



Dr. Benjamin Tuggle  
Regional Director  
U.S. Fish and Wildlife Service  
P.O. Box 1306  
Albuquerque, NM 87103

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Cc. All members of the Jaguar Recovery Team.

*Copies sent via email.*

Re: Recovery of the endangered jaguar.

Dear Dr. Tuggle and Jaguar Recovery Team members,

The U.S. Fish and Wildlife Service's April 2012 [Recovery Outline for the Jaguar](#) portends limited conservation benefits for the endangered jaguar while dampening if not entirely foreclosing the opportunity to significantly bolster the northern jaguar population against myriad threats. In the detailed critique below, we show that the fatal flaw in the recovery outline is its exclusion of the highest-quality jaguar habitat in the United States from the Northwestern Recovery Unit (the recovery area that extends northward only into the borderlands of Arizona and New Mexico). Unoccupied or barely-inhabited jaguar habitat further north in those two states, particularly along the Mogollon Rim at the headwaters of the Gila River, is comparable in quality to the habitats currently occupied by jaguars elsewhere within the Northwestern Recovery Unit.<sup>1</sup>

Perennial streams and rivers in the Gila headwaters / Mogollon uplands region have continued flowing throughout the ongoing, 14-year-long drought, maintaining lush riparian vegetation that threads through the darker green of mixed-conifer forests. The region is far from human population centers, is largely remote and rugged, and abounds in potential jaguar prey animals such as collared peccary, white-tail and mule deer, elk, and Rocky Mountain and desert bighorn sheep -- as well as myriad smaller animals such as jackrabbits, coatis, beavers and turkeys. Lastly, there remains functional landscape connectivity that would allow jaguars in their current breeding range to reach a future population of jaguars in the Mogollon uplands -- and vice versa.

Accordingly, five separate studies have found vast overlapping areas within the Gila headwaters / Mogollon uplands region fitting a variety of jaguar habitat models; extending the methodology of a sixth jaguar habitat study northward to include the region produces the same result. But the Recovery Outline for the Jaguar cursorily labels the Gila headwaters / Mogollon uplands region as "peripheral" and does not include it within a recovery area.

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<sup>1</sup> In referring to the Gila headwaters / Mogollon uplands region, we include not just the Mogollon Rim (and foothill canyons) in Arizona and the rim's extension into New Mexico on the Gila National Forest, but also sky island mountain ranges (and the valleys between them) such as the Pinaleno and Galiuro Mountains within the Gila River watershed but north of the Northwestern Recovery Unit.

The six, corroborating mapping exercises together strongly suggest that significant numbers of jaguars could live and breed beyond the boundaries of the Northwestern Recovery Unit, and in fact that lots more jaguars could live in the Gila headwaters / Mogollon uplands region than could live in the area of the U.S. that is included within the recovery unit.

Beyond that evidence, however, we believe that if the Fish and Wildlife Service and the Jaguar Recovery Team give due consideration to historical and recent jaguar reports in the U.S., consider the implications of the jaguar's origin and long tenure in a broad swath of North America, extending well beyond the Southwest, and inform the analysis of potential jaguar habitat in the Southwest with an accounting of how jaguars became extirpated – all of which we explain below – that you will wholeheartedly agree that the Northwestern Recovery Unit should be extended to include the Gila headwaters / Mogollon uplands region. We make that case below.

The Endangered Species Act is intended to conserve the ecosystems upon which threatened and endangered species depend, and provide a program for the conservation of such species. We are grateful for this opportunity to comment now because, distressingly, the present outline would lead to a jaguar recovery plan that would fulfill neither vital goal.

## **Introduction**

Humanity is pushing jaguars at the northern reaches of their current range toward extinction. Destruction of habitat and direct persecution threatens to eliminate jaguars from the Sierra Madre and the Sky Island mountain ranges, just as they were previously eliminated from the Mogollon Rim, from California, the Great Plains, and the swamps and forests of the Southeast.<sup>2</sup>

An estimated 750 jaguars survive in northwestern Mexico divided into two populations, the larger of which is thought to be declining and both of which are vulnerable to inbreeding. It is not clear how much if any functional connectivity exists between these populations, and they are both likely cut off from the remaining jaguar populations along the Pacific coast of Mexico into Central America. (Two additional populations further east in Mexico, outside the Northwestern Recovery Unit, may be even more isolated and vulnerable.)<sup>3</sup> Along with ensuring genetic connectivity between the two populations within the Northwestern Recovery Unit, and restoring connectivity from the unit to jaguars elsewhere, enabling the northernmost population in Sonora to expand northward and thereby increase in size offers the best opportunity to proactively buffer against inbreeding as well as partially mitigate ongoing mortality.

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<sup>2</sup> This formulation borrows from that of David E. Brown, who wrote in the early 1980s: “The wolf is about to disappear from the Sierra Madre as it has from so many other places—the Plains, the Rocky Mountains, the Great Basin in western North America, and numerous areas elsewhere.” (Brown, editor, *The Wolf in the Southwest: The Making of an Endangered Species*, University of Arizona Press, fourth printing, 1992; p. 1.) Wolves and jaguars were both exterminated from almost all of their (contiguous) United States habitats on behalf of the livestock industry. When Brown wrote his haunting words, above, wolves were still numerous in Canada (and Alaska) but today, of course, thanks to the Endangered Species Act, Mexican gray wolves also live in the Gila headwaters / Mogollon uplands region (and northern gray wolves live in other states). Similarly, while jaguars are still extant in the Republic of Mexico and further south in Central America and South America, and may still be numerous in the Amazon basin, their absence from all but a sliver of what was once a vast U.S. range is cause for concern and remedial action. We discuss the historic range of jaguars in the U.S. in sections V and VI, below.

<sup>3</sup> Recovery Outline for the Jaguar., pp. 17, 18, 27 & 41.

Disappointingly, in delineating the northernmost boundary of the Northwestern Recovery Unit immediately south of the area of greatest habitat potential for jaguars, the Recovery Outline for the Jaguar negates most of the potential benefits of a secondary recovery area that is devoted to allowing range expansion and population growth.



[Figure 1] Northwestern Jaguar Recovery Unit, from Fig. 1 of the Recovery Outline for the Jaguar, p. 58.

This course has been trodden before. The Arizona Game and Fish Department has long sought to delimit jaguar habitat in New Mexico and Arizona to areas that are south of Interstate 10,<sup>4</sup> and thereby severely circumscribe the extent of any future actions to conserve such habitat; not coincidentally, I-10 constitutes the northern boundary of the Northwestern Recovery Unit. In relying on the *Jaguar Conservation Assessment for Arizona, New Mexico and Northern Mexico* (Johnson et al 2011), the final product of the Arizona Game and Fish –led Jaguar Conservation Team, and incorporating from it extensive passages,<sup>5</sup> the Recovery Outline for the Jaguar adopts some of the politically-derived but factually unsupported conclusions therein

## **I. A dire prognosis for jaguars in northwestern Mexico**

Not surprisingly, the Recovery Outline for the Jaguar and supporting studies come up with varying estimates of the number of jaguars extant in northwestern Mexico and what that portends for population viability. Nevertheless, all the numbers and trends point to further contraction of the jaguar's historical range, with foreseeable extirpation of jaguars throughout the Northwestern Recovery Unit (NRU).

Even under optimistic baseline assumptions that are by no means assured, and even if all the ambitious on-the-ground measures that the upcoming recovery plan might recommend for Mexico were to be successfully accomplished, jaguars in Sonora would still face steep odds in persisting because of their low numbers, the limited capacity of Sonora and immediately-adjointing United States habitats to support additional jaguars, and inherent limitations on the functionality of a theoretical jaguar migration corridor connecting Sonora to southern Sinaloa, Nayarit and Jalisco.

Furthermore, habitat destruction has likely severed the Sinaloa/Nayarit/Jalisco jaguar population from the majority of still-inhabited jaguar range. According to the recovery outline, "current habitat conditions in the Jalisco/Colima border area are likely not suitable to support jaguars or provide connectivity between the NRU and small extant populations in Guerrero, Oaxaca, and Chiapas. This poses a barrier for connectivity between the NRU and remaining jaguar populations along the Pacific coast of Mexico into Central America."<sup>6</sup> This sobering reality – leaving aside the possibilities that optimistic assumptions may prove incorrect or that recovery actions in Mexico may yield less-than-desired success -- suggests that the surest route to boosting the prospects for Sonora jaguars would be to grow the population in the high-capacity jaguar habitat that is to the north of the currently constituted Northwestern Recovery Unit in the Gila headwaters / Mogollon uplands region.

### **A. How many jaguars survive in northwestern Mexico?**

The Recovery Outline for the Jaguar cites Zeller (2007) for an estimate of 50 to 100 jaguars in Sonora and over 500 in southern Sinaloa, Nayarit and Jalisco.<sup>7</sup> The recovery outline also refers to a model created from a population and habitat viability analysis for jaguars in

<sup>4</sup> The agency's first effort to set such a boundary was presented in a map distributed at the [second meeting of the Jaguar Conservation Team's habitat subcommittee](#); the boundary at issue in these minutes was drawn along I-10.

<sup>5</sup> As acknowledged in Recovery Outline for the Jaguar, p. 4, footnote b.

<sup>6</sup> Ibid., p. 41.

<sup>7</sup> Recovery Outline for the Jaguar, p. 17; K. Zeller. 2007. Jaguars in the New Millennium Data Set Update: The State of the Jaguar in 2006. Wildlife Conservation Society, New York; pp. 50, 51.

Mexico (Carillo et al. 2007), which estimated 150 jaguars in Sonora and 140 in Jalisco and Nayarit.<sup>8</sup> And the recovery outline cites the Mexican National Jaguar Census 2011 estimate of 271 jaguars in Sonora and 479 in the latter three provinces.<sup>9</sup> Thus, over recent years, the range of estimates for the number of jaguars within the two populations in Northwestern Recovery Unit extended from 50 to 271 in Sonora and from 140 to over 500 in Nayarit, Jalisco and Sinaloa -- with the most optimistic scenario being the most recent estimate of 750 animals.

#### B. Viability requires thousands, not hundreds of breeding animals.

The best-case scenario of 750 animals would still not suffice to ensure viability, even if loss of habitat and illegal killing could be stemmed. That is because viability is compromised and weakened by genetic drift and inbreeding depression stemming from small population size, and without connectivity with jaguars elsewhere, neither 271 nor 750 animals is enough (nor even on the right scale of magnitude). Lande (1995) calculated that effective populations of around 5,000 organisms (i.e. that number of reproducing animals -- not equaling the total number of animals) would be necessary to stave off deleterious mutations leading to inbreeding and other genetic ills.<sup>10</sup> Reed et al (2003) noted that population size is a major determinant of extinction risk and used population viability analysis to estimate minimum viable populations for 102 species, with a mean estimate of 7,316 organisms and median estimate of 5,816 adults. They advised that conservation programs for wild vertebrate populations conserve habitat capable of supporting approximately 7,000 adults in order to ensure long-term persistence.<sup>11</sup> In a meta-analysis of population viability studies for 212 disparate species, Traill et al (2007) determined that the median minimal viable population was 4,169 organisms.<sup>12</sup> Traill et al (2009) found that “thousands (not hundreds) of individuals are required for a population to have an acceptable probability of riding-out environmental fluctuation and catastrophic events, and ensuring the continuation of evolutionary processes.”<sup>13</sup>

#### C. Could jaguars in northwestern Mexico persist at lower numbers?

Flather et al (2011) challenged the universal applicability of a single number as a threshold for population viability. They agreed that in many instances “multiple populations totaling thousands (not hundreds) of individuals will be needed to ensure long-term persistence” and “realistic MVPs might well be in the thousands for many life histories,” but argued that “uncertainty around any guideline figure would be of a similar order of magnitude” because “estimates both among and within species show striking variation for many reasons. The fundamentally contingent nature of MVPs means that we cannot support a universally applicable

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<sup>8</sup> Recovery Outline for the Jaguar, p. 27. Carrillo, L., G. Ceballos, C. Chavez, J. Cornejo, J.C. Faller, R. List and H. Zarza. 2007. Analisis de viabilidad de poblaciones y del habitat del jaguar en Mexico. Pp. 187-223 in Ceballos, G, C. Chavez, R. List y H. Zarza (editors). 2007. Conservacion y manejo del jaguar en Mexico: estudios de caso y perspectivas. Conabio – Alianza WWF- Telcel – Universidad Nacional Autonoma de Mexico. Mexico; pp. 218, 219.

<sup>9</sup> Recovery Outline for the Jaguar, p. 18.

<sup>10</sup> Lande, R. 1995. Mutation and conservation. *Conservation Biology*, 9(4):782-791.

<sup>11</sup> Reed, D. H., J. J. O’Grady, B.W. Brook, J. D. Ballou, R. Frankham. 2003. Estimates of minimum viable population sizes for vertebrates and factors influencing those estimates. *Biological Conservation*, 113:23-34. They defined a minimum viable population size as one with a 99% probability of persistence for 40 generations.

<sup>12</sup> Traill, L. W., C. J.A. Bradshaw, B. W. Brook. 2007. Minimal viable population estimates: a meta-analysis of 30 years of published reports. *Biological Conservation*. 139:159-166.

<sup>13</sup> Traill, L. W., B. W. Brook, R. R. Frankham, C. J.A. Bradshaw. 2010. Pragmatic population viability targets in a rapidly changing world. *Biological Conservation*, 143:28-34; p. 28.



MVP threshold.”<sup>14</sup> Noting the importance of population trend in extinction risk, they determined that had a previous meta-study (Brook et al 2006) of 1,198 populations, which found a median minimal viable population number at 1,181 organisms, instead excluded populations with a significant declining trajectory, than the median for viability would drop to just 355 organisms.<sup>15</sup>

Regarding the two jaguar populations within the Northwestern Recovery Unit, experts convened in 2006 to assess the jaguar’s status across its range labeled the 500-plus jaguar population in Sinaloa, Jalisco and Nayarit as decreasing, and labeled the Sonora population of 50 to 100 animals as stable. The experts also labeled dispersal between the two populations as infrequent.<sup>16</sup> Flather et al’s critique, as well as other population viability models, suggest that the declining Sinaloa-Jalisco-Nayarit population could only be viable through connectivity to other, significantly larger or more resilient jaguar populations elsewhere. The experts judged that these jaguars were connected through frequent dispersal to others, presumably in Guerrero, Oaxaca, and Chiapas or the more distant Selva Maya of Mexico, Guatemala and Belize, and that the latter population’s status was stable – though only numbering 200 to 500 animals.<sup>17</sup> Unfortunately, another assessment projected that the Selva Maya population would decrease primarily due to habitat loss.<sup>18</sup> Now, however, as seen, the Recovery Outline for the Jaguar states that habitat loss has created a barrier for connectivity between the Sinaloa-Jalisco-Nayarit population and jaguars elsewhere.

If the Sonoran population is indeed stable and not declining, that correspondingly might suggest that it could be viable at somewhat lower numbers than the medians in the 5,000 to 7,000 range suggest. However, assessments of minimal viable populations are strongly influenced by the time frames used to determine the populations’ trajectories.<sup>19</sup> In the case of jaguars in Sonora, recent habitat protection and other conservation measures largely spearheaded by the non-profit Northern Jaguar Project have provided some jaguars critical respite, perhaps arrested a longer-term decline, and may have influenced the assembled experts to label the Sonora population as stable. Assessments of how many jaguars would be viable in this population should account for not just recent events but also for the uncertainty inherent in any chronologically-truncated analysis.

#### D. Tenuous connectivity, habitat loss and illegal killing imperil jaguars in northwestern Mexico.

If recovery planners determining demographic criteria for securing the Sonora population – which, as seen, is thought to receive merely infrequent dispersers -- are to rely on dispersal from the Sinaloa, Nayarit and Jalisco population, they must account for how the latter population’s decline and its own isolation will influence dispersal to the Sonora population. They also must address the uncertainty inherent in theoretical jaguar dispersal corridors, which may not work on the ground as intended. Zeller et al (2011) emphasized “the importance of field-verifying coarse-scale GIS-based corridor exercises. . . . The risk in not conducting a corridor assessment is that a poorly designed corridor will have less chance of success, resulting

<sup>14</sup> Flather, C. H., G. D. Hayward, S. R. Beissinger and P. A. Stephens. 2011. Minimum viable populations: is there a ‘magic number’ for conservation practitioners? *Trends in ecology and evolution*, 26(6):307-316; p. 314.

<sup>15</sup> Ibid, p. 311.

<sup>16</sup> Zeller (2007), p. 51, 52.

<sup>17</sup> Ibid, p. 50.

<sup>18</sup> Carrillo, p. 217.

<sup>19</sup> Reed et al (2003), p. 27; Flather (2011), p. 311.

in a waste of precious conservation resources”<sup>20</sup> For that reason, basing a recovery strategy on theoretical connectivity is unsound.

