BIG THORNE PROJECT
SIR APPENDIX A
Interagency Wolf Task Force Report
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Alaska Department of Fish and Game
Doug Vincent-Lang
Director, Division of Wildlife Conservation

Kim Titus
Chief Wildlife Scientist, Division of Wildlife Conservation

USDOI – U.S. Fish and Wildlife Service
Socheata Lor
Field Supervisor, Anchorage Field Office

Steve Brockmann
Southeast Alaska Coordinator

USDA – U.S. Forest Service
Brian Logan
Wildlife Program Leader, Tongass National Forest

Greg Hayward
Regional Wildlife Ecologist, Alaska Region

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Appendix A
Interagency Wolf Task Force Report

Background

This report presents the results of work by the Interagency Wolf Task Force team, a group of six authors from three agencies (listed on this document) who collaborated during the first few months of 2014 responding to a request by the Alaska Regional Forester regarding an appeal of the Big Thorne Project. In her letter dated 30 September 2013, the Regional Forester requested review of a Statement by Dr. David K. Person (hereafter Statement) to evaluate whether it offered information, analysis, and conclusions substantially different from the Forest Service analysis for the Big Thorne Project. This report, which consists of a narrative document along with one table and one attachment, represents the review by the Interagency Wolf Task Force.

A table (Table A), developed during the March 5-6, 2014 Task Force meeting, outlines the initial work of the team. Table A summarizes the team's conclusions regarding a set of points made in the Statement. Individual elements of the table are purposefully brief. The table extracts a large number of quotes from the Statement which together represent the primary thesis of the Statement. Decisions regarding which quotes to consider was not trivial. The team recognizes that other analysts could extract more-specific or more-general quotes. The team attempted to identify those items in the Statement that represented fundamental information building the case for the Statement's final conclusions.

Project analysis, such as the Big Thorne evaluation, builds from the general guidance of the Forest Plan and specific Forest Plan elements of the FEIS which together provide a contextual record, critical analysis, synthetic conclusions, and management design elements. Table A has a column titled "Tiered from Forest Plan?". This column points the reader to past analysis and contextual evaluation that was completed in the Forest Plan FEIS rather than during the Big Thorne analysis.

Table A demonstrates substantial overlap in the elements examined in the Statement and the Forest Service record for Big Thorne. Six analysis points from the Statement were highlighted by the Task Force that warranted further consideration. Attachment 1 provides the Interagency Team perspective on these six points of analysis.

The final set of elements in Table A (labeled "Broad Conclusions") show that the Statement reached a number of fundamental conclusions that differ from those in the Big Thorne analysis. These conclusions integrate the broad topics identified in the first column of Table A (Topic Categories). The substantive differences in conclusions (between the Statement and Big Thorne Record) are identified in the final five points highlighted in Table A (labeled "Broad Conclusions").

While these broad conclusions differ from those reached in the Big Thorne analysis, Table A shows how the Forest Service considered and disclosed the underlying issues and their projected impacts to deer, habitat, wolves and their use by humans as outlined in Table A. In the following pages we respond to the substantial differences represented by the final five broad conclusions.

Due to critical timelines, the Task Force did not specifically cite locations in the FEIS, ROD, or Forest Plan to document where particular topics were addressed. Rather, the team discussed the science question being addressed in the Statement and how it was examined in the Forest Service

documents. The team reviewed portions of the record to assess the analysis and discussed other pertinent portions of the record. In many cases, specific references would not have been sufficient because the science questions being addressed were complex and had been examined in an integrative way (in the ROD, FEIS, etc.) through multiple portions of the record.

Note: The team made a strong effort to develop a common report representing a joint evaluation by the six authors and three agencies regarding the Statement. Differences emerged among the team members/agencies. Consequently, alternative perspectives are recorded, and identified where necessary.

