Data Submitted (UTC 11): 11/8/2019 7:00:00 AM
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Comments: Please see attached comments. Thank you.

The Center for Large Landscape Conservation
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8 November 2019
Comments filed online
Kathleen Neelan
Forest Plan Revision Team Lead
Ashley National Forest
355 North Vernal Avenue
Vernal, UT 84078-1703
Re: Comments related to wildlife habitat connectivity in the Forest Management Draft Plan for the Ashley National Forest Plan Revision under the 2012 Planning Rule
Dear Ms. Neelan and Ashley National Forest Plan Revision Team,

As the Ashley National Forest (ANF) continues to engage the public during the Draft Land Management Plan (Plan) phase of the revision process we provide the following comments to support further inclusion of ecological connectivity into the Plan. The 2012 Planning Rule and its implementing regulations created an opportunity to assess connectivity as a key component to maintain ecological integrity and further promote connectivity as a strategy that addresses climate adaptation for plants and wildlife. Given the acknowledgement in the Draft Plan of the intent to put forward a plan in accordance with the 2012 Planning Rule, per 36 CFR Part 219, ecological connectivity provisions in the Plan must be more frequent and succinct. Connectivity management actions should be included both within boundaries of the ANF and between the forest and adjoining lands important to regional fauna and flora. Some of the information included in this comment letter was also included in CLLC's comments on the ANF Assessment in 2016 because it has not been included in this Draft Plan.

CLLC provided comments on the importance of including ecological connectivity management actions during the development of the 2012 Forest Planning Rule and we are pleased that connectivity is now a more robust consideration of forest plan revisions nationally. We think the Forest Service's next generation of management plans can make a great leap forward to ensure that ecological connectivity is part of the management of our public lands. CLLC feels strongly that more management provisions related to connectivity must be included.

This letter is organized as follows: First, we lay out elements of the Plan that consider connectivity. Next, we provide an overview of approaches taken by the other National Forests to promote connectivity in Plan revisions, which may provide useful examples of how the ANF might include greater consideration for connectivity issues. Next, we provide examples of existing connectivity studies and how they relate to the ANF in order to inform connectivity management on the Forest. Finally, we make the following recommendations and provide rationale for how ANF can improve its approach to connectivity in the Plan:

[bull] Recognize that providing for connectivity is the best strategy to allow wildlife to adapt in the face of

climate change.
[bull] Formally define infrastructure as a stressor and develop related mitigation measures to reduce the adverse impacts of roads, railways, transmission lines, pipelines and other linear man-made features on connectivity.
[bull] Identify and map wildlife movement corridors. Where key areas on the forest emerge as important landscapes for wildlife movement and migration, designate these as specific geographic areas that are prioritized for connectivity conservation.
[bull] Assess current species-specific and forest-wide standards and guidelines (S & Gs) for connectivity with
the aim of improving existing S & Gs and developing additional provisions, as needed.
[bull] Assess the current status of connectivity along Wild and Scenic Rivers on the Forest and ensure stringent standards are established in the Plan for connectivity along these natural corridors.
[bull] Assess current conditions with the aim of establishing S & Gs that promote connectivity for native pollinators.
[bull] Improve incorporation of regional, state, and local fish, wildlife, and habitat data into Plan.
[bull] Promote cooperation with Utah Department of Transportation (UDOT), Utah Division of Wildlife Resources (UDW), U.S. Fish & Wildlife Service (USFWS), and Federal Highways Administration (FHWA) in order to take advantage of other agencies' data and expertise.

EXISTING CONNECTIVITY CONSIDERATIONS IN THE DRAFT PLAN

There are nine mentions of connectivity in the Draft Plan. This is significantly fewer than those found in other Draft Forest Plans in the Western United States. Two of the mentions are specific, numbered, actionable management standards and guidelines. Three of those are less actionable desired conditions. The Plan does not have a single standard that specifically addresses terrestrial habitat connectivity. Connectivity management actions found in the Plan are illustrated by the following direct quote passages:
[bull] (FW-DC-WA) Aquatic habitat connectivity and ecological conditions, within or between watersheds, support self-sustaining populations of native and desirable nonnative aquatic and riparian species (Plan at 13).
[bull] (FW-DC-TV) A network of viable, healthy native plant communities is present across the landscape, such that genetic and species diversity and connectivity are maintained[hellip] (id. at 18).
[bull] (FW-ST-RUH) Avoid or mitigate management activities that would disrupt ecological processes and hydrologic connectivity, diminish organic soils, and compromise the overall ecological integrity and resilience of calcareous fens and peatlands (id. at 29).
[bull] (FW-DC-WL) Landscape patterns provide habitat connectivity for native species, which promotes daily and seasonal movement of species to facilitate maintenance of genetic diversity (id. at 33).
[bull] (DA-GL-HUW) New or rerouted trails in wilderness shall be located in resilient areas and not cause impacts to at-risk species, water quality, soils, hydrologic connectivity, or cultural resources unless an alternative location is not feasible and trail structures can minimize impacts (id. at 71).

