measure progress towards achieving the desired state in the quest for red wolf recovery. Be as specific as you can be where appropriate.
3. Create draft definitions of those terms for review by the Recovery Team.

Integrity

Genetic viability: Presence of genetic diversity, allelic richness, avoidance of autozygosity, high content red wolf ancestry; Measured by standard population genetic metrics and a panel of genome-wide loci with ancestry informative analyses

Retaining genetic variation for adaptive potential: define; measure

Functional preservation: From an ecologically-functioning phenotypic red wolf across the historic range, expectation for role of the wolf across a diverse landscape; Measured by a composite profile of an individual's collection of phenotypic/behavioral attributes

Possible to have different introgression thresholds based on geographic locations; zone-specific management?

PVA incorporate historic genetic variation on the landscape alongside the SSP variation at new recovery sites

The adaptive management plan must have the flexiblity for criteria/assessments to adjust objectives

NC and pedigree-based thresholds for adaptive management versus retaining important variation in admixed/hybrid individuals (targeted for preservation)

Preservation of genetic variation for 1) adaptive potential; 2) species-specific alleles; and 3) genetic diversity

Multiple (meta?) populations; dispersal

Inbreeding and trait depression

Anthropogenic disruption of breeding pairs

Threat of coyote introgression

Stratify by age of introgressed fragments

Appendix 3. (Continued)
Breakout Group Digital Whiteboards for Defining Success in Recovery (Operationalizing the Vision)

Key element: Human dimensions (pride, landowner support, trust, engagement)

Working group members:

Angelina Casillas, Amy Johnson, Jay Butfiloski, Wes Seegars, David Clegg, Becky Gwynn, Amielle DeWan, Duke Rankin, Kim Wheeler, Emily Weller, Regina Mossotti, Lauren Toivonen, Kelly Davis, Aaron Valenta

Instructions:
1. Identify appropriate words or phrases related to this key element that are included in the vision statement or are derived from the statement.
2. Discuss how you would specifically define those terms, particularly in terms of how you would measure progress towards achieving the desired state in the quest for red wolf recovery. Be as specific as you can be where appropriate.
3. Create draft definitions of those terms for review by the Recovery Team.

Public Trust — A true partnership that projects honesty, transparency and open communication and helps further red wolf conservation benefitting both red wolves and stakeholders

Measures of success: diversity and magnitude of stakeholders who attend (respond, comment, review, etc.), participation in "Prey for the Pack" program, positive communications/interactions between FWS and landowners, number of public and private partnerships (increasing) over time, % of community members who feel the NR agencies responsible for red wolf recovery are worthy of trust

Economic development (rather than growth) — Red wolves are a catalyst for the enhancement (and not the detriment) of the amount of goods of services (developed) per head of the population over a period of time.

Engagement — The involvement, participation, and exchange of knowledge with the relevant public in the recovery and conservation efforts of the red wolf for the benefit of the species and the community (stakeholders and / public?)

Pride — To achieve, identify with, and celebrate red wolves in the landscape as the only wolf species endemic to the United States.

Stakeholders — A person, agency, or organization that has interest in or is affected by red wolf conservation

Cultural importance — Red wolf recovery is reflective of the values, beliefs, and historical significance of the communities in which they coexist.

Community Ownership — The community influences the recovery and conservation of the species and is involved in the details and outcomes of the process

In the future, wild American red wolves will exist freely as multiple viable, sustainable, functional populations across their diverse historic range, where ongoing threats are effectively mitigated through the public's trust and engagement and aligned policies among all stakeholders. The American red wolf will provide a strong sense of community ownership, cultural importance, and pride, while promoting local economic growth.

Words not currently in the vision but under consideration

Coexistance

DISCUSSION NOTES FROM HUMAN DIMNESIONS GROUP FOR THE PARKING LOT AND LATER DISCUSSION
no follow-up, mistrust, miscommunication between service and landowners,
landowners could be ready to move on with appropriate communication, lessons learned, there are opportunities to get back the mistrust
small population
acceptance
economic engine - fishing, forestry, agriculture. Focus the reintro program as agriculture-friendly, forestry friendly, sportsman friendly, ecotourism-friendly
people don't need to love wolves, they need to not hate them (acceptance)
"We're here to listen", acknowledging different perspectives
small group meetings to get buy-in from communities representative of all groups within the red wolf reintro area - who are the leaders of these groups?
acknowledge that promises weren't kept the first time around
respect, truthfulness, integrity
relationship building with individual landowners
Identify landowner ambassadors that are representative of all groups involved
Locals didn't know who to contact - establish clear lines of communication
public hearings to solicit public input - involve the public in the entire process to avoid pushback, mistrust, etc.
use small working groups vs. large public meetings
work with commissioners to recruit landowners to discuss red wolf issues and request input
acknowledge differences in how decisions are made across state borders
liability can impact ecotourism
The recovery team needs to have these conversations in affected counties
They want to know how this recovery directly impacts them (they are tremendously engaged, not always positively)

Notes on Economic development: (local business benefitting from increased tourism, entrepreneurial growth. increased private lands access, industry is not negatively impacted by red wolves and is sometimes augmented by the presence of red wolves)

Appendix 3. (Continued)
Breakout Group Digital Whiteboards for Defining Success in Recovery (Operationalizing the Vision)

Key element: Alignment between agencies

Instructions:
1. Identify appropriate words or phrases related to this key element that are included in the vision statement or are derived from the statement.
2. Discuss how you would specifically define those terms, particularly in terms of how you would measure progress towards achieving the desired state in the quest for red wolf recovery. Be as specific as you can be where appropriate.
3. Create draft definitions of those terms for review by the Recovery Team.

