

649 F. Supp. 1070

PALILA (*Loxioides bailleui*, formerly *Psittirostra bailleui*), an endangered species; Sierra Club, a non-profit corporation; National Audubon Society, a non-profit association; and Alan C. Ziegler, Plaintiffs,

v.

HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES; and Susumu Ono, in his capacity as chairman of the Hawaii Board of Land and Natural Resources, Defendants,

and

Sportsmen of Hawaii, Inc., Hawaii Island Archery Club, Hawaii Rifle Association, Gerald Kang, Kenneth Funai, John Wong and Irwin Kawano, Defendants/Intervenors.

Civ. No. 78-0030.

United States District Court,
D. Hawai'i.

Nov. 18, 1986.

***1071** Michael R. Sherwood, Sierra Club Legal Defense Fund, Inc., San Francisco, Cal., William S. Hunt, Paul, Johnson & Alston, Pacific Tower, Honolulu, Hawaii, of counsel, for plaintiffs.

Edwin P. Watson, Deputy Atty. Gen., Corinne Watanabe, Atty. Gen., State of Hawaii, Honolulu, Hawaii, for defendants.

Katsuya Yamada, Hilo, Hawaii, for Sportsmen of Hawaii, Inc., Hawaii Island Archery Club, Gerald King, Kenneth Funai, and John Wong.

John S. Carroll, Honolulu, Hawaii, for Hawaii Rifle Ass'n and Irwin Kawano.

OPINION

SAMUEL P. KING, Senior District Judge.

In this proceeding, I face the competing interests of mouflon sheep hunters on the slopes of Mauna Kea and of the endangered bird species Palila, which makes its home there.

Earlier proceedings involved a similar conflict but were limited to feral [FN1] sheep and goats. In *Palila v. Hawaii Department of Land and Natural Resources*, 471 F.Supp. 985 (D.Hawaii 1979) (*Palila I*), I found that the feral sheep and goats were "harming" the Palila in contravention of the Endangered Species Act and ordered the State of Hawaii to remove all feral sheep and goats from the critical habitat of the Palila. [FN2]

FN1. A "feral" animal is one that was once domesticated or is descended from domesticated animals, but is now living as a wild creature.

FN2. The State is continuing its efforts to remove the feral sheep and goats. In addition,

although the order did not specifically address hybrid sheep, i.e., crosses between mouflon and feral sheep, the Department has included them in their removal program. The State's efforts have included public hunting, staff shooting, and fencing. There are significant gaps in the fences, however, and numerous animals have wandered into, or still remain in, the critical habitat. In the March 1986 census a total of 170 feral and hybrid sheep were counted within the Palila critical habitat boundaries.

At that time, Jon G. Giffin, Wildlife Biologist in the Division of Forestry and Wildlife in the Department of Land and Natural Resources, was studying mouflon sheep and their impact on the critical habitat of the Palila. In deference to Mr. Giffin, the State of Hawaii, and the claims of hunters that mouflon sheep did not present the same potential for harm to the Palila's critical habitat as did the feral sheep, the plaintiffs specifically excluded mouflon sheep from their prayers for relief.

The mouflon sheep study has since been completed. On the basis of the findings, plaintiffs refiled an action, essentially identical to their original action, but this time aimed at mouflon sheep. They seek a mandatory*1072 injunction requiring the State of Hawaii to remove all mouflon sheep from the critical habitat of the Palila. The only issue before me, then, is whether the mouflon sheep are "harming" the Palila, as prohibited by the Endangered Species Act and its corresponding regulations. [FN3]

FN3. The following experts were called to testify on trees, sheep, and birds:

For the plaintiffs:

Dr. Charles van Riper III, an ornithologist whose published Ph.D. thesis was on the breeding ecology of the Palila and who is a member of the Palila Recovery Team.

Dr. Andrew Berger, who has studied endangered Hawaiian birds, including the Palila, and authored numerous books on the subject, and who leads the Palila Recovery Team.

Mr. James Jacobi, a botanist employed by the U.S. Fish and Wildlife Service on Hawaii, who has participated in annual Palila studies and who has studied impacts of browsing ungulates on the Mauna Kea vegetation.

Dr. Cameron Kepler, a zoologist specializing in endangered Hawaiian birds, including the Palila.

Mr. Timothy Burr, an ornithologist who has participated in annual Palila surveys.

Dr. J. Michael Scott, a zoologist with a specialty in avian ecology, who directed the annual Palila studies until 1984, and who is a member of the Palila Recovery Team.

Mr. Paul Scowcroft, a research forester who specializes in mamane.

For the defendant State

Mr. Ronald Walker, Wildlife Biology Program Manager, Department of Land and Natural Resources, who is involved in state programs for mouflon management, mamane restoration, and Palila restoration.

Mr. Ronald Bachman, a wildlife biologist with the Department, who implements the various state programs on Mauna Kea.

Mr. Jon Giffin, a wildlife biologist for the Department of Land and Natural Resources who studied the mouflon on Mauna Kea and prepared the report entitled "Final Report: Ecology of the Mouflon Sheep on Mauna Kea," which was published in 1982.

For the Defendant/Intervenors (in addition to the State's witnesses):

Dr. Stephen Mountainspring, a wildlife biologist who has coauthored two studies on the Palila.

FACTUAL BACKGROUND

A. The Bird

The Palila, *Loxioides bailleui*, is a six-inch long finch-billed member of the Hawaiian honeycreeper sub-family (Drepanidinae). It has a golden-yellow head, black lores, [FN4] a whitish abdomen, and a gray back.

FN4. The "lores" are the areas on the sides of the head between the eyes and the bill.