The Recovery Outline for the Jaguar cites Carrillo et al (2007), who analyzed the population and habitat for jaguars in Mexico and estimated 150 jaguars in Sonora and 140 in Jalisco-Nayarit. (And they estimated 226 jaguars in Guerrero, Oaxaca, and Chiapas, outside the Northwestern Recovery Area but thought then to be connected to jaguars in Jalisco-Nayarit.) Carrillo et al projected that without considering anthropogenic effects, the Sonora population was likely to decline from 150 to about 65 animals over a one hundred year period, but accounting for hunting of jaguars it would decline to 20 animals. The Jalisco-Nayarit population would decline from 140 to about 120 animals over 100 years in the theoretical absence of anthropogenic effects, according to Carrillo et al, but ongoing illegal killing would reduce numbers to below 15 jaguars within 30 years, and to zero within 100 years, and habitat destruction would bring about extirpation of the population within 40 years, even were poaching not a factor.<sup>21</sup>

#### E. Recovery Outline for the Jaguar suggests unfounded optimism.

Despite the critical status of northern jaguars, the recovery outline states: “One-hundred percent of the 13,613 km<sup>2</sup> (5,256 mi<sup>2</sup>) Sonora JCU and 61 percent of the 29,409 km<sup>2</sup> (11,355 mi<sup>2</sup>) southern Sinaloa/Nayarit/Jalisco JCU were identified as areas where probability of long-term survival is high (Zeller 2007).”<sup>22</sup> However, “high” in Zeller (2007) is the lowest category of prioritization (below “highest” and “higher”) comparing Jaguar Conservation Units (JCUs) based on six qualities that experts rated important to survival; in other words, they are the least likely among extant populations that can still be saved, to survive. Under this numeric rating system, the Sonora JCU scored 140 out of a possible 300, and the Jalisco-Nayarit JCU scored 238. Populations with scores under 200 are considered at greatest risk.<sup>23</sup>

There is no basis in Zeller for the recovery outline statement that 100% of the Sonora and 61% of the Sinaloa/Nayarit/Jalisco JCUs are areas where probability of long-term survival is high. To the contrary, Zeller listed just four percent of the Sonora JCU and eleven percent of the Sinaloa/Nayarit/Jalisco JCU as “protected.”<sup>24</sup>

Lastly, it should be noted that both Zeller (2007) and Carrillo et al (2007) describe potential viability for the purposes of their modeling exercises at levels an order of magnitude lower than what appears merited through the literature described above. Zeller characterizes 50 breeding individuals as “potentially self-sustaining over the next 100 years,” and Carrillo et al uses 100 jaguars as a threshold for viability over the same period.<sup>25</sup>

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20 K. A. Zeller, S. Nijhawan, R. Salom-Pérez, S. H. Potosme, J. E. Hines. 2011. Integrating occupancy modeling and interview data for corridor identification: A case study for jaguars in Nicaragua. *Biological Conservation* 144 (2011) 892–901; p. 900.

<sup>21</sup> Carrillo et al (2007), pp. 218, 219, 221,

<sup>22</sup> Recovery Outline for the Jaguar, p. 17.

<sup>23</sup> Zeller (2007), p. 46.

<sup>24</sup> Ibid, p. 41.

<sup>25</sup> Ibid, p. 36; Carrillo et al (2007), p. 208. Carrillo et al presume viability so long as extinction risk is lower than 10% over a 100 year period, whereas Reed et al (2003) defined a minimum viable population size as one with a 99% probability of persistence for 40 generations (which for jaguars may be roughly equivalent to 100 years).

#### F. Limited habitat capacity in northwestern Mexico could support just 44 more jaguars.

Notwithstanding undue optimism on viability in the recovery outline, based in large part on a population viability study conducted for the recovery team, the recovery outline makes clear that population growth is essential:

[V]iability is critically dependent on at least minimal opportunities for population growth of key subpopulations in the absence of dispersal so that these areas can act as demographic source populations of dispersing individuals. The strength with which a source population can supply individuals for neighboring regions is critically dependent on its intrinsic capability for growth, itself a function of the threats imposed on it by local human activity.<sup>26</sup>

But how much population growth is possible within the Northwestern Recovery Unit? Carrillo et al (2007) assessed the carrying capacity of the habitats for the Sonora jaguars at 172 and for the Jalisco-Nayarit jaguars at 160, suggesting that under the most optimistic scenario the Sonora population could grow from their estimated 150 animals by 22 jaguars, and the Jalisco-Nayarit population could grow from 140 animals by just 20 jaguars.<sup>27</sup> Increasing the number of jaguars by a total of 44 animals, even assuming that habitat loss and poaching in Mexico could be stemmed, would not provide the jaguar with nearly enough of a demographic boost.

As the rest of this letter demonstrates, the region of the U.S. included within the Northwestern Recovery Unit can support fewer jaguars for the urgent project of boosting numbers than the region immediately to its north, the Gila headwaters / Mogollon uplands.

## **II. Core and secondary areas for jaguar recovery vs. peripheral areas**

Given the need for jaguar population growth, the Recovery Outline for the Jaguar identifies “secondary areas that provide connectivity between core areas (i.e. areas with the strongest long-term evidence of jaguar population persistence) and that could allow for range expansion and genetic exchange,”<sup>28</sup> while noting that the Northwestern Management Unit “does not connect two core areas; however, it may allow for expansion of the Sonora core area.”<sup>29</sup>

Identification of the Northwestern Management Unit (also called the Northwestern Recovery Unit Secondary Area) comports with a recommendation cited to Boydston and Lopez-Gonzalez (2005) “that range expansion to the north of eastern Sonora could help prevent genetic isolation and extinction of the northern jaguars and also increase chances for long-term survival of this species in the face of global anthropogenic changes.”<sup>30</sup> Yet the northern boundary of the

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<sup>26</sup> Recovery Outline for the Jaguar, p. 41.

<sup>27</sup> Carrillo et al (2007), pp. 218, 219.

<sup>28</sup> Ibid., p. 38.

<sup>29</sup> Ibid., p. 42.

<sup>30</sup> Ibid., p. 7. The American Society of Mammalogists agrees: “[H]abitats for jaguars in the United States, including Arizona and New Mexico, are vital to the long-term resilience and survival of the species, especially in response to ongoing climate change.” (“Conservation of Jaguars in North America,” resolution passed unanimously by attending American Society of Mammalogists members at the society’s 87<sup>th</sup> annual meeting in Albuquerque, New Mexico, June 2007. *Journal of Mammalogy*, 88(6), Dec. 2007; p. 1574.)



Northwestern Management Unit excludes the best jaguar habitat remaining in the United States, habitat that is relatively unfragmented and also biologically productive.

This exclusion would frustrate the management unit's purpose by sharply limiting the number of jaguars that could emanate from such an additional source population. The omitted area, labeled part of a vast "peripheral area," is immediately to the north of and accessible from the northern boundary of the Northwestern Management Unit. Labeling it a peripheral area rather than part of the Northwestern Management Unit is based on unsound information and faulty logic.

#### A. Narrative characterizations of secondary and peripheral areas.

The Recovery Outline for the Jaguar defines secondary areas as "those that contain jaguar habitat with historical and/or recent records of jaguar presence with no recent record or very few records of reproduction."<sup>31</sup> The outline goes on to describe the potential of secondary areas to add to the breeding pool particularly in instances in which the absence of breeding reflects active suppression of the population rather than destruction of the habitat: "Dispersing individuals may also periodically establish residency in secondary areas and become breeders. Jaguars may occur in lower densities in secondary areas because of past control efforts and the area has not been recolonized by jaguars."<sup>32</sup>

In contrast, the recovery outline describes peripheral areas as regions where "most historical jaguar records are sporadic and there is no or minimal evidence of long-term presence or reproduction that might indicate colonization or sustained use of these areas by jaguars."<sup>33</sup>

#### B. Bullet-point criteria for secondary and peripheral areas.

The Recovery Outline for the Jaguar provides criteria to identify secondary areas:

- Compared to core areas, secondary areas are generally smaller, likely contain fewer jaguars, maintain jaguars at lower densities, and exhibit more sporadic current and historical records of jaguars; some of the secondary areas may not have not [sic] been surveyed through the use of defined survey protocols, thus resulting in the unknown current status of jaguars in some secondary areas;
- There is no or little evidence of recent reproduction (within 10 years); and
- Quality and quantity of jaguar habitat is lower compared to core areas. Jaguar habitat is likely less optimal due to one or more or a combination of these variables important for jaguar presence, including increased human impact, smaller amount of contiguous habitat, different vegetation types, lower prey populations.<sup>34</sup>

The Recovery Outline for the Jaguar's criteria for peripheral areas are as follows:

- Areas that contain few verified historical or recent records of jaguar and records are sporadic;

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<sup>31</sup> Recovery Outline for the Jaguar, p. 21.

<sup>32</sup> Ibid.

<sup>33</sup> Ibid.

<sup>34</sup> Ibid., pp. 21-22.

- Quality and quantity of habitat are marginal for supporting adequate jaguar populations. Habitat may occur in small patches and is not well-connected to larger patches of high quality habitat; and
- May sustain short-term survival of dispersing jaguars and temporary residents.<sup>35</sup>

### C. Pan American Recovery Unit explanation of secondary and peripheral areas.

Notably, the Recovery Outline for the Jaguar explains delineation of peripheral areas within or adjacent to the Pan American Recovery Unit – but offers no explanation of peripheral areas adjoining the Northwestern Recovery Unit Secondary Area – as follows:

Jaguar peripheral areas within or adjacent to the PARU are those areas included in general range maps, but that are inhospitable to jaguars, rarely having jaguar presence, and almost never supporting resident jaguars in recent times (last 100 years). Examples would be areas of extreme and consistent flooding, extremely dry climates, and high-elevations. Some high mountain passes in the Andes, for instance, may have historical records of jaguars, and dispersers may pass through the low passes periodically, but the presence of jaguars is very rare, and resident jaguars are non-existent. The same would be true of coastal areas of Ecuador and central and northern Argentina.<sup>36</sup>

Within the Pan American Recovery Unit, “Secondary Areas are generally defined by the corridor areas modeled and mapped in Figure 2 of Rabinowitz and Zeller (2010; see Figure 2), excluding the two corridors connecting western Mexico to northwestern and northeastern JCUs.”<sup>37</sup>

### **III. Gila headwaters / Mogollon uplands region qualifies as a ‘secondary’ rather than ‘peripheral’ area**

The totality of the recovery outline’s narrative explanations, bullet-point criteria, and the examples pertaining to the Pan American Recovery Unit, when applied to the Gila headwaters / Mogollon uplands region, indicate that this region is improperly defined as a peripheral area and should be added to the Northwestern Recovery Unit Secondary Area. We begin by testing the applicability of the contrasting narrative descriptions of secondary and peripheral areas to the Gila headwaters / Mogollon uplands region.

Secondary areas “contain jaguar habitat with historical and/or recent records of jaguar presence with no recent record or very few records of reproduction,” whereas in peripheral areas “most historical jaguar records are sporadic and there is no or minimal evidence of long-term presence or reproduction that might indicate colonization or sustained use of these areas by jaguars.”<sup>38</sup>

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<sup>35</sup> Ibid., p. 22.

<sup>36</sup> Ibid., p. 23.

<sup>37</sup> Ibid., p. 22.

<sup>38</sup> Ibid., p. 21.

### A. Twentieth century records of jaguars in the peripheral area.

Brown and López González (2001) list 33 jaguars that were killed in the twentieth century in the area of Arizona (29 records) and New Mexico (4 records) that the recovery outline labels a peripheral area, all but one of them (in Otero County, New Mexico) within the watershed of the Gila River and/or upon or within a few miles of the Mogollon Rim.<sup>39</sup> The Arizona Game and Fish Department classifies ten of those in-state sightings within the peripheral area as Class 1 sightings,<sup>40</sup> while the New Mexico Department of Game and Fish identifies four sightings in the peripheral area as Class 1 or Class II records (including a 1990 sighting in the Gila National Forest by two biologists, Dr. Gerald Jacobi and Dr. Donna Jacobi of New Mexico Highlands University in Las Vegas, New Mexico).<sup>41</sup>

### B. Earlier records of jaguars in the peripheral area.

Jaguars were also reported in the peripheral area of both states prior to the twentieth century. In only the second written description of today's United States, Pedro de Castañeda, who recorded the 1540-1542 expedition of conquistador Francisco Vasquez de Coronado, of which he was a part, mentions that "Gray lions and leopards were seen" in the vicinity of the upper Gila River en route to Zuni. (Castañeda described the region as "all wilderness, covered with pine forests" and also mentioned springs and rivers – an apt description of much of today's Gila National Forest.)<sup>42</sup>

Mammalogist C.M. Barber, who spent at least parts of the period 1897 to 1902 in field investigations in New Mexico, along with recording the killing of a jaguar in May 1900 in the Gila National Forest, also mentioned that "I have heard of several others being seen or killed. It is probable that they find their way into the Mogollon Mountains by ascending the Gila River."<sup>43</sup> Sometime in the late 1800s, according to an oral account by Watson E. Rich that U.S. Fish and Wildlife Service biologist A. F. Halloran published in a 1946 *Journal of Mammalogy* article,

<sup>39</sup> Brown, D.E. and C.A. López González. *Borderland Jaguars*. University of Utah Press, 2001; pp. 7-9.

<sup>40</sup> Hatten, J.R., A. Averill-Murray, and W.E. Van Pelt. 2002. [Characterizing and mapping potential jaguar habitat in Arizona](#). Nongame and Endangered Wildlife Program Technical Report 203. Arizona Game and Fish Department, Phoenix, Arizona), p. 28, Appendix 1. (This study was later published as Hatten, J.R., A. Averill-Murray, and W.E. Van Pelt. 2005. A spatial model of potential jaguar habitat in Arizona. *Journal of Wildlife Management* 69(3):1024-1033. To link to the version posted on the Arizona Game and Fish Department website, in this and additional footnotes we reference the 2002 report.)

<sup>41</sup> Menke, K.A. and C.L. Hayes. 2003. [Evaluation of the relative suitability of potential jaguar habitat in New Mexico](#). New Mexico Department of Game and Fish. Santa Fe, New Mexico; p. 5.

<sup>42</sup> Castañeda, Pedro de, et al. *The Journey of Coronado*. New York: Dover. 1990; pp. 51-52. The original words in Spanish are "ounces" and "tigres," according to U.S. Bureau of Biological Survey scientist Vernon Bailey (1931), who interpreted the latter as jaguars and noted that the sightings occurred as they traveled northward to Zuni, New Mexico. (Bailey, V. *The Mammals of New Mexico*. U. S. Department of Agriculture, Bureau of Biological Survey, North American Fauna, No. 53. Washington, D.C.: Government Printing Office. 1931; p. 283.) Castañeda et al's translator and primary editor G. P. Winship and additional editor F.W. Hodge place the sightings in or around today's Gila National Forest, based on their guess that a fish mentioned immediately before the "gray lions and leopards" might have been a Gila trout. (Castañeda et al, notes).

<sup>43</sup> Barber, C.M. 1902. Notes on little-known New Mexican mammals and species apparently not recorded from the territory. *Proceedings of the Biological Society of Washington*, XV:191-193 (10/10/1902); p. 192. The New Mexico Department of Game and Fish accepts as a Class 1 sighting Barber's account of the 1900 jaguar pelt from the Gila that he observed. Gila National Forest ranger Jack Stockbridge, who also saw another jaguar in the Mogollon Mountains that is not known to have been killed, gave a personal account of the confirmed jaguar as well – though he remembered it from 1902 not 1900. (McFarland, E. 1974. *Wilderness of the Gila*, University of New Mexico Press; pp. 44, 46.)

