Recovery Planning for the Red Wolf

Part 2: Revisions and Updates

June – July 2023

Workshop Report
August, 2023

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A contribution of the IUCN/SSC Conservation Planning Specialist Group, in collaboration with the United States Fish and Wildlife Red Wolf Recovery Team.

Workshop support provided by the United States Fish and Wildlife Service.

Recommended citation:

CPSG and USFWS (Eds.). 2023. Recovery planning for the red wolf – part 2: Revisions and updates. Workshop report. Apple Valley, MN: IUCN SSC Conservation Planning Specialist Group.

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Introduction

The United States Fish and Wildlife Service (USFWS, or 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 The existing recovery plan was adopted in 1990 and, therefore, is largely out of date while also containing important historical information on the species and its status at the time the plan was adopted.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 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.

An online workshop process was conducted August – September 2021, with the goal of developing the bulk of the material necessary for the red wolf draft recovery plan. The draft plan was completed in September 2022 and made available for review by the recovery team and for public comment. A set of comments were submitted to the Service which guided revisions to the draft plan. In parallel with the recovery plan development and review process, a detailed population viability analysis (PVA) was being developed to inform the creation of robust recovery criteria and broad species management priorities. A draft PVA report was delivered to USFWS in early June 2023, which was then followed by a series of online workshop sessions held 26 – 28 June 2023 that were devoted to crafting revised recovery criteria. These workshops were followed by another set of online sessions held 13 – 14 July 2023 to create site-specific actions as required by USFWS recovery planning guidance. With the completion of these sessions, red wolf recovery leadership in the Service would have the material to complete the review species recovery plan.

The material documented in this report is a written record of the discussions and accompanying notes from both the recovery criteria and site-specific actions workshop sessions. Every attempt has been made through the design and facilitation of these workshops to generate appropriate and useful material for an effective plan that lays out broad guidance for achieving recovery of the red wolf in its historic range.

Summary of the Draft Recovery Plan Revision Workshop Process

June 2023: Recovery Criteria Workshop

The recovery criteria development workshop, composed of three distinct sessions, was held 26 – 28 June 2023 in the virtual meeting space using Zoom. A total of 37 recovery team members (74% of the full team) attended at least one workshop session: ten members attended one session, nine attended two, and 18 attended all three sessions. The workshop began with a Emily Weller (USFWS red wolf recovery lead) giving an overview of the current recovery plan document, with a focus on the existing criteria and how those criteria must be revised in light of public comments on the draft plan. Recovery vision and strategy statements created at the 2021 workshop and finalized through subsequent review are given in the text box below.

Recovery Vision

In the future, wild and free red wolves will coexist with humans in multiple viable populations across the historic range, where ongoing threats are effectively ameliorated through conservation activities, 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, in line with the values of the communities in which they occur.

Recovery Strategy

- Expand distribution of the species
- Increase population abundance and maintain gene diversity long-term
- Implement collaborative conservation

Workshop process facilitator and population viability analysis (PVA) lead Phil Miller (IUCN SSC Conservation Planning Specialist Group) then summarized the current version of the PVA modeling exercise, emphasizing the high-level draft results and the value of the process as a whole in helping to inform the creation of defensible recovery criteria for the final recovery plan.

Following these opening presentations, workshop participants self-divided into two thematic working groups based on the draft recovery criteria: a Population Management group (criterion 1) and a Threat Mitigation group (criterion 2). Each working group discussed and revised their respective recovery criterion focusing on the desired outcome and provided justification over three breakout sessions. The recovery criteria revisions were presented to the full body of workshop participants at the end of each breakout session for discussion.

July 2023: Site-Specific Recovery Actions Workshop

The site-specific recovery actions workshop, composed of three distinct sessions, was held 13 – 14 July 2023, once again in the virtual meeting space using Zoom. A total of 33 recovery team members (66% of the full team) attended at least one workshop session: six members attended one session, eight attended two, and 19 attended all three sessions. Workshop facilitator Phil Miller and red wolf recovery lead Emily Weller provided brief summaries of the process used and the content created, respectively, at the June 2023 recovery criteria workshop sessions. After revising the recovery criteria, workshop participants were

asked to reassess the existing recovery actions and keep, revise, remove or add actions as needed to ensure the site-specific actions were necessary and sufficient to achieve the revised recovery criteria.

To ensure that site-specific actions included the existing wild population as well as new sites, participants self-divided into two working groups: Northeastern North Carolina and New Sites. Both groups agreed to keep but revise all seven existing recovery actions and three additional recovery actions were developed. For each recovery action discussed in the working groups, initial time and cost estimates were generated, and recovery priority was also specified for new actions emerging from this workshop. As with the June 2023 recovery criteria workshop sessions, the recovery actions workshop was largely composed of iterative working group sessions where specific information was discussed and actions identified. These sessions were separated by occasional plenary sessions during which time each working group summarized their progress and took on board any comments or suggestions from the other group. Through this process, the recovery team as a whole was able to shape the material that would be used by USFWS personnel in the creation of a revised red wolf recovery plan.

Revising Recovery Criteria

Workshop participants were asked to revise the draft recovery criteria based on comments from the official review of the Draft Revised Recovery Plan for the Red Wolf (*Canis rufus)* (USFWS 2022a).

Recovery criteria provide objective, measurable targets for achieving the recovery vision and represent the most current scientific information available for the red wolf. The recovery criteria should be:

- Objective, measurable thresholds or targets for the 3Rs (resiliency, redundancy, representation) and threats
    - Will measure progress toward and achievement of the desired recovered state.
    - When met, it would result in determination to delist the species.
- At least one must be quantitative, others when feasible

The revised delisting criteria for red wolf produced by the working groups in the breakout sessions are given below and the worksheets used by each working group to discuss their recovery criteria revisions are reproduced in Appendix 2. The Service compiled Revised Recovery Criteria (Box 1) based on the materials generated by participants in the June workshop sessions which were presented on Day 1 of the July workshop and were subject to discussions and minor revision by all participants.

Working Group: Population Management (Criterion 1)

Draft delisting criteria:

At least three viable wild populations occur within the red wolf historic range and are distributed to maximize species redundancy.

Red wolf populations would be considered for delisting if they meet the following conditions:

- Occur in suitable areas representing different habitat types within the historic range (see Service 2018, p. 15; Figure 1 for historic range). Populations must be established in at least 2 ecoregions within their historic range, with at least one of the populations in ecoregions 8.3 and/or 8.4 (see Map of Ecological Regions of North America); and

- Occur in habitats of sufficient quantity and quality to support natural demographic processes (e.g., survival, reproduction, dispersal, and mortality) that lead to stable or increasing populations. This is defined as:
    - Each population is stable or growing (mean population growth rate $\geq$ 1.0) after a period of 2 generations with minimal management (e.g. coyote management, release levels, threat mitigation) as defined in the RIS, AND
    - Each population has a 95% probability of persistence for 100 years and [80% of the current or future founders of the SAFE population's gene diversity maintained for XX years], as projected by site-specific population simulation models under a scenario assuming minimal management, AND
    - According to the current PVA, each population should be at least 200 individuals, with at least 2 populations at a minimum of 300, with the number of individuals based on an estimate of the number of individuals 1 year and older.

Discussion:

It was noted that red wolves have a large historic geographic distribution and there was concern that the criterion may have subjective interpretation in the future as to whether recovery has been achieved over a significant portion of the historic range if not quantified.

Ecoregion specifications were included in the criterion to ensure that spatial representation would be achieved (e.g., diverse distribution) while remaining flexible (e.g., ecoregions are large and can shift in response to climate change). However, the concern was raised that including specific ecoregions in the criterion could limit recovery options (e.g., multiple populations in one ecoregion with broad geographic distribution could ensure redundancy as well as ecological/biological representation).

Sufficient habitat quantity and quality will need to be considered as selection factors for new sites (i.e., specified in the RIS).

It was agreed that a specific genetic threshold should be included in the criterion. Based on the model results, a level of gene diversity greater than 80% would be too difficult to maintain unless additional sources of genetic diversity are discovered. Current or future founders include initial founding population and any new genes brought into the population (both wild and SAFE) whether through the discovery of additional genetic diversity in remnant wild populations or new technology. Further consultation with genetic experts and additional qualifications for genetic goals may be needed.

Three populations were considered the minimum number for recovery. The option of using a sliding scale for the number and size of populations needed to achieve recovery was discussed (e.g., Whooping Crane, CWS & USFWS 2007) as well as the option to express population sizes in terms of percent of carrying capacity.

Working Group: Threat Mitigation (Criterion 2)

Draft delisting criteria:

Threats to the red wolf are effectively mitigated such that the wild populations exhibit sufficient numbers, structure, and behaviors to maintain ecologically functional and phenotypic population characteristics and remain viable into the foreseeable future.