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NEW CONNECTIVITY ANALYSES TAILORED TO ANF

If desired, CLLC has the ability to collaborate with the ANF Planning Team on designing and conducting a series of connectivity analyses to ensure that the Final Plan incorporates the best available scientific information while meeting Forest-specific objectives. These analyses would focus on both structural and functional connectivity and be used to identify areas within the planning area and between it and adjacent federal land management units that are predicted to have high importance for regional connectivity of both generalist species and specialist species that use forest, grassland, shrubland, and alpine habitats. The approaches used would be developed in consultation with the Planning Team and would rely on ANF-specified objectives and peerreviewed, freely available, spatially explicit datasets.

If these analyses were conducted, it would be CLLC's hope that the results would allow for greater consideration of connectivity in management provisions in the Plan, more thoroughly described in the suggestions below, as well as result in the designation of "Areas of Connectivity Conservation" on the forest.

These areas would be managed first-and-foremost for connectivity, similar to areas designated on the Flathead National Forest, as described below.

A LOOK AT OTHER FOREST'S APPROACHES TO CONNECTIVITY

Other national forests have incorporated various elements related to connectivity in their Plan revisions. Examples from the Flathead and Carson National Forests may help inform the ANF as it develops its approach to addressing connectivity in the Plan.

FLATHEAD NATIONAL FOREST

The Flathead National Forest's Final Plan published in 2017 includes species-specific provisions, has designated and mapped "connectivity areas for geographic area plan components", and includes other Desired Conditions, Objectives, Guidelines, and Standards that may help inform the ANF Plan in addressing connectivity. The map of "connectivity areas for geographic area plan components" can be seen below as Figure 1. The following list is a sampling of connectivity-related provisions found in the FNF Final Plan that might be of interest for inclusion in or to guide the ANF Plan:

1. Defined a riparian management zone DC as, "If new openings are created in riparian management zones through even-aged regeneration harvest (see glossary) or fuel reduction activities, each created opening's distance to cover (see glossary) should not exceed 350 feet to provide wildlife habitat structural diversity, connectivity, and cover" (FNF Plan at 23).

2. Defined a terrestrial ecosystems and vegetation GL as, "To maintain connectivity and avoid adverse impacts to old-growth forest, new road construction or reconstruction should not be located within oldgrowth forest. Exceptions may occur, such as when there are no feasible alternative road locations" (id. at 44).

3. Defined a wildlife habitat diversity DC as, "Ecological conditions provide for wildlife diversity (including species of conservation concern) and wildlife habitat connectivity (including seasonal movements of animals within home ranges; the dispersal and genetic interchange between populations; and the long-distance range shifts of species) (id. at 47).

4. Defined a northern bog lemming habitat DC as, "Areas in and within 300 feet of peatlands have low groundcover and downed woody material that contribute to northern bog lemming habitat and connectivity between clusters of individual sites" (id. at 47).

5. Defined an infrastructure GL as, "Within areas specifically identified as being important for wildlife connectivity across highways, the Forest should cooperate with highway managers and other landowners to design approaches and crossings that contribute to wildlife and public safety" (id. at 69).

6. Defined a lands and special uses DC as, "Land ownership adjustments, through purchase, donation, exchange, or other authority, improve national forest management by consolidating ownership, reducing

wildlife-human conflicts, providing for wildlife habitat connectivity, improving public access to public lands, and retaining or acquiring key lands for wildlife and fish and within wild and scenic river corridors" (id. at 70).

7. Defined two partnerships and coordination DCs as, 1) "The Forest works towards an all-lands approach to management, cooperating with other land managers; this includes efforts to mitigate threats or stressors, provide for wildlife and fish habitat connectivity, and provide social, economic, and ecological conditions that contribute to mutual objectives", and 2) "The Forest works towards an all-lands approach to management of species of conservation concern, cooperating with other land managers across the range of a species and including efforts to provide for habitat connectivity, mitigate threats or stressors, and provide other ecological conditions that support the species" (id. at 83-84).

8. Defined a Hungry Horse Geographic Area DC as, "The Coram connectivity area (see figure [1]) provides habitat connectivity for a north-south movement corridor for wide-ranging species (e.g., grizzly bear, Canada lynx, wolverine) moving between the southern and northern watersheds on the Forest" (id. at 118).

9. Defined a Middle Fork Geographic Area DC as, "The Nyack Pinnacle, Essex, and South Glacier connectivity areas (see figure [1]) provide habitat connectivity for wide-ranging species (e.g., grizzly bear, Canada lynx, wolverine) moving north- south between Glacier National Park and the Bob Marshall Wilderness and east-west within the Middle Fork watershed" (id. at 123).

10. Defined a Middle Fork Geographic Area objective as, "Acquire one or more parcels and/or provide one or more easements for wildlife crossings along Highway 2 and the Burlington Northern Santa Fe Railway corridor in the Nyack Pinnacle and Essex connectivity areas (see figure [1])" (id. at 124).

11. Defined a North Fork Geographic Area DC as, "The Haskill Basin connectivity area (see figure [1]) provides habitat connectivity for wide- ranging wildlife species (e.g., grizzly bear, Canada lynx, wolverine) moving north-south between the Swan Range and the Whitefish Range.