Bob Burch, a foreman on the Goldberg Ranch in the Caballo Mountains (east of the Rio Grande near Truth or Consequences), killed a jaguar in that vicinity.<sup>44</sup> In Arizona, a female jaguar and her two kittens were reported killed in the Grand Canyon sometime between 1885 and 1890,<sup>45</sup> and another jaguar was killed in 1890 in the Sierra Ancha Mountains north of Globe.<sup>46</sup>

### C. Jaguar reproduction in the peripheral area.

Brown and López González (2001) list one record of jaguar reproduction in the peripheral area in Arizona in the twentieth century -- the 1910 killing of a female jaguar and her kitten on the Mogollon Rim. But two other female jaguars and 21 additional jaguars whose sexes were not recorded were killed within the peripheral area (primarily on the Mogollon Rim) as well; among the latter instances were two jaguars poisoned together in 1912 on the Mogollon Rim.<sup>47</sup>

Brown (1989) assessed jaguar reproduction and residency in Arizona:

That there is a record of a female and two cubs killed in the Grand Canyon between 1885 and 1890, and a female and her young killed near the head of Cheylon Creek in 1910, is evidence that jaguars were historic residents of Arizona. Other reports of multiple kills of jaguars running together were probably females and subadults, and are further indication of resident status. . . . Additional evidence of resident status is the pattern of decline. Plotted at ten-year intervals, the numbers of jaguars reported killed in Arizona show a decay curve characteristic of an over-exploited resident population. If Arizona jaguars were the sole result of incursions from Mexico, the pattern of kills would always have been erratic or irregular.<sup>48</sup>

Swank and Teer (1989) believed that “breeding populations of the jaguar probably disappeared from the United States early in the 1960s.”<sup>49</sup> This assessment likely reflects the 1963 killing of a female jaguar in the Apache National Forest in Arizona, on the Mogollon Rim, approximately 175 miles from the border with Mexico, and the killing of a male less than four months later in 1964 within the same watershed (the Black River) a few miles away.<sup>50</sup> Female jaguars are thought to generally stay closer to their natal ranges, and are less likely to disperse long distances than males,<sup>51</sup> so it seems likely that this female (and perhaps also the male subsequently trapped so close in time and place) were born nearby.

### D. Criteria point to non-peripheral nature of Gila headwaters / Mogollon uplands region.

The foregoing material demonstrates a rough fit for the Gila headwaters / Mogollon uplands with the description of a secondary area -- containing jaguar habitat with historical and/or recent records of jaguar presence with no recent record or very few records of

<sup>44</sup> Halloran, A.F. 1946. The Carnivores of the San Andres Mountains, New Mexico. *Journal of Mammalogy*. 27(2):154-161; p. 160.

<sup>45</sup> Lange, K.I. 1960. The jaguar in Arizona. *Transactions of the Kansas Academy of Science*, 63(2):96-101; p. 96.

<sup>46</sup> Brown, D.E. 1989. Cat Fever. *Game Country*. May/June 1989, p. 66.

<sup>47</sup> Brown and López González (2001), pp. 7-9.

<sup>48</sup> Brown, (1989), p. 66.

<sup>49</sup> Swank, W. G. and J. G. Teer. 1989. Status of the Jaguar – 1987. *Oryx* 23(1):14-21; p. 16.

<sup>50</sup> Brown and López González (2001), p. 7.

<sup>51</sup> Brown, D. & R. Thompson. 2010. [Lions, tigers and bears, oh my! The legacy of Curtis J. Prock](#). Pages 153-165 in *Arizona Wildlife Trophies*, Arizona Wildlife Federation. Mesa, AZ; p. 162.

reproduction, and also an area in which jaguars may occur in lower densities because of past control efforts but which they have not (yet) recolonized. It's an awkward fit describing a peripheral area with primarily sporadic historical jaguar records and none or minimal evidence of long-term presence or reproduction that might indicate colonization or sustained use of these areas by jaguars.

The bullet-point criteria distinguishing secondary from peripheral areas, though similar to the narrative criteria in being qualitative and on their face subjective, also support expanding the Northwestern Recovery Unit to include the Gila headwaters / Mogollon uplands region. Boiling the (somewhat redundant) criteria down to their essences, secondary areas are often smaller, more fragmented, more affected by humanity, support different vegetation types and/or lower prey populations than do core areas, which qualities generally result in lower jaguar densities, fewer jaguars, and more sporadic current and historical jaguar records than in core areas, including exhibiting little or no evidence of reproduction over the past ten years. Secondary areas also may not have been surveyed through the use of defined survey protocols, thus resulting in little information on their use by jaguars. Again, these attributes are a rough fit for the Gila headwaters / Mogollon uplands region.

Peripheral areas, in dissonant contrast, contain habitats that are marginal in quality, size and connectivity, and hence support even fewer and more-sporadic verified historical or recent records of jaguars than, presumably, secondary areas. Peripheral areas' only contribution to recovery is in sustaining short-term survival of dispersing jaguars and temporary residents.

#### E. Applying criteria from the Pan American to the Northwestern recovery units.

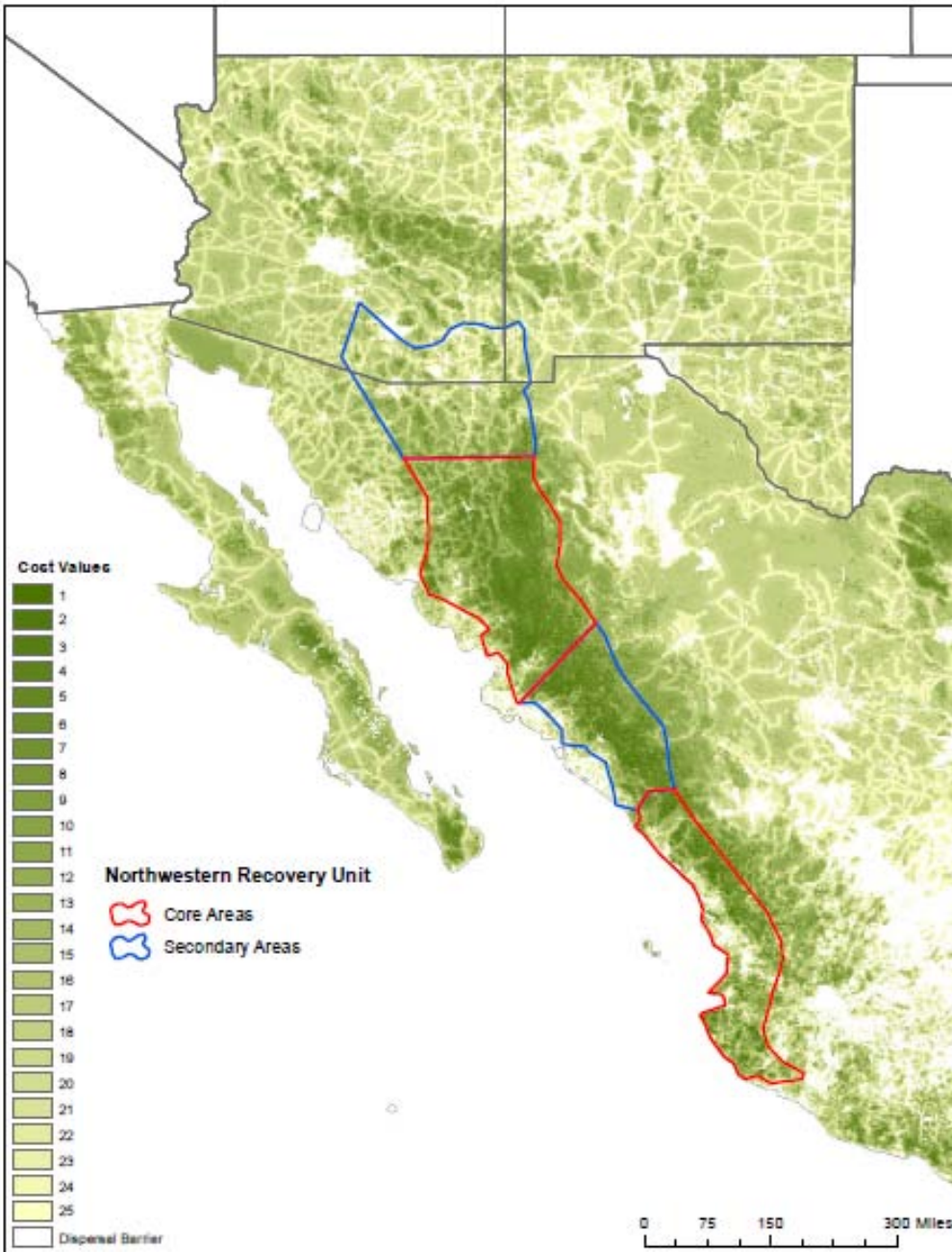
Applying the recovery outline's description of peripheral areas within or adjacent to the Pan American Recovery Unit, to the Northwestern Recovery Unit, would also demonstrate the incongruity between this description and any analogous conditions in the Gila headwaters / Mogollon uplands region. The peripheral areas in the Pan American Recovery Unit are inhospitable to jaguars due to extreme and consistent flooding, extremely dry climates, and high-elevations such as mountain passes in the Andes. Consequently, jaguars rarely use these peripheral areas, and over the past 100 years these areas rarely supported resident jaguars. But the Gila headwaters / Mogollon uplands region is less dry than the areas in the U.S. that are part of the secondary areas, is not inhospitable to jaguars at all, and did support resident jaguars over the past 100 years – but they were actively exterminated.

The Pan American Recovery Unit's general definition of secondary areas would also apply to the Gila headwaters / Mogollon uplands region: the corridor areas modeled and mapped in Figure 2 of Rabinowitz and Zeller (2010). Figure 2 in Rabinowitz and Zeller is based on the corridors identified in Figure 1 of their study; that analysis extends only a short distance into the United States.<sup>52</sup> Extending their methodology in developing Figure 1 to include the entire states of Arizona and New Mexico, as we do in our Figure 2 (next page), reveals a swath of low-cost-value potential jaguar habitat in the Gila headwaters / Mogollon uplands region. Except for the current absence of a jaguar population in the Gila headwaters / Mogollon uplands region – the connecting of which one to another was the point of Rabinowitz and Zeller (2010) – extending their methodology northward demonstrates that the habitat in the Gila headwaters / Mogollon uplands region offers better jaguar movement permeability than the area of Arizona, New

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<sup>52</sup> Rabinowitz, A. and K.A. Zeller. 2010 A range-wide model of landscape connectivity and conservation for the jaguar, *Panthera onca*. Biological Conservation 143:939-945; pp. 942-943.

Mexico, Sonora and Chihuahua delineated as the Northwestern Recovery Unit Secondary Area. Its permeability appears approximately as good, perhaps even better, according to the map below, as the permeability in the narrowly configured Sinaloa-Nayarit-Jalisco Core Area.

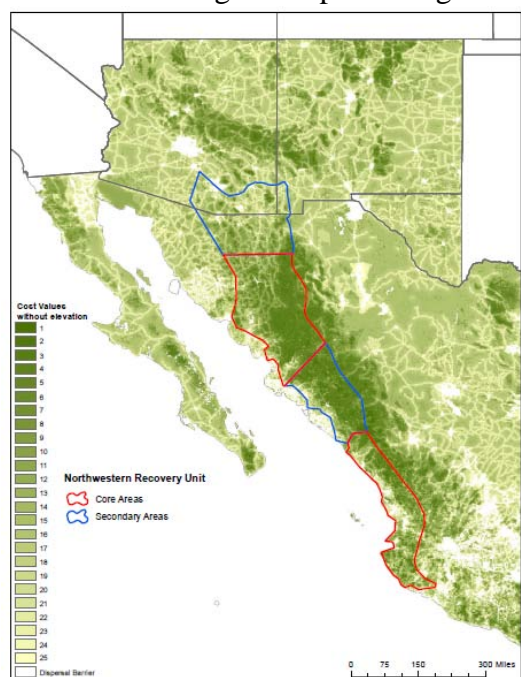


[Figure 2] Jaguar dispersal permeability matrix adapted from Fig. 1 in, and replicating the methods described in sections 2.1 and 2.2 of Rabinowitz & Zeller (2010), superimposed with an outline of the Northwestern Recovery Unit boundaries and secondary and core area sub-boundaries. This map extends Rabinowitz and Zeller's study-area northward to include the entireties of the states of Arizona and New Mexico. The lower the value (i.e. the darker the green coloration), the more permeable a pixel is to jaguar movement. (Map by Curtis Bradley, Center for Biological Diversity.)



#### F. Removing elevation from criteria as applied to Northwestern Recovery Unit.

The habitat permeability parameters cited as the basis for secondary areas in the Pan American Recovery Unit, despite their manifest applicability to the Gila headwaters / Mogollon uplands region, may underestimate the region's habitat value for jaguars. The parameter of elevation that Rabinowitz and Zeller (2010) use appears to be less meaningful in the Gila headwaters / Mogollon uplands region, and unduly discounts the region's potential value to jaguars. Fifteen of the jaguars killed in New Mexico and Arizona during the twentieth century were killed in or adjoining to Rocky Mountain conifer forest or subalpine conifer forest.<sup>53</sup> Findley et al (1975), contemplating the 9,000-foot elevation of one of these, a jaguar killed in 1902 in the Datil Mountains of New Mexico (north of the Gila National Forest), noted that "[i]t seems somewhat unlikely that an individual tropical lowland animal would wander to high altitudes in northern mountains and take up residency," and concluded that "[p]erhaps the northern jaguars, *F. o. arizonensis*, were a resident, temperate-adapted race of this widespread neotropical cat" – hypothesizing that northern jaguars may be adapted to high elevations.<sup>54</sup> Yet, based on expert opinion, Rabinowitz and Zeller (2010) set elevation as a delimiting criteria. With the other Rabinowitz and Zeller criteria intact, removing this criterion reveals the Gila headwaters / Mogollon uplands region as even better jaguar habitat:



[Figure 3] Jaguar dispersal permeability matrix adapted from Fig. 1 in, and replicating the methods described in sections 2.1 and 2.2 of Rabinowitz & Zeller (2010) -- with the exception that elevation is removed as a factor. (As in Fig. 2, above, this map includes an outline of the Northwestern Recovery Unit including secondary and core areas.) This map extends Rabinowitz and Zeller's study-area northward to include the entireties of the states of Arizona and New Mexico. The lower the value (i.e. the darker the green coloration), the more permeable a pixel is to jaguar movement. (Map by Curtis Bradley, Center for Biological Diversity.)

<sup>53</sup> Brown & López González (2001), pp. 7-10.

<sup>54</sup> Findley, J.S., A. H. Harris, D.E. Wilson and C. Jones. 1975. Mammals of New Mexico. University of New Mexico Press; p. 317.

The foregoing material demonstrates that jaguar records in the Gila headwaters / Mogollon uplands region were neither few nor sporadic, and that the region still supports the habitat variables that are thought to be important to jaguars. The following sections demonstrate that jaguar habitat in the region is not marginal in quality, size or connectivity, and that that habitat also supports significant numbers of potential jaguar prey animals.

#### **IV. Separate models independently identify Gila headwaters / Mogollon uplands region as jaguar habitat**

##### **A. Jaguar Conservation Team's habitat identification criteria and ensuing map identify vast remaining habitat in Arizona and New Mexico.**

The Arizona Game and Fish Department-led interagency Jaguar Conservation Team included a habitat subcommittee that began working in 1998 to develop and refine criteria for what would constitute jaguar habitat in Arizona and New Mexico. As part of this exercise, the subcommittee (which included wildlife conservationists and ranchers with widely divergent views) consulted with the team's Scientific Advisory Group and revised its draft criteria in response to the scientists' feedback.<sup>55</sup> The subcommittee's final criteria for identifying suitable jaguar habitat were as follows:

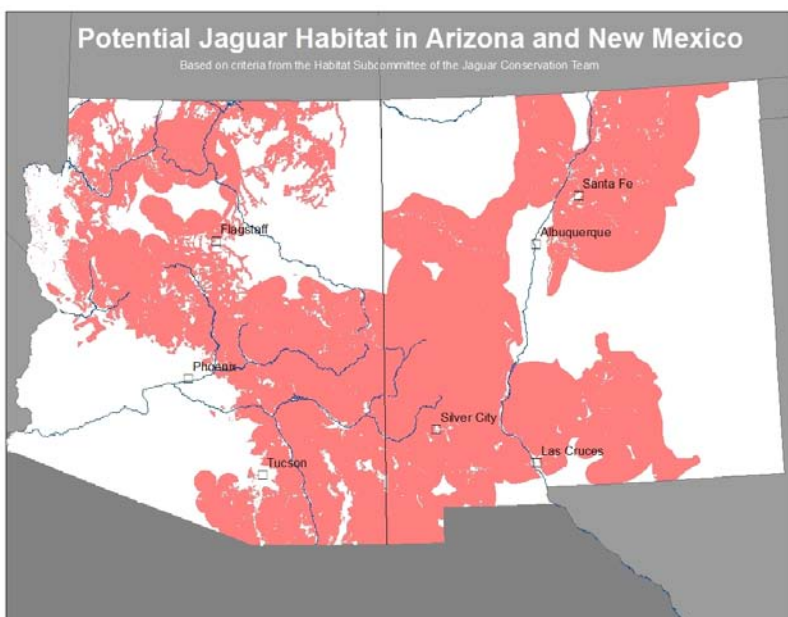
- Area being considered must be within 50 miles of a documented jaguar occurrence. This would include an entire mountain range, if a portion of that range is within 50 miles of the occurrence.
- Based on Brown and Lowe (1980) habitat associations, the area must be in the Semi-desert Grassland, Plains and Great Basin Grassland, Subalpine Grassland, Interior Chaparral, Madrean Evergreen Woodland, Great Basin Conifer Woodland, Petran Montane Conifer Forest, Petran Subalpine Conifer Forest, Chihuahuan Desertscrub, Arizona Upland Sonoran Desertscrub, or Great Basin Desertscrub. Areas in the Lower Colorado River Sonoran Desertscrub, Mojave Desertscrub, and Alpine Tundra are not considered jaguar habitat.
- Area must be within 10 miles of surface water, at least seasonally. Most areas within habitat associations listed in b. above have suitable water availability.
- Areas with continuous row crop agriculture over an area greater than 1 square mile and any agricultural crop areas immediately adjacent to those areas are not considered adequate habitat. Areas with human residential development in excess

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<sup>55</sup> [In response to a 1999 comment by Dr. Alan Rabinowitz](#), a member of the Scientific Advisory Group, the habitat subcommittee added a maximal-distance-to-surface-water criterion to identify potential jaguar habitat and removed a criterion based on elevation. Responding to Dr. Brian Miller, also a member of the group, the subcommittee removed a prey density criterion on the grounds that prey density in some areas could be increased through management (email of 4/1/1999 to the rest of the group and to Bill Van Pelt of the Arizona Game and Fish Department.) In September 2000, due to continued disagreement, the habitat subcommittee posed eleven questions to the group and received in response an 11-page memo that reaffirmed the criteria the subcommittee had developed and suggested additional use of a terrain ruggedness index. (Memo from Bill Van Pelt to Carlos López González, Brian Miller, Howard Quigley, Alan Rabinowitz, Michael Tewes, and Raul Valdez, "Review of jaguar conservation strategy," 9/12/2000; and memo from Brian Miller, Alan Rabinowitz and Carlos Lopez, 10/25/2000 in response.)

of 1 house per 10 acres are not considered jaguar habitat. Areas developed for industrial purposes or a combination of industrial and residential development that create a footprint equal to or greater than 1 house per 10 acres are not suitable jaguar habitat.<sup>56</sup>

Between 2002 and 2006, the Jaguar Conservation Team's habitat subcommittee developed a set of maps of potential jaguar habitat in Arizona and New Mexico, with accompanying reports summarized in a final report.<sup>57</sup> Among these maps were two which, combined as the bi-state map below (Figure 4), "strictly apply" the "habitat criteria approved by the JAGCT"<sup>58</sup> [i.e. Jaguar Conservation Team].