Working group members:
Kelly Davis - Timer,
Andrea Shipley - notetaker
Pete Benjamin - presenter
Liz Rutledge - facilitator
Dave Holdermann
Joe Madison
Mike Gilikin
Duke Rankin

Goal is to get species off the ESA and into state agency management. Reasons for lacking communication. State directors don't really love their wolves. Ungulate hunters are going to be most vocal stakeholders to state directors.
Reintroduction is a big ask.

A long time trapper in Hyde county was told there would be a huntable and trappable wolf population - this wasn't lived up to.

10J Rule and state wildlife agency resolutions are going to be an ongoing issue in aligning service and state management goals. Management through litigation creates complication.

Field level coordination is a good place to start - when Andrea was living in the area it worked well. Interagency field team for the Mexican wolf. Demonstrate landowners a coordinated face of agencies to the public. Funding issues - need to work out

States without red wolves - these issues will need to be hashed out ahead of time. Get alignment prior to reintroductions.

Same cast of characters still here with staked out positions and movement off of positions is not happening. Straightforwardness in communication is important. Good place to start is at the field level for building unitedness between agencies. Start with marketing on that. Flexibility on acceptance of coyotes. It is important who supports the program on the landscape, especially large landowners. Wolf releases are going to continue to happen on NEP. A nuetral NGO should be available as a space for team to work.

Biological behavior of wolves in the hunting community. Educational component of biological behavior on how the process works by united agencies. Marketing.

Landownership changes due to climate change? Start a new dialouge with new landowners

Miscommunication on red wolf mortalities - misconception on risks of roads. Two agencies and other partners can come together on road crossings. Wildlands Network project on road crossings on a broad level for multiple SGCN species, etc. Conversation around this could soften discussions.

Lesson for other states: this part needs to be really thought out all the way through to what it would like when the animal comes off the list.

What would a huntable population look like?

United marketing with both agencies for outward demonstration of alignment agencies

Service/DOT relationship has been collaborativerecently. Study on bear and wolves. There's no money -- funding issue.

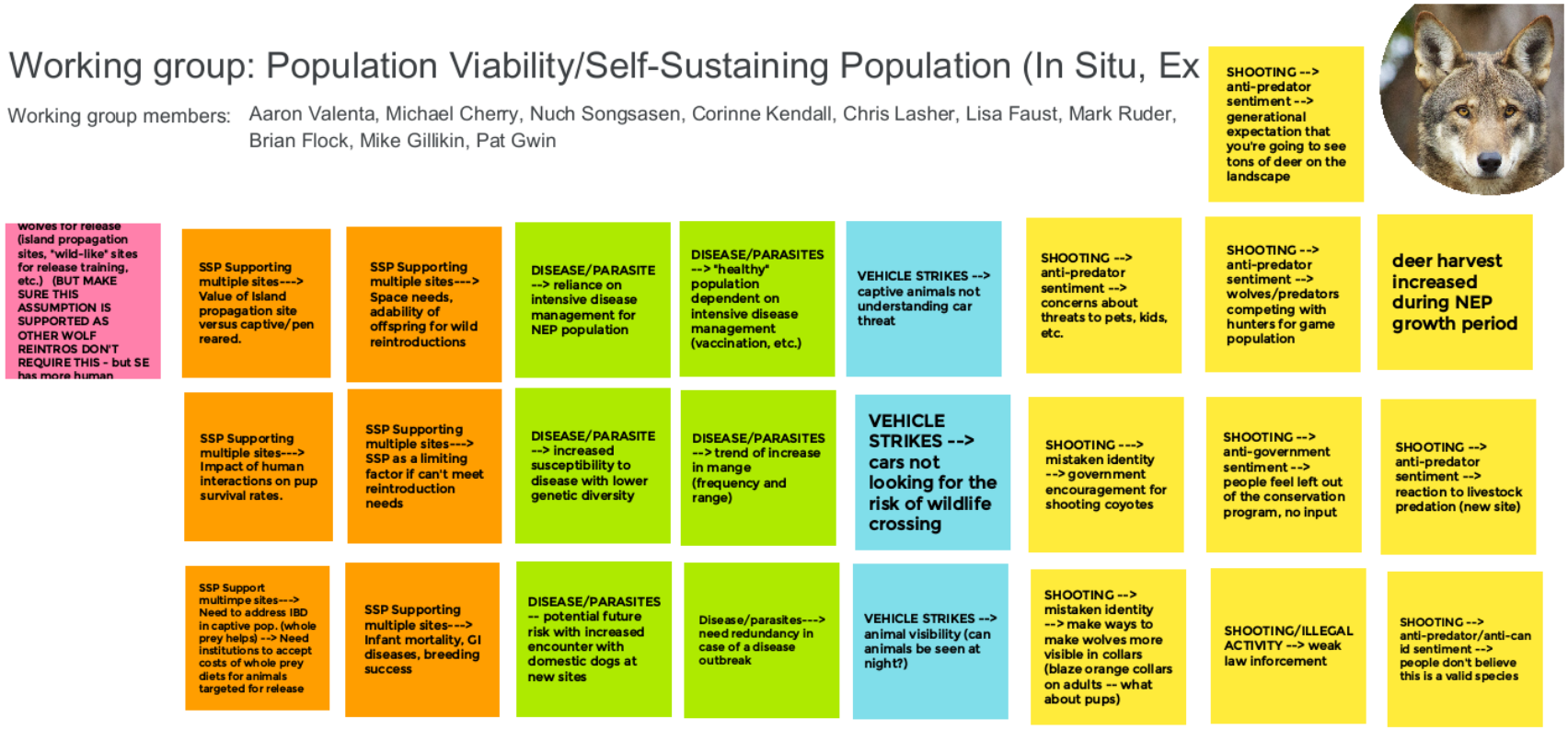
Management through litigation will always be an issue