Palila, which are endemic to Hawaii, are today found only in a small area on the upper slopes (approximately 6600 feet to treeline, 9400 feet) of Mauna Kea on the island of Hawaii. This represents approximately ten percent of the bird's historical range. When first officially discovered in 1876, Palila lived only on the island of Hawaii. [FN5] It was common in north and south Kona and on the slopes of Mauna Kea in the Hamakua and Hilo Districts. By 1894, the birds were no longer found in Kona. This extirpation may have resulted from avian malaria carried by mosquitoes whose populations increased rapidly with ranching activities in the late nineteenth century.

FN5. Fossil records show that the bird may originally have occupied mamane forests on other islands.

By the mid-twentieth century, the range had shrunk to its present area, largely due to habitat destruction from grazing ungulates (hoofed mammals). Feral cattle, horses, sheep, and pigs were established on Mauna Kea by the early 1800s. However, the feral cattle and horses were removed in the 1920s and 1930s, and the feral pigs do not appear to have a significant adverse effect on the mamane ecosystem. Feral goats appeared in some numbers in the 1930s, and mouflon sheep were introduced in 1963. As discussed more fully in Palila I, 471 F.Supp. at 989-90, the feral goats and sheep, which the Department of Land and Natural Resources maintained for sport hunting purposes, had a devastating effect on the mamane forest. The ensuing negative impact on the Palila habitat and on the Palila prompted my order for the removal of the feral sheep and goats from the bird's critical habitat.

The Palila was listed as an endangered species by the Secretary of the Interior in 1967, 32 Fed.Reg. 4001 (1967), and it remains on the list of endangered species *1073 today. 50 C.F.R. ' 17.11 (1985). The primary reasons for listing the Palila, in addition to the bird's low population, were that a significant portion of its historical range was no longer occupied and that its present habitat was being adversely modified by feral ungulate browsing. [FN6]

FN6. U.S. Fish and Wildlife Service, Revised Palila Recovery Plan 2 (1986).

In 1979, at the time of the Palila I decision, the Palila's estimated population was between 1400 and 1600 birds, which was "dangerously close to that minimum number of individuals below which a population cannot drop if the species is to survive." 471 F.Supp. at 988.

At present, there are approximately 2200 Palila in existence. [FN7] Although the population is somewhat higher now than in 1979, no clearly defined pattern exists concerning population abundance. Most experts agreed that the bird has not experienced any significant "upward trend." At best, the population remains "static" at a level where the bird is still biologically endangered. [FN8]

FN7. Recent population figures for the Palila are as follows:

| ----- | |
|---------------------|------|
| Estimated Number | |
| ----- | |
| 0 | 3350 |
| | 6410 |
| | 3305 |

2268
 uary) 2022
 | 2021
 ary) 1317
 | 1867
 uary) 2221
 | 2269
 lila Recovery Plan at 7.

Dr. Stephen Mountainspring suggested that the population figures might be somewhat underestimated due to the placement of the random sampling transects.

The population may have experienced the dramatic spurt in 1981 because it was an exceptionally wet year, and thus that there was an overabundance of food. The population crashed back to normal the following year, which was dry.

FN8. E.g., Test. of van Riper; test. of Scott.

The Revised Palila Recovery Plan, issued in 1986, suggested that population figures of the past four years may indicate a decline in Palila population. Revised Palila Recovery Plan at 6-7. Similarly, Dr. Charles van Riper, III, stated that because of its low numbers, very low fertility rate, restricted habitat, and continued habitat destruction, the bird is still close to its "critical population" or minimum sustainable population.

The Palila is totally dependent on the mamane and mamane-naio forests for its existence. The bird's preferred food is the pods of the mamane tree (*Sophora chrysophylla*), but it will also eat mamane flowers, buds, and leaves, and berries of the naio tree (*Myoporum sandwicense*). [FN9] The bird also depends on the mamane for shelter and nesting sites.

FN9. The bird will also sometimes eat insects during months when mamane pods are scarce.

The highest densities of Palila are found in well-developed tall pure mamane ecosystems with a native understory. Population studies have also shown a dependence of Palila on wider belts of woodland, i.e., a mamane forest that stretches over a wider altitudinal gradient. This allows the bird to take advantage of seasonal variations in the mamane fruits and flowers, providing it with the most ample and stable food source throughout the year. [FN10]

FN10. Scott, Mountainspring, van Riper, III, Kepler, Jacobi, Burr, & Giffin, Annual Variation in the Distribution, Abundance, and Habitat Response of the Palila, 101 *The Auk* 647 (Oct. 1984) [hereinafter *Auk Study*].

In 1977, the U.S. Fish and Wildlife Service officially designated the Palila's critical habitat as a 200 km sub2 ring around the upper slopes of Mauna Kea. 50 C.F.R. ' 17.95 (1985). This area contains the entire known population of Palila and essentially encompasses the existing mamane and mamane-naio forests on Mauna Kea and coincides with the remaining ten percent of the Palila range. [FN11] Because of the *1074 Palila's various habitat requirements, however, the bird is not spread evenly throughout the critical habitat. The bird is only found in 140 km sub2 of its 200 km sub2 habitat, and 75-80% of the population is located in a 10 km sub2 area close to Puu Laau, which not surprisingly, has the most developed mamane ecosystem on the mountain. [FN12]

FN11. Revised Palila recovery Plan at 64 (app. A).

The Revised Palila Recovery Plan exhibits some confusion as to the extent of the mamane forest

on Mauna Kea. According to Dr. Charles van Riper, III, there are 545 km² of mamane forest ecosystem remaining on the entire island of Hawaii, not on the slopes of Mauna Kea, as the Revised Plan states at page 5.