[Figure 4] Center for Biological Diversity bi-state map developed for the Jaguar Conservation Team's habitat subcommittee that depicts potential jaguar habitat according to the criteria approved by the subcommittee. (Map by Curtis Bradley)

<sup>56</sup> Robinson, M.J. 2006. [Habitat for jaguars in New Mexico. Contract report to Arizona Game and Fish Department, Center for Biological Diversity, Silver City, New Mexico](#); pp. 9-10.

<sup>57</sup> Van Pelt, W.E. 2006. [Potential jaguar habitat in Arizona and New Mexico: Summary of Work and Recommendations of the Jaguar Habitat Subcommittee of the Jaguar Conservation Team](#).

<sup>58</sup> Ibid., p. 7. See also the [minutes for the penultimate meeting](#) of the Jaguar Conservation Team's habitat subcommittee, and the [minutes of the subcommittee's final meeting](#), to read how opposing interests came to a difficult "general consensus" on identifying jaguar habitat – a fragile moment of compromise, eight years in the making -- that the Recovery Outline for the Jaguar unduly neglects in not incorporating the resulting five maps (four of which we reproduce as Figures 4, 5, 6 & 7) into jaguar recovery planning. [The fifth Jaguar Conservation Team map, developed by the Sierra Institute for the team's habitat subcommittee before the subcommittee developed its jaguar habitat criteria, is not reproduced in this letter because it was hand-drawn without the precision of GIS mapping, and thus does not significantly add to the information we already present. That map delineated roughly the same area as potential jaguar habitat, including the Gila and Apache national forests within the Gila headwaters / Mogollon uplands region, as did the [Jaguar Conservation Framework for Arizona, New Mexico and Northern Mexico](#) (Arizona Game and Fish Department and New Mexico Department of Game and Fish, 2007) in what that framework referred to as an "emphasis area for conservation action;" p. 20. See Figure 7, below, for that emphasis area.]

B. State game agencies' independent habitat criteria and associated maps highlight jaguar potential in Gila headwaters / Mogollon uplands region.

In addition, the New Mexico and Arizona game agencies each developed jaguar habitat maps of their respective states for the Jaguar Conservation Team habitat subcommittee, each using an “alternative analysis not based on the habitat criteria approved by the JAGCT.”<sup>59</sup> Both state agencies added to the habitat subcommittee’s criteria an additional parameter delimiting jaguar habitat through a terrain ruggedness index. The Arizona Game and Fish Department delineated jaguar habitat in two models, one inclusive of and the other excluding relatively flat and gentle terrain (and a third, with little effect, that added Madrean montane conifer forest to the applicable vegetation types, which were measured by AZGAP classification).<sup>60</sup>

The New Mexico Department of Game and Fish weighted steeper and more rugged areas higher in its evaluation, except for the highest category of ruggedness, such as sheer cliffs, which it downgraded. Moreover, the New Mexico Department of Game and Fish introduced several additional changes from the habitat subcommittee’s criteria, assigning greater value to Madrean evergreen woodland habitats, areas with multiple water sources and with perennial (as opposed to intermittent) water sources; the agency did not incorporate anthropogenic point water sources such as stock tanks. The analysis also incorporated an assessment of jaguar prey density that was weighted toward areas supporting more collared peccaries and white-tailed deer, but also incorporating densities of elk, mule deer and coatis. And, as we explain further on, the study area was limited to southwestern and parts of west-central and south-central New Mexico as a consequence of omitting seemingly-qualifying historical jaguar occurrence records from elsewhere in the state.<sup>61</sup>

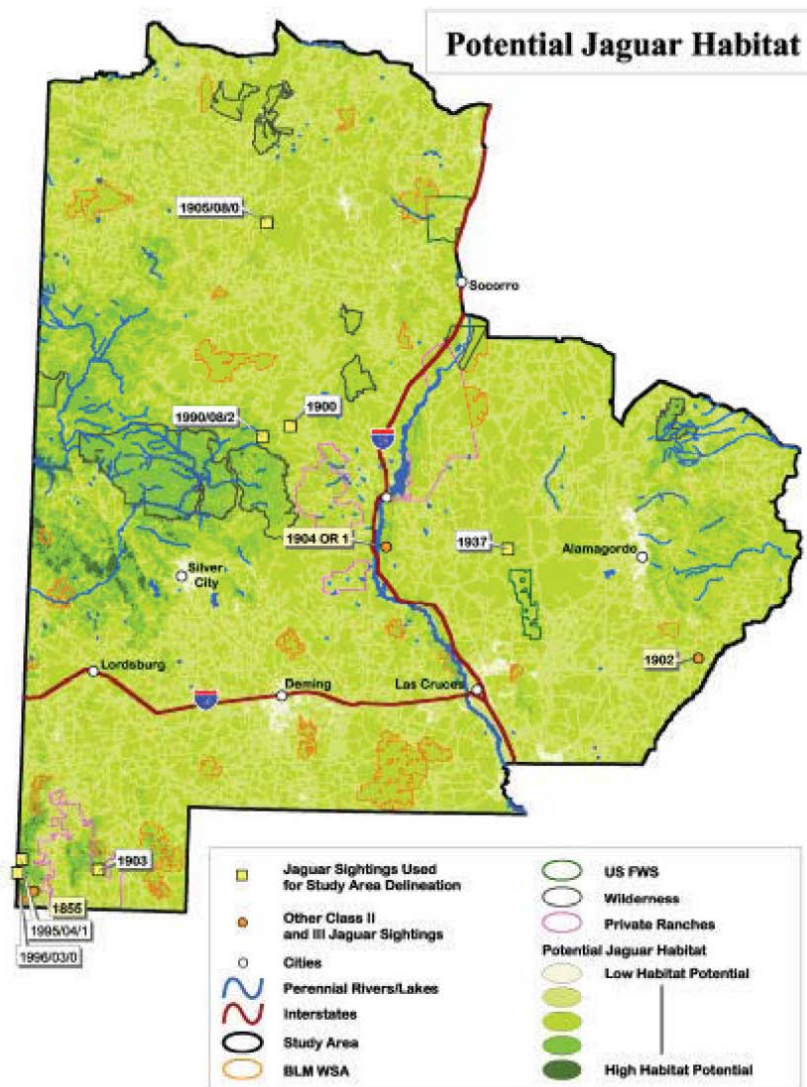
These state agency maps of potential jaguar habitat, Figures 5 and 6 (in the following pages), depict subsets of the areas depicted in Figure 4. The New Mexico Department of Game and Fish’s summary map of potential jaguar habitat in southwestern New Mexico depicts gradations in habitat-potential chromatically. Almost the entire vast region contains some habitat potential, according to the map, with the greatest potential in and around the Gila Wilderness Area and the Aldo Leopold Wilderness Area in the Gila National Forest, and along the Gila River and its tributary the San Francisco River (which meet each other downstream in Arizona).

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<sup>59</sup> Van Pelt, 2006, p. 7.

<sup>60</sup> Hatten et al (2002), pp. 5, 19, 20, 21.

<sup>61</sup> Menke and Hayes (2003), pp. 8-21.

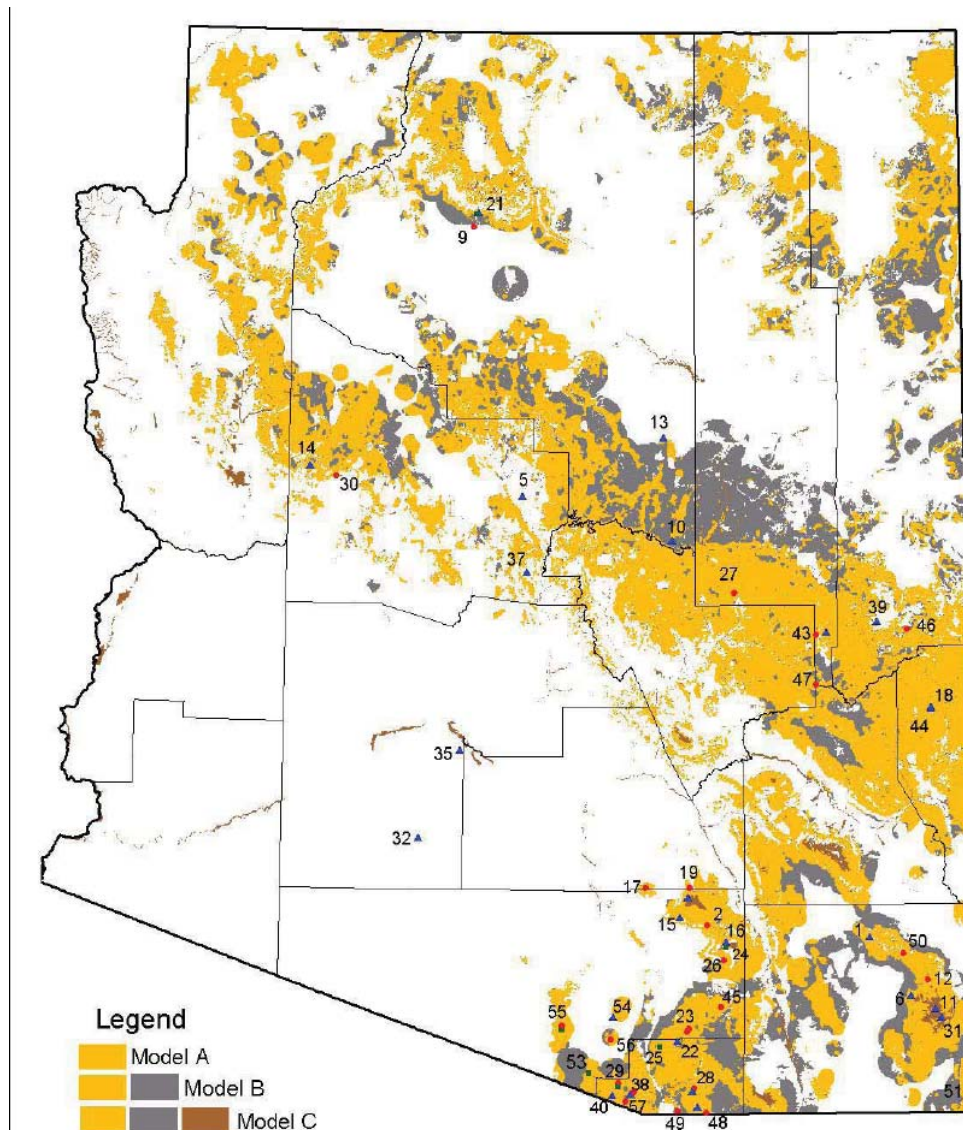


[Figure 5] Menke, K.A. and C.L. Hayes. 2003. Evaluation of the relative suitability of potential jaguar habitat in New Mexico. New Mexico Department of Game and Fish, Santa Fe, New Mexico; p. 22. The dated squares indicate jaguar occurrences. Note that this map covers just the southwestern quadrant of New Mexico.

Note that the Arizona Game and Fish Department map's most restrictive model (A), which incorporates a terrain ruggedness index, still results in identification of significant, contiguous habitat across the boundary between the Recovery Outline for the Jaguar's Northwestern Recovery Unit and its peripheral area, within the Sky Islands bioregion. Furthermore, the map shows near-contiguity between qualifying habitats in the Sky Islands and a much larger swath of habitat on the Mogollon Rim. It also shows contiguity between qualifying habitats along the Mogollon Rim in Arizona and the New Mexico areas identified by the New Mexico Department of Game and Fish as showing greatest potential of supporting jaguars, as the latter agency acknowledged: "Despite some differences in specific methodology used compared to jaguar habitat suitability mapping in Arizona (Hatten et al 2002), the most highly suitable



habitats from New Mexico generally connected with delineated areas of suitable habitat directly across the New Mexico-Arizona border.”<sup>62</sup>



[Figure 6] Hatten, J.R., A. Averill-Murray, and W.E. Van Pelt. 2002. Characterizing and mapping potential jaguar habitat in Arizona. Nongame and Endangered Wildlife Program Technical Report 203. Arizona Game and Fish Department, Phoenix, Arizona; p. 21. The numbered dots and triangles indicate jaguar occurrences.

These maps were developed by the Jaguar Conservation Team’s habitat subcommittee to help fulfill the pledge in the team’s 1997 charter document to address threats to the jaguar “consistent with the intent of the [Endangered Species] Act . . . through actions to gather relevant information to identify and eventually coordinate protection of jaguar habitat, and carry-out any

<sup>62</sup> Ibid., p. 24.



other appropriate conservation actions.”<sup>63</sup> The charter proposed to “Identify, maintain, and promote existing and other suitable jaguar habitats,”<sup>64</sup> and to carry that out the team would map habitat suitable for jaguar occupancy and the two state game agencies would spearhead “protection and enhancement agreements for suitable jaguar habitat with federal and state land managers and willing private landowners.”<sup>65</sup>

### C. A final Jaguar Conservation Team map and a unfulfilled purpose.

The Jaguar Conservation Team produced one final map (Figure 7) through an unorthodox process. The habitat subcommittee’s four final maps and an accompanying report with two unanimously derived recommendations were on the agenda of the April 27, 2006 meeting of the team. A motion to reject the second recommendation was discussed but then not acted upon until after 21 New Mexico soil and water conservation districts plus Greenlee County, Arizona were formally admitted, through a vote, to themselves become voting members of the Jaguar Conservation Team (along with the six pre-existing voting members of the team). Following that instantaneous growth in the voting membership of the team, the motion to reject the habitat committee’s recommendation, which had been held in abeyance, received a vote. The 22 new members voted as a bloc, along with two of the pre-existing members – but opposed by four of the pre-existing members – to reject the subcommittee’s recommendation “that the JAGCT use the completed maps to prioritize conservation efforts for potential habitat. Prioritization would begin with areas where the maps are in agreement.”<sup>66</sup> The team’s vote endorsed conservation of

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<sup>63</sup> Johnson, T.B. and W.E. Van Pelt. 1997. [Conservation assessment and strategy for the jaguar in Arizona and New Mexico](#). Nongame and Endangered Wildlife Program Technical Report 105. Arizona Game and Fish Department, Phoenix; p. 1.

<sup>64</sup> Ibid., p. 16

<sup>65</sup> Ibid., p. 18. The maps were finished seven years later (2006) than planned (1999) but we know of no habitat conservation agreements consummated as a consequence.