Wolf Task Force Response to Final Conclusions of Statement

The bottom of Table A lists five broad conclusions reached by Dr. Person in his Statement. The Wolf Task Force regards these conclusions as the thesis of the Statement or the take-home message. Because none of these conclusions were reached in the Big Thorne analysis, they represent possible new circumstances, interpretations, conclusions, or information relevant to cumulative effects on wolves. In the following pages the team comments on the conclusions (quotes from the Statement) and demonstrates why the predicted outcome for wolves is inconsistent with the scientific information and analysis presented in the Big Thorne record. Four of these conclusions refer to a predicted collapse of the predator/prey system on Prince of Wales Island or associated geographic area. The narrative in the text around the remaining conclusion makes reference to the same phenomena. Given the similarity of the conclusions we will respond to them as a unit.

Note: This evaluation does not attempt to repeat or cite the analysis or science references contained in the FEIS, ROD, or wildlife specialist report but builds on that understanding without direct reference except where necessary to clarify a point.

Overview of Case presented in Statement

The line of reasoning that forms the foundation for all five substantive conclusions in the Statement relates to the complex interactions between deer habitat, roads, snowpack, deer populations, deer hunters, wolves (as predators of deer), and wolf trappers/hunters. The Statement builds a case for "unstable predator/prey dynamics" or the "ecological collapse of the predator-prey system" ultimately questioning the viability of wolves. The eight points listed under *predator/prey dynamics* in the Table A (see top portion of Table A for overview) outline the ecological interactions leading to unstable dynamics that could result in the collapse of the deer/wolf system (referred to in the Statement conclusions). In the Statement and in referenced material (particularly in Person and Brinkman 2013) a case is made for the complexity of the deer/human/wolf system. The argument begins with the idea that winter deer habitat (old growth forest, which intercepts snow and provides forage) is reduced (through timber harvest) to the point where a severe winter (or series of such winters) with deep snow results in high deer mortality. Deer abundance remains low (or is perceived to remain low) in subsequent years because of a combination of factors – particularly deer mortality from hunting and predation on deer by wolves. Consequently, competition for deer (wolves, bears, and humans) occurs, resulting in high hunting/trapping mortality of wolves coupled with low wolf production due to reduced deer abundance. The ultimate outcome is the loss of wolf viability on Prince of Wales and associated islands. The argument is outlined in the Statement and is loosely framed as a risk assessment. As a risk assessment, it contends that the series of causal events outlined above has sufficient probability of each occurring to result in the outcome – risk of wolf extirpation on

Prince of Wales and associated islands. The perspective outlined in the Statement relies on several critical assumptions. Our assessment of underlying assumptions and risk is outlined below.

Prior to our assessment, however, we examine several critical points from two science documents referenced in the Statement that form much of the foundation for understanding wolf dynamics. The conclusions of the Statement build indirectly from the evaluation presented in the Conservation Assessment (Person et al. 1996:19-20) and modeling in the 1997 population viability analysis (Person and Boyer 1997). The referenced viability modeling of deer/wolf interactions suggests that:

- Prior to 'industrial logging' (pre-1954), the existing old-growth forest supported higher deer carrying capacity than after 1954 which likely resulted in high (but variable) deer and wolf abundance.
- Modeling and theory suggest that sustainable wolf harvest (hunting and trapping) is a stabilizing factor largely because it reduces the frequency of high wolf numbers depressing deer abundance, especially after a winter with high deer mortality. The stabilizing influence is most effective when wolf harvest is a consistent proportion of the wolf population (e.g. rate-based harvest system).
- Modeling suggests that deer populations appear to recover under all model conditions following extreme winter-induced mortality events.
- Wolf extirpation did not occur in the modeling scenarios.

The narrative in the Wolf Conservation Assessment describing modeling results (Person et al. 1996:19-20) focuses on a model objective of retaining equilibrium in the deer/wolf system that would sustain 250 to 300 wolves on Prince of Wales and associated islands. This level of wolf abundance was not set as a State management objective but as a modeling value in the 1996 document because it was the population estimate at the time. This model value (250 – 300 wolves) represents a strong foundation for managing habitat for 13 deer/ mi^2. This objective does not represent a management target for deer associated with a 'minimum viable population for wolves' but was motivated by a broad, multiple-use goal of managing wolves for hunting/trapping while also managing deer to support wolf and human harvest of deer in the context of a multiple-use forest management system.