FN12. There is also a fairly extensive mamane forest in the area near Pohakuloa flats, but for some unexplained reason, there are no Palila there. Experts suggest that the absence of birds may be due to site tenacity, thermal stress, disease, and/or military activity in the vicinity. Auk Study at 656, 661-62.

B. The Sheep

The European mouflon (*Ovis montanus*) is a native of Corsica and Sardinia. The sheep are light tan to rich brown, with white on the tail, rump, and underparts, and they have large horns of excellent trophy quality. The State Division of Fish and Game introduced the mouflon onto Mauna Kea with the original hope that they would upgrade the existing feral sheep and modify some of their undesirable characteristics. [FN13] A total of 99 hybrid sheep and 94 pure mouflon were released between 1962 and 1966. Due to political pressures from hunters, however, the hybridization project was never completed.

FN13. Technically, the mouflon is not a feral ungulate, because it has never been domesticated.

The defendant Department of Land and Natural Resources presently maintains the mouflon population for sport-hunting purposes within the Mauna Kea Game Management Area. [FN14] (This state game management area happens to include most of the Palila's critical habitat.) The mouflon has become exceedingly popular with local hunters because of its excellent sporting, meat, and trophy qualities. As of March 1986, there were approximately 501 mouflon sheep within the Game Management Area, including some adjoining ranchland. Most of these sheep (412) were found within the Palila critical habitat, although there were no sheep presently located near Puu Laau, the area of highest Palila density. [FN15]

FN14. Most of the land on Mauna Kea within the Palila's critical habitat is under state ownership and control. The upper reaches of the mountain lie within the Mauna Kea Forest Reserve and Game Management Area. A portion of the land on the southeastern slopes has been surrendered to the United States Army for training purposes; the Hawaiian Homes Commission has jurisdiction over a portion of the southeastern slopes; and there is a small portion in the northeast corner that is privately owned by the Kukiau Ranch.

FN15. The mouflon have roamed quite a bit over the years. In 1979, the sheep, estimated at 525, were located exclusively on the eastern slopes of the mountain. In January 1985, the sheep numbered approximately 466 and had spread all over the mountain; however, in that census, 301 of the sheep were located outside of, and only 165 within, the Palila critical habitat. Job Progress Report, Game Mammal Survey, Mauna Kea Game Management Area (7/1/85-6/30/86) (Defendant's Exhibit 3); test. of Walker.

THE LAW

Under the Endangered Species Act of 1973, 16 U.S.C. " 1531-1543 (1982), the Secretary of the Interior is authorized to declare species of animal life "endangered" [FN16] and to identify the "critical habitat" [FN17] of these species. Once a species *1075 has been listed as endangered, section 9 of the Act makes it unlawful for any person to "take" any such species. 16 U.S.C. ' 1538(a)(1)(B). As defined by the Act, the term "take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or

collect or to attempt to engage in any such conduct." 16 U.S.C. ' 1532(19). At issue in this litigation is whether the state's maintenance of mouflon sheep on Mauna Kea "harms" the Palila so as to result in a "taking."

FN16. "Endangered species" means "any species which is in danger of extinction throughout all or a significant portion of its range...." 16 U.S.C. ' 1532(6) (1982).

FN17. The Act defines "critical habitat" as "the specific areas within the geographical area occupied by the species ... on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection." 16 U.S.C. ' 1532(5) (1982).

"Critical habitat" is further defined in 50 C.F.R. ' 402.02 (1985) as:

any air, land, or water area ... and constituent elements thereof, the loss of which would appreciably decrease the likelihood of the survival and recovery of a listed species or a distinct segment of its population. The constituent elements of critical habitat include, but are not limited to: physical structures and topography, biota, climate, human activity, and the quality and chemical content of land, water, and air. Critical habitat may represent any portion of the present habitat of a listed species and may include additional areas for reasonable population expansion.

The Secretary of the Interior has defined "harm" to mean:

an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

50 C.F.R. ' 17.3 (1985).

I understand this to prohibit activities that significantly modify or degrade the habitat, resulting in actual injury to the wildlife species. This would include activities that significantly impair essential behavioral patterns to the extent that there is an actual negative impact or injury to the endangered species, threatening its continued existence or recovery.

A. The Secretary's Redefinition of Harm

The proper interpretation of the term "harm" has been disputed by the parties throughout the proceedings. In particular, defendants stress the Secretary's redefinition of the term in 1981. These amended regulations, however, did not embody a substantial change in the previous definition. [FN18] Under both the original definition and the definition as amended in 1981, "harm" may include significant habitat destruction that injures protected wildlife.

FN18. Although I already reached this conclusion at the summary judgment stage of the instant proceedings, *Palila v. Hawaii Department of Land and Natural Resources*, 631 F.Supp. 787 (D.Hawaii 1985) (denying plaintiffs' motion for summary judgment), defendants continued to argue throughout trial that the amendment had worked a major substantive change in the law. Thus I feel it is necessary to elaborate more fully on my previous determination.

Defendants argue that, following my *Palila I* decision, the Secretary redefined "harm" to stress that there must be an "actual injury" to wildlife from habitat destruction or modification. Defendants argue that a showing of "actual injury" requires plaintiff to show a present pattern of decline in the number of Palila. They argue that because the Palila population has remained static, or is perhaps slightly larger than at the time of *Palila I*, there is no evidence that the mouflon are harming Palila.