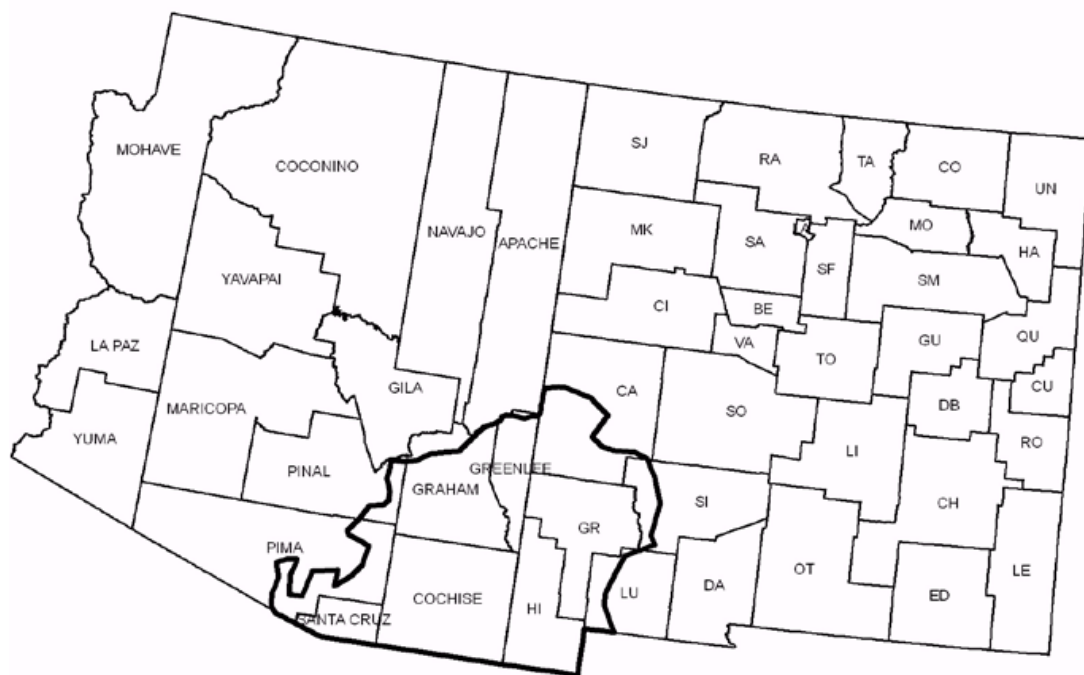
<sup>66</sup> Van Pelt (2006), p. 8. This parliamentary legerdemain was omitted entirely from the [minutes of the April 2006 meeting](#), which did not mention either the vote regarding the team membership nor the vote on the habitat subcommittee’s recommendation. The [minutes of the February 2007](#) meeting, however, discuss both these votes and the development of the final map:

Last May, all willing SWCDs [soil and water conservation districts] were accepted into the JAGCT as formal cooperators (no NRCs had requested such status at that time). This was in accordance with the agreement in place at that time. However, one of the first votes taken by the newly broadened partnership was to constrain the JAGCT emphasis area in New Mexico to Hidalgo County, excising a broader area that was defined through the best available science. AGFD and NMDGF voted in the minority on that issue, and the final vote proved challenging to us because of our respective statutory responsibilities for wildlife management and conservation and our responsibilities to the U.S. Fish and Wildlife Service (USFWS) under Section 6 of the Endangered Species Act for maintaining adequate conservation programs. In discussion afterward, over a period of several months, our agency Directors agreed that we could not sustain that course of action, and consequently the MOA needed to be revised accordingly to address the emphasis area issue and to address issues of equity in voting membership.

First, AGFD and NMDGF determined that the MOA should become a Memorandum of Understanding (MOU), since it does not convey funds. Copies of the revised draft AGFD-NMDGF MOU are available at today’s meeting. Note that the emphasis area has been enlarged to the area of overlap among the analyses that JAGCT conducted and another one published by Povilitis et al.” (Jaguar Conservation Team meeting minutes, 2/1/2007, pp. 1-2)

In actuality, the “area of overlap” excludes significant areas that do overlap among the five maps. (Of lesser consequence, the meeting described was in April, not May, and the vote to “constrain the JAGCT emphasis area” was not just “one of the first votes taken by the newly broadened partnership” but its very first and immediate vote and the express purpose that these additional entities joined the Jaguar Conservation Team.)

jaguars in New Mexico solely in Hidalgo County. At a [Jaguar Conservation Team meeting on February 1, 2007](#), however, the two state game agencies announced an effective reversal of the 2006 vote on the habitat subcommittee's recommendation, reflected in a map of an "emphasis area for conservation action" that, while omitting significant regions of the Mogollon Rim and elsewhere that the habitat subcommittee had identified as potential jaguar habitat, included nonetheless most of the Southwest's highest-density potential jaguar habitat in the Gila and Apache national forests:



[Figure 7] "Emphasis area for conservation action." From Arizona Game and Fish Department and New Mexico Department of Game and Fish. 2007. [Jaguar Conservation Framework for Arizona, New Mexico and Northern Mexico](#); p. 20.

Throughout the contentious, eight-year (1998-2006) Jaguar Conservation Team map-development process preceding the behind-closed-doors decision on the final map (Figure 7), the maps' conservation purpose remained foremost in the habitat subcommittee's participants' considerations. For example, at an August 2004 meeting of the subcommittee, held to discuss the New Mexico Department of Game and Fish's jaguar-habitat mapping process, the department reaffirmed that its jaguar habitat map was intended for "identifying and prioritizing areas for conservation measures"<sup>67</sup> Nevertheless, thus far, the existence of the Jaguar Conservation Team has led to little if any conservation of jaguar habitat. The recovery planning process, and the upcoming designation of critical habitat, provide the opportunities to transform model-driven maps into on-the-ground conservation.

<sup>67</sup> [Final Summary Notes, Jaguar Habitat Subcommittee Meeting](#), 8/30/2004, p. 3. Cognizance that the Jaguar Conservation Team mapping endeavour was meant to lead to on-the-ground conservation induced habitat subcommittee members who opposed additional restrictions on uses of public lands to seek to minimize the areas identified.

D. Independently produced maps also show jaguar habitat in the Gila headwaters / Mogollon uplands.

In addition to the maps reproduced above (Figures 4, 5, 6 & 7) which were developed as part of the Jaguar Conservation Team's endeavours, two other modeling exercises sought to identify potential jaguar habitat in the United States. Boydston and López González (2005) found areas on the Mogollon Rim and in the Sky Islands with some of the same geographic features as found in areas in which both male and female jaguars have been confirmed in the U.S. and Mexico (see Figure 8).<sup>68</sup> Boydston and López González's most restrictive map, in panel d, representing archetypal habitats for female jaguars, depicts near-contiguity between high-confidence habitat in the Sky Islands and in the Gila headwaters / Mogollon uplands region; panels b (male and female habitats) and c (male habitats only) show greater connectivity.

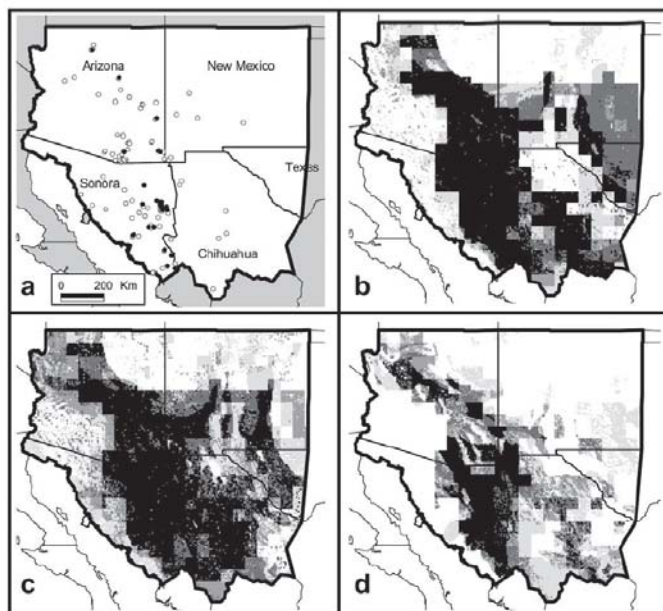


Figure 1—(a) Records of occurrence of male jaguars (open circles) and female jaguars (solid circles) in the study area which included all of Arizona, New Mexico, Sonora, Chihuahua, and the panhandle of Texas, shown in white with a bold outline. In (b), (c), and (d), the predicted distributions are shown in graduated shades representing confidence with black indicating where all 4 best subset models overlapped for distributions based on (b) all occurrence points, (c) male occurrence points only, and (d) female occurrence points only.

[Figure 8] Boydston, E. E. and C. A. Lopez Gonzalez. 2005. Sexual differentiation in the distribution potential of northern jaguars (*Panthera onca*). In: Connecting mountain islands and desert seas: biodiversity and management of the Madrean Archipelago II. 2004 May 11-15; Tucson, AZ. Proceedings RMRS-P-36. G. J. Gottfried, B. S. Gebow, L. G. Eskew & C. Edminster (eds.). U. S. Forest Service. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station; p. 53.

Lastly, Grigione et al (2009) delineated the Mogollon Rim in Arizona and New Mexico as a high priority conservation area for jaguars, based on its connectivity to other habitat areas, and the habitat's quality, size and configuration, its relatively low road and human population

<sup>68</sup> Boydston, E. E. and C. A. Lopez Gonzalez. 2005. Sexual differentiation in the distribution potential of northern jaguars (*Panthera onca*). In: Connecting mountain islands and desert seas: biodiversity and management of the Madrean Archipelago II. 2004 May 11-15; Tucson, AZ. Proceedings RMRS-P-36. G. J. Gottfried, B. S. Gebow, L. G. Eskew and C. Edminster (eds.). U. S. Forest Service. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station; p. 53.

densities, and the degree to which jaguars would be vulnerable there including through human hunting of felids and of their prey.<sup>69</sup> See Figure 9, below. Consistent with each of the other modelers, their map does not support the proposed northernmost boundary of the Northwestern Recovery Unit. Grigione et al identify the Sky Islands as a very high priority jaguar conservation area, but the boundary bisects that area, as well as entirely excluding the Mogollon Rim.

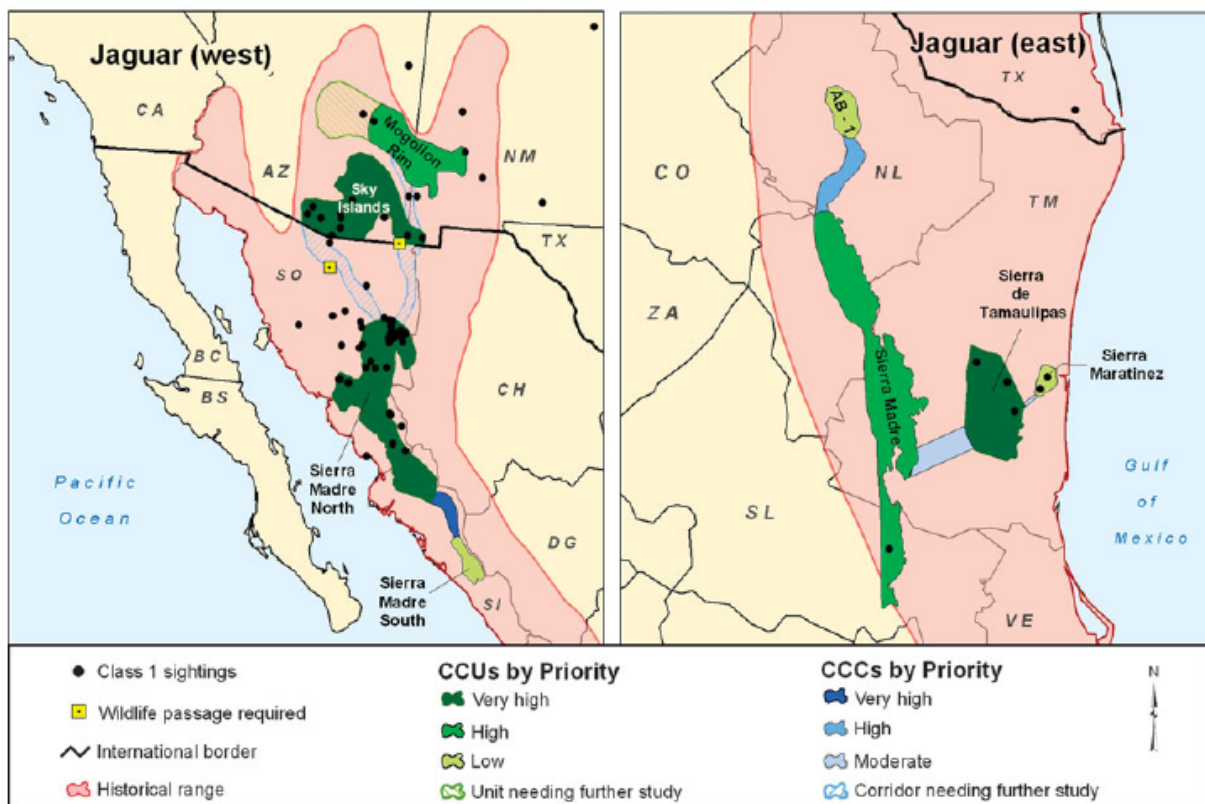


FIG. 2 Cat Conservation Units (CCUs) and Cat Conservation Corridors (CCCs) for ocelot (western and eastern bioregions) and jaguar (western and eastern bioregions). Units and Corridors are ranked by level of importance. JC-R1, LL-R4, and AB-1 are names given to Units during the mapping workshop.

[Figure 9] M.M. Grigione, K. Menke, C. Lopez-Gonzales, R. List, A. Banda, J. Carrera, R. Carrera, A.J. Giordano, J. Morrison, M. Sternberg, R. Thomas and B. Van Pelt. 2009. Identifying potential conservation areas for felids in the USA and Mexico: integrating reliable knowledge across an international border. *Oryx* 43(1), 78-86; p. 82.

Each of the foregoing five studies delineated significant swathes of habitat for jaguars within the Gila headwaters / Mogollon uplands region. As seen, significant numbers of jaguars were killed within those overlapping, identified habitat areas. The habitat itself can hardly be described as “marginal,” and each of the maps indicates functional connectivity from the current delineation of the northern boundary of the Northwestern Recovery Unit to the Gila headwaters / Mogollon uplands region and beyond.

<sup>69</sup> M.M. Grigione, K. Menke, C. Lopez-Gonzales, R. List, A. Banda, J. Carrera, R. Carrera, A.J. Giordano, J. Morrison, M. Sternberg, R. Thomas and B. Van Pelt. 2009. Identifying potential conservation areas for felids in the USA and Mexico: integrating reliable knowledge across an international border. *Oryx* 43(1), 78-86; pp. 80, 82.

E. There are a lot of potential large prey animals for jaguars in the Gila headwaters / Mogollon uplands region.

The Recovery Outline for the Jaguar specifies that illegal hunting of jaguar prey species is one of the main threats to jaguars.<sup>70</sup> Subsistence, unregulated killing of wildlife in Mexico is a threat to many local populations. In the U.S., hunting is successfully regulated, poaching is comparatively minimal, and there are robust populations of potential jaguar prey species. As seen, the New Mexico Department of Game and Fish incorporated prey density into its model of potential jaguar habitat in southwestern New Mexico, and that was partly responsible for the high jaguar habitat potential found for the Gila National Forest.<sup>71</sup>

Arizona supports an estimated 30,000 to 35,000 elk and 75,000 to 80,000 mule deer, post-hunt, most of which are on the Mogollon Rim,<sup>72</sup> as well as smaller numbers of white-tailed deer, javelina and bighorn sheep in the same region. The Gila headwaters / Mogollon uplands region also supports a variety of smaller mammals that could also serve as prey for jaguars, including coatis, skunks, jackrabbits and beavers.

**V. The Recovery Outline for the Jaguar excludes the Gila headwaters / Mogollon Rim region based on misrepresentations of the jaguar's historic distribution in Arizona and New Mexico**

The Recovery Outline for the Jaguar states that examination of historic as well as recent jaguar range underlies delineation of core, secondary, and peripheral areas: “Based on our examination of historical and recent evidence, and utilizing a format applied in other recovery outline documents, we categorized jaguar habitat and occurrences, as: 1) core areas; 2) secondary areas, and 3) peripheral areas.”<sup>73</sup> As seen in section III A of these comments, Brown and López González (2001) list 33 jaguars that were killed in the twentieth century in the peripheral area of Arizona and New Mexico, all but one of them in or near the Gila headwaters / Mogollon uplands region.<sup>74</sup>

We believe that these records of 33 jaguars, along with the other evidence we have presented, support inclusion of the Gila headwaters / Mogollon uplands region in the Northwestern Recovery Unit. But in fact, the actual number of jaguars killed in the peripheral area of New Mexico and Arizona was almost certainly higher. Brown and López González (2001), Menke and Hayes (2003)<sup>75</sup> and Hatten et al (2002)<sup>76</sup> all left out key occurrences from their tabulations of jaguar records. Furthermore, the recovery outline unfairly impeaches the credibility of a long-accepted record of a female jaguar shot in 1963 in the Gila headwaters / Mogollon uplands region. Evidence points to the validity of these omitted and discounted records, suggesting that more jaguars lived in more places throughout the peripheral area, and

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<sup>70</sup> Recovery Outline, p. 29.