Threats are either eliminated or minimized to levels that do not negatively impact population function (i.e., mortality and fecundity rates result in stable or increasing growth rate and support pack behavior).

Red wolf populations would be considered for delisting if they meet the following conditions:

- Maintain genetic diversity through outbreeding, based on markers believed to correlate with red wolf ancestry, and reflected in red wolf phenotype.
- Threats are considered mitigated if the population is stable or growing at >83.8% (or near as based on results of PVA that populations could exhibit positive growth with 16.2% human caused mortality) of the carrying capacity of each site over eight years/2 generations, as determined by best available science.
- Does not require extensive human intervention for the purpose of demographic stability over an 8 year/2 generation period. Extensive human intervention includes fostering, placeholder or adaptive management, sterilizing coyotes, and translocation. Pup fostering to improve genetic diversity or to improve the health of a population is not considered extensive human intervention.
- States, Tribes, and other federal agencies will ensure regulatory mechanisms are in place to prohibit or regulate human-caused mortality in those areas necessary for recovery such that the Service determines at least three stable recovery locations (Criterion 1) animals are likely to be maintained in the United States in the absence of Federal ESA protections.

Discussion:

The group focused their discussion on the two main threats of human-caused mortality and hybridization with coyotes and how to best quantify successful mitigation. It was determined that threat mitigation criteria could be measured through red wolf population metrics (e.g., trends in pair formation and territory establishment, number of breeding individuals, population growth rate, mortality driven by natural processes, etc.). As such, there was overlap between the criteria developed by the two working groups.

The group discussed how phenotypic representation and genetic quantification can differ in red wolves. Measurement of both phenotypic and genetic traits were included in the criterion to ensure that red wolf ancestry and behavior are maintained on the landscape and that the species does not become diluted in the event of improved scientific understanding in the future.

There were some concerns and confusion around expressing a population target in terms of carrying capacity, especially as it relates to mortality rate in the PVA model. It was suggested that population growth rate over time would be easier to quantify and justify compared to threat mitigation or mortality rate (e.g., Mexican Wolf, USFWS 2022b). However, it was noted that the situation is different for red wolves as the available habitat area is constrained due to coyotes and consideration of stable or growing populations near carrying capacity may be more applicable.

While population growth provides indirect proof that threats are being mitigated, the importance of addressing threats directly through long term regulatory structures was noted. This point was emphasized by the cautionary example of liberal harvest of gray wolves by states in the Northern Rockies after

population recovery thresholds were achieved. It was further noted that states and tribes' regulatory capacity will be key in terms of species recovery and determining who has authority could help avoid controversy.

Box 1. Revised Recovery Criteria for Red Wolf

Revised Recovery Criteria

Criterion 1:

Three or more viable wild populations occur within the Red Wolf historic range and are distributed to maximize species redundancy.

- Populations occur in suitable habitat of sufficient quantity and quality to support natural demographic processes (e.g., survival, reproduction, dispersal, and mortality) that lead to viable populations as defined in Criterion 2.

Criterion 2:

Each Red Wolf population meets the following criteria for viability:

- Population consists of a minimum of 180 individuals with at least two populations consisting of a minimum of 280 individuals, based on an estimate of the number of individuals one year and older;
- Once the population meets minimum abundance, the population is stable or growing for a period of 10 years without extensive human interventions (mean population growth rate for those ten years is $\geq$ 1.0);
- Each population has a 95% probability of persistence for 100 years; and
- 80% of current and future founder gene diversity can be maintained for 100 years.

Criterion 3:

Adequate State, Tribal, Federal, or other appropriate regulatory mechanisms are in place to prohibit or regulate threats to the Red Wolf such that Criterion 2 for each population can be maintained into the foreseeable future without the protections of the Act.

Review and discussion of revised recovery criteria

Criterion 1:
Change in criterion: removed specific ecoregion requirement to ensure flexibility/not limit options; three "or more" populations likely won't be included in final version.

Extensive discussion (and support) to include a requirement for interior population(s):

- Would ensure representation of historic range (i.e., historically not a coastal species) / different environment to improve chances of survival.
    - The group chose ecoregions as they are revised to account for changes e.g., climate, but other scales exist so could be defined differently.
- However, better from a management standpoint to leave out specific regions - current wording around redundancy prevents all populations from being affected by the same catastrophic event.

- Discussion around value of specifying regions e.g., can redundancy/population persistence objectives be achieved even if all populations are in same ecoregion? – need to consider how the team wants to think about redundancy.
    - No functional relationship between ecosystem and population demographics (as currently modelled in PVA)
    - Alternative strategy: metapopulation with three connected sites close together?

Criterion 2:
Clarification of sub-bullets 1 and 4:

- 1: Confusing wording about population sizes – suggested wording put forward to improve clarity.
- 4: Confirmed that the projected gene diversity loss will be based on original starting point of PVA when re-evaluate at later date (i.e., 80% loss 100 years from 2023) and that future founders would include new gene diversity as introduced by new technology.

Criterion 3:
New criterion introduced after June sessions: Ensure regulatory mechanisms in place to address threats and maintain viable populations in future.

- Focus on desired outcome that threats are low enough (reduced to manageable level) to maintain viable populations.
- The group felt this was an important criterion to include.

Discussion around:

- How criterion would be determined and who would be making the judgment call.
- Concern that doesn't hold the team to anything beyond criterion 2 and will be difficult to quantify.
- Wordsmithing: prohibit vs mitigate
- Clarity of tribal structure and function of wildlife operations
- How to address potentially unmanageable threats like climate change

Revising Recovery Actions

Site-specific management actions are necessary to achieve the recovery criteria and actions should be developed so that if all the actions related to a specific recovery criterion are complete, it is likely that the recovery criterion has been achieved. The recovery actions will be accomplished by implementing shorter-term activities, which will be described in the RIS.

To ensure that site-specific actions included the existing wild population as well as new sites, participants self-divided into two working groups: Northeast North Carolina and New Sites. Both groups agreed to keep but revise all seven existing recovery actions (Table 1) and three additional recovery actions were developed (Table 2). The worksheets used by each working group to discuss their recovery actions revisions are reproduced in Appendix 3.

Over the course of revising the recovery actions it was determined that further discussion was warranted on the structure of the management teams specified in Action #4 and the representation of stakeholders in Action #5. A working group session was devoted to defining the name, purpose, membership, responsibilities, any pros/cons, and possible fixes of proposed management teams. Both working groups proposed similar two-tiered systems where higher-level teams specific to each site would provide oversight and strategic planning to sub-teams. The proposed team structures are presented in Appendix 4 and will be used to inform the RIS.

Table 1. Revised site-specific actions for red wolf recovery

Action Number	Site-Specific Action	Associated Criteria
1	Identify potential reintroduction sites to support a viable population or subpopulation within the species' historical range using the best available science complemented with informed practice.	Criterion 1
2	Increase the capacity within the Red Wolf SAFE to maintain a minimum of 400 ex-situ wolves to support establishing additional wild populations of red wolves and maintain gene diversity.	Criterion 1 Criterion 2
3	Update controlled propagation plan for the captive population to reach the new capacity and optimize reproduction, reduce mortality, and sustain a healthy population so that it can support in situ recovery.	Criterion 1 Criterion 2
4	Organize and maintain management teams (MT) for each population (i.e., reintroduction sites identified in Action 1 and NENC recovery population) with appropriate members that represent those who possess the authority, resources, land, expertise, and those with a diverse vested interest in the outcome of MT actions to jointly manage recovery of red wolves in collaboration with stakeholders outlined in Action Statement 5. *	Criterion 1 Criterion 2 Criterion 3
5	Establish and maintain formal participation of all stakeholders (e.g., individuals from the local community, particularly private landowners, other State, County, and Federal agency representatives, other Tribal representatives, NGOs) in management and recovery planning processes for each population (i.e., reintroduction sites identified in Action 1 and NENC recovery population) to ensure engagement of all perspectives in red wolf recovery.	Criterion 1 Criterion 2 Criterion 3
6	Develop and implement population-specific adaptive reintroductions for each population (i.e., reintroduction sites identified in Action 1 and NENC recovery population) with MT and stakeholders. Management plans for each of these reintroductions should include, but are not limited to: ● Near term and long-term metrics to determine progress toward the recovery criteria ● NENC should establish a MT within one year ● New sites should establish a MT before on the ground implementation ● Reintroduction schedule and techniques ● Initial population targets ● Habitat and prey needs and management ● Research and adaptive management ● Identification of site-specific threats	Criterion 1 Criterion 2 Criterion 3