Evaluation of Conclusions

In the following pages, we evaluate the thesis of the Statement regarding the status of wolves (risk of extirpation on Prince of Wales Island) by examining the scientific understanding of the predator/prey system AND by considering the risk analysis and uncertainty inherent in the Statement conclusions. We outlined some key areas of basic agreement between the Statement and our perspective on the predator/prey system and the risk evaluation. We then presented key assumptions representing the framework for the Statement's risk assessment and evaluate of the strength of those assumptions and the resulting risk assessment.

Deer population dynamics in Southeast Alaska and Prince of Wales Island depend critically on deer winter habitat and deer condition at the beginning of winter (Hanley et al. 2012, Parker et al. 1999). Empirical observations also confirm that heavy winter snowpack can lead to substantial deer mortality which can be mitigated by deer condition and the availability of forest with sufficient canopy cover to intercept snow and provide forage during these extreme events. The

harvest of old growth removes quality winter habitat.

The strong link between predators and prey (whether bottom up, top down, or a mixture of interactions) is well documented throughout both theoretical and empirical literature (e.g. Holling 1959, Peterson 1995, Krebs et al. 2001, National Research Council 1997, Boyer et al. 2005). Recent studies of wolves and their ungulate prey in areas such as Yellowstone have added to that body of knowledge. The relationship is strongest in relatively simple systems where a single predator species relies on a single prey species (Begon et al. 1996, Gotelli 1998). Some recent theory suggests that declines in prey habitat can have especially strong impacts on large predators (Carbone et al. 2010). Thus, both empirical and theoretical evidence supports the notion of interrelated population dynamics of deer, wolves, and humans in this system. These interactions have also been well documented in in other places in Alaska where moose are the primary prey ungulate (e.g., National Research Council 1997, Keech et al. 2011). Furthermore, experience demonstrates that the characteristics of hunting/trapping are key in determining the short- and long-term status of wolves where human access is a factor.

Empirical evidence supports the contention that wolf populations become locally extirpated from intentionally focused killing by humans and that hunting/trapping mortality, both legal and illegal, can lead to wolf extirpation in a wide range of situations. The absence of wolves throughout much of North America south of the 50th parallel provides numerous examples. Sweeping changes in wolf distribution were largely a result of targeted wolf killing by humans (Paradiso and Nowak 1982).

The team and Statement agree on fundamental elements of the predatory/prey system on Prince of Wales Island. Applying the science of predator/prey/habitat dynamics specifically to the effects of the Big Thorne Project on Prince of Wales Island to reach the substantive conclusions outlined in the Statement requires a set of important assumptions and an associated risk evaluation (or consideration of the likelihood of a series of causal events). In order to understand the differences in conclusions by the Wolf Task Force and the Statement, we considered a set of interconnected assumptions that form the foundation for the Statement and its conclusions, and we identified differences in risk assessment reached by the Statement and the Task Force.

The set of critical assumptions we identified as forming the foundation for the scenario outlined in the Statement include:

A. Reductions in habitat resulting from the Big Thorne Project that reduce the extent of high-quality winter deer habitat on Prince of Wales Island by ~2 percent will, in combination with cumulative effects of past timber harvest, result in the cascade of consequences outlined in the Statement beginning with the catastrophic mortality of deer during a heavy snow winter (or series of heavy snow winters) and the development of wolf population sinks as a result of hunting and trapping. [Note: the center of the island where Big Thorne is located includes much of the best remaining deer winter habitat on this part of the island. High-volume productive old growth on the island will be reduced to about 41 percent of its 1954 extent].

B. Wolves must be managed for the modeled value of 250 – 300 individuals to assure stable or resilient predator/prey dynamics and avoid a high risk of extirpation. Alternatively stated (by USFWS and Logan (USFS)): maintaining adequate deer habitat to provide prey for a population of approximately 250 to 300 wolves will result in a resilient predator/prey system capable of recovering from periodic perturbations such as

successive harsh winters.

C. The predator/prey system on Prince of Wales Island is not resilient to low deer abundance because of the tendency of humans to reduce wolf populations when deer abundance is low or perceived to be low (to achieve the goal of increasing deer abundance).

D. Agencies will inadequately protect sufficient winter deer habitat, inadequately regulate wolf harvest, and to a lesser extent, inadequately regulate deer harvest by humans or not effectively apply existing regulatory mechanisms in these three areas because of political pressure.