<sup>71</sup> Menke and Hayes (2003), p. 16.

<sup>72</sup> Arizona Game and Fish Department. 2012. [Hunt Arizona: Survey, harvest and hunt data for big and small game](#); pp. 6, 55.

<sup>73</sup> Recovery Outline, p. 20.

<sup>74</sup> Brown, D.E. and C.A. López González. Borderland Jaguars. University of Utah Press, 2001; pp. 7-9.

<sup>75</sup> Menke and Hayes (2003), p. 5.

<sup>76</sup> Hatten et al (2002), p. 28.



bolstering our argument that jaguars could thrive once again in the Gila headwaters / Mogollon uplands region.

A. The recovery outline's sources discount previously credited jaguar reports without basis.

The elimination of jaguars from the United States began in an era predating not only widespread photography but also before the advent of near-universal literacy. And even among frontier trappers and settlers who could write, not all recorded what they killed. Previous generations of scientists sought to overcome that limitation by interviewing witnesses to wildlife encounters and paraphrasing their accounts – as well as recording their own occasional skepticism; other scientists generally accepted the judgments of their predecessors as credible or at least worthy of consideration. But many of those old accounts that were once deemed credible, today, due to the lack of extant physical evidence, are unfairly discredited or simply ignored. That the passage of time would erode the map of once-accepted jaguar point-occurrences is at odds with the fact that older records reflect a time when jaguars were more numerous in the Southwest than today – not less so; recent records should not be weighted in credence when establishing the baseline historic range of the jaguar.

The New Mexico Department of Game and Fish's habitat analysis by Menke and Hayes (2003) was based on seven reports and records that the department first characterized as representing “jaguar observations accompanied by physical evidence (Class 1) or reported as first-hand observations from a reliable source (Class 2)”<sup>77</sup> – and two pages later characterized as only representing Class 1 sightings.<sup>78</sup> Regardless, the selected reports appear to be an almost random selection from the larger universe of plausible jaguar accounts in New Mexico, others of which also appear credible.

For example, two of the seven records are attributed to “Bailey (1932)” – the publication year was actually 1931. One of those two pertained to a jaguar poisoned in the Datil Mountains (north of the Gila National Forest) in August 1902, a photograph of whose mounted pelt was reproduced in Bailey's *The Mammals of New Mexico* (1931), and therefore about which no question of its authenticity could be entertained.<sup>79</sup> The other record cited to Bailey stems from the following passage in *The Mammals of New Mexico*:

In 1908, while in the Animas Valley in extreme southwestern New Mexico the ranchmen told the writer of a jaguar killed in 1903 in Clanton Creek Canyon about 6 miles west of the Gray ranch. It had killed a bull that had wandered back in the canyon and was shot while feeding on him. W. P. Burchfield told the circumstances of its capture and where the skin had been sent for mounting. E.A. Goldman also secured a record of one that had been killed by a hunter named Morris on the west slope of Sierra de los Caballos about 1904 or 1905.”<sup>80</sup>

Goldman was a colleague of Bailey's at the U.S. Bureau of Biological Survey (predecessor agency of the Fish and Wildlife Service), and along with Bailey one of the preeminent wildlife biologists of the era. The Biological Survey's biologists including Goldman and Bailey gathered

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<sup>77</sup> Menke and Hayes (2003), p. 5.

<sup>78</sup> Ibid., p. 7

<sup>79</sup> Bailey, V. *The Mammals of New Mexico*. U. S. Department of Agriculture, Bureau of Biological Survey, North American Fauna, No. 53. Washington, D.C.: Government Printing Office. 1931; Plate 16 & p. 284.

<sup>80</sup> Ibid., p. 284.



extensive information on species' ranges through inquiring about wildlife sightings as well as through collecting specimens themselves.<sup>81</sup> The New Mexico Department of Game and Fish included among its seven jaguar occurrence reports and records the first record cited by Bailey above, of the jaguar in the Peloncillo Mountains close to the border with Mexico, but not the second, of an animal in the Sierra de los Caballos bordering the Rio Grande significantly further north. We maintain that the record that Goldman "secured" should be accorded the same validity as the record that Bailey directly secured (or more, since Morris was said to do the killing whereas Bailey does not state that Burchfield himself did the killing – and does not identify the shooter).<sup>82</sup>

Other examples abound. Bailey (1931) cited three additional 1902 and 1903 jaguar records for New Mexico that the New Mexico Department of Game and Fish omitted from its report.<sup>83</sup> Aside from missing those three, the state agency also missed four New Mexico jaguar occurrence records for the years following 1931. For example, Hill (1942) included the statement: "A jaguar was killed some years ago near Springer; its skin is now in the collection of Mr. Waite Phillips. None has been reported from this region since then."<sup>84</sup> There are two reasons to give this statement full credence. Author John E. Hill was assistant curator of mammals at the American Museum of Natural History which, in July 1938, he wrote at the outset of his article, had "sent a mammalogical expedition to northeastern New Mexico, Near Cimarron, Colfax County. Here the cooperation of Mr. Waite Phillips, owner of the Philmont Ranch, enabled the expedition during two months to make a survey of the mammalian fauna of the southern Sangre de Cristo Range, and adjacent high plains."<sup>85</sup> Hill had access to Phillips' collection: "The grizzly bear is now quite or nearly exterminated in this region. A skin, in Mr. Phillips' collection, of a grizzly killed many years ago near Cimarron was dark brown with well-marked, pale yellowish overlay."<sup>86</sup> It is not plausible that over a 2-month period focusing on documenting the region's mammals, Hill did not personally view the jaguar skin that he asserted was in Phillips' collection.

Moreover, the Springer, New Mexico occurrence is plausible because of two other jaguar reports from prior decades in the same watershed. Springer lies along the Cimarron River near its confluence with the Canadian River. In the winter of 1902/1903, according to Bailey (1931),

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<sup>81</sup> Robinson, M.J. 2005. *Predatory Bureaucracy: The Extermination of Wolves and the Transformation of the West*. University Press of Colorado; pp. 58, 59, 61.

<sup>82</sup> Brown and Lopez Gonzalez (2001) include the Sierra de los Caballos jaguar killed by Morris in their table of jaguars reportedly killed or photographed in Arizona and New Mexico, 1900-2000; p. 9.

<sup>83</sup> Bailey, pp. 283-284. Of those three, one was proven through Bailey's personal observation of the pelt of a jaguar killed in Otero County (location unknown – hence its omission from the New Mexico Department of Game and Fish report). The other two consisted of jaguar sightings on the northeastern plains of New Mexico that the State game warden of New Mexico, Page B. Otero, had "perfect confidence in . . . as he knew the men who saw the animals." Still other, perhaps less reliable jaguar reports emanated from the San Andres and Sacramento Mountains. In addition to those reports, Bailey cited an additional four, but one record was attributed originally to Barber, to which NMGF cites it, and three other records precede the 20<sup>th</sup> century cut-off for NMGF's analysis; one of those three – a jaguar said to have taken refuge from floodwaters in a convent building in Santa Fe in 1825, killing four men there – Bailey expressed his skepticism about; that record has since been debunked, vindicating Bailey's suspicions.

<sup>84</sup> Hill, J.E. 1942. Notes on mammals of northeastern New Mexico. *Journal of Mammalogy*. 23(1):75-82; p. 78.

<sup>85</sup> *Ibid.*, p. 75

<sup>86</sup> *Ibid.*, p. 78.

a jaguar was sighted on another New Mexico tributary of the Canadian River, Ute Creek.<sup>87</sup> And on September 7, 1853, along the Canadian River in north Texas, Lieutenant A. W. Whipple, who was in an Army scouting expedition, reported that “a large tiger was discovered near camp but he escaped.”<sup>88</sup> These other two records indicate that jaguars had previously been present in the Canadian River watershed and thus lend additional credence to Hill’s record. Yet, while previous assessments found Hill’s record convincing (see Hall 1959<sup>89</sup> and Findley et al 1975<sup>90</sup>), and although the Jaguar Conservation Team’s habitat subcommittee decided to accept this report as valid,<sup>91</sup> it was not included in the New Mexico Department of Game and Fish tabulation (nor in Brown and López González’s table) – and thus also disregarded in the Recovery Outline for the Jaguar.

#### B. Modelers did not include some known jaguar records.

Antiquity’s erasure of proof and unduly restrictive contemporary judgments as to which records to accept do not account for omission of three additional jaguar observation records within the Gila headwaters / Mogollon uplands region in New Mexico during the 1990s. The first sighting occurred immediately north of Interstate 10 (the boundary of the Northwestern Recovery Unit) and the last two were in and around the Gila National Forest, well north of the boundary.<sup>92</sup> All were brought to the attention of the Jaguar Conservation Team but they are also absent from the New Mexico Department of Game and Fish report (and from Brown and López González).<sup>93</sup> [One other sighting, by the (married) biology professors Gerald and Donna Jacobi

<sup>87</sup> Bailey (1931), p. 284. The Ute Creek jaguar sighting and another jaguar sighting a few dozen miles distant on the Great Plains in the summer of 1903 comprised the two sightings that the state game warden was said to have “had perfect confidence in.” (See footnote 83.)

<sup>88</sup> Foreman, Grant (editor). 1941. A pathfinder in the Southwest: the itinerary of Lieutenant A. W. Whipple during his explorations for a railway route from Fort Smith to Los Angeles in the years 1853 & 1854. Norman: The University of Oklahoma Press; p. 77.

<sup>89</sup> Hall, E.R. and K.R. Kelson. 1959. The mammals of North America, volume II. Ronald Press, New York; p. 955.

<sup>90</sup> Findley et al (1975), p. 317.

<sup>91</sup> [Final Summary Notes, Jaguar Habitat Subcommittee Meeting](#), 8/30/2004, pp. 2-3.

<sup>92</sup> Robinson (2006), p. 8 (1990 L. Link sighting); T. Snow, “Proposed Jaguar Sighting Report,” 8/15/2000 (fall 1998 T. & B. Duffy sighting); B. Van Pelt to M. Robinson, “Ranking for Burro mountain jaguar sighting,” e-mail 8/8/2005 (5/1999 J. Trewern sighting) –Jaguar Conservation Team habitat subcommittee records. These omissions likely stemmed from New Mexico Department of Game and Fish’s low level of participation with the Jaguar Conservation Team’s habitat subcommittee during this period, as shown by the following passage from the [meeting minutes of October 1999](#): “Also, during this time, a question was raised regarding NM Game and Fish Department’s participation on the committee and at this meeting. Information and an invitation were sent, seeking participation, and some individuals have provided information for the group. Suggestions were made to contact offices in Las Cruces and Silver City. We have most of the information needed, but lack prey density information.” In the case of a 1990 sighting by Larry Link, proprietor of the Steins Ghost Town immediately north of I-10 in the northern Peloncillo Mountains, New Mexico Game and Fish did not follow through on its intention to interview Mr. Link and assess the record’s credibility, which was brought to the Jaguar Conservation Team’s attention third-hand. Michael Robinson of the Center for Biological Diversity interviewed Mr. Link by phone on 9/13/2004 and conveyed essential information to the Jaguar Conservation Team. Mr. Link was shot to death on his property in June 2011, in what remains an unsolved homicide. In the case of one of the omitted sightings, from May 1999, of a large black animal seen by Silver City high school biology teacher John Trewern who was driving home from a turkey hunt in the Burro Mountains of the Gila National Forest, the New Mexico Department of Game and Fish instructed a nearby game warden not to utilize his team of lion hounds to track the cat and establish its identity. A track cast showed it to be a felid within the size range of a jaguar or a large mountain lion. (B. Van Pelt to M. Robinson, “Ranking for Burro mountain jaguar sighting,” e-mail 8/8/2005).

<sup>93</sup> Menke and Hayes (2003), p. 5; Brown and López González, pp. 6-7.

of New Mexico Highlands University, on August 25, 1990, in the Gila National Forest, was properly included in the New Mexico Department of Game and Fish assessment.<sup>94]</sup>

A third reason -- aside from the unfounded skepticism at older records and the neglect of more recent reports due to disengagement -- that the New Mexico Department of Game and Fish analysis omitted credible sightings is because the study's purpose was not to document the historic range of jaguars in the state but rather to assess current potential habitat for jaguars. With that aim, the study only included 20<sup>th</sup> century jaguar records and only those whose locations were precisely described; furthermore, the study area was confined to southwestern, west-central and south-central New Mexico, while acknowledging that "Historic range of jaguars in New Mexico is defined, in part, by reports of jaguars having been killed in New Mexico as far north as Colfax County, and as far east as Otero County (Findley 1975, Schmitt 1998)."<sup>95</sup> (Those two counties were where two of the jaguars not included in the New Mexico Department of Game and Fish 7-jaguar-list were killed. As discussed, Hill saw the Colfax County pelt; Bailey (1931) saw the Otero County pelt.<sup>96</sup>)

Despite this straight-forward caveat, the Recovery Outline for the Jaguar erroneously states that "only seven jaguar reports and records from 1900 to 1996 have occurred in New Mexico."<sup>97</sup> This error is significant because, as seen, the recovery outline delineates core, secondary, and peripheral areas "[b]ased on our examination of historical and recent evidence."<sup>98</sup> We maintain that a more thorough examination of both the historical and recent evidence would not permit the conclusion that areas north of I-10 in New Mexico hold virtually no value for jaguar recovery.

Similarly, the modeling conducted by Boydston and López González (2005) was based on a limited set of jaguar records that did not include the 1930s jaguar killed near Springer, New Mexico, the 1990 jaguar sighting by doctors Jacobi in the Gila National Forest (both discussed earlier and the latter used in the mapping that was conducted by the New Mexico Department of Game and Fish)<sup>99</sup> nor two female jaguars reported by officials of the Biological Survey as killed in Arizona between 1924 and 1927 (including one poisoned).<sup>100</sup>

Boydston and López González sought to identify habitat elements that would separately support male and female jaguars and found "potentially suitable areas that are currently unoccupied . . . within the female distribution" [i.e. the female niche].<sup>101</sup> Their map (Figure 8 of this letter, panel d) shows that some of these potentially suitable areas are in the Gila headwaters / Mogollon uplands region. They also stated: "Our results indicated that the availability of areas meeting females' environmental requirements may be an important factor limiting the distribution of northern jaguars."<sup>102</sup>

Boydston's and López González's incomplete data set, particularly for female jaguars of which they used just six records in the U.S., suggests limited utility for this method of

<sup>94</sup> Menke and Hayes (2003), p. 5.

<sup>95</sup> Ibid., pp. 8, 23.

<sup>96</sup> Bailey (1931), pp. 283-284.

<sup>97</sup> Recovery Outline for the Jaguar, p. 13.

<sup>98</sup> Recovery Outline, p. 20.

<sup>99</sup> Boydston and López González (2005), p. 53.

<sup>100</sup> Fisher, A.K. and W.B. Bell. 1927. Report of the committee on economic mammalogy, American society of mammalogists. Archives of the Museum of Vertebrate Zoology, University of California at Berkeley; see Appendix.

<sup>101</sup> Ibid, p. 55.

<sup>102</sup> Ibid.

identifying jaguar habitat and distinguishing male from female habitat niches in currently unoccupied historic range.

For example, assuming that the two females killed in the 1920s were the only female jaguars in the U.S. Southwest that were omitted from the model – a dubious assumption given Brown’s (1989) reasonable conjecture that “reports of multiple kills of jaguars running together were probably females and subadults”<sup>103</sup> – the model would have been able to use just 75% of the total female jaguars in the Southwest to characterize the entire supposed female-jaguar niche. Appropriately, the authors warned: “There are important limits to the interpretation of our results.”<sup>104</sup> In light of the hefty evidence presented throughout the first four sections of this letter, coupled with the uncertainty in interpreting Boydston’s and López González’s results, their study is not a sufficient basis for excluding the Gila headwaters / Mogollon uplands region from the Northwestern Recovery Unit.