12. Defined a Swan Valley Geographic Area DC as, "The portion of the Seeley Clearwater connectivity area from Condon south to the boundary of the Swan Valley geographic area and from the south end of Swan Lake to Lost and Porcupine Creeks (see figure [1]) provide habitat connectivity for wide-ranging wildlife species (e.g., grizzly bear, Canada lynx, and wolverine) moving between the Swan and Mission Mountain Ranges" (id. at 148).

13. Defined a Plan monitoring question and indicators as, "What is the status of forest conditions that support wildlife habitat connectivity? And indicators are defined as follows: 1) In riparian management zones: acres with trees with an average d.b.h. of 5 inches or greater and canopy cover greater than 40%, 2) In riparian management zones: distribution of trees with an average tree d.b.h. of 5 inches or greater and canopy cover greater than 40%, 3) In connectivity areas identified for the geographic areas: mapped distribution of forest cover with an average tree d.b.h. of 5 inches or greater and canopy cover greater than 40%" (id. at 164).

Figure 1. Connectivity areas for geographic area plan components (Appears as Map B-30, Appendix B, FNF 2017).

SIERRA NATIONAL FOREST

The Sierra National Forest completed its Forest Assessment in 2014 (SNF 2014) which included many types of connectivity evaluations including the least cost path (LCP) corridor analyses for forest carnivores, LCPs between old growth/late successional forest patches, and LCPs among large blocks of relatively intact landscape

(Figure 2). Similar forest-wide analyses are available to the ANF for its Forest Plan Revision which we discuss in the next section.

Figure 2. Key sources of information on connectivity from the Sierra NF's Assessment (SNF 2014).

CARSON NATIONAL FOREST

The Carson National Forest (CNF) released the third version of their Draft Plan in 2019 (CNF 2019). The Plan also lacks a single standard that addresses terrestrial habitat connectivity, though they have many desired conditions related to connectivity. The following is a list of connectivity-related provisions found in the Draft Plan Version 3:

1. Determined that "Management needs to protect important habitat features and maintain habitat by protecting, restoring, and maintaining ecosystem condition, function, and connectivity" to be one of 14 key findings related to risk (CNF 2017 at 20).

2. Defined a vegetation community desired condition (DC) as "Vegetation connectivity and abundance provide for genetic exchange, daily and seasonal movements of animals, and predator-prey interactions across multiple spatial scales, consistent with existing landforms and topography. Habitat configuration and availability and species genetic diversity allow long distance range shifts of plant and wildlife populations, in response to changing environmental and climatic conditions" (id. at 27).

3. Defined a watershed and water DC as "Aquatic habitats are connected and free from alterations (e.g., temperature regime changes, lack of adequate streamflow, barriers to aquatic organism passage) to allow for species migration, connectivity of fragmented populations and genetic exchange. Barriers to movement are located where necessary to protect native fish from non-native species" (id. at 80).

4. Defined a riparian management zone DC as "Riparian ecosystems exhibit connectivity between and within aquatic, riparian, and upland components that reflect their natural linkages and range of variability. Stream courses and other links provide habitat and movement that maintain and disperse populations of riparian-dependent species, including beaver" (id. at 83).

5. Defined a riparian management zone guideline as "The exact width of riparian management zones may vary based on ecological or geomorphic factors or water body type, but includes those areas which provide riparian and aquatic ecosystem functions and connectivity" (id. at 83).

6. Defined a forest, shrub, and scrub riparian (FSSR) DC as "Connectivity within FSSR should be maintained and enhanced by protecting ecological functions, tree density and growth, and native understory, to reduce the risk of predation and nest parasitism, and to provide habitat for at-risk and other wildlife species" (id. at 98).

7. Defined a wildlife, fish, and plant DC as "Habitat connectivity and distribution provide for genetic exchange, daily and seasonal movements of animals, and predator-prey interactions across multiple spatial scales, consistent with existing landforms and topography" (id. at 108).

8. Defined a wildlife, fish, and plant DC as "range shifts of plant and wildlife populations, in response to changing environmental and climatic conditions. Barriers to movement may exist to protect native species and prevent movement of nonnative species (e.g., a fish structure to protect Rio Grande cutthroat

trout from nonnative invasion)" (id. at 108.

9. Defined a wildlife, fish, and plant objective as "Improve wildlife or aquatic habitat connectivity by removing unneeded structures (e.g., fences, roads, cattleguards, culverts, and spring developments) or completing improvement projects (e.g., removing barriers and connecting fragmented habitat) in at least 10 - 20 locations, during each 10-year period following plan approval" (id. at 108).

10. Defined a wildlife, fish, and plant objective as "Complete at least 5 projects to improve habitat connectivity for aquatic and riparian species (e.g., remove barriers, restore dewatered stream segments, connect fragmented habitat, wildlife passage friendly fences, etc.), during the 10 years following plan approval" (id. at 109).

11. Defined a wildlife, fish, and plant guideline as "To conserve wildlife and fish habitat connectivity, constructed features (e.g., exclosures, wildlife drinkers, range improvements, fences, and culverts) should be maintained to support the purpose(s) for which they were built. Constructed features should be removed when no longer needed, in order to restore natural hydrologic function and maintain habitat connectivity" (id. at 109).

12. Defined a wildlife, fish, and plant guideline as "New infrastructure (e.g., fences, roads, facilities, drinkers) should be designed, to improve habitat connectivity" (id. at 110).