Military perceptions of red wolves? Bases have own biological staff. DOD on bombing range has been with the program from the beginning. Influence of DOD on public perception and funding

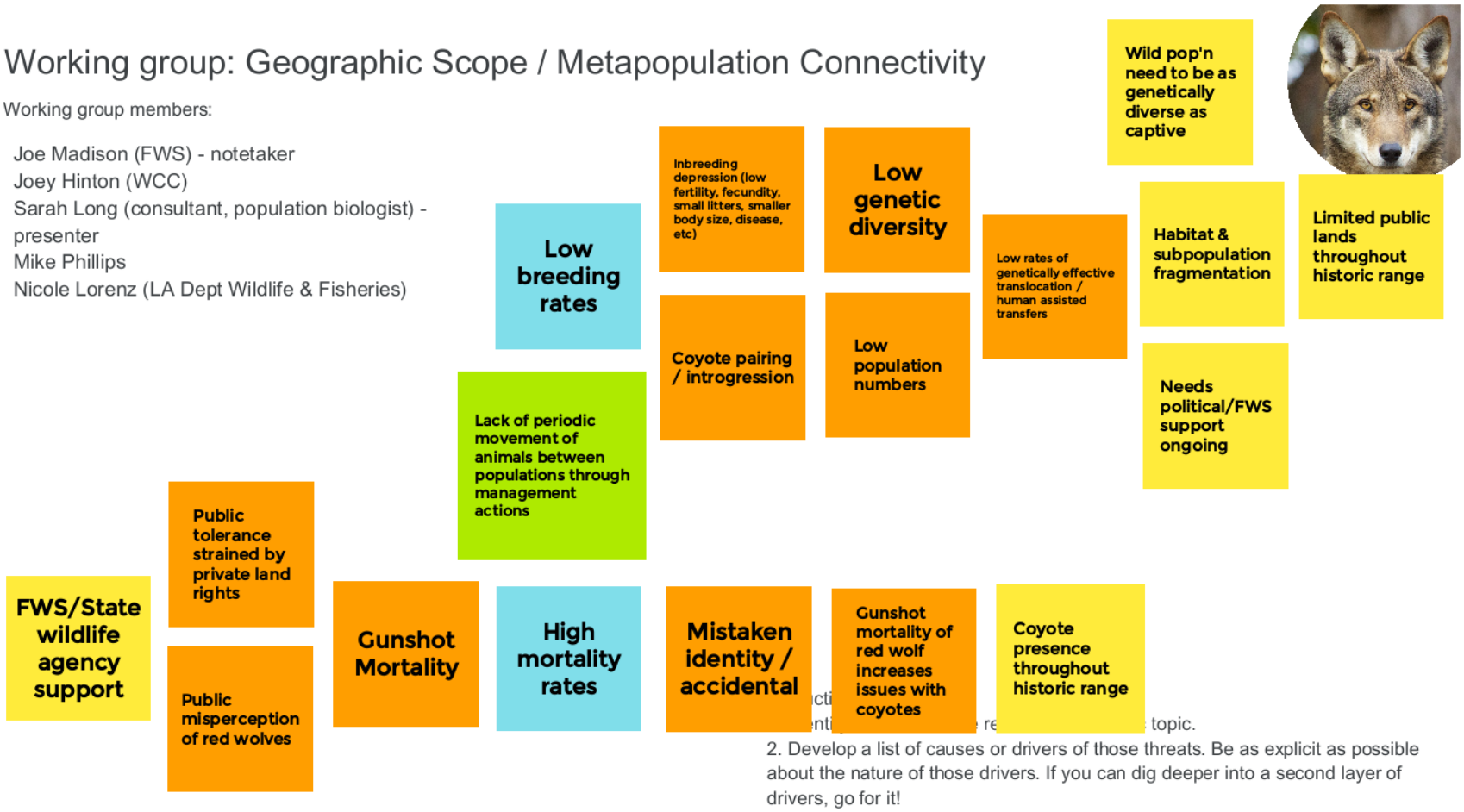
Alignment of agencies would look like: interagency field teams, united agency marketing, strategic communications, relationship building - landowner liason team with different partners (landowners can choose who to work with, but team is united), interagency policy dream team (start on softer items), as the cast of characters rotates catch them up and continue communications, other partners for support on projects/issues - directed by interagency team, compilation of stakeholder groups support, have a landowner representative (who is a tough sell) on interagency team,

Appendix 3. (Continued)
Breakout Group Digital Whiteboards for Defining Success in Recovery (Operationalizing the Vision)