### C. Extensive poisoning may have killed more jaguars than were located and recorded.

Jaguars killed in the United States may also have been undercounted due to the broad-scale predator poisoning of their habitat and the ability of poisoned animals to cover ground before dying. Fur and bounty hunters as well as livestock owners began to bait carnivores and poison them with strychnine beginning in the mid- to late-1800s in the western U.S.<sup>105</sup> – and this had a known effect on jaguars. For example, Bailey (1931) described the circumstances of the Datil Mountains, New Mexico jaguar’s 1902 death:

Mrs. Manning had been in the habit of putting out poison to kill the predatory animals about their ranch, in the mountains 12 miles northwest of Datil, and among the victims of the poisoned baits was this jaguar which had been killing stock on the ranch for some time. It had killed 17 calves near the house during a short period before it was secured. The ranch was located at about 9,000 feet altitude in the pine and spruce timber of this exceedingly rough range of mountains. At the time Hollister [Bailey’s informant] was there [1905] another jaguar was supposed to be at large in the general neighborhood.<sup>106</sup>

No record exists of the demise of another jaguar in or near the Datil Mountains, but that raises the question of how many jaguars may have been poisoned yet never found. Two jaguars were poisoned together on the Mogollon Rim in 1912.<sup>107</sup> Beginning in 1917, the magnitude of the poisoning grew greatly when the U.S. Bureau of Biological Survey developed a plant to mass-produce strychnine-impregnated cubes of fat or meat, and assigned hundreds of its employees to place the baits along streams, wildlife trails, and surrounding carcasses (used as draws) throughout the West. Until banned by executive order in 1972, the Biological Survey (and after 1940 its successor agency the Fish and Wildlife Service) annually distributed over a million poisoned baits across the western landscape, including Arizona and New Mexico.<sup>108</sup> In 1926,

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<sup>103</sup> Brown (1989), p. 66.

<sup>104</sup> Boydston and López González, 2005, p. 55.

<sup>105</sup> Robinson (2005), pp. 17-18, 27, 29-30.

<sup>106</sup> Bailey (1931), p. 284.

<sup>107</sup> Brown and López González (2001), p. 8.

<sup>108</sup> Robinson (2005), pp. 110-113, 170-172, 225, 315-316, 319. I (Robinson) was only able to obtain poison-bait figures for some years, but the growing budget of the Bureau of Biological Survey and the Fish and Wildlife Service

two jaguars (separately) were poisoned in southern Arizona<sup>109</sup> – likely including the female separately identified as poisoned sometime between 1924 and 1927. This promiscuous federal poisoning primarily but not exclusively targeted coyotes, yet only a fraction of poisoned coyotes were ever located while coyotes as a species disappeared from most of the western landscape (and repopulated after the poisoning was greatly constrained).<sup>110</sup> There is no reason to believe that the carcass of every poisoned jaguar was found, either.

#### D. Manufacturing a ‘dispute’ over a female jaguar.

Subjective judgment invariably factors into assessing the validity of jaguar reports, but an excess of subjectivity can poison sound judgment. Misguided reliance on Johnson et al (2011) has tainted the Recovery Outline for the Jaguar’s judgment of the Gila headwaters / Mogollon uplands region’s suitability for jaguars, in particular through sowing unfounded doubt on the last known female jaguar in the U.S., shot on September 28, 1963 in the Apache National Forest of Arizona. Whether or not this female jaguar was there naturally is important because her presence approximately 175 miles north of the border with Mexico would seem to indicate that she was born in that region, surely a factor in evaluating the area’s suitability.

In explaining the delineation of the Northwestern Recovery Unit, the recovery outline states: “In the U.S. portion of the NRU, including southeastern Arizona and extreme southwestern New Mexico, only male jaguars have been documented since 1950; the last female documented in this area was in 1949 (Brown and López-González 2001). No jaguars have been documented north of the NRU in the U.S. since 1963 (Brown and López-González 2001, Johnson et al. 2011).”<sup>111</sup> Yet, according to Brown and López González (2001), the Fish and Wildlife Service trapped and killed a male jaguar on January 16, 1964 on the breaks above the Black River on the Fort Apache Indian Reservation (i.e. Mogollon Rim of Arizona).<sup>112</sup>

More consequential than omitting the 1964 male jaguar is the equally misleading footnote that accompanies the recovery outline’s statement about the 1963 cut-off for jaguars north of the Northwestern Recovery Unit: “The validity of this record (a female jaguar killed in the White Mountains of Arizona) has been disputed. See Johnson et al 2011 for further information.”<sup>113</sup>

Johnson et al (2011) is the second iteration of the Jaguar Conservation Team’s charter document. The original charter, Johnson and Van Pelt (1997), suggested no dispute over this record: “Jaguars persisted in central Arizona as late as the 1960s, when three were taken on the Fort Apache and San Carlos Indian Reservations.”<sup>114</sup> Even the 2009 draft of the 2011 edition expresses no doubt about this occurrence: “Six of the seven jaguars confirmed in Arizona and New Mexico from 1960 through 2009 and identified to gender have been males (the lone female was killed in 1963 near Big Lake, White Mountains, Arizona) and all have been solitary

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for predator eradication or control during the span 1917-1972, and no contrary evidence, suggests that during most if not all years the number of poisoned baits never dropped below 7 figures.

<sup>109</sup> Brown and López González (2001), p. 8.

<sup>110</sup> Robinson (2005), pp. 112, 133, 296-297, 299-300

<sup>111</sup> Recovery Outline for the Jaguar, p. 41.

<sup>112</sup> Brown and López González (2001), p. 7.

<sup>113</sup> Recovery Outline for the Jaguar, p. 41 (footnote e).

<sup>114</sup> Johnson, T.B. and W.E. Van Pelt. 1997. [Conservation assessment and strategy for the jaguar in Arizona and New Mexico](#). Nongame and Endangered Wildlife Program Technical Report 105. Arizona Game and Fish Department, Phoenix; p. 4. The reference to three jaguars on these two reservations appears to be in error, but the proximity of the 1963 female to the Fort Apache Indian Reservation suggests that was one of the records supporting the statement.

individuals.”<sup>115</sup> Nor do any other published accounts suggest a dispute over this record; all accept it at face value.

However, Johnson et al (2011) states: “The veracity of some mid-1900s records has been questioned because they might have resulted from jaguars being imported into AZ or NM and released, in some instances for ‘canned’ hunts or for some other reasons.”<sup>116</sup> Three separate footnotes (11, 12 & 13) annotate this statement:

11. In the White Mountains of east-central AZ, in 1963 a hunter (T. Penrod) killed a small female jaguar and in 1964 a federal government trapper (R. Culbreath) killed a male (Brown and López-González 2001). AGFD law enforcement officers speculated one or both of the jaguars had been imported for “canned hunts” (hunts involving release of captive animals) by C.J. Prock, a guide who was investigated for canned hunts involving other species of wildlife. The premise was that the Penrod and Culbreath jaguars had escaped from Prock hunts but the jaguar case could not be made (R. Kohls personal communication; R. Thompson personal communication). Prock, who did not guide Penrod or Culbreath, later asserted he had “never let a jaguar get away in Arizona and that is the whole truth” (Brown and Thompson 2010). However, Prock did lead three successful jaguar hunts in southern AZ in 1958-59 and was fined in 1964 in U.S. District Court in Phoenix AZ for violating the Lacey Act by importing mountain lions into AZ and turning them loose for canned hunts (see: Dean 1974; Jones 1974; W. Swank personal communication). Because of the circumstances, all jaguars taken on hunts guided by C.J. Prock were dropped from the occurrence record for AZ years ago (AGFD unpublished data; Brown and López-Gonzalez 2001).

12. T.B. Johnson: In a January 2008 email, D. Robertson said that world-famous lion and jaguar hunter Dale Lee had confided to him long ago over a campfire in the Chiricahua Mountains (southeastern AZ) that Lee and his brother [Clell] had “gone down to Guatemala for the Guatemalan government ... and brought back a litter of jungle cats [jaguars], nurtured them to a survivable state, and turned them loose in that area. (Twixt Wilcox [sic] and the Chiracahuas [sic].)” Robertson said Lee had sworn him to secrecy and he was only making a “public statement” because Lee “passed in the 1980s” and, now that he was in his own “twilight years,” he “felt it was time to say something.” To date, I have not found corroborating evidence for Robertson’s statements.

13. In comment submitted to USFWS on proposed designation of critical habitat for the jaguar in the United States, D. Parker (2010) referenced canned hunts (among other things) as discrediting the proposal. Parker also addressed the 1963-64 Arizona jaguar records mentioned above and “guaranteed” jaguar hunts in NM in 1972-73. According to Jones (1974), in 1972-73 nine jaguars were imported and released by C.J. Prock before being killed on guaranteed guided hunts near Apache Creek NM (i.e. less than 50 mi east of the 1963-64 AZ records). According to Jones (1974), in December 1973 Prock pleaded *nolo contendere* in U.S. District Court to conspiracy, one of six counts on which he was indicted by a NM grand jury. Parker referenced an August 5, 2010 personal communication from Prock from which Parker inferred that a small female jaguar (and

<sup>115</sup> Ibid, p. 30.

<sup>116</sup> Johnson, T.B., W.E. Van Pelt and J. N. Stuart. 2011. Jaguar conservation assessment for Arizona, New Mexico and northern Mexico. Arizona Game and Fish Department, Phoenix. 81 pp; pp. 8-9.



perhaps others) released in the 1972-73 NM hunts had not been killed. Based on Prock's comments, Parker asserted the 1963-64 AZ jaguars taken by Penrod and Culbreath should be rejected as legitimate records. At one point, Parker seemed to imply that a small female jaguar Prock released in the 1972-73 New Mexico hunts escaped and might be the 78 lb female that Penrod killed in AZ in 1963. USFWS has not responded to Parker's letter and his supporting "documentation" is not available to us, so it remains unclear how a jaguar released in New Mexico in 1972-73 could have been killed in Arizona in 1963. We do not consider Parker's comment a sufficient basis for rejecting the Penrod and Culbreath jaguar records.<sup>117</sup>

The Center for Biological Diversity submitted a public-records request to the Arizona Game and Fish Department for the records cited in these footnotes, including Brown and Thompson (2010), Dean (1974), Jones (1974) -- none listed in the Literature Cited section of this Jaguar Conservation Team document -- as well as the personal communications and emails, and the judicial and law-enforcement records cited above.

None of the records subsequently released by the Arizona Game and Fish Department support the notion that C.J. Prock or Dale Lee had anything whatsoever to do with the female jaguar killed in 1963. The agency was unable to provide any records supporting even that "AGFD law enforcement officers speculated one or both of the jaguars had been imported for 'canned hunts' (hunts involving release of captive animals) by C.J. Prock."

The footnotes above concede that "the jaguar case not be made" regarding Prock. The footnotes concede that Dale Lee's supposed sharing of a confidence with D. Robertson, pertaining to release of jaguar, cannot be corroborated. The footnotes concede that jaguars released in the 1970s could not have been killed in the 1960s. If that was the sum of the evidence, it should not suffice to allude to a "dispute" over the validity of the 1963 and 1964 jaguars killed on the Apache National Forest.

But that is not the sum of the evidence. It is worth noting that Lee's alleged release of jaguars occurred dozens of miles from where the 1963 jaguar was killed. Supposedly, according to an email from Dale Robertson to Terry B. Johnson of Arizona Game and Fish Department, Lee went "down to Guatemala for the Guatemalan government to capture and relocate some nuisance animals," and came back with a large litter of jaguars cubs that he raised and then released.

However, even if this tale is assumed true, not just the location but also the timing of the event suggests it's irrelevancy to the 1963 jaguar. She was small and was likely under three years old. From 1960 onwards, Guatemala was convulsed by a civil war that seems an unlikely setting for the besieged government to invite, and for a U.S. citizen to act on capturing and relocating errant jaguars.

Finally, one of the sources for the Arizona Game and Fish Department's footnote 11, above, Brown and Thompson (2010) flatly contradicts the premise of the supposed dispute: "Circumstances and subsequent investigations demonstrated that all of the jaguars taken in Arizona after 1959 were natural occurrences rather than translocations or escapees."<sup>118</sup>

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<sup>117</sup> Ibid, p. 9.

<sup>118</sup> Brown, D. & R. Thompson. 2010. [Lions, tigers and bears, oh my! The legacy of Curtis J. Prock](#). Pages 153-165 in Arizona Wildlife Trophies, Arizona Wildlife Federation. Mesa, AZ; p. 157.

It is not sufficient for the Recovery Outline for the Jaguar merely to state, in its own footnotes: “The validity of this record (a female jaguar killed in the White Mountains of Arizona) has been disputed. See Johnson et al. 2011 for further information.”<sup>119</sup> A “dispute” that effects public policy by serving as a substantial part of the basis for excluding the best U.S. range for jaguars, must be grounded in fact. In this instance, none of the sources cited in Johnson et al (2011) support the existence of any dispute over the 1963 female jaguar; and, as seen, the most recently-published cited source, Brown and Thompson (2010) entirely rebuts the premise that she was translocated there before being shot.

In contrast to the Jaguar Conservation Team’s lately-concocted, cockamamie proposition that the 1963 female jaguar was a plant, Brown (1989) provided a plausible explanation for her presence: “An inordinate number of jaguars also came from the Fort Apache and San Carlos Indian reservations, possibly because these ‘trust lands’ were not opened to exploitation by Anglo ranchers until after 1900.”<sup>120</sup> Given the 1963 jaguar’s close proximity to the Fort Apache Indian Reservation, and the 1964 jaguar’s trapping on the reservation, that explanation rings true. The presence of a female jaguar that was likely born in this region of the Gila headwaters / Mogollon uplands where she was shot 49 years ago, must be considered in delineating the Northwestern Recovery Unit.

## **VI. The jaguar’s historic range in the United States was extensive**

The Fish and Wildlife Service and the Jaguar Recovery Team should not disregard the implications of the jaguar’s origin and millennia-long tenure in North America, extending far beyond the Southwest.

### **A. The extant species of jaguar, *Panthera onca*, evolved to its present form in North America.**

The jaguar evolved in today’s (contiguous) United States before colonizing Central America and South America.<sup>121</sup> Nowak and Paradiso (1983) wrote: “Until the end of the Pleistocene, *P. onca* occurred through the southern United States, and seemed to be especially common in Florida. There is some evidence that the species still inhabited the southeastern United States in historical time.”<sup>122</sup> (As we show in the following sections, with discovery of a “new” record from nineteenth-century Kentucky, that evidence must now be regarded as dispositive.)

Were they walking around today, Pleistocene jaguars would be virtually indistinguishable from contemporary jaguars. Simpson (1941) posited through examination of paleontological remains of what he identified as jaguars in Tennessee, Florida and Nebraska, and probable jaguars in Oregon and Washington, that in the Pleistocene, “true jaguars specifically inseparable from *Panthera onca*, the living species, occur[ed] widely. They may (doubtfully) average

<sup>119</sup> Recovery Outline for the Jaguar, pp. 18, 41.

<sup>120</sup> Brown (1989), p. 66.

<sup>121</sup> Simpson, G. G. 1941. Large Pleistocene felines of North America. American Museum Novitates, No. 1136 (8/11/1941), published by the American Museum of Natural History, New York; p. 11.

<sup>122</sup> Nowak R. M. and J. L. Paradiso. 1983 Walker’s Mammals of the World 4<sup>th</sup> Edition. Johns Hopkins University Press; p. 1091.

somewhat larger than the largest living races and may be tentatively distinguished as *P. onca augusta*.<sup>123</sup>

Daggett and Henning (1984) depicted the “Pleistocene distribution of *Felis onca*,” which we reproduce in Figure 10 below, based on paleontological evidence:



Fig. 1. Pleistocene distribution of *Felis onca*.  
1—Whitman County, Washington (Simpson 1941b);  
2—Fossil Lake, Oregon (Simpson 1941b); 3—Niobrara,  
Nebraska (Simpson 1941b); 4—Schulze Cave, Edwards  
County, Texas (Dalquest 1969); 5—Little Salt River  
Cave, Franklin County, Tennessee (McCardy 1951);  
7—Craighead Caverns, Tennessee (Simpson 1941a);  
8—Vero, Florida (Simpson 1941b); 9—Melbourne,  
Florida (Simpson 1941b); 10—Port Kennedy, Pennsylv-  
ania (Simpson 1941b).

[Figure 10] Locations of ancient jaguar bones, from Daggett, P.M. and D.R. Henning. 1974. The jaguar in North America. *American Antiquity*. 39(3): 465-469; p. 466.

#### B. Native American societies in the U.S. were familiar with jaguars.

The Fish and Wildlife Service accepts that jaguars’ historic range included California, Arizona, New Mexico, Texas and possibly Louisiana. However, in discussing the distribution and significance of jaguars in the U.S. the Recovery Outline for the Jaguar cites Alan Rabinowitz’s erroneous 1999 assessment that “the lack of substantial anecdotal evidence, mythology, religious beliefs, or folklore about jaguars in old books, by hunters, or recorded among Native American groups north of the Mexican border strongly suggests a lack of permanent presence even by relatively small numbers of jaguars within the last several hundred years.”<sup>124</sup>

Dr. Rabinowitz’s assessment did not take into account Daggett’s and Henning’s (1984) overview of jaguar representations in Native American art and folklore. What they termed the “cultural distribution of *Felis onca* in North America” included seeming depictions of jaguars on artifacts found in Washington state, Ohio, Missouri, Alabama and Florida, as well as oral histories or myths passed down by the Creek, Natchez and Comanche peoples referring to

<sup>123</sup> Ibid, p. 1, 20, 22.