13. Suggested a management approach for the CNF to work collaboratively with relevant stakeholders to "identify wildlife migration routes and important habitat and improve or maintain connectivity for terrestrial species[hellip][and] coordinate when proposing management that may impact habitat connectivity and discuss what mitigation may be needed" (id. at 111).

14. Defined a transportation and forest access DC as "Unneeded roads, trails, and routes are closed to motor vehicle use and naturalized, to reduce impacts to ecological resources (i.e., watersheds, wildlife, and soil erosion) and improve habitat connectivity" (id. at 151).

15. Defined a transportation and forest access guideline as "To improve habitat connectivity, methods that accommodate wildlife (e.g., fencing, underpasses, overpasses, larger culverts) should be used when constructing or reconstructing highways or high traffic volume forest roads" (id. at 152).

16. Defined a transportation and forest access guideline as "Road and trail networks should accommodate terrestrial and aquatic wildlife species movement and habitat connectivity" (id. at 153).

17. Suggested a management approach for lands on CNF that encourages "collaborative relationships with adjacent stakeholders and public land managers[hellip]in order to develop contiguous habitat connectivity across multiple ownerships" (id. at 164).

CONNECTIVITY STUDIES AND INFORMATION AVAILABLE FOR THE ANF'S PLAN REVISION

The purpose of this summary is to suggest that the following resources be considered by the ANF Plan Revision Team as key components of the best available scientific information (BASI) pertaining to connectivity in and around the ANF. We recommend utilization of these sources of scientific information pertaining explicitly to connectivity in order to fully support wildlife movement and continuity of ecological processes on the ANF. We emphasize how each may help prioritize key linkage zones (specific geographies where the protection of connectivity should be a management priority) within the ANF and guide development of a revised Plan that fully supports connectivity based on the BASI.

Please note that geospatial data for most of the connectivity studies described below is freely available online as part of the Great Northern Landscape Conservation Cooperative Ecological Connectivity Data Atlas (https://databasin.org/galleries/5c51bde995e84581b444b9bec7942b43#), which allows the user to download the data and/or view the data as customizable maps in DataBasin.

A. Landscape integrity-based connectivity models. Several connectivity models designed to predict key corridors among intact blocks of natural habitat are available for the region. These models are not speciesspecific; instead, they serve as a coarse-filter approach to identifying areas expected to support movement of a wide range of species as well as continuity of ecological processes. They are intended to provide a first-pass, "20,000 feet" view of areas expected to be important for connectivity, and should not form the basis for finescale, site level management decisions. Instead, these models can help to guide selection of general areas within which to prioritize collection and/or use of finer-scale data.
While these models were designed with the same concept in mind, they employ different methodology, encompass different geographic extents, and are presented in different forms. Therefore, while similarities exist, predictions of key corridors from each model will often disagree, particularly at finer scales. We suggest that each model offers a potentially valuable perspective on priorities in managing for connectivity, and should be considered alongside other resources described below.

1. Belote et al. (2016) modeled least-cost corridors between large protected areas (e.g., wilderness areas, GAP status 1 and 2 lands from the Protected Area Database) using the program Linkage Mapper. The authors considered four underlying landscape resistance models based on combinations of two "naturalness" measures (a human modification index and a wildness index) and two methods of converting these indices to measures of landscape resistance (linear and non-linear). They calculated a composite corridor value for each landscape cell to identify areas with high agreement among the four underlying models. Results of this analysis indicated areas of high corridor value within and around ANF that connect the large protected areas in the region, including the High Uintas Wilderness, Dinosaur National Monument, and several Areas of Critical Environmental Concern

(Fig. 3). Corridors associated with the High Uintas Wilderness were particularly numerous and of high value, encompassing much of the area between the northern and southern portions of ANF.
Figure 3. Corridor value between large protected core areas (Belote et al. 2016).

2. The Western Governors' Association produced a west-wide Crucial Habitat Assessment Tool (CHAT) as part of its Wildlife Corridors and Crucial Habitat Initiative1. The CHAT is a cooperative effort of 16 Western states to provide the public and industry a high-level overview of "crucial habitat" across the West. "Crucial habitats" are places that are likely to provide the natural resources important to aquatic and terrestrial wildlife, including species of concern, as well as hunting and fishing species. The west-wide CHAT is intended to help users in the pre-planning of energy corridors and transmission routes, or in comparing fish and wildlife habitat, by establishing a common starting point across the West for the intersection of development and wildlife. As part of the CHAT effort, connectivity among large intact blocks of habitat was modeled throughout the West. These models identify centrality flow lines, or corridor routes predicted to be crucial for maintaining broad-scale connectivity of several major biomes, including forested systems (Figure 4). Much of the northern 1 This effort and the resulting CHAT is now overseen by the Western Association of Fish & Wildlife Agencies (WAFWA).portion of ANF, particularly on its east side, consists of connectivity zones identified in the CHAT connectivity analysis.

Although this analysis was conducted throughout the west, individual states adopted it at their own discretion. Therefore, because some states selected alternative methods for modeling connectivity (e.g., Montana) and many states chose not to make connectivity layers public via the CHAT, this layer is not available for download from the WAFWA (formerly WGA) CHAT website (http://www.wafwachat.org). Instead, please reach out the for support through the CHAT website.