Defendants' expert witness, Dr. Mountainspring, further stressed the distinction between "actual" and

"potential" harm. He argued that the mouflon are not presently harming Palila because the sheep eat primarily the shoots and sprouts of mamane, whereas the birds feed primarily on the seeds and pods. Thus, the sheep are not depriving Palila of their food source at present. He conceded, however, as did each expert at trial, that the mouflon sheep are presently degrading the mamane forest, that this degradation is irreversible because it is suppressing the forest's regeneration, that Palila depend on mamane for their existence, and that continued degradation could drive the Palila into extinction. Defendants maintain, though, that any effect the mouflon has on mamane and indirectly on Palila is only a "potential" injury and does not fall within the redefinition of harm.

I refuse to accept, the Secretary's final redefinition does not support, and Congress could not have intended such a shortsighted and limited interpretation of "harm." A finding of "harm" does not require death to individual members of the species; nor does it require a finding that habitat degradation is presently driving the species further toward extinction. Habitat destruction that prevents the recovery of the species by affecting essential behavioral patterns causes actual injury to the species and effects a taking under section 9 of the Act.

***1076** In passing the Endangered Species Act, it is "beyond doubt that Congress intended endangered species to be afforded the highest of priorities." *Tennessee Valley Authority v. Hill*, 437 U.S. 153, 175, 98 S.Ct. 2279, 2292, 57 L.Ed.2d 117 (1978). Moreover, Congress was aware that the primary threat to endangered species was destruction of habitat. 437 U.S. at 179, 98 S.Ct. at 2294. Thus, one of the main purposes of the Act was conservation and preservation of the ecosystems upon which endangered species depend. 16 U.S.C. ' 1531(b). It is clear, then, that Congress intended to prohibit habitat destruction that harms an endangered species. [FN19]

FN19. See generally Field, *The Evolution of the Wildlife Taking Concept from its Beginning to its Culmination in the Endangered Species Act*, 21 *Houston L.R.* 457 (1984).

The Secretary originally defined harm as follows:

"Harm" in the definition of "take" in the Act means an act or omission which actually injures or kills wildlife, including acts which annoy it to such an extent as to significantly disrupt essential behavioral patterns, which include, but are not limited to, breeding, feeding or sheltering; significant environmental modification or degradation which has such effects is included within the meaning of "harm." [FN20]

FN20. 50 C.F.R. ' 17.3, as quoted in Proposed Redefinition of "Harm," 46 *Fed.Reg.* 29,490 (1981) (proposed June 2, 1981).

This definition was in effect at the time of my Palila I decision.

In 1981, the Secretary proposed to amend the definition of "harm" to read simply "an act which injures or kills wildlife." 46 *Fed.Reg.* at 29,490. He reasoned that under the original definition, a showing of habitat modification alone, without any concomitant injury to wildlife, could be sufficient to invoke the criminal penalties of section 9. 46 *Fed.Reg.* at 29,490. [FN21] Under this proposal, "harm" would require actual death or injury to individual species members. [FN22]

FN21. The Secretary's redefinition was prompted at least in part by my decision in Palila I. The legal memorandum, authored by the Acting Deputy Assistant Secretary for Fish and Wildlife and Parks, accompanying the proposed redefinition recommended that the "Service clarify its definition to prevent the result reached in Palila." 46 *Fed.Reg.* at 29,492. In promulgating the final redefinition, the Secretary explained that Palila I could "be read to incorrectly imply that under the Services [sic] definition of "harm" a taking may occur from habitat modification

alone." 46 Fed.Reg. at 54,749.

This conclusion was not intended by my opinion. I believe that the Acting Deputy Assistant Secretary misconstrued my finding, which was affirmed by the Ninth Circuit, *Palila v. Hawaii Department of Land and Natural Resources*, 639 F.2d 495 (9th Cir.1981), that the presence of feral sheep and goats on Mauna Kea harmed the Palila. Contrary to the assertion made in the legal memorandum, I did not find that habitat modification alone caused harm to Palila. 46 Fed.Reg. at 29,492 n. 4. On the contrary, the evidence considered at the summary judgment hearing overwhelmingly showed that the feral animals had a drastic negative impact on the mamane forest which in turn injured the Palila by significantly disrupting its essential behavioral habits.

It is true that the evidence at the hearing was conflicting on the exact population figures for Palila. Plaintiffs argued that the population was at the critical population level; defendants argued that the population was in fact increasing. Based on this evidence, the Acting Deputy Assistant Secretary came to his own conclusion that there could be no "taking," presumably because there was no concrete evidence that Palila figures had recently declined. As discussed further infra, I do not read either the definition of "harm" that was in effect at the time or the current definition to require an actual decline in population of an endangered species. I believe the Secretary has clarified his position on this point in promulgating the final definition of "harm."

FN22. The legal memorandum accompanying the proposed redefinition relied on, and I believe misconstrued, *TVA v. Hill*, 437 U.S. 153, 98 S.Ct. 2279, 57 L.Ed.2d 117 (1978), as supporting the proposed redefinition. In this case, the Supreme Court was primarily wrestling with section 7 of the Act which affirmatively required federal agencies to insure that their actions do not "jeopardize the continued existence" of an endangered species or "result in the destruction or modification of habitat of such species...." 16 U.S.C. ' 1536 (1976 ed.). However, the Court also indicated that the environmental effects resulting from Tellico Dam would also amount to a "taking" of the snail darter under section 9.