<sup>124</sup> Recovery Outline for the Jaguar, p. 19.

animals whose behaviors and/or appearances recall jaguars, as depicted cartographically in Figure 11.<sup>125</sup>



Fig. 2. Cultural distribution of *Felis onca* in North America. 1—Northwest Coast (Covarrubias 1954); 2—California Indians (Seton 1919); 3—Zuni-Coronado 1540 (Seton 1925); 4, 5—Commanche-Tale, Quivers (Cannonge 1958; Sage in Warren 1942); 6—Shell gorget, Benton County, Missouri (Wood 1961); 7, 8—Moundville, Alabama, A.D. 1400 (Fundaburk 1956); 9, 10—Hopewell burial mound Ohio, 500 B.C. (Covarrubias 1954); 11—Creek, Natchez tales (Swanton 1929); 12—Florida mortuary pottery, Moore collection (Holmes 1899).

[Figure 11] Locations of artifacts depicting, or oral histories describing apparent jaguars, from Daggett, P.M. and D.R. Henning. 1974. The jaguar in North America. *American Antiquity*. 39(3): 465-469; p. 467.

Dr. Rabinowitz also did not account for Merriam's (1919) note that "an old chief of the Kammei tribe (called by the Spanish 'Diegenos') told me that in the Cuyamaca Mountain region in San Diego County, the 'Tiger,' while rare, was well known to the old Indians, who call it the 'Big-spotted Lion,' *Hut-te-kul*."<sup>126</sup> (Merriam was not only a highly-accomplished mammalogist and the founder of the agency that later became the Fish and Wildlife Service, but also a noted ethnologist and linguist who devoted his retirement to studying Native American societies.<sup>127</sup>) Nor did Dr. Rabinowitz account for Strong's (1926) follow-up interviews establishing "similar information [to Merriam's] . . . given the present writer by northern neighbors of the Diegueno, the Cahuilla Indians of the Coachella Valley and San Jacinto and Santo Rosa Mountains . . . Francisco Nombre, an old clan chief of the Desert Cahuilla near Coachella, stated that in his youth an animal called tu'kwut, described as a large cat with a yellow brown skin marked with

<sup>125</sup> Daggett, P.M. and D.R. Henning. 1974. The jaguar in North America. *American Antiquity*. 39(3): 465-469. Daggett and Henning, in numeral 3 of the map we reproduce as Figure 11, place the Coronado expedition's sightings of "tigres" to the West of where Bailey (1931) and others placed the sightings in today's Gila National Forest south of Zuni; see section III B and footnote 42 of this letter. Daggett and Henning also mis-state the assessed date of an artifact found in the Hopewell burial mound of Ohio, in numeral 10 of our Figure 11; the correct date should be 500 A.D., not 500 B.C., as Daggett and Henning correctly noted on p. 466, and as their source affirms (See Covarrubias, M. 1954. *The eagle, the jaguar, and the serpent: Indian art of the Americas, North America: Alaska, Canada, the United States*. Alfred A. Knopf, NY; Fig. 82.)

<sup>126</sup> C. Hart Merriam. 1919. Is the jaguar entitled to a place in the California fauna? *Journal of Mammalogy*, 1(1):38-40; p. 40. Diacritic marks in the original Kammei word are not reproduced in this letter.

<sup>127</sup> Sterling, K. B. 1977. *Last of the naturalists: The career of C. Hart Merriam*. Arno, New York.

spots and having a long tail, was well known in the mountains bordering the desert. . . . Jaguar skins as described above were quite often brought as gifts.”<sup>128</sup>

Furthermore, Pavlik (2003) showed that Indians throughout the U.S. Southwest described jaguars in stories, reproduced their likenesses in art and vivified their presence in rituals. There are jaguar pictographs and murals along the Rio Puerco in New Mexico, downstream on the Rio Grande near El Paso, and at a Hopi archaeological site in northeastern Arizona. Pavlik himself witnessed a Hopi ceremony in 1998 using an arrow-quiver case made of jaguar skin. He further cited and described a variety of oral histories showing that the Navajo, Apache, Tohono O’odam, Sobaipuri, Yavapai, Mojave and Comanche were all familiar with jaguars.<sup>129</sup> Native American knowledge of jaguars in North America was widespread and helps affirm the jaguar’s longstanding tenure.

### C. Jaguars were encountered throughout much of the United States in the 1700s and 1800s.

Just like the anthropological record, the historical record from explorers and settlers also suggests a dramatically more extensive distribution of the jaguar in North America in the 1700s and 1800s than now, including in the southeastern U.S.. Jaguars (and their synonyms *tigers*, *tigres* and *leopards* as well as the scientific nomenclature *Panthera onca*) were reported as far afield as California, Colorado, Texas, Louisiana, North Carolina and Kentucky (as well as in Arizona and New Mexico, as seen).

Daggett and Henning (1984) found a substantial geographic overlap between the anthropological and historical (as well as paleontological) records of jaguars, as seen in Figure 12 (below).



Fig. 3. Distribution of *Felis onca* 1700-1960 based upon zoological reports. 1-6—California (Seton 1919; Hall 1959); 7—Arizona (Lange 1960); 8—New Mexico (Mearns 1901; Hall 1959); 9—Colorado (Warren 1942); 10, 11, 12—Ohio Valley (Jefferson 1799); 13—Texas (Mearns 1901; Hall 1959).

[Figure 12] Daggett, P.M. and D.R. Henning. 1974. The jaguar in North America. *American Antiquity*. 39(3): 465-469; p. 468.

Other reports not mentioned by Daggett and Henning corroborate and even extend their distributional maps. Lawson (1714) reported “tygers” (distinguished from “panthers”) in 1700 at

<sup>128</sup> Strong, W.D. 1926. Indian records of California carnivores. *Journal of Mammalogy*, vol. 7:59-60; p. 59.

<sup>129</sup> Pavlik, S. 2003. Rohonas and spotted lions: the historical and cultural occurrence of the jaguar, *Panthera onca*, among the native tribes of the American Southwest. *Wicazo Sa Review*. Spring 2003:157-174.

the headwaters of the Santee River in today's South Carolina and further east in what was likely today's Lancaster County, South Carolina or Union or Mecklenburg counties, North Carolina.<sup>130</sup> Brickell (1737), also reported "tygers" (described as "most beautifully mottled with several kinds of spots" and "large, strong and swift Beasts") in the same region.<sup>131</sup> Both Lawson and Brickell reported first-hand sightings. Harlan (1825) described the jaguar's range as including "east of the Mississippi."<sup>132</sup> In a [previously unreported record](#), Rafinesque (1832) reported jaguars killed in Kentucky:

While I was in Kentucky I heard of several [jaguars] having been seen and shot. Two of them, a male and female, did once make a stand near Russellville, and alarm many travelers, feeding on hogs, until a party of hunters went in pursuit of them, killed one, and drove away the other.

Before that, another was shot on the 6<sup>th</sup> of June, 1820, by Mr. John Six, on Green River, 10 miles south-east of Hartford, in Ohio county [Kentucky]. The skin was brought to Frankfort and an account given in the papers. This animal appeared to be a true Mexican Jaguar. The body was 5 feet long and the tail 2 feet. It weighed 150 pounds before skinning. The back and sides were yellow with black spots curiously arranged in several rows, a row on the back longer much larger and extending over half the tail, which was rather slender, with very long hair at the end. Chin, belly, and feet white, ears small round black outside, white inside. Whiskers stiff, 6 inches long, black with the end white.<sup>133</sup>

Jaguars were also described in the southern Rocky Mountains, including the "head waters of the Rio Grande"<sup>134</sup> and in December 1843 at the headwaters of the Platte River, where a trapper observed "a strange looking animal . . . of the leopard family," a species "not unfrequently met with in some parts of the Cumanche country [where] their skins furnish to the natives a favorite material for arrow-cases."<sup>135</sup>

Comanches on the southern Great Plains indeed used jaguar skins during this period precisely for that purpose, as attested by a German naturalist who saw them "wearing jaguar skin quivers" along the San Saba River in Texas as well as observing Delaware Indians in San Antonio selling pelts from two locally-killed jaguars for \$18 apiece.<sup>136</sup> As seen, in 1853, on the Canadian River in northern Texas, near the 100<sup>th</sup> Meridian, an Army Lieutenant reported "a large

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<sup>130</sup> Lawson, J. 1714. *The History of Carolina, Containing the Exact Description and Natural History of that Country : Together with the Present State Thereof. And a Journal of a Thousand Miles, Travel'd Thro' Several Nations of Indians; Giving a Particular Account of their Customs, Manners, &c.* London: W. Taylor and J. Baker, pp. 11, 13, 48.

<sup>131</sup> Brickell, J. 1737. *The Natural History of North Carolina.* Dublin, p. 114.

<sup>132</sup> Harlan, R. 1825. *Fauna Americana.* Anthony Finley, Philadelphia, p. 96.

<sup>133</sup> Rafinesque, C.S. 1832. [On the large wandering tygers or jaguars of the United States](#). *Atlantic Journal and Friend of Knowledge*, 1(1):18-19. Philadelphia; p. 18.

<sup>134</sup> Audubon, J.J. and J. Bachman. 1854. *The Quadrapeds of North America*, vol. III, p. 9.

<sup>135</sup> Sage, R.B. 1857. *Rocky Mountain Life.* Donohue, Henneberry, and Co., Chicago, p. 346. See also Seton, E.T. 1920. The jaguar in Colorado. *Journal of Mammalogy*. 1(5), p. 241.

<sup>136</sup> Roemer, F. 1849. *Roemer's Texas*, appendix (translated from the German language edition at the Geology Library, UT Austin by Helga H. von Schweinitz).



tiger.”<sup>137</sup> In 1905, Vernon Bailey recorded details of jaguars killed throughout Texas, including areas of the Great Plains, and in 1911, Bailey recorded another jaguar killed the previous year near London, Texas – also on the plains.<sup>138</sup> John James Audubon mentions a jaguar encounter “on the head waters of the San Marco.”<sup>139</sup> (And, as noted earlier, a jaguar was also killed, and its pelt reported, sometime prior to 1938 on the plains of northeastern New Mexico near the headwaters of the Canadian River.<sup>140</sup>)

Finally, jaguars were also reported along the California coast as far north as the region between San Francisco and Monterey, as well as in the Tehachapi Mountains and mountains and deserts further south in California.<sup>141</sup> A first-hand nineteenth century account even exists of a pair of jaguars at a den with two kittens in the Tehachapi Mountains of southern California – an account that the founder of the U.S. Bureau of Biological Survey, C. Hart Merriam, who also established the discipline of mammalogy, described as admitting “no question as to the identity of the animal. Adams either saw a pair of jaguars and their young, or he lied out of whole cloth.”<sup>142</sup>

Collectively, these historic accounts show that rather than being marginal along the U.S. – Mexico border and impermanent, jaguars extended many hundreds of miles into the interior U.S., and that any peripheral jaguars may have been those roaming in the Southeast, Midwest, Great Plains, southern Rocky Mountains, and central coast of California. In contrast, jaguars in the Gila headwaters / Mogollon uplands region would likely have been part of a much broader breeding population.

## **VII. Recovering jaguars in the Gila headwaters / Mogollon uplands region is consistent with the Endangered Species Act’s ecosystem conservation purpose**

The Endangered Species Act’s first statement of purpose is to conserve the ecosystems upon which endangered species depend. The American Society of Mammalogists noted in a 2007 resolution that “ecosystems in the United States in which jaguars formerly occurred are not intact without the sustained presence of jaguars (Ray et al. 2005).”<sup>143</sup> (Just as these areas are not intact without their jaguars, so jaguars need them. The mammalogists also stated in their resolution: “[H]abitats for jaguars in the United States, including Arizona and New Mexico, are vital to the long-term resilience and survival of the species (Channell et al. 2000), especially in response to ongoing climate change.”<sup>144</sup>)

Including the Gila headwaters / Mogollon uplands region in the Northwestern Recovery Unit, and ensuring that a jaguar population will be established there, would help fulfill that

<sup>137</sup> Foreman, G., ed. 1941. *A Pathfinder in the Southwest: The Itinerary of Lieutenant A. W. Whipple*. University of Oklahoma Press.

<sup>138</sup> Bailey, V. 1905. *Biological Survey of Texas*. Gvt. Printing Office, pp. 164-165; Bailey, V. 1911. *A Jaguar in Texas*. Forest and Stream, p. 6.

<sup>139</sup> Audubon, J.J. and J. Bachman. 1854.

<sup>140</sup> Hill (1942); Findley (1975).

<sup>141</sup> Merriam, C.H. 1919. Is the jaguar entitled to a place in the California fauna? *Journal of Mammalogy* 1(1);

Strong, W.D. 1926. Indian records of California carnivores. *Journal of Mammalogy*.

<sup>142</sup> C. Hart Merriam. 1919. Is the jaguar entitled to a place in the California fauna? *Journal of Mammalogy*, 1(1); p.

39.

<sup>143</sup> Conservation of jaguars in North America. *Journal of Mammalogy*, 88(6):1574, 2007.

<sup>144</sup> Ibid.

conservation purpose in ecological types that jaguars used to inhabit but are apparently extirpated from today, including Petran subalpine conifer forest and Petran montane conifer forest. As Hatten et al (2002) noted, “the apparent preference of jaguars for scrub grasslands may actually reflect the use of travel corridors from the Sierra Madres of Mexico into southeastern Arizona rather than a preferred vegetation type.”<sup>145</sup> Aside from where jaguars have shown up in their latest forays of (potential) recolonization in the U.S. there is no reason to believe that higher elevation habitats were not significant for jaguars.

Redford et al (2011) described successful conservation of a vertebrate species in terms of six attributes that cannot be met in the current boundaries of the Northwestern Recovery Unit: (a) be self-sustaining demographically and ecologically, (b) be genetically robust, (c) have healthy populations, (d) have representative populations distributed across the historical range in ecologically representative settings, (e) have replicate populations within each ecological setting, and (f) be resilient across the range.<sup>146</sup> We respectfully request that the Gila headwaters / Mogollon uplands region be included in the Northwestern Secondary Area and that establishing a jaguar population in that region serve as part of the suite of criteria necessary to identify recovery and trigger delisting.

Thank you for your consideration.

Sincerely,



Michael J. Robinson  
Conservation Advocate

Center for Biological Diversity  
P.O. Box 1727  
Silver City, NM 88062

[michaelr@biologicaldiversity.org](mailto:michaelr@biologicaldiversity.org)

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<sup>145</sup> Hatten et al (2002), p. 16.

<sup>146</sup> Redford, K. H., G. Amato, J. Baillie, P. Beldomenico, E. L. Bennett, N. Clum, R. Cook, G. Fonseca, S. Hedges, F. Launay, S. Lieberman, G. M. Mace, A. Murayama, A. Putnam, J. G. Robinson, H. Rosenbaum, E. W. Sanderson, S. N. Stuart, P. Thomas, J. Thorbjarnarson. 2011. What does it mean to successfully conserve a (vertebrate) species? *BioScience*, 61(1):39-48.

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IX. Appendix

From Report of the Committee on Economic Mammalogy  
American Society of Mammalogists

Signed by A. K. Fisher & W. B. Bell  
of U.S. Bureau of Biological Survey  
1927

from archives of The Museum  
of Vertebrate Zoology, University of California  
at Berkeley

their capture. A number of wolves which cross our southern boundary from Mexico travel several hundred miles to the northward before they are finally captured. Although we may not have as positive data on the subject, the mountain lion is supposed to travel even much further during certain times of the year. It is a well-known fact, however, that the jaguar coming from Mexico sometimes reaches the northern portions of New Mexico and Arizona. During the year just past a fine male jaguar was killed some forty miles west of Prescott, Arizona. During the past two or three years at least five jaguars have been killed in Arizona. Most of these wanderers have been males, but there are some exceptions, as at least one female was killed and another is supposed to have been poisoned.

A few itinerant bounty hunters and trappers, feeling that their vicarious form of living might be interfered with, have broadcast statements that poison operations are practically exterminating all fur-bearers. From their language one would imagine that the marten and fisher were once abundant in the open country and deserts instead of in the colder and higher regions where fir and spruce trees exist. The general public not knowing conditions, is liable to be led astray by these statements. Since the war furs have been so high that fur-bearers have been sadly reduced in numbers by trappers who are thinking only of the money which they hope to secure from the sale of furs. If they learn of a locality where marten exist, they usually stay there until it is possible to secure the last individual. After very careful inquiry by all of the predatory