Appendix 4
Breakout Group Digital Whiteboards for Identifying Threats and Challenges to Red Wolf Recovery



Appendix 4 (Continued)
Breakout Group Digital Whiteboards for Identifying Threats and Challenges to Red Wolf Recovery



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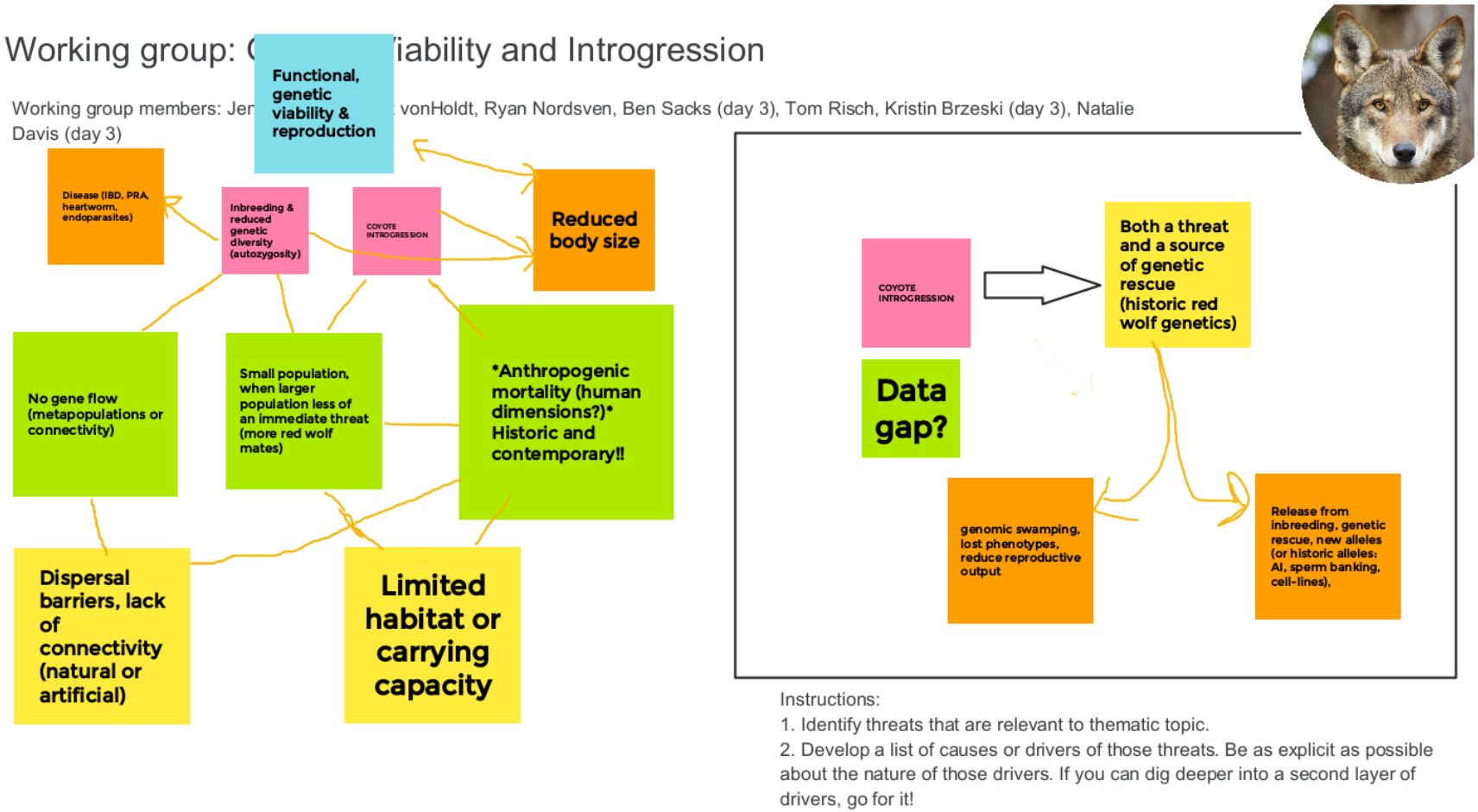