Perspectives within the Wolf Task Force vary regarding the strength of these assumptions.

ADFG and Hayward (USFS) contend that theory and empirical observations in combination with a risk assessment do not support the contention of a likely collapse of the predator/prey system nor the loss of wolf viability, based on the evidence and logical arguments linking these critical assumptions underlying the Statement.

USFWS and Logan (USFS) maintain that the Big Thorne Project, when combined with the cumulative effects of past and foreseeable timber harvest and associated road building, increases the likelihood of low wolf populations occurring on Prince of Wales and associated islands. Because the interactions among deer habitat, snow, roads, deer populations, wolves, and humans are complex, it is unknown whether a substantial risk of island-wide predator/prey collapse or loss of sustainable populations of deer and wolves will result.

We briefly respond to each of the four assumptions that form the foundation for Person Statement in order:

Assumption A (loss of winter deer habitat in the Big Thorne area will trigger a collapse in the island's deer/wolf system):

The Big Thorne Project boundary includes 232,000 acres or about 7 percent of Prince of Wales Island, and occurs at an important location for movement of large, mobile vertebrates between the north and south portions of the island. The project will harvest 6,186 acres of old-growth forest recognized as winter habitat, including 2,358 acres of high-quality winter habitat for deer. As outlined in Table A, both the Big Thorne record and the Statement carefully examined the consequences of changes in deer habitat resulting from the project; both conclude that there will be measurable declines in the winter habitat capability in the project area (see more details below).

The scenario of predator/prey collapse outlined in the Statement begins with an understanding of the extent of winter habitat loss and the importance of snow interception for winter food availability to deer. Old-growth forest is effective at snow interception, providing a refuge for deer during uncommon, but critical heavy snow accumulation periods. The relationship between old-growth forest, quality deer habitat, and potential deer mortality during periods of deep snow is well documented (Parker et al. 1999). However, extending the consequences of removing old-growth forest in Big Thorne, in combination with past harvest and future harvest associated with land transfers, to concerns for island-wide collapse of the predator/prey system suggests a dramatic response of the predator/prey system to the Big Thorne Project.

We begin with a brief review of some specifics regarding the loss of winter habitat before more directly addressing the idea that timber harvest in Big Thorne dramatically increases the

probability of a collapse in the predator prey system beginning with a winter deer die-off.

- The Big Thorne Project will reduce the extent of old-growth forest by 6,186 acres, a level of timber harvest within the expectations of the Forest Plan. Within the project area, this will represent a direct 3 to 7 percent decrease in the extent of forest classified as deep snow winter range and 6 percent decline in forest classified as average snow winter range. One Wildlife Analysis Area (WAA – a division of land larger than a watershed used by ADFG for wildlife analysis) will lose an estimated 13 percent of the habitat that currently provides protection to deer in deep snow winters. Following Big Thorne, the cumulative decrease in forest classified as deep snow winter range will be 40 to 70 percent depending on WAA (Big Thorne ROD, Table ROD-9).
- Within the northern portion of Prince of Wales Island, the project will reduce the modeled deer habitat capability by 2 percent after project implementation, and by about 5 percent at stem exclusion (Table WLD-24). Cumulatively, this represents a 29 percent reduction as compared to historic (1954) condition.
- At the biogeographic province scale (Northern-central Prince of Wales Biogeographic Province), modeled deer habitat capability is currently 14.1 deer per square mile on all lands regardless of ownership (ROD Table ROD-8) and 17.95 deer per square mile on FS lands only (ROD Table ROD-7). With implementation of the Big Thorne Project, this value will decrease to 14.0 deer per square mile on all lands regardless of ownership and 17.9 deer per square mile on FS lands only (ROD Tables 7 and 8). [Note that the level of precision displayed is not intended to suggest a high level of model precision. Rather, it is difficult to indicate any model differences without displaying fractional results.]