The district court below had found that the dam would "result in the adverse modification, if not complete destruction, of the snail darter's critical habitat,' making it 'highly probable' that 'the continued existence of the snail darter' would be 'jeopardize[d].'" 437 U.S. at 165-66, citing 419 F.Supp. 753, 757 (E.D.Tenn.1976). Specifically, the district court found that the snail darter needed a clear flowing river with a high oxygen content and that a reservoir would have a low oxygen content; that the high silt and low oxygen of a reservoir would be unsuitable for spawning; and that the snail darter's primary source of food would probably not survive in a reservoir environment. 437 U.S. at 165-66 n. 16, citing 419 F.Supp. at 756.

The Supreme Court emphasized that the definition of harm included "significant environmental modification or degradation" which "actually injures or kills wildlife" by "significantly disrupting essential behavioral patterns," and the Court noted: "We do not understand how TVA intends to operate Tellico without 'harming' the snail darter." 437 U.S. at 184-85 n. 30, 98 S.Ct. at 2297 n. 30.

The Secretary found support for its proposed definition by "interpreting" the Supreme Court's statement "only to apply to the situation where an action would both degrade habitat and kill individual fish." 46 Fed.Reg. at 29,492 n. 2.

On the contrary, the Supreme Court's opinion evidences an understanding that habitat modification may prevent further procreation of the species or may decrease food supply, thus limiting the endangered species' population size. *TVA v. Hill* simply does not support a requirement that individual dead snail darters float atop the impounded reservoir.

The Secretary received 328 comments on the proposed redefinition, 262 of which *1077 were in opposition to the proposal. The Secretary thus did not adopt the original proposal, but promulgated the

version that exists today. The Secretary explained that "harm" was being redefined to mean any action, including habitat modification, which actually kills or injures wildlife, rather than the present interpretation which might be read to include habitat modification or degradation alone without further proof of death or injury. Habitat modification as injury would only be covered by the new definition if it significantly impaired essential behavioral patterns of a listed species. [FN23]

FN23. 46 Fed.Reg. 54,748, 54,748 (Nov. 4, 1981) (Final Redefinition of "Harm").

The Secretary clarified his intent that the redefinition did not limit harm to direct physical injury to an individual member of the wildlife species.... The purpose of the redefinition was to preclude claims of a Section 9 taking for habitat modification alone without any attendant death or injury of the protected wildlife. Death or injury, however, may be caused by impairment of essential behavioral patterns which can have significant and permanent effects on a listed species.

46 Fed.Reg. at 54,748.

Thus the redefinition stresses the critical link between habitat modification and injury to the species. Obviously since the purpose of the Endangered Species Act is to protect endangered wildlife, there can be no finding of a taking unless habitat modification or degradation has an adverse impact on the protected species. [FN24] As the Secretary explained, however, this injury to the species does not necessitate a finding of death to individual species members. Drawing from this, I conclude that a showing of "harm" similarly does not require a decline in population numbers. The Palila is hovering at or near the critical population mark; it is both biologically and legally endangered. Until the bird has reached a sufficiently viable population to be delisted, it should not be necessary for it to dip closer to extinction before the prohibitions of section 9 come into force. The key to the Secretary's definition is harm to the species as a whole through habitat destruction or modification. If the habitat modification prevents the population from recovering, then this causes injury to the species and should be actionable under section 9.

FN24. For example, if the State were to mow the lawn within the Palila's critical habitat, this modification would not in and of itself result in a taking under section 9. There would have to be a showing of concomitant injury to Palila, such as a significant impairment of Palila breeding or feeding habits.

MOUFLON SHEEP ARE HARMING THE PALILA

At the time of the Palila I decision, the record was clear that feral sheep and ***1078** goats had a severe negative impact on the mamane forest. By consuming the shoots and seedlings, the animals prevented regeneration of the forest and thus brought about the "relentless decline of the Palila's habitat." 471 F.Supp. at 990. As Mr. Giffin has summarized,

The feeding and herding habits of feral sheep have a devastating effect on the endemic mamane forest. The most serious problem occurs at timber line. Tree growth and reproduction are almost totally prevented due to constant browsing pressure. Many mature plants exhibit definite browse lines. Old trees are dying without replacements, causing the upper forest line to recede each year.

The loss of mamane also affects grasses and herbs which commonly grow under each tree at higher elevations. These plant communities depend on fog drip from branches and leaves for much of their moisture. When an individual tree dies, the associated ground cover rapidly disappears. Soils are then subject to wind and water erosion. Trampling and soil disturbance by feral animals speed this process. Vast areas that were formerly covered with vegetation are now sterile sand and cinder slopes. [FN25]

FN25. J. Giffin, Final Report: Ecology of the Mouflon Sheep on Mauna Kea, (Pittman-Robinson Program No. W-17-R, Study No. R-III, 1979-79) (published in 1982 by State of Hawaii, Department of Land and Natural Resources, Division of Forestry and Wildlife) at 23.

The record was similarly clear that this loss of habitat was the most important factor limiting the Palila population. Continued destruction of the forest would have driven the bird into extinction. As it was, the bird was, and still is, at the critical population level, that is, perched on the verge of extinction. The bird is thus highly susceptible to harm from other environmental factors, such as fire or drought. At the time then, the continued presence of feral sheep had a severe negative impact on the Palila by indirectly suppressing the population figures to a level which threatened extinction and by preventing the expansion or recovery of the population. These factors supported my decision to order removal of the feral sheep and goats in Palila I.

Now I must determine whether mouflon sheep have a similar negative impact on the mamane and on the Palila. If the mouflon sheep are similarly "harming" the Palila, the Endangered Species Act mandates their removal.

A. Impacts of Mouflon on Mamane and on Palila

Since the Palila I decision, Dr. Giffin has conducted extensive research into the mouflon. His findings on the mouflon feeding habits and the corresponding impact on the ecosystem are of particular significance.