	● Strategies to: ○ Maximize genetic health ○ Address anthropogenic threats (e.g., orange collars, mobile electronic road signs, etc.) ○ Target coyote hybridization/introgression ○ Minimize disease/parasitic outbreaks ○ Provide assistance to landowners ● Monitoring of: ○ Key population demographics ○ Genetic diversity and integrity ○ Long-term trends and movement ○ Specific causes of mortality ○ Threats	
7	Conduct outreach and engagement/involvement on red wolf conservation within communities near or associated with wolf populations to improve hunter, trapper, landowner, and global public awareness of red wolves.	Criterion 1 Criterion 2 Criterion 3

Table 2. Proposed new site-specific actions for red wolf recovery

Site-Specific Action	**Associated Criteria**	**Responsible Party**	**Estimated Time (years)**	**Total Cost (USD)**	**Action Priority**
Ensure NENC site of sufficient size with adequate habitat, prey, and conditions to support a functional population or subpopulation within NENC using available reintroduction site studies and ongoing analyses. Threats: ● Climate change effects - monitor and assess impacts, annual review of NENC specific climate change impacts. ● poor habitat - monitor and maintain or restore - NRCS monitoring effort, 60 miles of dike fortification, Implement prey for the pack program. ● human caused mortality - monitor, document, and ameliorate, create underpasses, open roadside site lines, outreach to hunters, create value to the community. ● social habitat - monitor (surveys) and analyze, education and outreach, ● hybridization - monitor and implement adaptive management plan, Establish/ repair holding area for sterilized coyotes for healing before placement. ● genetic diversity - monitor, utilize established labs to do genetic analysis., Continue work to find potential new founders. Utilize AI to recover lost genetics.	Criterion 1	Service, MT			Priority 1
Engage states and local communities to [inform the final selection] of an identified reintroduction site.	Criterion 1 Criterion 3	Service/Service + States	3	$300 000	Priority 1
Ensure regulations as specified in Criteria 3 are in place and collaborate with partners to develop management plans and to prepare for post-recovery transition of authority to prevent species from being relisted.	Criterion 2 Criterion 3				

References

Canadian Wildlife Service and U.S. Fish and Wildlife Service. 2007. International recovery plan for the whooping crane. Ottawa: Recovery of Nationally Endangered Wildlife (RENEW), and U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 162 pp.

U.S. Fish and Wildlife Service. 2018. Red Wolf Species Status Assessment. U.S. Fish and Wildlife Service, Atlanta, GA.

U.S. Fish and Wildlife Service. 2022a. Draft Revised Recovery Plan for the Red Wolf (*Canis rufus*). U.S. Fish and Wildlife Service, Atlanta, Georgia. 20 pp.

U.S. Fish and Wildlife Service. 2022b. Mexican Wolf Recovery Plan, Second Revision. Region 2, Albuquerque, New Mexico, USA.

Appendix 1. Workshop Participants

Name	Organization	Recovery Criteria Sessions (June 26-28)			Recovery Actions Sessions (July 13-14)		
		1	2	3	1	2	3
Jennifer Adams	University of Idaho	X			X	X	X
Suzanne Agan	Kennesaw State University			X	X	X	
Pete Benjamin	U.S. Fish and Wildlife Service	X	X	X	X	X	
Art Beyer	U.S. Fish and Wildlife Service		X	X	X		
Kristin Brzeski	Michigan Technology University	X				X	X
Jay Butfiloski	South Carolina Department of Natural Resources				X	X	X
Angelina Casillas	Independent	X	X	X			
David Clegg	Tyrrell County, North Carolina		X	X			
Kelly Davis	Hyde County Landowner/ North Carolina Wildlife Resources Commission	X	X	X	X	X	X
Amielle DeWan	Impact by Design Inc.	X		X			
Lisa Faust	Lincoln Park Zoo	X	X	X	X	X	X
Brian Flock	Tennessee Wildlife Resources Agency	X	X				
Eric Gese	Utah State University	X	X	X	X	X	X
Becky Gwynn	Virginia Department of Wildlife Resources		X		X	X	X
Becky Harrison	U.S. Fish and Wildlife Service	X				X	
Joey Hinton	Wolf Conservation Center				X	X	X
Dave Holderman	Texas Parks and Wildlife	X	X	X	X	X	X
Bridgett vonHoldt	Princeton University	X			X	X	X
Dana Karelus	Texas Parks and Wildlife Department		X	X	X	X	X
Corinne Kendall	North Carolina Zoo	X	X	X	X		
Chris Lasher	North Carolina Zoo	X	X	X	X	X	X
Sarah Long	Independent Consultant	X	X	X			
Nicole Lorenz	Louisiana Department of Wildlife and Fisheries				X		
Joe Madison	U.S. Fish and Wildlife Service	X	X	X	X	X	

Name	Organization	Recovery Criteria Sessions (June 26-28)			Recovery Actions Sessions (July 13-14)		
		1	2	3	1	2	3
Phil Miller	Conservation Planning Specialist Group	X	X	X	X	X	X
Nicholas Moore	Florida Fish and Wildlife Conservation Commission	X			X		
Regina Mossotti	Saint Louis Zoo	X	X	X		X	X
Ryan Nordsven	U.S. Fish and Wildlife Service	X	X	X	X	X	
Colleen Olfenbuttel	North Carolina Wildlife Resources Commission	X					
Duke Rankin	U.S. Department of Agriculture Forest Service		X	X	X	X	X
Tom Risch	Arkansas State University	X	X				
Mark Ruder	University of Georgia				X	X	X
Liz Rutledge	North Carolina Wildlife Federation	X	X	X	X	X	X
Ben Sacks	University of California, Davis	X	X	X			
Wes Seegars	Hyde County Landowner / North Carolina Wildlife Resources Commission	X	X	X	X	X	X
Andrea Shipley	North Carolina Wildlife Resources Commission	X	X	X	X	X	X
Nucharin Songsasen	Smithsonian Conservation Biology Institute	X			X	X	X
Brad Stoop	North Carolina Wildlife Resources Commission	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	X
Emily Weller	U.S. Fish and Wildlife Service	X	X	X	X	X	X
Kim Wheeler	Red Wolf Coalition	X	X	X	X	X	
Stephanie Winton	Conservation Planning Specialist Group – Canada	X	X	X	X	X	X

Appendix 2. Breakout Group Worksheets for Revising Recovery Criteria

Working Group: Population Management

Working group members:
Kelly Davis, Regina Mossotti, Lisa Faust, Thomas Risch, Pete Benjamin, Wes Seegars, Corinne Kendall, Joe Madison, Lauren Toivonen, Sarah Long, Eric Gese, Dave Holderman, Kim Wheeler, Art Beyer, Brian Flock

Underline text – existing text in draft recovery plan
Red text – suggested revision to existing text

Draft Criterion 1:
At least three viable wild populations occur within the red wolf historic range and are distributed to maximize species redundancy.

Red wolf populations would be considered for delisting if they meet the following conditions:

- Occur in suitable areas representing different habitat types within the historic range (see Service 2018, p. 15; Figure 1 for historic range). Populations must be established in at least 2 ecoregions within their historic range, with at least one of the populations in ecoregions 8.3 and/or 8.4 (see https://gaftp.epa.gov/EPADataCommons/ORD/Ecoregions/cec_na/NA_LEVEL_II.pdf for EPA Ecoregions map); and
- Occur in habitats of sufficient quantity and quality to support natural demographic processes (e.g., survival, reproduction, dispersal, and mortality) that lead to stable or increasing populations. This is defined as:
    - Each population is stable or growing (mean population growth rate ≥ 1.0) after a period of 2 generations with minimal management (e.g. coyote management, release levels, threat mitigation) as defined in the RIS, AND
        - **need measurement of wild generation length
    - At least 3 populations each has a 95% probability of persistence for 100 years and [80% of the current or future founders of the SAFE population's gene diversity maintained for XX years], as projected by site-specific population simulation models under a scenario assuming minimal management, AND
        - *We're concerned about the 80% and setting a specific genetic goal because when we're modeling this 10 or 20 years from now when significant genetic diversity will already have been lost…the group struggled with how to set an appropriate genetic goal*
        - *We should also define this in the context of getting new genes in - the current or future founders*
        - *Think about % loss from the starting point rather than 80%*
        - *How do we make the language flexible if there was another population of red wolves found (e.g. if Algonquin works were identified red wolves) – and wanted to be translocated - we don't want the recovery criteria to limit that; if they went straight*

from Algonquin to wild, does including "SAFE population" in above restrict the definition too much?
- *If there are new genetics, we'd want those founders in all current populations (SAFE, NENC, wild populations)*