Figure 4. Connectivity zones and large intact blocks, WGA (now WAFWA).

3. Noss et al. (2001) identified core areas and linkages in the Utah-Wyoming Rocky Mountains Ecoregion using a combined coarse-filter/fine-filter approach that integrated three basic planning strategies: (1) protection of special elemements (e.g., sites of high biodiversity value), (2) representation of the full spectrum of habitats, and (3) conservation of focal species (grizzly bear, gray wolf, wolverine, lynx, and elk). The study area for this analysis included the majority of the northern portion of ANF (excluding Flaming Gorge) but did not extend to the southern portion of ANF. The authors identified much of this northern portion of ANF as core area that is important for biological conservation in the ecoregion (Fig. 5). Several important linkages were also identified along the western margin of ANF that connect the Uinta Mountains to the Wasatch and Bear River Ranges. A linkage to the east of ANF was also identified that connects the Uintas to core areas in northwest Colorado.

Figure 5. Core areas and linkages in the Utah-Wyoming Rocky Mountains Ecoregion (Noss et al. 2001)

B. Focal species-specific connectivity models. Several researchers have produced species-specific models of connectivity for forest carnivores that encompass the ANF and surrounding lands. These models use habitat suitability models and expert opinion to infer resistance to movement associated with landscape characteristics, and then identify areas offering the least resistance to movement. Providing for movement of these species is commonly thought to serve as an umbrella for movement of other species as well as ecological processes. Therefore, we suggest that these models can serve as important guides for identifying key areas in which to prioritize management for connectivity.

1. Bates and Jones (2007) modeled probable dispersal corridors for lynx between core habitat patches within the Rocky Mountains, including a large habitat patch in the Uinta Mountains that is partially within the ANF. Core habitat areas were identified using a habitat suitability model based on vegetation community type, road density, and minimum patch size. A landscape permeability layer reflecting the effects of land cover, housing density, road density, and slope on ease of movement through the landscape was derived using expert opinion and previously published research. The authors then used least-cost path analysis to identify the most favorable dispersal corridors between core areas (Fig. 6). Two key corridors that are highly relevant to ANF were identified in this analysis: 1) a corridor linking the northwest portion of ANF to core habitat in the Bear River Range to the northwest, and 2) a corridor linking the northeast portion of ANF to core habitat to the southeast in Colorado. Preserving connectivity through these areas could be critical for allowing lynx to disperse through and establish home ranges within suitable habitat in the Middle Rockies.

Figure 6. Least-cost corridors between core habitat areas for lynx in the Rocky Mountains. Greater cost distances indicate corridors with smaller probability of successful dispersal between core habitat areas. Figure reprinted from Bates and Jones 2007.

2. Carroll et al. (2012) used graph-theoretic methods to map least-cost habitat centrality across potentially suitable habitat for gray wolves in the western U.S. The authors adapted a previously published habitat suitability model that incorporated the influences of land cover, primary productivity, slope, and humanassociated mortality factors, and assumed that habitat suitability was inversely proportional to movement cost.

The least-cost centrality values calculated for hexagonal landscape units in the analysis measured the relative role of potential movement paths in facilitating movement of wolves across the landscape; hexagons with highest centrality had the largest number of predicted least-cost paths passing through them, such that their loss would be expected to disproportionately increase the cumulative cost of movement between locations within the landscape. Two of the highest centrality movement paths in the western U.S. pass directly through or within several miles of ANF (Fig. 7), linking suitable wolf habitat in the Uinta Mountains with habitat in the southern Greater Yellowstone Ecosystem and western Colorado.

Figure 7. Least-cost habitat centrality across potentially suitable habitat for gray wolves in the western U.S. (Caroll et al. 2012). Higher centrality values indicate movement paths that are more important for facilitating movement of wolves across the landscape. Left panel shows data at full western U.S. extent; right panel shows close-up of ANF region.

3. Two studies on connectivity for greater sage-grouse have been conducted for portions of the ANF region. Knick et al. (2013) modeled pathways for potential sage-grouse movement between leks and populations within a study area that encompassed the majority of ANF lands (excluding Flaming Gorge). They used a circuit theory approach to model connectivity, with an underlying resistance surface derived from a habitat similarity index that included the effects of abiotic, land cover, and anthropogenic variables. Areas of high movement potential for sage-grouse (Fig. 8) were identified along the western boundary of the southern portion of ANF, and along the east side of the northern portion of ANF, potentially providing important links to other regional populations. Additionally, the Heart of the West Coalition (2004) developed a regional conservation plan that included the delineation of cores, linkages, and compatible use areas for wildlife species including sage-grouse. That analysis identified several core areas and linkages for sage-grouse adjacent to ANF lands (Fig. 9).

Figure 8. Estimated potential for sage-grouse movement, Knick et al. 2013.

Figure 9. Critical sage-grouse habitat connectivity, Heart of the West Coalition 2004.