Mouflon sheep also prefer the mamane habitat. They depend on mamane for shade, concealment, moisture, and most importantly, for food. Unfortunately for the Palila, mamane is also the favorite food of the mouflon sheep and is the most important item in the mouflon diet. (The mamane is a legume and is therefore very tasty.) The mouflon eat the leaves, stems, seedlings, and basal shoots of the mamane; they also commonly strip and eat the bark of the tree. [FN26] The sheep also eat grasses and the pukiawe shrub, although these items are of lesser importance in the diet. [FN27]

FN26. One old ram was even observed to climb a mamane tree, teeter out on a horizontal limb, and browse on succulent leaves that could not be reached from below.

FN27. Data suggests that the mouflon may experience a seasonal shift in preferred food, concentrating on grasses in the winter and spring and the mamane in the summer and fall.

Defendants argue that mouflon do not have as deleterious effect on the mamane habitat as the feral sheep, because they do not eat exclusively mamane. However, Giffin and others have concluded that the mouflon's feeding habits are "essentially the same" as those of the feral sheep. *1079 Like the feral sheep, the mouflon also overbrowse the mamane, particularly at timberline. This feeding similarly results in lower abundance and growth rates of mamane, poor survival of mamane seedlings and saplings, and general destruction of the native understory. [FN28]

FN28. Giffin at 21-25, Scowcroft & Giffin, Feral Herbivores Suppress Mamane and Other Browse Species on Mauna Kea, Hawaii, 36 J. Range Management 638 (Sept. 1983); Scott, Mountainspring, Ramsey & Kepler, Forest Bird Communities of the Hawaiian Islands: Their Dynamics, Ecology and Conservation at 359 [hereinafter Plaintiffs' Exhibit 8]; Revised Palila Recovery Plan at 15, 33-35; test. of van Riper; test. of Scott; test. of Jacobi; test. of Kepler; test. of Berger; test. of Giffin.

Defendants also argue that the mouflon sheep travel in smaller herds than the feral sheep and thus cause

less harm to the mamane ecosystem. [FN29] While mouflon herd size does tend to be smaller, this difference does not seem to be significant. Scowcroft and Giffin conclude that mouflon sheep have essentially similar herding habits, behavior, and habitat use as feral sheep. [FN30] In short, mouflon are "potentially as destructive to the mamane subalpine woodland as feral sheep." [FN31]

FN29. Feral sheep tend to travel in large herds and to bed down together at night, thus crushing mamane seedlings and flattening large areas of native understory.

FN30. Scowcroft & Giffin at 644.

FN31. Revised Palila Recovery Plan at 15.

The mouflon sheep impacts are readily apparent on Mauna Kea. [FN32] Portions of the mountain, where mouflon sheep populations are, or have been, high, are heavily damaged. [FN33] In these areas, there is heavy overgrazing, a decrease in total ground cover, a sharp browseline, many dead mamane (snags), and little or no regeneration. The suppression of mamane is particularly acute at treeline. [FN34] Research has shown that if the mouflon sheep were removed from these areas, regeneration would occur with time. [FN35]

FN32. Much of the existing damage on Mauna Kea has been caused by feral sheep over the past decades. It is difficult, then, to determine what damage is actually caused by mouflon. Experts testified, however, that in several areas, the damage could be attributed to the mouflon because the damage was fresh and there were many mouflon and few ferals in the area. Test. of Jacobi; Giffin at 24.

FN33. Damage is particularly severe in the southeastern corner of the mountain near transects 110-113.

FN34. Test. of Scowcroft; Maps of Browseline, Snags, and Regeneration on Mauna Kea (Plaintiffs' Exhibit 10); Giffin at 23-25.

FN35. Since the state has maintained the feral sheep, and now the mouflon sheep, for hunting purposes, it developed exclosures, or fenced areas, to study the impact the animals have on the ecosystem. Several of these exclosures are located in prime mouflon territory, and the contrast between the vegetation inside the exclosure, which has been protected from grazing, and outside the exclosure is dramatic. For example, the Puu Kole exclosure near transect 110 is within an area of heavy mouflon density. The land outside the exclosure is devoid of mamane, littered with snags, has no regeneration and is nearly barren of vegetation. Inside the exclosure, which was fenced in 1963, are numerous mamane, a healthy understory, and vigorous regrowth. In the absence of grazing pressure, the mamane achieved a 25% canopy coverage through natural regeneration within twelve years. Similarly, at the Wailuku exclosure, near transect 113, research indicates a 50% survival rate for new mamane seedlings inside the exclosure, and a 0% survival rate outside where the seedlings are eaten by mouflon. Scowcroft & Giffin; Giffin at 24; Plaintiffs' Exhibit 6 (photographs); test. of Scowcroft.

Thus the evidence shows that at their present level, which is approximately the number of sheep necessary to maintain a viable sport hunting population, [FN36] mouflon sheep are having the same destructive impact on the mamane as the feral sheep. The mamane forest in its present state is at its peak carrying capacity. In other words, the Palila population may be as large as it can be now, given the condition of the *1080 mamane on the mountain. [FN37] Continued grazing by mouflon will continue to suppress mamane growth and regeneration. This in turn will harm the Palila in one of two ways.

Either the mouflon sheep will further degrade the mamane ecosystem, thus decreasing the remaining Palila habitat and further depressing the Palila population. Or, at best, the mouflon will merely slow or prevent the recovery of the mamane forest, suppressing the available food supply and nesting sites for Palila, and thus preventing the Palila population from expanding toward recovery.