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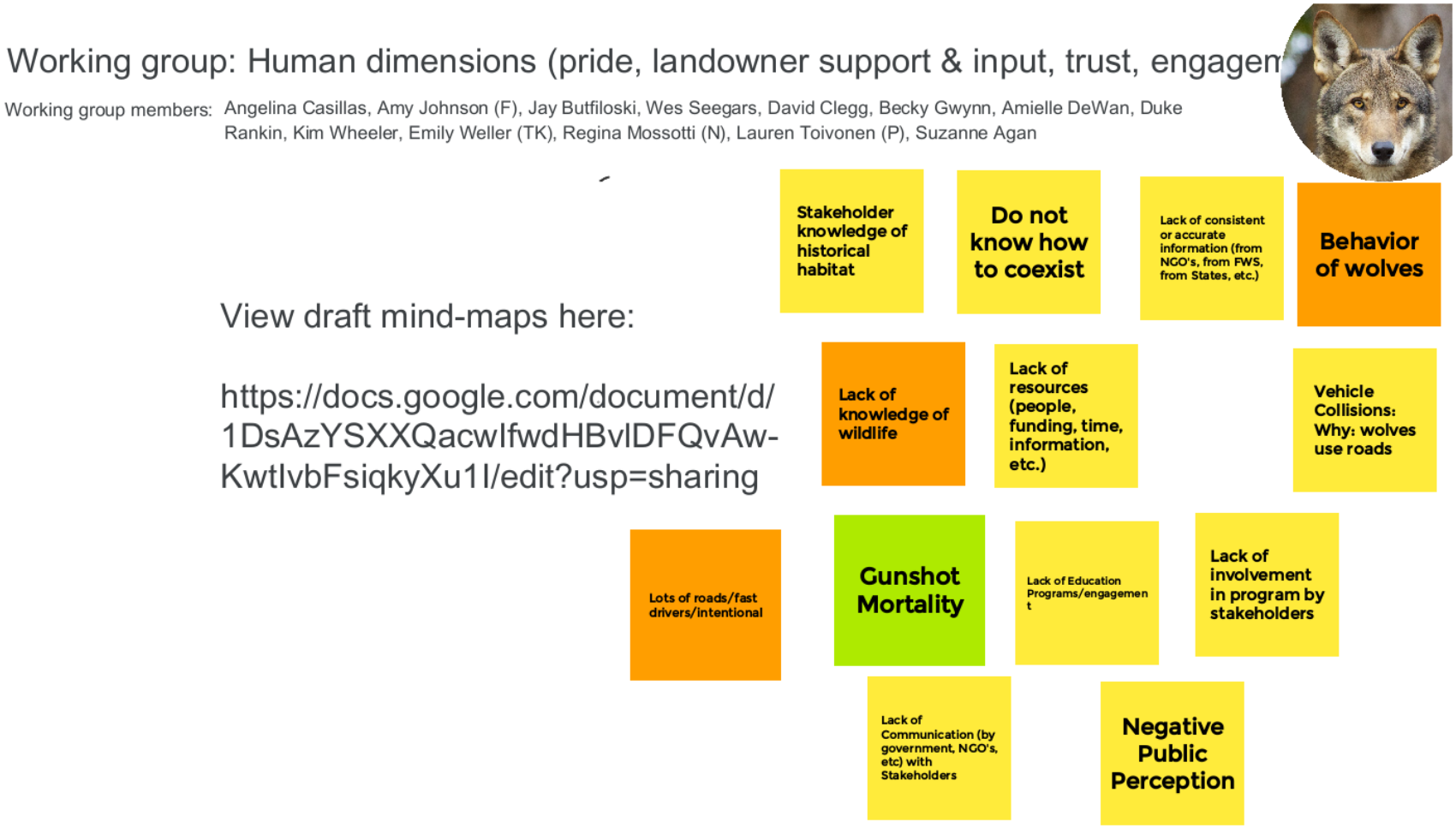

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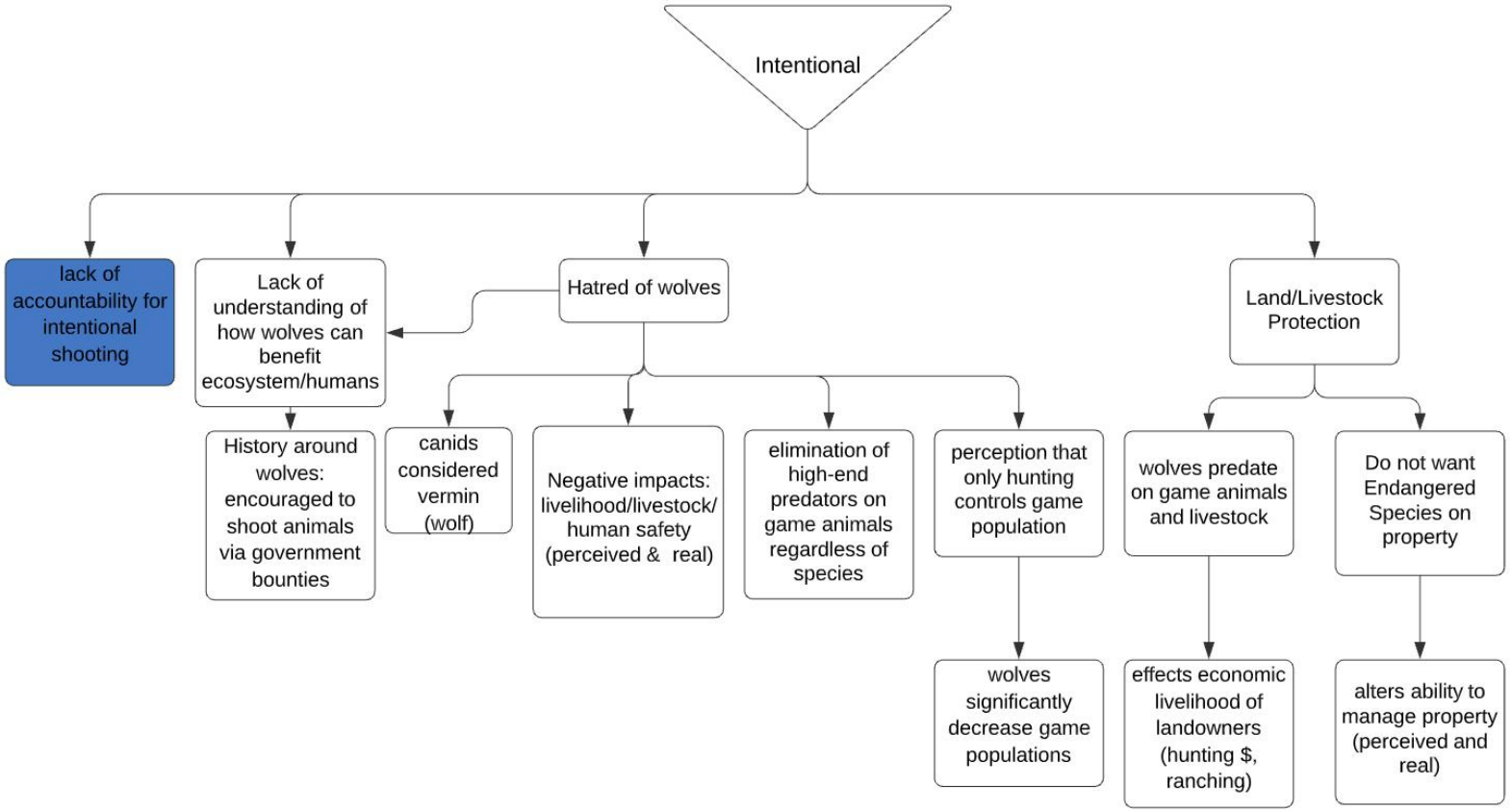