Building on this background, we address the role of winter habitat loss initiating a collapse in the predator/prey system. The scenario postulates that habitat loss in the Big Thorne project area (and eventually the forest in areas of pending land transfers) will cause reductions in the deer population, resulting in a cascade of events that would be triggered by a severe winter snowpack. The status of deer and wolves would be influenced across the entire island, leading to collapse of the predator/prey system. The case for such a cascade of causal events requires that the change in existing winter habitat (less than 5 percent reduction across the biogeographic province after stem exclusion in 25 years) results in a fundamental shift in wolf/deer interactions – a threshold response following the cumulative 27 percent reduction since 1954. [An ecological threshold is a fundamental change in an ecological relationship indicated by an abrupt change in direction or rate in a response curve.]

We agree with the Statement that the conversion of habitat associated with this project occurs after the accumulated habitat loss from 60 years of forest management and removal of 59 percent of the highest volume old-growth stands and 49 percent of all productive old growth in the biogeographic province stands (Big Thorne ROD, Table ROD-9). Consequently, the additional, incremental conversion in habitat may have a greater (or lesser) non-linear influence on deer abundance than a 5 percent reduction in habitat in 1960. However, the current projected change in habitat capability from implementation of the Big Thorne Project is small compared to the variability in winter habitat capability and other factors influencing deer from year-to-year in response to differences in snowpack, timing of snow, spatial variation in snowfall, and variation in vegetation production (see modeling in Person et al. 1997 as an example).

Given the relatively small change in habitat capability at the spatial scale of the biogeographic

province and therefore across the island (which is the scale of interest in this case when examining viability), ADFG and Hayward (USFS) suggest a negative threshold response in deer to loss of winter habitat from the project at a broader scale would have a low probability of occurring. Moreover, the existence of such a threshold dynamic in deer/wolf systems has not been documented, nor is it likely given the relationship of predator/prey body size and the potential for management regulation of wolf harvest in the system. Furthermore, as stands harvested in the past develop and are thinned, they contribute to deer habitat capability and reduce the cumulative effects.

Alternatively, USFWS and Logan (USFS) believe that evidence of a critical response from the wolf population on Prince of Wales Island exists in the form of Person's (2006) documentation that wolf mortality exceeds reproduction when logging and roading covers over 40 percent of a wolf pack's home range. Recent evidence from the Big Thorne Project area suggests about 80 percent over-winter mortality for wolves in the local area (16 of 18 harvested legally) during winter 2012-2013 - the first year of the interagency project (Person and Larson 2013) - over double the estimated sustainable rate (Person and Russell 2008).

While Assumption 'A' is focused largely on the loss of winter habitat for deer, the habitat change also influences habitat for wolves more directly through changes in human access and mortality of wolves from hunting/trapping, both legal and illegal. Wolf mortality analyses (e.g. Person and Russell 2008, Person and Logan 2012) document the strong positive relationship between wolf mortality and road density and were examined closely in the FEIS. The Statement suggests that wolf mortality typically exceeds reproduction when more than 40 percent of a wolf pack's home range is logged and roaded. The scenario outlined in the Statement then suggests that Big Thorne Project could lead to island-wide declines in wolves as a result of deer population declines (winter mortality) in combination with increases in wolf harvest resulting from current, new, and future development and roading (in part associated with proposed or pending land transfers). The scenario suggests that these highly developed areas will become population sinks. A population sink is an area with negative population growth that reduces population growth in surrounding areas through immigration that is non-compensatory. The Statement suggests that over 50 percent of the island is at or near the level of development where it could become a population sink.

Nonlinear responses of predators and prey following changes in habitat capability are expected (e.g. Carbone et al. 2010) but how these will occur on Prince of Wales and associated islands is unknown. Very few predator/prey/habitat systems have been studied sufficiently to document trends in all three components simultaneously, let alone understand the various mechanistic interactions. As outlined in the Big Thorne record, high mortality of wolves is expected in the Big Thorne Project area and other areas of high road densities. We are unaware, however, of evidence demonstrating that when a level of wolf harvest representing what is often called 'overkill' is passed in a local area, the critical processes associated with a population sink (reducing population growth in neighboring areas) has been demonstrated for Prince of Wales Island nor are we aware of any evidence that population sink dynamics are occurring on over 50 percent of the island.