FN36. The State's experts estimated that the State would have to maintain 250 sheep, at the very minimum, for a viable sport hunting program, although the sheep's current approximate population of 475-525 would be preferable. Test. of Bachman; test. of Walker.

FN37. Test. of Scowcroft; test. of Kepler; test. of van Riper.

In conclusion, I find that the mouflon sheep are harming the Palila within the definition of 50 C.F.R. ' 17.3. The mouflon are having a significant negative impact on the mamane forest, on which the Palila is wholly dependent for breeding, feeding, and sheltering. This significant habitat degradation is actually presently injuring the Palila by decreasing food and nesting sites, so that the Palila population is suppressed to its current critically endangered levels. [FN38] If the mouflon continue eating the mamane, the forest will not regenerate and the Palila population will not recover to a point where it can be removed from the Endangered Species List. [FN39] Thus, the presence of mouflon sheep on Mauna Kea threatens the continued existence and the recovery of the Palila species. If the Palila is to have any hope of survival, the mouflon must be removed to give the mamane forest a chance to recover and expand.

FN38. The Palila's continued existence is threatened even at its current levels. The population is close to that minimum number necessary for the survival of the species. In addition, at this low level, the bird is critically susceptible to the influence of disease, environmental stress, drought, and other limiting factors.

FN39. The Revised Palila Recovery Plan recommends that Palila may be taken off the Endangered Species List when the population has achieved a density of 25 birds/km² throughout the 200 km sub² critical habitat continuously for five years. The population will undoubtedly have to be much larger than 5000 birds in order to satisfy the recommended density and distribution levels, and may need to be as high as 14,000-20,000 birds. Revised Palila Recovery Plan at 26; test. of Berger.

B. Inappropriateness of Multiple Use Approach

The State argues for multiple use on Mauna Kea, asserting that both mouflon sheep and Palila can coexist on Mauna Kea. The State's position stems from their conflicting obligations to foster sport-hunting and to protect endangered species such as the Palila. They argue, based in part on recommendations by their wildlife biologist, Jon Giffin, that with careful management and oversight, it is possible both to maintain a viable sport-hunting population of mouflon and to enhance the mamane ecosystem to encourage the survival of Palila.

The State acknowledges that the mamane ecosystem on Mauna Kea has been severely damaged by grazing ungulates, but they argue that since the feral sheep removal program began in 1982, there has been dramatic regeneration in some areas. Furthermore, the State is undertaking steps to improve the mamane forests and to minimize the impact of the mouflon. [FN40] The State argues that it will be a number of years before it can be determined what impact the mouflon actually are having on the mamane, and that in the meantime, this court should allow the present mouflon population to remain on Mauna Kea under strict management and surveillance.

FN40. For example, the State has instituted a mamane replanting program that is meeting with some success. Since 1979, the State has planted over 6000 mamane trees on 70 acres of the critical habitat, and they have maintained nine fenced exclosures of 4.5 acres each. They have begun a fog drip project to capture moisture to encourage native vegetation. They are continuing efforts to fence the entire Palila critical habitat to keep feral sheep and other ungulates out and to improve their ability to manage the mouflon herd. In addition, they have removed some of the hunting restrictions on mouflon sheep, allowing more mouflon to be taken.

There are several major problems with the State's position. First, it is unclear ***1081** whether the mamane forests are regenerating to any significant extent. [FN41] Even if the mamane seedlings were taking root, it would take between 25 and 50 years before the trees were large enough to withstand grazing by sheep and to provide food and shelter for the Palila. Thus, Palila would not benefit from today's regrowth for many years.

FN41. Defendants' experts testified to and introduced photographs and a video showing healthy mamane stands and evidence of regeneration in various areas on the mountain. On the other hand, plaintiffs experts introduced photographs showing desert-like conditions on the mountain with large areas devoid of mamane. They argued that defendants' pictures showing regeneration were taken near roads, where sheep are less prevalent, and that there is no evidence of significant recovery of the mamane.

Second, and more importantly, the Endangered Species Act does not allow a "balancing" approach for multiple use considerations. [FN42] I have found that mouflon sheep are "harming" the Palila population within the meaning of 50 C.F.R. ' 17.3. Once this significant negative impact has been shown, the Act leaves no room for mixed use or other management strategies or policies. In addition, all of the experts agreed that, biologically speaking, mouflon were harming Palila--that is, mouflon sheep are basically incompatible with the mamane ecosystem which the bird needs to survive. [FN43] It was only when the State's experts were faced with the competing objectives of trying to maintain viable populations of both sheep and bird, that they advocated a policy of "coexistence" with Palila.

FN42. The multiple-use approach has been embraced in many areas of environmental management. However, multiple use poses particular problems in a small fragile island ecosystem, such as Hawaii. Because of geographic isolation, islands develop unique endemic ecosystems. Populations of plants and animals are smaller, less stable, and more susceptible to disruption. Human interference has substantial negative impact on native flora and fauna not only through direct habitat destruction, but also through the introduction of non-native plant and animal species. Thus native island ecosystems are much more vulnerable to multiple use than are larger continental ecosystems where the biota has had millenia to adjust to human interference. Juvik & Juvik, *Mauna Kea and the Myth of Multiple Use: Endangered Species and Mountain Management in Hawaii*, 4 *Mountain Research and Development* 191 (August 1984). Hawaii, then, represents a unique and fragile ecosystem. There are more endangered and extinct species here than anywhere else in North America. Out of 70 indigenous bird species found here in the nineteenth century, 26 are extinct and 30 are on the Endangered Species List, for a total of 56 out of 70 endangered or extinct birds. By comparison, continental North America has 24 endangered bird species. Test. of Berger; 50 C.F.R. ' 17.11 (1985).