- According to the current PVA, each population should be at least 200 individuals, with at least 2 populations at a minimum of 300, with the number of individuals based on an estimate of the number of individuals 1 and older
  - *This is based on the probability of extinction and retained genetic diversity of the current PVA; target numbers may change as more information is available*
  - *200 is based on the 5 county area in NENC; when it gets back up to this size will need to address whether the population can grow or not; but, we did not want to eliminate the value of NENC or other smaller populations by setting a higher required population size*

Discussion notes:

USFWS perspective:
- Quantify that the population isn't under similar habitat types or subject to the same risks - how do we quantify that with some figure?
- Perhaps easier: How do we define objective, measurable, quantitative things to describe viability?
- Distribution + redundancy - in other recovery plans, have used some criteria of "populations in each of three habitat types that they formerly occurred" or, "restored to 6 of 8 river basins" – nothing leaps to mind for red wolf historic range, but could do something like that

Bullet 1: occur in suitable areas representing different habitat types within the historic range (see Service 2018, p. 15; Figure 1 for historic range);
- What threats are we guarding against?
  - We don't list climate change as one of the major threats, but we should have one population in an area that is less affected by climate change (but worded without explicitly calling out climate change as the motivator, possibly)
    - Climate change (sea level rise) factors will likely affect coastal populations/areas
    - Hurricanes haven't represented a large issue for the wild population thus far (affects crew more than red wolves); however, potential for future increases in severity
  - Disease - wouldn't want populations so closely situated that a single event could take them all out
- To mitigate climate change:
  - We have a coastal site; need upland/interior sites
  - Because they're habitat generalists, a bit easier to identify any of these
  - "At least one of which should be in an "interior habitat", based on a projected map of sea level rise (ref)" or "at least one of which is currently situated greater than 100 ft above sea level"
  - https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/24886/22Apr2022%20final%20MP%20Emily%20Drobes.pdf?sequence=1&isAllowed=y
  - Interior - are there areas where rain and flooding is increasing, drought is increasing, all of which could impact prey availability

    - Could we just say "climate resistant/intact habitat" locations
- We want populations to not be connected (to avoid disease outbreaks, wildfire, etc.) - can we put a distance on there?
    - This is in conflict - with Representation, Redundancy, Resiliency - there are benefits to connectivity [do we want individuals to move between subpopulations?] and also risks
- "Significant portion of range" - need interior of range as well as coastal part of range - it doesn't need to be completely repopulated, but there needs to be some spread across the range
- GROUP DISCUSSION: Is it spatial representation? Eco-regional representation? Is all in one corner of range OK?
    - Are there other species we can pull from?
    - Single state vs. multiple states?
- "Geopolitical" range - what are pros and cons of having multiple states involved with recovery?
    - If all 3 populations are in one state, does that create more risk?
    - Tension between balancing socio-politcal/legal considerations and recovery/biological considerations; should this sociopolitical thing be put on hold, and we focus more heavily on biological aspects on what would be most sound?
    - Geopolitics is too hard to predict;
    - Be careful to not tie the hands for future
- Historic range map was derived from EPA ecoregion map (level 3) - if we go up to level 2 ecoregion map (coarser resolution), that might be helpful (see map below) -
    - "Populations in 2 or more Level II ecoregions"
    - NENC population may not make sense in the very long-term future - we may not even want to specify a coastal population as one specific population
    - At least two ecoregions, and specifying that one population should be in the two interior ecoregions (8.3 and 8.4, which are large and represent the historical range)
    - Gives some future resiliency - when ecoregions change as climate changes, the EPA maps will track with them as they move
    - Aaron caution: what is the desire to be in different ecoregions? - if we had 5 that were all in coastal ecosystems, would that be a success? Is the concern really about redundancy, wherever those populations are located, regardless of ecoregion? Or is it about ecological representation and ability to adapt to changing habitat conditions?
    - Joe: this criteria says "different habitat types" - ecoregion gets at that, and the two cited ecoregions (8.3 and 8.4) are a vast swath of the historical range, but inland. If climate change/sea level rise effects all coastal areas, that is different then a hurricane hitting a single coastal population but other coastal populations are there for redundancy
- Angelina comment: could we keep the language vague enough so it is encouraged but not required might help with flexibility;
    - Joe: we did leave that one population could be anywhere; we loosen it up more and have we made this more quantitative or not?
- Is there a chance to now say "at least 3" populations rather than hard 3 now that the rest of the criteria are more quantitative? This group favors saying **at least** 3
- Is "populations" pigeon-holing us for the future?

    - Northern Rockies started with 3 reintroduction sites rather than 3 populations, and now the population is essentially contiguous – are we restricting ourselves with "3 populations" – should we say 3 reintroduction sites or 3 recovery areas?
    - How will the population criteria interact with the reintroduction site idea?
- We still feel it is important to have one inland region and like the 8.3 and 8.4 designation - keep as is
- SEE DRAFT MODIFIED CRITERIA ABOVE

Bullet 2: Occur in habitats of sufficient quantity and quality to support natural demographic processes (e.g., survival, reproduction, dispersal, and mortality) that lead to stable or increasing populations.

- **Sufficient quantity of habitat** is going to be vastly different across ecoregion and based on site
    - Things we can quantify: distance from highways; human population; distance from staff; minimum % public land, minimum acreage of cooperative landowners for access; site where ability to manage coyotes is feasible; locations of trappers and vets; prey base
    - These should all be used when selecting new sites, but many of them would be hard to use as delisting criteria
    - Maybe public land component is important enough to establish in a recovery criteria (because we can't envision a population being established without it); but, after discussion, we decided that if a population didn't have a federal land base and was thriving, we wouldn't want to restrict ability to delist
    - Ultimately decided that "sufficient quantity and quality" could not be stated more specifically or with clearer measurement
- **Population size:**
    - *Guidance from service: we can have a number X, but if 20 years from now there is new science saying that the number is now Y, is the X number constraining you? can we give a number with a level of certainty about setting it as a threshold? Depends on whether science is fairly settled or not*
        - *Keep in mind with numbers - are you looking for total population size vs. numbers of individuals breeding*
        - *Number should be defensible and thoughtful - be careful not to do something like require 11,000 wood storks in Everglades to recover – locked into that number even though they now occurred across SE with large numbers*
    - Careful about limiting ourselves to a number from the PVA based on NENC, as the situation in a different site may be very different
    - Specific number seems challenging
    - Need to set some minimum of 200 or some other minimum size to guard against "recovery" if the population is growing but still very small (20 individuals)
    - Phil from PVA: for new population with very positive management, 300 individuals can be viable but struggles to maintain a level of gene diversity consistent with earlier levels of GD over 100 years; Fig 17
        - 200 in PVA is based on NENC recovery area and canid home range size
        - Assumes we are doing all the management things needed in new populations (wild-2 and wild-3)

        - Wild 2 - end adding pups in year 50-55
        - Wild 3 - end adding pups in year 55-60
    - Can maintain 85% GD for 40-50 years, but then will erode over time
    - GD100 is higher (0.805-0.809) at 300 individuals
    - For at least two of the populations, size of habitat should be able to support a population of a minimum of 300 individuals (5000-5500 km2 if area relationship holds from NENC) in order to maintain genetic diversity over 85%
- Why wouldn't we work to expand NENC habitat size to get towards that larger population size? Should we be constrained to 200? Additional counties have been talked about in the past as places to expand to; expansion would result in a very challenging rule-making process, and may be more challenging
    - If we got back to a population size in mid-2000s where peninsula is full of red wolf territories, and then the wolves will tell us what they'll do and how they will expand
- Is there also a possibility of future genetic tools and technologies that will make that 85% threshold less essential or allow more ability to play with the population size?
- Is the 85% threshold need to be maintained per population or just across the entire wild?
    - Original intent was for each population to maintain it
    - Is challenging from the PVA to estimate GD across the 3 wild populations as a metapopulation
    - For delisting, want each subpopulation to be largely independent
    - But, recovery can occur even if it requires occasional management - declared red wolves to be a conservation dependent species
        - Good example - red cockaded woodpecker - states will do low level of management needed (burning forest, moving individuals) to sustain species after federal recovery
    - "Recovery will occur in the presence of no significant human intervention"
        - Minimal translocations, minimal releases allowed
- 300 individuals is important for maintenance of GD over time, but a smaller minimum population for it just to be stable
    - BFF = 1500 individuals across 10 populations
    - Northern rocky wolves = want to downlist with 500
- Phil's models are very optimistic to get to those levels of GD
- Minimum of three populations, with 300 individuals each
    - Or, X populations that have 300, and each population has some minimum size for demographic viability
    - X numbers of individuals that maintain the genetic viability
    - Every population is going to drift in their own direction, retaining different combinations of allele, so occasional genetic management between different populations (moving adults between wild populations occasionally)
- Do we want to include a GD specifically in the recovery criteria, which requires FWS to monitor and estimate this for each subpopulation, or do we say that the population size sufficient to maintain X GD with the population size being what is monitored? Or make the GD "estimated" so the service can use any method they want to
    - How much of genetics is RW? What is quantifiable levels of introgression