C. Raw focal species data. Datasets collected by biologist and researchers from state and federal natural resource agencies, universities, and conservation organizations in the ANF region may help to directly identify key sites supporting focal species movement at fine scales and/or confirm that a focal species does indeed utilize a particular site predicted to be important for movement by the models described above. Most state wildlife agencies (e.g., Utah Division of Wildlife Resources, Wyoming Game and Fish Department) conduct population counts or occupancy surveys for species of interest. For some species, more informative radiotelemetry data, GPS location data, or genetic data may even be available to assist in connectivity analyses.

Road Impact Studies and Information Available for the ANF's Plan Revision

The Utah Department of Transportation (UDOT) has produced two reports on wildlife-vehicle collisions that could inform this effort. The UDOT Quality Improvement Team (2005) identified wildlife-vehicle collision "hotspots" (highway sections with >20 accidents per mile during 2000-2003) throughout Utah, including one hotspot around milepost 89 of US-40 that lies between the northern and southern portions of ANF. West (2007) presented the results of a workshop attended by transportation and wildlife experts with the purpose of "identify[ing] major sections of Utah's highways that serve to disrupt wildlife connectivity, or pose wildliferelated problems to the traveling public." Workshop participants identified several important wildlife connectivity zones that intersect major roads and freeways in the vicinity of ANF. These include a high priority connectivity zone within the northern portion of ANF that is intersected by US-191 and SR-44; a moderate priority zone between the northern and southern portions of ANF that is intersected by US-40; and a high priority zone just outside the northwest boundary of ANF that is intersected by SR-150 (Fig. 9).

Other factors that may influence connectivity or create barriers for movement by wildlife on the ANF by the transportation system and motorized recreation trails should be analyzed and included in the Plan in addition to road mortality, such as road and motorized trail densities and presence of highway fencing.

PROPOSALS TO STRENGTHEN THE PLAN

CLLC encourages the ANF to consider the following recommendations for increasing consideration of ecological connectivity in its Plan:

Recognize that providing for connectivity is the best strategy to allow wildlife to adapt in the face of climate change The importance of wildlife corridors in maintaining permeability through forests such as the ANF has become a paramount consideration in facilitating wildlife adaptation to climate change. Climate change affects natural systems and wildlife populations by exacerbating the negative effects of habitat loss, degradation, and fragmentation. Local climate disruptions are changing long-term patterns of fire, drought, and flood, as well as seasonal patterns of precipitation and temperature. To adapt and survive, many wildlife species will need to adjust their home ranges and movement patterns (Chen et al. 2011). Scientific reviews of the best strategies to protect biodiversity highlight the importance of maintaining landscape connectivity to ensure that species can move in response to climate-induced changes (Mawdsley et al. 2009). A review of 25 years of peer-reviewed articles found that the most common recommendation for protecting biodiversity in the face of climate change was to increase connectivity (Heller & Zavelata 2009). To bolster this argument, Gilbert-Norton et al. (2010), in their review of empirical studies of corridors, found that corridors increase movement between habitat patches by approximately 50% compared to patches that are not connected by corridors. Thus, conserving corridors is not only strategic and climate-smart, but a proven method of allowing wildlife to move in response to environmental change. The ANF Plan should recognize the need to adapt to address the current and anticipated effects of climate change, and then identify and protect ecological connectivity for plants and animals and build resiliency on the landscape through actionable standards and guidelines.

Formally define infrastructure as a stressor and develop related mitigation measures to reduce the adverse impacts of roads, railways, transmission lines, pipelines and other linear man-made features on connectivity Roads on the Forest fall into two general categories, Forest Service managed roads (lower density, usually unpaved), and highways and other larger roads managed by UDOT, FHWA, and counties (higher density, usually paved). The Plan should address the need for different wildlife mitigation plans and restrictions for each type of road. While forests often do not set restrictions on larger roads managed by other entities, in order to protect forest natural resource integrity, they must. Along I-90 where the highway crosses Snoqualmie Pass in Washington State, multiple wildlife crossing overpasses and underpasses are being constructed across the highway as a direct result of forest plan standards for connectivity on forest lands that border highways.

The Utah Department of Transportation (UDOT) has produced two reports on wildlife-vehicle collisions that could inform this effort. The UDOT Quality Improvement Team (2005) identified wildlife-vehicle collision "hotspots" (highway sections with >20 accidents per mile during 2000-2003) throughout Utah, including one hotspot around milepost 89 of US-40 that lies between the northern and southern portions of ANF. West (2007) presented the results of a workshop attended by transportation and wildlife experts with the purpose of "identify[ing] major sections of Utah's highways that serve to disrupt wildlife connectivity, or pose wildlife-related problems to the traveling public." Workshop participants identified several important wildlife connectivity zones that intersect major roads and freeways in the vicinity of ANF. These include a high priority connectivity zone within the northern portion of ANF that is intersected by US-191 and SR-44; a moderate priority zone between the northern and southern portions of ANF that is intersected by US-40; and a high priority zone just outside the northwest boundary of ANF that is intersected by SR-150 (Fig. 10).

Figure 10. Priority wildlife connectivity zones that are bisected by Utah highways. Zones labeled 2-09, 3-09, and 3-15 are within or near ANF lands. Figure reprinted from West 2007.

Road density is one of several stressors modeled in the U.S. Forest Service National Terrestrial Condition Assessment (TCA;(Cleland and others 2017). Figure 7 is the result of modeling habitat quality for wildlife based on road density across all National Forests including the Ashley.