ADFG and Hayward (USFS) would argue that, given the incremental loss of winter habitat from Big Thorne and proposed and pending land transfers, (and acknowledging the nonlinear consequences of those losses) and the apparent resilience of wolf population over the past decades (post road development), the risk of catastrophic, sustained deer mortality or island-wide

wolf population sink dynamics is low.

USFWS and Logan (USFS) hold a different perspective outlined in this paragraph. They are concerned that if a threshold exists beyond which deer and wolf populations will decline dramatically in response to relatively small changes in habitat, we don't known how close the Prince of Wales wolf/deer/ habitat system may be to that threshold. USFWS and Logan (USFS) also note that much of the best remaining winter habitat would be removed from the project area, which could have much greater influence on deer and wolf populations following a series of extreme winters than indicated by the percentage loss of habitat capability. USFWS and Logan (USFS) also suggest that winter weather in Southeast Alaska is predicted to become progressively colder with greater precipitation as the region moves into a 10- to 15-year cold phase of the Pacific Decadal Oscillation (D'Aleo and Easterbrook 2011, Baichtal 2012), increasing the probability of significant winter deer mortality on Prince of Wales in the foreseeable future. Declines in deer populations are expected to result in declines in wolf populations (USFS 2008, p. 3-232). The effects of declining deer populations on wolves could be magnified by intensified wolf trapping efforts. Ongoing efforts of some trappers, operating within and outside existing regulatory mechanisms, have apparently already reduced wolf numbers in an effort to improve local deer populations (Person and Russell 2008).

Assumption B (wolves must be managed for the modeled value of 250 – 300 individuals to assure resilient predator prey dynamics):

The Statement emphasizes that maintaining a high abundance of deer is key to maintaining a stable, resilient wolf population. The analysis points toward 13 deer/mi^2 as necessary to maintain resilient predator/prey dynamics. This idea develops from analysis of wolf/deer dynamics necessary to support 250-300 wolves on Prince of Wales and associated islands (Person et al. 1996:19). However, the Statement implies a threshold for viability of wolves related to this value. In particular, on page 2 the Statement indicates "a minimum density of 13 deer/mi^2 is important to reduce the risk of unstable predator-prey dynamics and provide for predators and subsistence hunters". Throughout the Statement, the instability of the predator/prey system is presented as the cause for substantial concern regarding viability.

Given the high productivity of the terrestrial Prince of Wales (POW) ecosystem, the availability of alternative food at certain times of year, and the resilience suggested in the 1997 modeling effort (Person and Boyer 1997) the level of risk posed by wolf numbers falling below the 250-300 model value does not appear to suggest that "wolves are already facing the possibility of extinction on Prince of Wales Island" as indicated on page 14 of the Statement. Rather than representing a threshold for viability, the model value of 250-300 wolves on POW and Kosciusko Islands was used in an equilibrium-probabilistic modeling effort.

The assumption regarding the 250-300 wolves highlighted in the Person et al. (1996) assessment (and associated deer abundance addressed under Assumption A) deserves additional attention here. The Conservation Assessment (Person et al. 1996) and Statement indicate that wolf numbers have varied on POW Island in the past. This pattern of population fluctuations does not suggest strong threshold dynamics nor does it suggest a dramatic lack of resilience in response to the system drifting away from the modeled value of 250-300. Given the range of dynamics illustrated in Person and Bowyer (1997) and the empirical and modeling studies on wolves and prey, the resiliency under more-aggressive timber harvest regimes illustrated in these models, and the observations of variable wolf and deer abundance on POW, evidence appears weak for a

threshold value or loss of resilience in the predator/prey system.

USFWS and Logan (USFS) note that, according to the Tongass Land Management Plan, maintaining adequate habitat to support at least 18 deer/ mi^2 will provide a high likelihood of maintaining a resilient wolf/deer system. This TLMP guideline is based on a calculation for the Prince of Wales and associated islands that assumed an average annual wolf population of 250 animals that was expected to vary over time (Person et al. 1996; Person et al. 1997). Currently, the North Central POW biogeographic province is modeled to support 14.6 deer/mi^2. USFWS and Logan (USFS) believe there is some risk that predator/prey dynamics could become more erratic and the resilience of deer to predation, hunting, and extreme winter weather may be reduced.