        - Are we assuming 75% or above is RW for our population size estimate?
    - Caution: setting minimum population size in the west has enabled states to set harvest targets of any individuals above that number
    - Comments from Pete: I think we should further explore the idea of wording population size in terms of % of carrying capacity as opposed to a specific number. Our understanding of carrying capacity will likely evolve as the science evolves; so, the recovery plan tied to carrying capacity would not need updating in the same was as a recovery plan tied to a specific number. The issue with K is it depends on the size of the area under consideration. I think you need some sort of lower bound so that you don't end up with some population(s) with a very low K occupying a very small area.
    - Phil: Whooping cranes did an interesting mix:

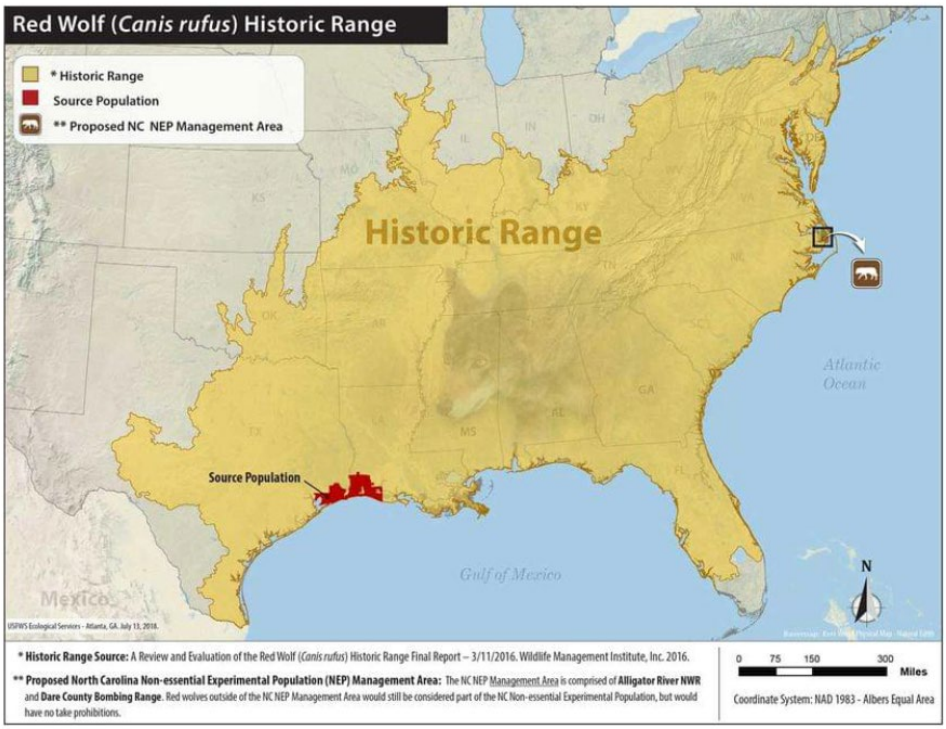
> **Objective 1** – Establish and maintain self-sustaining populations of whooping cranes in the wild that are genetically stable and resilient to stochastic environmental events.
>
> **Criterion 1** – Maintain a minimum of 40 productive pairs in the AWBP for at least 10 years, while managing for continued increase of the population. Establish a minimum of 25 productive pairs in self-sustaining populations at each of 2 other discrete locations.
>
> A productive pair is defined as a pair that nests regularly and has fledged offspring. The two additional populations may be migratory or non-migratory. Multiple populations provide protection against stochastic, catastrophic events in nature. A single wild population remains vulnerable to extinction during singular, or a series of, adverse events, regardless of its size.
>
> Population targets are 160 in the AWBP, and 100 each in the Florida non-migratory population and the eastern migratory population. These targets are consistent with a population viability assessment of what is needed to maintain genetic variability for the population (see Appendix A). All 3 populations must be self-sustaining for a decade at the designated levels before downlisting could occur. A self-sustaining population is defined as a stable or growing population that is not supplemented with any additional reintroductions from captivity.
>
> The AWBP has been maintained at above 40 productive pairs since 1992; however, additional populations are not yet self-sustaining. An alternative criterion may be applied for downlisting in the event that attempts to establish additional self-sustaining populations do not succeed.
>
> **Alternative Criterion 1A** – If only one additional wild self-sustaining population is re-established, then the AWBP must reach 400 individuals (i.e. 100 productive pairs), and the new population must remain above 120 individuals (i.e. 30 productive pairs). Both populations must be self-sustaining for a decade at the designated levels before downlisting could occur. This alternative is based on the principle that with the re-establishment of only one additional population separate from the AWBP, then crane numbers must be higher in both populations than if there are three distinct populations.
>
> **Alternative Criterion 1B -** If establishment of second and third wild self-sustaining populations is not successful, then the AWBP must be self-sustaining and remain above 1,000 individuals (i.e. 250 productive pairs) for downlisting to occur. The *Memorandum of Understanding on Conservation of Whooping Cranes*, approved by Canadian and U.S. federal officials, recognizes a goal of 1,000 individuals in the AWBP population. This higher number ensures a better chance for survival of the AWBP in the event of a catastrophic event within its extremely limited range. The target of 1,000 is reasonable for downlisting given the historical growth of the AWBP and theoretical considerations of minimum population viability. To ensure sufficient genetic variability, the AWBP must increase to the level where the creation of new alleles through genetic mutation will offset the loss of genetic diversity. After reaching the goal of 250 pairs, the population should gain genetic variation faster than the population loses genetic material.

- When will recovery plan next be revised? Not specific timeline, but FWS resources are limited enough that we need to assume that this will be in place for the foreseeable future
- **<u>Population growth rate</u>**
  - 5% extinction risk
    - *New models needed for any new wild populations to establish this*
    - *Extinction risk in baseline scenario once management ceases?*
  - Growth rate:
    - *Growth rate without releases?*
  - Mexican wolves = 8 years = based on generation length, average growth rate plus growth over the last three years; specifics:

> 1. A minimum of two populations meet all abundance and genetic criteria as follows:
>
> *United States*
>
> a) The population average over an 8-year period is greater than or equal to 320 wolves (e.g., annual wolf abundance of 200, 240, 288, 344, 412, 380, 355, and 342 averages 320 wolves);
>
> b) The population must exceed 320 wolves each of the last 3 years of the 8-year period;
>
> c) The annual population growth rate averaged over the 8-year period is stable or increasing (e.g., annual averages of 1.2, 1.2, 1.2, 1.2, 1.2, 0.9, 0.9, and 1.0 averages 1.1); and
>
> d) Gene diversity available from the captive population has been incorporated into the United States population through scheduled releases of a sufficient number of wolves to result in 22 released Mexican wolves surviving to breeding age in the United States population. "Surviving to breeding age" means a pup that lives 2 years to the age of breeding or an adult or subadult that lives for a year following its release. "Scheduled releases" means captive releases and translocations that achieve genetic representation, as described in Rationale for Recovery Criteria.