Large animals, like elk, are thought to be more vulnerable to roads than small ones. They are more mobile and more likely to encounter roads and suffer their ill effects. Large animals also have inherently lower reproductive rates and recover from population declines relatively slowly (Carr and Fahrig 2001 and Gibbs and Shriver 2002 in Fahrig and Rytwinski 2009).

Figure 7: Ratings of the total road density metric of the land-type associations (LTAs) from the Terrestrial Condition Assessment on USDA Forest Service lands (Reproduced from Figure 10 in Cleland et al. 2017).
By including the above information on road density as well as explicitly defining infrastructure stressors, the resulting Plan can include management actions targeted at reducing negative impacts to wildlife due to roads. Specifically, the ANF should commit to:

[bull] Designing and building linear infrastructures (e.g., fences, roads, and transmission lines) in a manner that does not create unreasonable or unnecessary movement barriers or hazards for terrestrial and aquatic wildlife.

[bull] Designing new, replacement, and reconstructed stream crossing sites (i.e. bottomless culverts, bridges) to provide and maintain passage for fish, other aquatic species, and/or riparian-associated terrestrial species (although constructed barriers may need to be maintained in instances where native species benefit from physical isolation).

[bull] Implementing a pilot project to develop a standardized methodology for reporting and collecting data on wildlife-vehicle collisions and wildlife carcasses along Forest Service roads.

[bull] Defining minimum wildlife-vehicle collision (mortality) and traffic volume (connectivity) thresholds that determine when the Forest must consider wildlife mitigation measures.

[bull] Decommissioning or reducing access to Forest-managed roads that bisect seasonal migration corridors for big game species and/or see traffic densities that may negatively affect wildlife movement.

Promote cooperation with Utah Department of Transportation (UDOT), Utah Division of Wildlife Resources (UDW), U.S. Fish & Wildlife Service (USFWS), and Federal Highways Administration (FHWA) in order to take advantage of other agencies' data and expertise.

The ANF should collaborate with Federal, state, tribal, and local partners to share wildlife data, identify and prioritize areas of ecological significance, and establish appropriate management actions during project planning, design, review, and construction. Where appropriate (e.g., for projects involving ANF- and state or federally-managed roads), the Forest should ensure that wildlife and their ecosystems are considered early during transportation and other infrastructure and development projects.

Identify and map wildlife movement corridors. Where key areas on the forest emerge as important landscapes for wildlife movement and migration, designate these as specific geographic areas that are prioritized for connectivity conservation Using the connectivity data and modeling examples above, as well as other relevant connectivity data available and relevant to the Forest, the Plan should model and map connectivity so the resulting Plan can designate specific geographic areas prioritized for connectivity. The Plan should also designate and map wildlife movement corridors within Forest lands as well as points on the ANF border where important movement corridors intersect surrounding lands that are privately owned or administered by another public agency. By mapping corridors and core habitat, management standards and guidelines can be established with the intent of promoting wildlife movement in key areas on the Forest. As mentioned above, CLLC would be happy to have the opportunity to partner with the ANF to conduct connectivity analyses like those described here to help populate the Plan.

Assess current species-specific and forest-wide standards and guidelines (S & Gs) for connectivity with the aim of improving existing S & Gs and developing additional provisions, as needed
As the Planning Team knows, some types of connectivity modeling and management standards and guidelines can be applied Forest-wide with successful application (i.e., requiring that wildlife fencing constructed on the Forest must be wildlife-friendly). There is also a need for more species-specific standards and guidelines in this Plan that have direct, positive impact on particular species that are threatened, endangered or those of greatest conservation need as identified by the Utah State Wildlife Action Planand/or the Regional Forester's list. For instance, because certain species of concern are disproportionately negatively affected by roads due to the barrier effect, the Forest should develop S & Gs that describe to transportation agencies (Federal, state, county) and its own engineers that manage Forest roads the mitigation measures needed to maintain connectivity if certain thresholds are surpassed (i.e. open road densities, traffic volumes, type of road, number of lanes). Because wildlife movement is unique to each
species, the needs of particular species of concern will require specific protocols (fine-scale) while Forestwide S & Gs can have an immensely positive impact on connectivity across the Forest (coarse-scale).
Assess the current status of connectivity along Wild and Scenic Rivers on the Forest and ensure stringent standards are established in the Plan for connectivity along these natural corridors
Because Wild and Scenic Rivers that flow through the Forest have stringent conservation guidelines, we urge the Forest to assess connectivity along these corridors with the aim to include explicit guidelines that protect connectivity along all of these river corridors in the Plan. In doing so, vital aquatic and riparian corridors can be designated as geographic areas significant for connectivity of both aquatic and terrestrial species in the final Plan.

Assess current conditions with the aim of establishing S & Gs that promote connectivity for native pollinators. The loss and decline of native pollinators is an emerging issue of concern, and the scientific and management information regarding their decline and ways to reverse this trend through conservation action is rapidly increasing. One important priority for protecting native pollinators is maintaining their ability to move through a diversity of habitats and through fragmented habitats along road corridors. The latest Federal transportation act (FAST Act of 2015, Public Law No. 114-94) includes direction for roadsides to provide pollinator habitat and corridors for movement. Given the extent of the road network on the Forest, we suggest that a pollinator section be added to the Plan, that includes desired conditions, objectives, guidelines, and standards to provide for connected pollinator habitat along roadways and otherwise.