The full Task Force contends that many predator/prey systems exhibit dramatic variation in predator abundance but also exhibit resilience – the herbivore rebounds following declines in abundance, facilitating predator rebound (e.g. Krebs 2001, National Research Council 1997, Korpimaki and Norrdahl 1989). Strong density-dependent population growth in prey populations facilitate recovery following periods of low abundance (as shown in these long-term empirical studies). It is particularly important to stress that, as illustrated in Person and Bowyer (1997), regulated harvest of wolves on POW provides a mechanism to facilitate more-rapid deer recovery after high winter mortality. Furthermore, availability of secondary wolf prey, such as salmon and beaver on Prince of Wales, provide a mechanism to buffer low wolf abundance following deer population declines and the presence of another large predator, black bear, adds further complexity to the system.

Additional evidence that predator/prey systems exhibit both variable abundance and long-term viability comes from long-term studies (e.g. Begon et al. 1996:118, Perrins et al. 1991, Nat. Research Council 1997). Examples indicate that density-dependent population growth within the context of variable population dynamics appears to be the norm in temperate terrestrial predator/prey systems (e.g. National Research Council 1997, Krebs 2001, Korpimaki and Norrdahl 1989, Stephens et al. 2006, 2012). Therefore, changes in wolf abundance from the modeled value of 250-300 and observations of changing wolf and deer numbers do not categorically suggest the collapse of the predator/prey system. ADFG and Hayward (USFS) conclude that the risk of collapse does not appear high. USFWS and Logan (USFS) share some concern that additional loss of deer winter range could increase the magnitude of local deer declines during deep-snow winters, and delay population recovery. The full Task Force notes that there continues to be scientific and wildlife management interest in how these ungulate-predator-habitat-human systems function.

Assumption C (excessive wolf mortality could result from increased efforts to reduce or eliminate wolf populations in response to low deer populations):

Humans represent a significant component of the predator/prey system on POW Island (Brinkman et al. 2007). Harvest of deer and wolves represent key elements in the social and cultural framework. Given the importance of deer to the (non-monetary) economy of island inhabitants, it is quite reasonable to expect hunters to put additional effort into deer hunting and to change locations of hunting and tactics during periods of low deer numbers. Consequently, the spatial distribution of deer harvest and proportion of the population removed may change following a deer decline. Furthermore, political pressure for increased predator control is likely to increase as described in Person and Brinkman (2013) citing increased legal predator control in

Canada responding to a severe decline in deer.

ADFG and Hayward (USFS) suggest that several factors support a conclusion that the probability of a scenario resulting in sustained overharvest of deer and wolves occurring is unlikely to be high.

- As described later, deer harvest is regulated on POW and favors harvest of males to maintain the productivity of the population.
- Following a large mortality event (e.g. from heavy winter snow), awareness of potential declines in deer and wolves will increase, motivating regulator attention, education programs, and law enforcement (see Assumption D).
- Like any predator, humans respond to poor hunting (high effort and low success) by switching prey or moving to a new area. Therefore hunter harvest of deer will likely decline in the long-run following a dramatic deer mortality event. This behavior is no different than hunter behavior in other settings where ungulate populations vary over time. Our level of certainty in this feature, however, is low and hunter behavior may depend substantively on agency regulatory, education, and enforcement actions (see discussion under Assumption D).
- The behavior of wolf trappers and wolf hunters in response to a decline in deer numbers is difficult to predict, but will be influenced by changes in regulations, information and education, peer pressure, and law enforcement.
- In Alaska, if an Intensive Management program was initiated, it would occur under the State's Intensive Management Protocol that mandates long-term sustained yield of both predators and prey, beginning with a predator/prey/habitat assessment. Furthermore, there is no evidence of extirpation of wolves in Alaska at the scale of a GMU despite attempts to do so in the past prior to Statehood (including Southeast Alaska).

Whether residents of POW will increase their harvest of wolves in response to low deer numbers is unknown. While this response may be expected, the degree to which it results in wolf mortality will depend on a range of factors. The response from hunters and trappers will be important and is examined below. We note that understanding of this characteristic of the predator/prey system is low and there is modest uncertainty in our conclusion.