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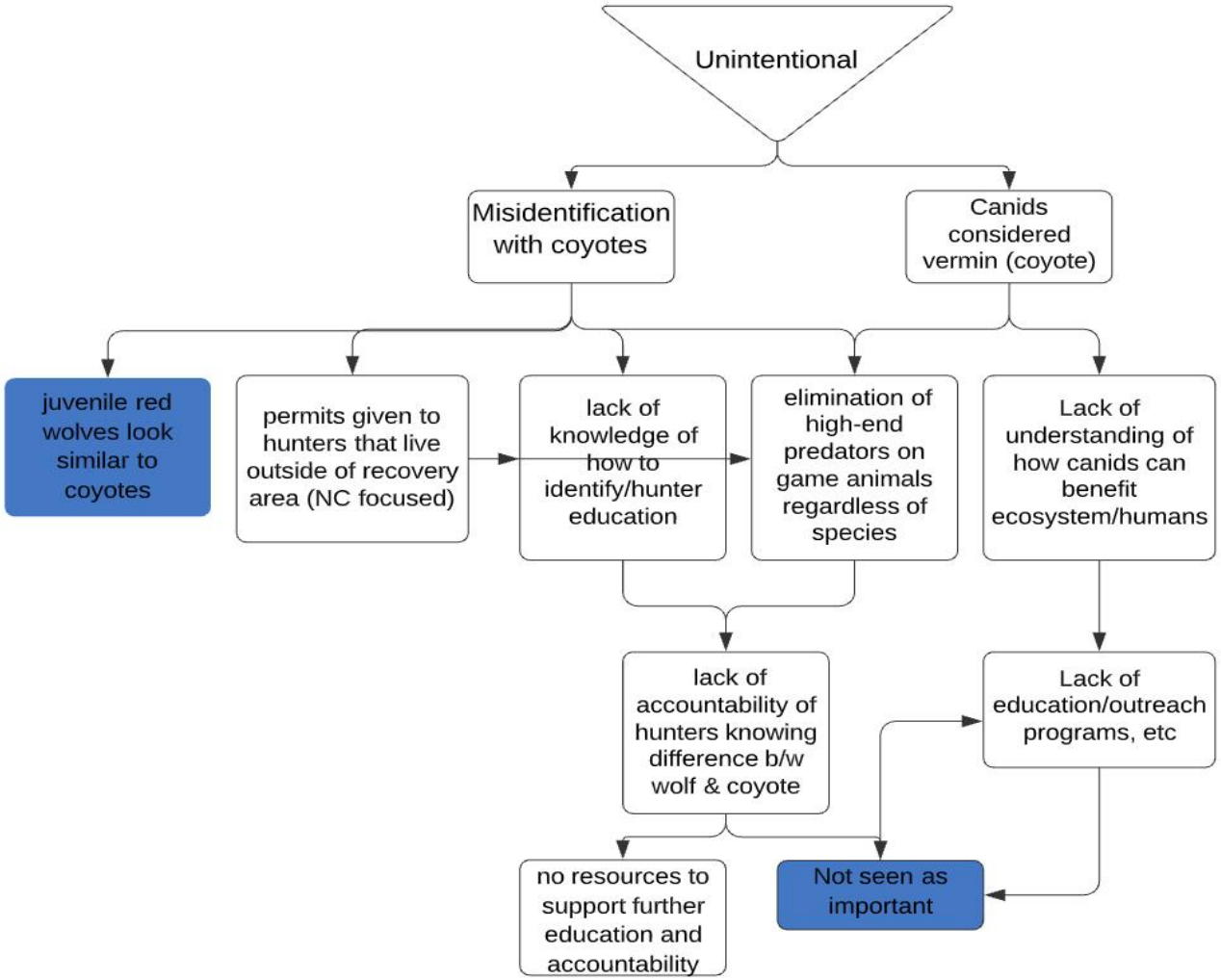