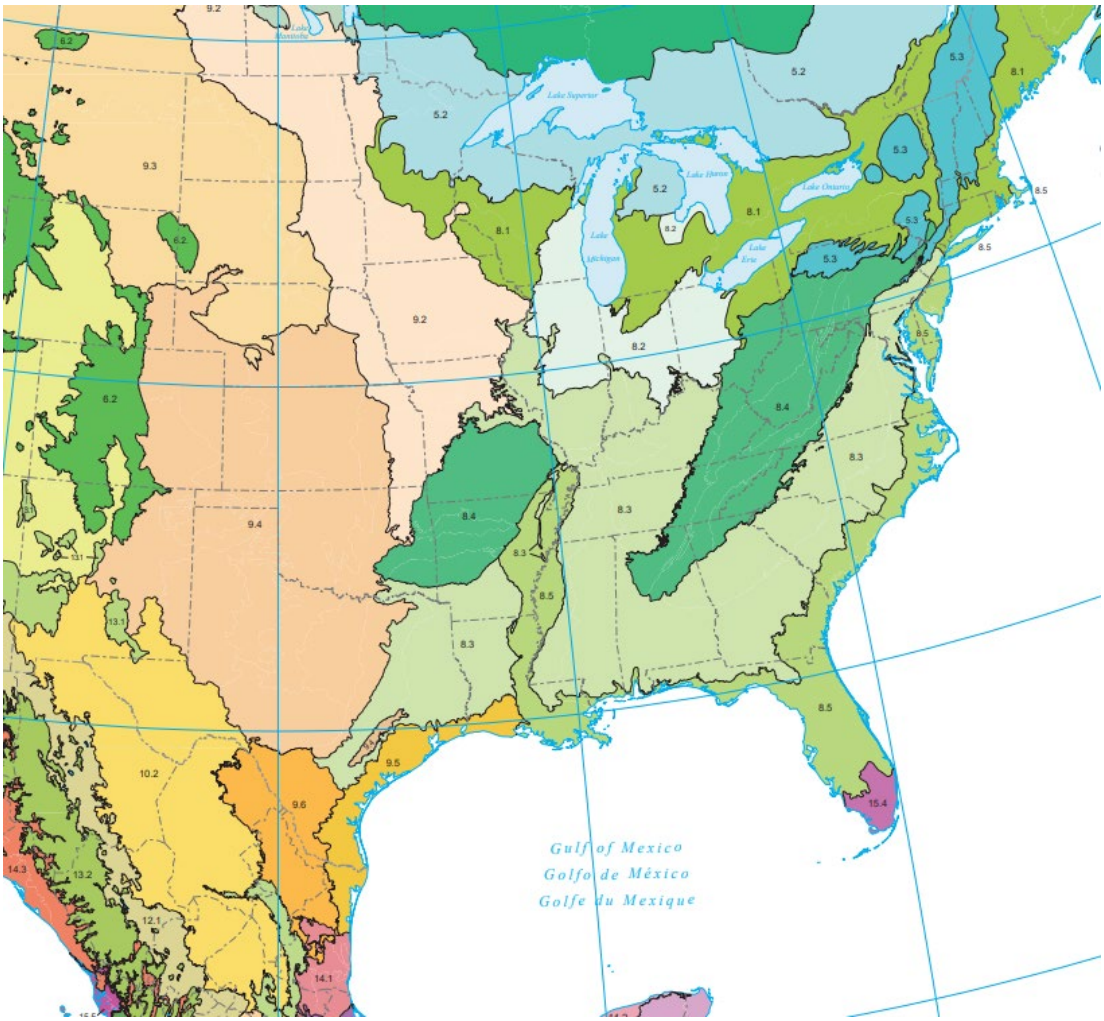
  - Drafts:
    - The population average over a 10-year period is greater than or equal to X percent of the carrying capacity per population with each population's carrying capacity at least 200 animals.
    - The annual population growth rate averaged over the 10-year period is stable and increasing and exceeds X percent of the carrying capacity per population each of the last 3 years of the 10-year period.
  - 300/350 are if we really pull it off perfectly; to be conservative, we'd want to have higher numbers
  - Carrying capacity: that is a challenging thing to actually measure, so minimum number of a population is more measurable
    - Best estimate of K is size dependent; need minimum population size too
    - Some relationship between K and probability of persistence
      - This would need to require more modeling for the new sites to establish accurate probability of persistence
    - It would also likely require the high probability of persistence without regular FWS intervention (.e.g viable without regular management)
    - This is nice in that we don't know the combination of management and demographic rates at the new sites that might be very different from NENC

- Because of the hybridization issue, may need massive management for a long time at each site; what we would need at NENC is a core protected area where displacement occurs, and in dispersal outside of area may have opportunities for hybridization
  - Can FWS run 3 sites? They will be interagency management teams across other sites, which will build capacity at the other sites
- Minimum of 200 with some populations at least 300;
  - Allows for value in smaller populations that are sustainable but don't necessarily meet the genetic diversity criteria
  - Using a total population size in combination with some minimum population size: What are political/communication implications of saying "we need 900 wolves"; better to not do the math for everyone
  - Minimum management is dependent on what partners agree on will be sustainable management - define in RIS
  - Do we need a statement about genetic persistence?
    - Number of individuals we're counting is already defined as "wolf", not hybrid
  - Focus on the number of breeding pairs rather than total population?



Red wolf historical range with non-essential experimental population management area. Map by Jose Barrios, USFWS.

Level 2 ecoregions:
https://gaftp.epa.gov/EPADataCommons/ORD/Ecoregions/cec_na/NA_LEVEL_II.pdf


Lake Superior
Lake Huron
Lake Ontario
Lake Michigan
Lake Erie
Gulf of Mexico
Golfo de México
Golfe du Mexique

Appendix 2. (Continued) Breakout Group Worksheets for Revising Recovery Criteria

Working Group: Threat Mitigation

Working group members:
Jennifer Adams, Chris Lasher, Nucharin Songsasen, Emily Weller, Andrea Shipley, Angelina Casillas, Ryan Nordsven, Ben Sacks, Liz Rutledge, Dana Karelus, Suzanne Agan, David Clegg
D. Rankin, Wes Seegars

Underline text – existing text in draft recovery plan

Draft Criterion 2:
Threats to the red wolf are effectively mitigated such that the wild populations exhibit sufficient numbers, structure, and behaviors to maintain ecologically functional and phenotypic population characteristics and remain viable into the foreseeable future.

Threats are either eliminated or minimized to levels that do not negatively impact population function (i.e., mortality and fecundity rates result in stable or increasing growth rate and support pack behavior).

Red wolf populations would be considered for delisting if they meet the following conditions:

[1] Maintain genetic diversity through outbreeding, based on markers believed to correlate with red wolf ancestry, and reflected in red wolf phenotype. [Addresses threat from hybridization and/or genetic swamping, with a focus on genetics that matter as opposed to the genetics as we measure them.]

[2] Threats are considered mitigated if the population is stable or growing at >83.8% (or near) of the carrying capacity of each site over eight years/2 generations, as determined by best available science. The 83.8% came from the PVA, which stated that populations could exhibit positive growth with 16.2% human caused mortality. [Addresses threat from human-caused mortality.]

Does not require extensive human intervention for the purpose of demographic stability over an 8 year/2 generation period. Extensive human intervention includes fostering, placeholder or adaptive management, sterilizing coyotes, and translocation. Pup fostering to improve genetic diversity or to improve the health of a population is not considered extensive human intervention. [Addresses the requirement to address the level of human intervention].

States, Tribes, and other federal agencies will ensure regulatory mechanisms are in place to prohibit or regulate human-caused mortality in those areas necessary for recovery such that the Service determines at least three stable recovery locations [insert Group 1 number here] animals are likely to be maintained in the United States in the absence of Federal ESA protections.

Discussion notes:

Threats need to be addressed for the total historical range, but may vary by physiographic province. For example, rising sea levels may be a threat along the coast, but not in the Piedmont or mountains. Our charge is to determine criteria to measure recovery, based on desired conditions rather than actions.

Use population growth and demographic metrics (e.g., lambda, fecundity, survival), phenotypic characteristics, genetic characteristics.
Annual and frequent releases = extensive intervention

- Breeding pairs are more important than transient animals at a snapshot in time but if we're looking at the population over X consecutive years, how we would realistically do that with breeding pairs (fluctuating number)
- Need to go with what modern science says is the caring capacity of the recovery area; carrying capacity can change based on observation, prey base, etc. The carrying capacity can change over time
- Coyote management: as the red wolf population grows, they will displace more and more coyotes, helping with coyote management
- During the implementation strategy: consider using % of carrying capacity as a metric; consider having triggers tied to management actions
- Use population trends as an indication of when and what type of intervention is needed
- In NC, the current human-caused mortality is about 2/3. Safe to assume it will be similar in other areas.
- The greatest threat will always be human-caused mortality.
- PVA states a 50% decrease in human-caused mortality but that may not be realistic.
- Ideas: laws around hunting, night hunting, road closures, etc. In what other artificial ways can protect the rw? What policies need to be in place to ensure success?
- Can we use a regulatory environment as a recovery characteristic? (Forrest service uses regulation as our monitoring criteria)
- Threats are mitigated to an extent so that the total mortality rate of sub-adults is less than x and young adults is less than y
- Should natural/natural selection death even be considered when talking about delisting criteria? focus on the non-natural threats
- need laws/ we need regulatory mechanisms with teeth and we need prosecutions that come with it
- If we decide the population needs to follow a certain trend over 8 years, and there is a where threats are severe and there is a major dip in e.g. year 5, you start the 8 year clock again
- Look at % of carrying capacity, plus x% need to be in breeding age - can we be this specific?