FN43. Dr. Mountainspring vacillated somewhat on this issue. At his deposition, he testified that mouflon were biologically harming the Palila. In addition, he participated in writing two reports which advocated the complete removal of mouflon sheep from the Palila habitat. Auk Study at 662; Plaintiffs' Exhibit 8 at 359. On the stand, however, he testified somewhat differently. He agreed that the mouflon are degrading the mamane forest, that the degradation is irreversible

because there is no regeneration, and that if nothing is done to alter the present situation, the mouflon will drive Palila into extinction. However, he testified that mouflon were not "harming" Palila, at least in terms of the Code of Federal Regulations definition, because the sheep are not actually killing the birds. He further testified that he did not agree with the conclusions of the two reports which he had co-authored. Instead, he stated that mouflon did not pose a threat to Palila if they were properly managed.

Jon Giffin, who was called by the State, as the leading expert on mouflon sheep, agreed that mouflon have a substantial negative impact on the mamane, are as potentially destructive as feral sheep, and that, considering the issue from a biological standpoint alone, the mouflon should be eradicated. [FN44] However, when faced with the State's management objective to "maximize sheep numbers while still protecting endemic vegetation," Giffin recommended a density of fifteen sheep per square mile in prime habitat, ten sheep per square mile in good habitat, and five per square mile in lower quality habitat. [FN45] Giffin's report candidly admits, however, that optimum *1082 population numbers have not been determined for mouflon, and that continued study is necessary so that the sheep density can be adjusted as needed. [FN46]

FN44. Test. of Giffin; Giffin & Scowcroft at 644; Revised Palila Recovery Plan at 35.

FN45. Giffin at 28-29; test. of Giffin.

FN46. Giffin at 28-29.

I cannot accept this essentially "experimental approach" as applied to the endangered Palila. Giffin admitted on the stand that there are no quantitative studies to support his figures and that they were simply "starting points for management." Giffin and others acknowledged that it is wholly uncertain whether mamane recovery would occur at this level or whether degradation of the forest would continue. [FN47] Moreover, Giffin agreed that it would take many years to determine if these estimates are appropriate. This approach plays Russian roulette with a critically endangered species. Sheep densities will only be adjusted in response to a negative impact on the mamane or Palila. However, biological time lags impede an accurate analysis of species interaction, and by the time mouflon numbers have been readjusted, Palila may be extinct.

FN47. Test. of Giffin; test. of Bachman; test. of Walker.

Whereas defendants experts were unclear as to the impact that 15 sheep/mi sub2 would have on the mamane and the Palila, plaintiffs' experts were adamant that this number of sheep would bring about Palila's extinction. Although some experts conceded that perhaps a "very small number" of sheep could coexist with Palila, this number would not be a viable hunting population. Plaintiffs experts, approaching the question from a biological viewpoint, stressed that the bird was presently in such "dire straits" that it needed as pristine a habitat as possible on the mountain. Given the extremely poor condition of the forest, plaintiffs experts agreed that there was "no room for compromise:" At present, the presence of any mouflon sheep on Mauna Kea would "significantly threaten" the Palila's prospects for recovery and survival.

Plaintiffs' experts acknowledged that there are other negative influences, many of them uncontrollable, that affect the Palila and its environment. Drought, thermal and climatic conditions, and avian disease may harm the Palila; drought, fire, caterpillars and larvae may adversely affect the mamane. However, they argued that the fact that there are numerous factors that may imperil the bird only heightens the imperative to eliminate those factors over which man has some control. Moreover, the evidence shows that the primary threat to Palila is habitat destruction and that mouflon sheep, which are controllable, are the primary cause of this degradation.

CONCLUSION

In conclusion, I find that the presence of mouflon sheep in numbers sufficient for sport-hunting purposes is harming the Palila. They degrade the mamane ecosystem to the extent that there is an actual present negative impact on the Palila population that threatens the continued existence and recovery of the species. Once this determination has been made, the Endangered Species Act leaves no room for balancing policy considerations, but rather requires me to order the removal of the mouflon sheep from Mauna Kea.

The mamane forest can be expected to recover slowly when released from the current browsing pressures. [FN48] At some point in the future, the mamane on Mauna Kea may have recovered sufficiently to support Palila beyond its current endangered population. Likewise, at some future date, the forest and the bird population may be sufficiently stable to allow the coexistence of some mouflon sheep with Palila. At present, however, the Endangered Species Act mandates the protection of the Palila to the extent possible, in the hope that this bird does not join the many other indigenous species that have disappeared from these islands.

FN48. In the absence of sheep, the mamane forest should recover in 30-50 years. In ten to twelve years, new mamane seedlings will grow a few pods. In 25 years, the trees will be strong enough to support a Palila nest. In 30-50 years, the mamane will be tall enough so that they cannot be topped by sheep, and the new forest may have sufficiently regenerated to withstand some grazing. Test. of van Riper; test. of Berger; test. of Jacobi.

The foregoing constitutes my findings of facts and conclusions of law in accordance with Fed.R.Civ.P. 52. Based on these findings and conclusions, the plaintiffs are to draw up an appropriate order and send it to this court, through the defendant State and the defendant/intervenors. The order shall *1083 reflect the conclusion of this court that the mouflon sheep are to be removed from the critical habitat of the Palila on Mauna Kea. In addition, the order shall be combined with my previous order of 1979 mandating the removal of the feral sheep and goats. Finally, it shall also specifically order the removal of the hybrid mouflon/feral sheep, which the State has, in practice, been eliminating along with the feral sheep. [FN49]

FN49. See supra footnote 2.