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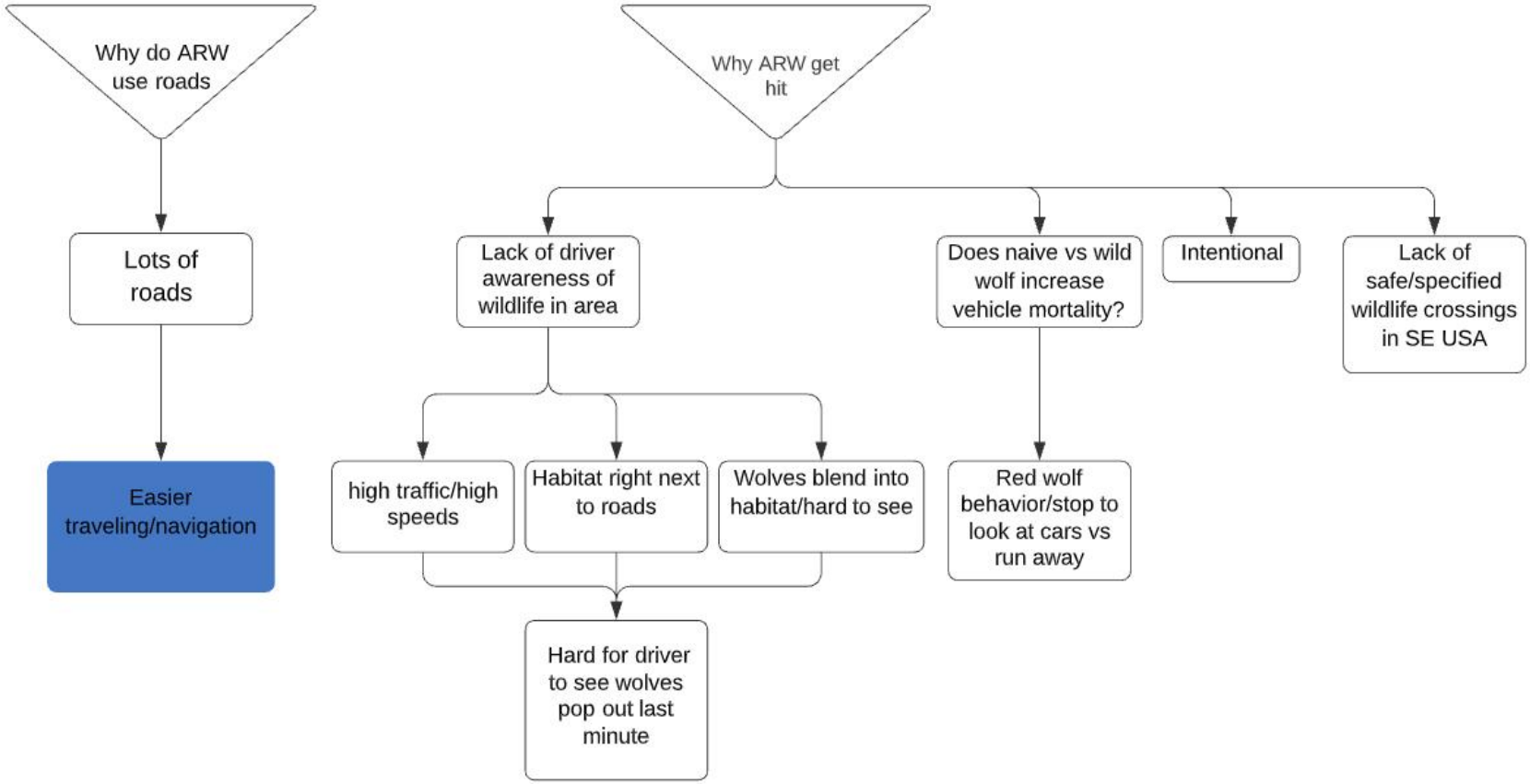

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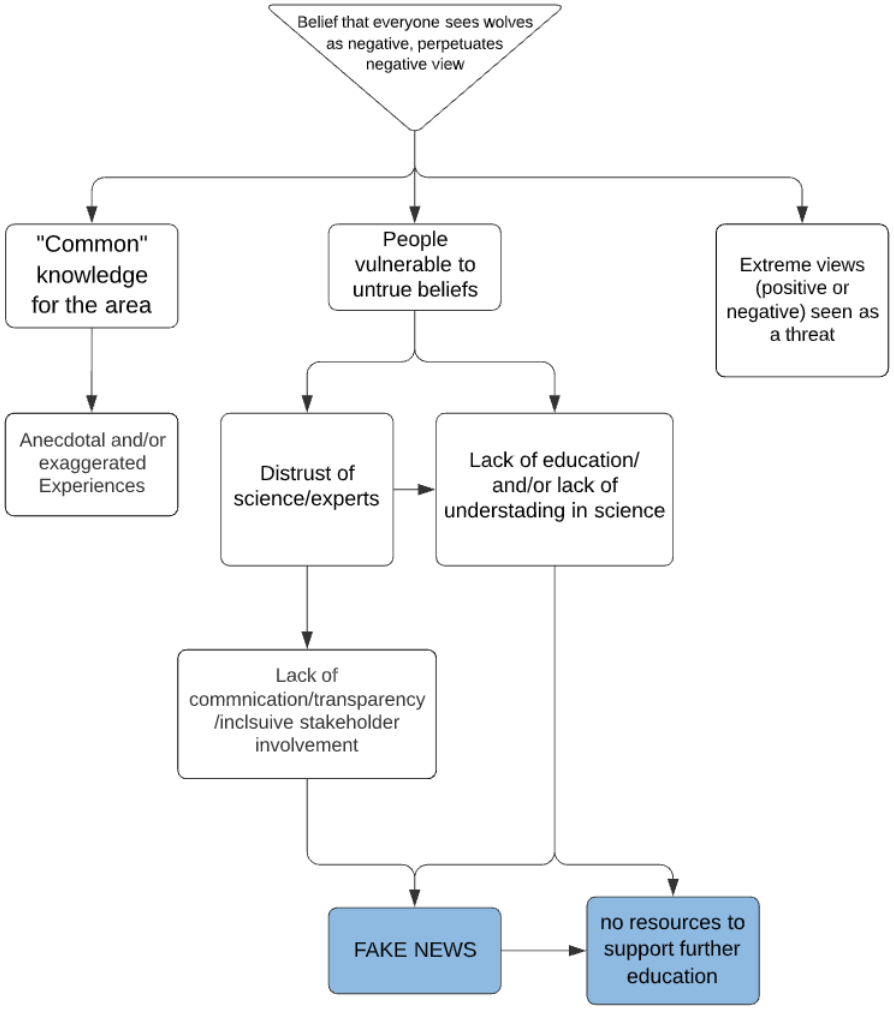