Appendix 3. Breakout Group Worksheets for Revising Recovery Actions

Working Group: New Sites

Working group members:
Lead: Regina Mossotti/Nucharin Songsasen
Reporter: Lisa Faust
Note taker: Bridgett vonHoldt

Other members:
Becky Gwynn, Dana Karelus, Em Weller, Jay Butfiloski, Lauren Toivonen, Mark Ruder, Eric Gese, Dave Holdermann, Kristin Brzeski

Red text – suggested revision to exiting text

SITE-SPECIFIC RECOVERY ACTIONS

Action Statement 1: Identify potential reintroduction sites ~~of sufficient size with adequate habitat, prey, and conditions~~ ~~(biological & regulatory)~~ to support a viable population or subpopulation within the species' historical range using the best available science complemented with informed practice ~~available reintroduction site studies and ongoing analyses~~ **Note: Considering threats (biological? socio?)**	
Associated criteria:	**1**
Responsible parties:	**Service**
Estimated time (years):	**3**
Total cost estimate (USD):	**$300 000**
Action priority:	**Priority 1**

Action Statement 2: Increase the capacity to increase the captive population to support establishing additional wild populations of red wolves and maintain gene diversity	
Associated criteria:	**1 and 2**
Responsible parties:	**~~SSP~~ SAFE**
Estimated time (years):	**20**
Total cost estimate (USD):	**$9 540 000**
Action priority:	**Priority 1**

Note for possibly combining Action Statements 2 & 3: "Develop an updated controlled propagation plan to increase the capacity of the captive population to provide animals for release into existing and newly established free-ranging populations."

Action Statement 3: ~~Develop~~ Update controlled propagation plan for the captive population to reach the new capacity and optimize reproduction, reduce mortality, and sustain a healthy population so that it can support in situ recovery	
Associated criteria:	**1 and 2**
Responsible parties:	**~~SSP~~ SAFE, Service**
Estimated time (years):	**1.5**
Total cost estimate (USD):	**$50 000**
Action priority:	**Priority 3**

Action Statement 4: Organize and maintain interagency management field? teams (IMT IFT?) for each reintroduction site identified in Action 1 with appropriate Service, State wildlife agency, County government, local government, Tribal government, and/or other Federal agencies to jointly manage recovery of red wolves in collaboration with stakeholders outlined in Action Statement 5	
Associated criteria:	**1 and 2 and 3**
Responsible parties:	**Service, State, and other Federal agencies, County government, local government, Tribal government**
Estimated time (years):	**30 per population**
Total cost estimate (USD):	**$10 004 430**
Action priority:	**Priority 1**

Revise this option, as the name "IMT" limits the team to government staff/employees; option 2 to consider development populations by recovery teams. Inter-entity team is essential. More likely this Action Statement could/should be included with Action Statement 1? Start the effort with a collaborative involvement/plan, including all the partners to start the umbrella and then define/detail the subactions. Interagency Field Team (IFT) implements the on-the-ground management that IMT decides upon and is restricted to federal/government/tribal agencies.

FACA prevents the construction of a non-federal team from reaching consensus. Recovery teams are exempt from FACA [IMTs are not exempt from FACA] so we can structure a group that meets to reach consensus on recovery actions but it is organized as a sub-recovery team. This team could provide guidance for the recovery plan. Landowner alliance (as another action statement)?
IMT and policy/process; implementation team designed the function of wolves on ground and keep them going. IFT is working on the ground with stakeholders vs IMT. Perhaps define what IMT actions really mean.

Action Statement 5: ~~Increase~~ Establish and maintain formal participation of all stakeholders (e.g., individuals from the local community, particularly private landowners, other State, County, and Federal agency representatives, other Tribal representatives, NGOs) in management and recovery planning processes for each population ~~reintroduction site identified in Action 1~~ to ensure engagement of all perspectives in red wolf recovery	
Associated criteria:	**1 and 2 and 3**
Responsible parties:	**IMT**
Estimated time (years):	**30 per population**
Total cost estimate (USD):	**$26 417 330**
Action priority:	**Priority 1**

This is the community involvement. If we use a Recovery Team, that opens it up but we still want more involvement from stakeholders. IMT and this action may still be two separate actions.
Stakeholders are impacted by decisions vs. shareholders have an ownership interest in the outcomes

Action Statement 6: Develop and implement population-specific adaptive reintroductions for each population ~~reintroduction site identified in Action 1~~ with IMT and stakeholders. Management plans for each of these reintroductions should include, but are not limited to: ● Reintroduction schedule and techniques ● Initial population targets ● Habitat and prey needs and management ● Research and adaptive management ● Identification of site-specific threats ● Strategies to: ○ Maximize genetic health ○ Address anthropogenic threats (e.g., orange collars, mobile electronic road signs, etc.) ○ Target coyote hybridization/introgression ○ Minimize disease/parasitic outbreaks ● Monitoring of: ○ Key population demographics ○ Genetic diversity and integrity ○ Long-term trends and movement ○ Specific causes of mortality ○ Threats	
Associated criteria:	**1 and 2 and 3**
Responsible parties:	**Service, IMT**
Estimated time (years):	**30 per population**
Total cost estimate (USD):	**$180 000 000**
Action priority:	**Priority 1**

Action Statement 7: Conduct outreach and ~~education~~ engagement/involvement on red wolf conservation within communities near or ~~affected by~~ ~~reintroductions~~ associated with wolf populations to improve hunter, trapper, landowner, and global public awareness ~~and tolerance~~ of red wolves.	
Associated criteria:	**1 and 2 and 3**
Responsible parties:	**Service, ~~SSP~~SAFE, State wildlife agencies, other Federal agencies, Tribal governments, NGOs**
Estimated time (years):	**30 per population**
Total cost estimate (USD):	**$29 805 060**
Action priority:	**Priority 2**

Action Statement 8: Engage states and local communities to [inform the final selection] of an identified reintroduction site. (bringing states and other stakeholders perspective into final selection)	
Associated criteria:	**1 and 3**
Responsible parties:	**Service (or Service+States)**
Estimated time (years):	**3**
Total cost estimate (USD):	**$300 000 (3 service staff, 3 trips/year/site)**
Action priority:	**Priority 1**
Action Statement 9: To make Criterion 3 happen: considering management and regulatory Pre-delisting, collaborate with partners to prepare for post-recovery transition of authority. States could agree to manage prey base at levels that are compatible with persistence of red wolf populations (is this post or during recovery?) Coyote or other predator management?; Management plan for "occasional" management for genetic purposes. Details for the (sub)team structures? (is this post or during recovery?) States will continue with the management plan to ensure levels are maintained.	
Associated criteria:	**2, 3**
Responsible parties:	
Estimated time (years):	
Total cost estimate (USD):	
Action priority:	

Appendix 3. (Continued) Breakout Group Worksheets for Revising Recovery Actions

Working Group: NE North Carolina

Working group members:
Wes Seegars, Pete Benjamin, Joey Hinton, Andrea Shipley, Jennifer Adams, Joe Madison, Ryan Nordsven, Chris Lasher, Kelly Davis, Suzanne Agan, Liz Rutledge, Becky Harrison, Art Beyer, Kim Wheeler

Red text – suggested revision to exiting text

SITE-SPECIFIC RECOVERY ACTIONS

Action Statement 2: Increase the captive population to support establishing additional wild populations of red wolves and maintain gene diversity
-Grow capacity within the Red Wolf SAFE to maintain a minimum 400 ex-situ wolves
- 400 wolves needed to maintain genetic diversity of the Ex-situ population above 80% for 100 years while also supporting multiple recovery populations with pup fostering and adult releases opportunities.

Associated criteria:	**1 and 2**
Responsible parties:	**SSP/SAFE**
Estimated time (years):	**20**
Total cost estimate (USD):	**$9 540 000**
Action priority:	**Priority 1**

Action Statement 4: Organize and maintain management teams (MT) for each reintroduction site and NENC recovery population with appropriate Federal, State wildlife agency, County government, local government, Tribal government, non-governmental organizations, academia, community and landowner organizations to jointly manage recovery of red wolves. Members of the MT should represent those who possess the authority, resources, land, expertise and those with a diverse vested interest in the outcome of MT actions.

-NENC should establish a MT within one year
- New sites should establish a MT before on the ground implementation

Broaden to include NENC population- 'for each population area'
-Be more specific about purpose of MT 'collaborative'
-Should specify that this should include both planning and implementation in the field
-Team comprised of organizations with authority and expertise to carry out the recovery actions
Suggested but not limited to below:
-NCWRC
-DOD
-DOT
-USDA (Wildlife Services, NRCS)
-Land Owner Alliance
-Other state agencies

Are private or non-profit entities able to be a part of MT -'Jointly manage recovery of red wolf', need more specifics here? -Different levels of IMT? Regulatory versus planning versus implementation - management team a sub group of a recovery team to skirt FACA - site specific team - scientific advisory team?	
Associated criteria:	**1 and 2**
Responsible parties:	**Service, State, and other Federal agencies, County government, local government, Tribal government, other organizations or entities that have resources to carry out the implementation plan**
Estimated time (years):	**30 per population**
Total cost estimate (USD):	**$10 004 430**
Action priority:	**Priority 1**
Assumptions:	Assume Management Team is organized as a sub-committee of the Recovery Team and is, as such, FACA-exempt. We are also assuming that the MT is structured in such as way as to have the authority to carry out actions identified in the Management Plan (i.e., the MT has actual power to make decisions and implement recovery actions.).