Improve incorporation of regional, state, and local fish, wildlife, and habitat data into Plan
The ANF should review and consider relevant regional, state, and local data sources when planning for aquatic and terrestrial connectivity. As discussed above in the connectivity data and modeling section, the Crucial Habitat Assessment Tool (CHAT) originally championed by the Western Governors' Association (WGA) and currently hosted by the Western Association of Fish and Wildlife Agencies (WAFWA) can be used for a variety of planning purposes. ANF should use the CHAT to create a coarse-scale overview of the Forest and adjacent lands to inform a long-term environmental goal of identifying and managing for increased connectivity. Where CHAT or Forest data show that a proposed action will harm aquatic or terrestrial connectivity, the ANF can work to implement mitigation measures by establishing standards in the resulting Plan.

IN CONCLUSION

We suggest that the key wildlife corridors identified by the models and the management actions proposed and described above provide the strongest available basis for setting priorities for connectivity management action in the ANF Forest Plan Revision. Again, we ask that the ANF designate specific areas on the Forest to manage primarily for connectivity, as exemplified by the Flathead National Forest Plan.
We ask that the ANF Plan Revision Team consider the resources and recommendations included in this letter and that they be incorporated into the upcoming Plan as the best available scientific information upon which to

base connectivity management on the Forest.

Thank you for the opportunity to provide comments on the Draft Plan regarding ecological connectivity. If you have any questions regarding our comments or the information we have provided, please be in touch.

Regards,

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LITERATURE CITED

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Bates, W., and A. Jones. 2007. Least-Cost Corridor Analysis for Evaluation of Lynx Habitat Connectivity in the Middle Rockies. Report prepared for the Utah Office of The Nature Conservancy. Wild Utah Project, Salt Lake City, UT.

Belote, R.T., M.S. Dietz, B.H. McRae, D.M. Theobald, M.L. McClure, G.H. Irwin, P.S. McKinley, J.A. Gage, and G.H. Aplet. 2016. Identifying Corridors among Large Protected Areas in the United States. PLOS ONE 11(4): e0154223.

Carroll, C., B.H. McRae, and A. Brookes. 2012. Use of Linkage Mapping and Centrality Analysis Across Habitat Gradients to Conserve Connectivity of Gray Wolf Populations in Western North America. Conservation Biology 26(1):78-87.

Chen I-C., J.K. Hill, F. Ohlemuller, D.B. Roy, and C.D. Thomas. 2011. Rapid range shifts of species associated with high levels of climate warming. Science 333:1024-1026.

Cleland, D, K. Reynolds, R. Vaughan, B. Schrader, H. Li, and L. Laing. 2017. Terrestrial Condition Assessment for the National Forests of the USDA Forest Service in the Continental US. Sustainability 9: 2144-2163.

CNF (Carson National Forest). 2019. Draft Plan V3 - Revised Forest Plan. USDA-Forest Service, Carson National Forest, Taos, NM.

FNF (Flathead National Forest). 2017. Final Plan - Revised Forest Plan. USDA-Forest Service, Flathead National Forest, Kalispell, MT.

Gilbert-Norton, L., R. Wilson, J.R. Stevens, and K.H. Beard. 2010. A meta-analytic review of corridor effectiveness. Conservation Biology 24(3):660-668.

Heart of the West Coalition. 2004. Heart of the West Conservation Plan. Wild Utah Project, Salt Lake City, UT.

Heller, N.E., and E.S. Zavelata. 2009. Biodiversity management in the face of climate change: a review of 22 years of recommendations. Biological Conservation 142(2009):14-32.

Knick, S.T., S.E. Hanser, and K.L. Preston. 2013. Modeling ecological minimum requirements for distribution of greater sage-grouse leks: implications for population connectivity across their western range, U.S.A. Ecology and Evolution 3(6):1539-1551.

Mawdsley, J.R., R. O'Malley, and D.S. Ojima. 2009. A review of climate-change adaptation strategies for wildlife management and biodiversity conservation. Conservation Biology 23(5):1080-1089.

Noss, R., G. Wuerthner, K. Vance-Borland, and C. Caroll. 2001. A Biological Conservation Assessment for the Utah-Wyoming Rocky Mountains Ecoregion. Report prepared for The Nature Conservancy. Conservation Science, Inc., Corvallis, OR.

SNF (Sierra National Forest). 2014. Final Sierra National Forest Assessment, R5-MB-269. USDA-Forest Service, Sierra National Forest, Oakhurst-North Fork, CA.

West, P.W. 2007. Wildlife Connectivity across Utah's Highways. Report prepared for the Utah Department of Transportation, UT-06.09. Utah Dept. of Transportation, Salt Lake City, UT.

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Largelandscapes.org
Wildlife Quality Improvement Team. 2005. Wildlife and Domestic Animal-Vehicle Collisions. Utah Department of Transportation Report No. UT-05.10. Utah Dept. of Transportation, Salt Lake City, UT.

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