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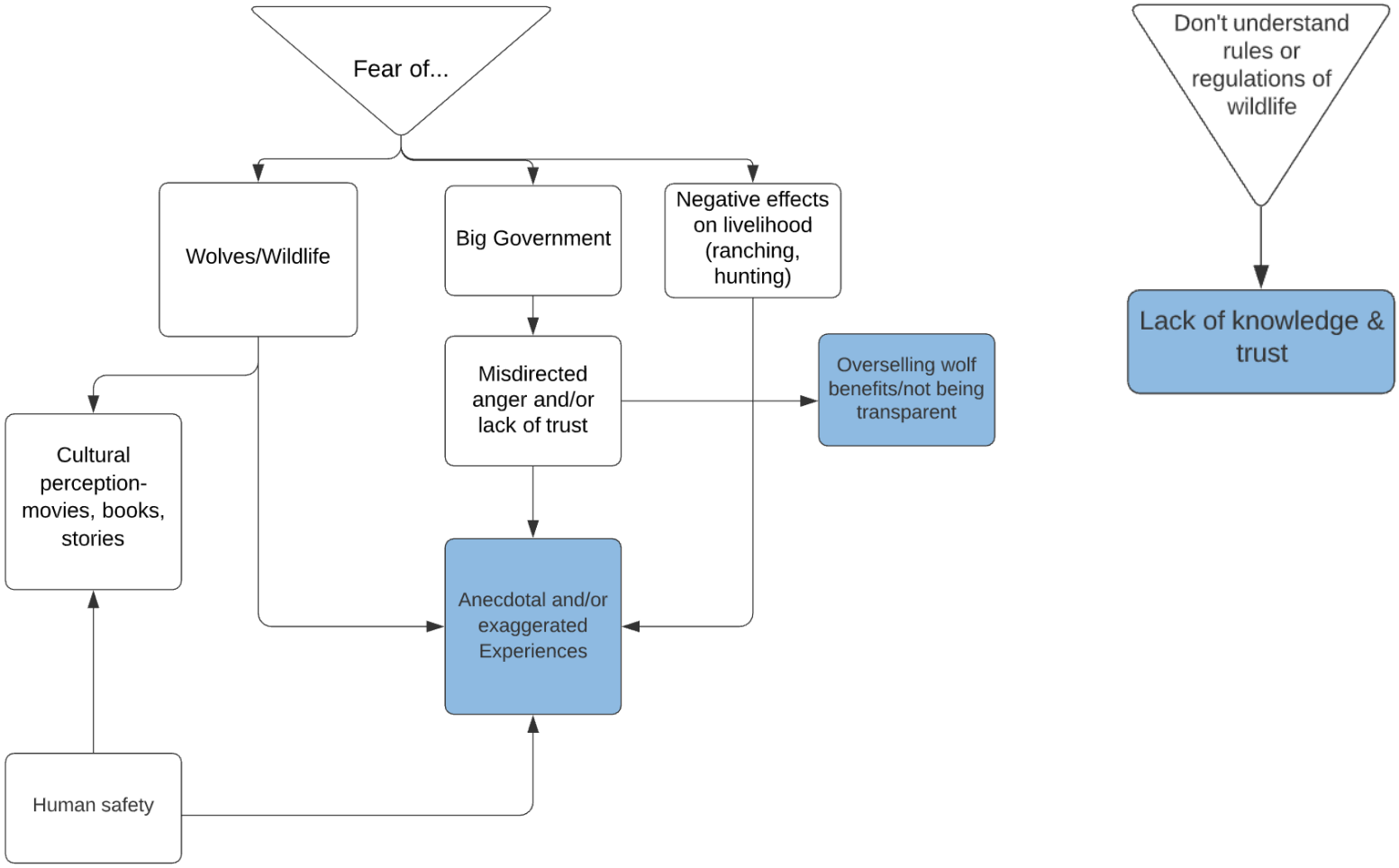

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