Action Statement 5: Increase formal participation of all stakeholders (e.g., individuals from the local community, particularly private landowners, other State, County, and Federal agency representatives, other Tribal representatives, NGOs) in management and recovery planning processes for each reintroduction site identified in Action 1 and NENC recovery population to ensure engagement of all perspectives in red wolf recovery	
Associated criteria:	**1 and 2**
Responsible parties:	**MT**
Estimated time (years):	**30 per population**
Total cost estimate (USD):	**$26 417 330**
Action priority:	**Priority 1**

Action Statement 6: Develop and implement population-specific adaptive reintroductions for each reintroduction site identified in Action 1 and NENC recovery population with MT and stakeholders.

Management plans for each of these reintroductions should include, but are not limited to:

- Near term and long term metrics to determine progress toward the recovery criteria.
- NENC should establish a MT within one year
- New sites should establish a MT before on the ground implementation

- Reintroduction schedule and techniques
- Initial population targets
- Habitat and prey needs and management
- Research and adaptive management
- Identification of site-specific threats
- Strategies to:
    - Maximize genetic health
    - Address anthropogenic threats (e.g., orange collars, mobile electronic road signs, etc.)
    - Target coyote hybridization/introgression
    - Minimize disease/parasitic outbreaks
    - Provide assistance to landowners
- Monitoring of:
    - Key population demographics
    - Genetic diversity and integrity
    - Long-term trends and movement
    - Specific causes of mortality
    - Threats

Associated criteria:	**1 and 2**
Responsible parties:	**Service, MT**
Estimated time (years):	**30 per population**
Total cost estimate (USD):	**$180 000 000**
Action priority:	**Priority 1**
Assumptions:	We are assuming "high end" management needs (e.g., maximum need for coyote management). This determines resource needs and key partners.

<u>Action Statement 7:</u> Conduct outreach and education on red wolf conservation within communities near or affected by reintroductions to improve hunter, trapper, landowner, and public awareness and tolerance of red wolves, and more broadly.	
Associated criteria:	**1 and 2**
Responsible parties:	**Service, SSP/SAFE, State wildlife agencies, other Federal agencies, Tribal governments, NGOs**
Estimated time (years):	**30 per population**
Total cost estimate (USD):	**$29 805 060**
Action priority:	**Priority 2**

Action Statement 8: Ensure NENC site of sufficient size with adequate habitat, prey, and conditions to support a functional population or subpopulation within NENC using available reintroduction site studies and ongoing analyses.

- Threats:
  - Climate change effects - monitor and assess impacts, annual review of NENC specific climate change impacts.
  - poor habitat - monitor and maintain or restore - NRCS monitoring effort, 60 miles of dike fortification, Implement prey for the pack program.
  - human caused mortality - monitor, document, and ameliorate, create underpasses, open roadside site lines, outreach to hunters, create value to the community.
  - social habitat - monitor (surveys) and analyze, education and outreach,
  - hybridization - monitor and implement adaptive management plan, Establish/ repair holding area for sterilized coyotes for healing before placement.
  - genetic diversity - monitor, utilize established labs to do genetic analysis., Continue work to find potential new founders. Utilize AI to recover lost genetics.

Associated criteria:	**1**
Responsible parties:	**Service, MT**
Estimated time (years):	**30 per population**
Total cost estimate (USD):	**$70000/yr + $3-4mi one time cost for dike fortification + $70k/yr every 3yrs for 2yrs + $70k/yr for outreach, public education + $?? DOT cost estimate for underpasses + $25K/yr for social survey through Qualtrix for 2 yrs + $70k for 1yrpost-doc for social data analysis + cost of FWS staff and trapper compensation for sterilizations (mobile vet?) + cost of proof of concept for sterilizations plus visual representation + $75-100k/yr for genetic research +**
Action priority:	**Priority 1**
Assumptions:	We are assuming “high end” management needs (e.g., maximum need for coyote management). This determines resource needs and key partners.

Appendix 4. Breakout Group Worksheets for Defining Management Team Structure

Team Structure: New Sites Working Group

- Tier 1: Recovery Strategy Team (RST)
    - Purpose: Makes recommendations to field implementation team
    - Membership: All interested parties: government agencies, landowners, academia, stakeholders
        - Consider a sub-team(s) to be utilized for addressing various aspects and technicalities of this team's actions (e.g., developing an initial management plan)
    - Responsibilities
        - Develop initial management plan for their respective red wolf site and population
        - Decision-making for ongoing management
        - Community engagement that operates under written operational guidelines, etc. with some mechanism to influence management authorities but the exact structure can be individualized
        - Involve a social scientist [or a community engagement specialist] to guide community engagement
    - Pros/cons/fixes
        - Con: Too large of a group for decision-making
        - Pro: Full inclusion of all community members
        - Fix: Membership process (by invitation); voting rules (odd numbers); sub-team presence and contribution to discussion
        - Could be organizations/individuals offering decisions, and not reaching consensus, and final decision making is with other group
- Tier 2: Field Implementation Team (FIT)
    - Purpose: Implements the recommended actions from the RST
    - Membership: Agency biologists
        - Consider a sub-team(s) to be utilized for doing recommended field actions for their respective red wolf site and population
    - Responsibilities
        - Implement the recommended actions (on the ground)
        - Periodic meetings with RST for exchange of updates, challenges, modifications, etc
    - Pros/cons/fixes
        - Fixes: Membership process for biologists to show collaboration, open mindedness, etc.

Appendix 4. (Continued) Breakout Group Worksheets for Defining Management Team Structure

Team Structure: NENC Working Group

Name: ***Policy/High Level Team***

Purpose: *Establish adaptive management plan for NENC, resource allocation, overall recovery discussions - clearing house for subteam information for discussion, collaboration allocation (task management)*

Membership: *Action 4 identified representatives and subteam representatives*

Pros/cons/fixes:
- *CON: At some point group meeting up didn't seem important*
- *PRO: don't need consensus*
- *PRO: dissenting opinions*
- *PRO: existing relationships*
- *CON: not all entities may be interested in participating*

Sublevel Teams

Name: ***Field/Implementation Team***

Purpose: *Team to implement on the ground work for the recovery plan*

Membership: *NCWRC, FWS, Private local trappers, USDA (?), SAFE, Representatives from county subteams,*

Pros/cons/fixes:
- PRO: Spread out work load across collaborators
- CON: toe stepping
- CON: compliance - stand alone permit for private trappers to provide individual responsibility
- PRO: information sharing

Name: ***Scientific Advisory Team***

Purpose: facilitate adaptive management through research, to bring in new and evolving research techniques, advisory on new science

Membership: Academia - covering spread of different expertise adhoc, NCWRC, FWS, SAFE

Pros/cons/fixes: *Identify obstacles that may need to be overcome for this approach*

Name: ***Stakeholder Team***

Purpose: represent all perspectives in red wolf recovery

Membership: Local community, landowners, corporate entities, local/county government, local NGOs, hunt clubs

Pros/cons/fixes: *Identify obstacles that may need to be overcome for this approach*

Name: ***County SubTeams (1 for each county of AP)***

Purpose:

Membership: *stakeholders for each county - choose 1 representative from each county to represent each team on the stakeholder team*

Pros/cons/fixes: *Identify obstacles that may need to be overcome for this approach*

An example of how teams have been organized:

Regional Longleaf Pine Partnership Council

In recognition that successful range-wide longleaf conservation will require the resources, talents, and collaborative efforts of many partners, the Partnership Council was formed in October 2011. Its organization followed two earlier meetings in the fall of 2010 and spring of 2011 involving some 80 individuals representing diverse agencies and private groups. Recommendations from these earlier meetings framed the Partnership Council, its operational guidelines and structure.

The Partnership Council is comprised of 33 members representing non-governmental organizations, state and federal agencies, implementation teams and other collaborative efforts, private industry, universities/research/extension and private landowners. Its purpose is to promote effective communication and collaboration among the large number of partners working to conserve longleaf pine ecosystems across the South. It provides a forum where the diverse partners can bring their different objectives, missions, responsibilities and contributions required to make the conservation implementation efforts successful and demonstrate collective progress.

The Partnership Council is governed by a chair, chair elect and past chair, with each serving a one year term. Here's the current leadership:

- *Chair Carol Denhof, representing The Longleaf Alliance*
- *Chair-Elect Jason Dockery, representing the Alabama Forestry Commission*
- *Past Chair Colette DeGarady, representing The Nature Conservancy*

The Partnership Council expects to meet face-to-face no less than twice a year and by conference call on an as-needed basis. Check back here to learn more about the activities of the Partnership Council and its meeting schedule.