USFWS and Logan (USFS) note that widespread, chronically unsustainable harvest of wolves (defined as ≥5 wolves per 300km2 ≥ 5 years over a 25 year record) has already been documented on Prince of Wales Island (Person and Logan 2012). A significant portion (up to half of the total wolf harvest) appears to be illegal (Person and Russell 2008). Discussions with residents, and testimony at an April 4, 2014 ADFG public meeting on Prince of Wales suggest that several of the most effective wolf trappers on POW focus their efforts on areas with perceived low deer densities, in an effort to improve deer hunting. Thus, a tradition of wolf control is established. Additional education coupled with regulatory and enforcement efforts may be required to maintain viable wolf populations if informal wolf control intensifies following declines of deer after one or more harsh winters.

Assumption D (management agencies will fail to adequately regulate habitat loss, wolf harvest, and deer harvest):

The behavior of hunters/trappers harvesting deer and wolves represents a key element of the

scenario outlined in the Statement leading to "unstable predator/prey dynamics" or the "ecological collapse of the predator-prey system" or finally "wolves are already facing the possibility of extinction on Prince of Wales Island". Overharvest of deer, especially following a winter die-off along with high wolf harvest is outlined. The Statement also suggests inadequate regulation of timber harvest and roads as a factor contributing to the outcome. We addressed this last item under Assumption A and examine deer and wolf harvest management here.

Government agencies cooperating with public organizations have demonstrated effective regulatory, information, and education programs in response to threats to species (e.g. Beissinger and Perrine 2001, Smith 2005), demonstrating the ability of governments and various publics to collectively solve management issues. Indeed, State and Federal partners have worked together to avoid the need to list species many times. It is reasonable to expect that agencies will indeed work to conserve wolves and avoid listing. The Statement describes a scenario that could result if adequate precautions are not taken.

The predator/prey system on POW Island is managed and maintained via an existing regulatory structure and law enforcement infrastructure. Public buy-in and compliance are key features of the system. These include State regulation of hunting and trapping and both Federal and State regulation of subsistence harvest. The State of Alaska has a constitutional requirement to manage and maintain sustainable wildlife populations (see West and others vs. State of Alaska 2010 – Alaska Supreme Court Opinion No. 6497; Alaska Department of Fish and Game 2012). As noted below, the State takes this obligation seriously and manages for sustainable populations of both deer and wolves. Estimates of illegal harvest suggest opportunities for improvement in the law enforcement arm of that structure along with improved information and education programs (Person and Russell 2008). However, given the ability of State and Federal authorities to enforce wildlife laws elsewhere, it is more reasonable to assume that similar effective enforcement and hunter education is likely, than to assume otherwise.

Several factors reinforce optimism for effective regulation of wolf harvest:

- the current regulatory system has provided sustainable deer and wolf populations.
- the current regulatory structure is designed to limit legal harvest of wolves to a specific fraction of the estimated autumn population. Effectiveness of this approach relies on an indication of population size, and for the past 2 years an interagency group has been pursuing field investigations testing various approaches to estimate wolf population size.
- State and Federal agencies have indicated an intention to address regulatory changes.

The rapid, coordinated response of State and Federal agencies closing wolf harvest in Game Management Unit #2 in March, 2014 (closed 19 March 2014) and similar action in 1999 (Person and Brinkman 2013) demonstrates the ability of regulators to move quickly to regulate legal harvest of wolves. If harvest mortality, including both legal and illegal/unreported take of wolves, is maintained below approximately 35 percent of the autumn population, harvest is likely to be sustainable (Person and Russell 2008).

Deer harvest regulations focus on take of bucks to preserve the productive capacity of the population. Similar to wolf management, trustees have the capacity to alter bag limits, seasons, and methods of take in response to changes in deer abundance in order to meet mandates to maintain sustainable deer populations, respond to subsistence priority, and if necessary, respond to threats to wolf viability.

Appendix A

Conclusion

Our assessment of the four assumptions that are critical to the substantial conclusions reached in the Statement raises considerable doubt regarding the scenario leading to "the ecological collapse of the predator prey system" (Statement p7), the contention that "wolves are already facing the possibility of extinction on Prince of Wales Island" (Statement p15) or that "the Big Thorne timber sale, if implemented, represents the final straw that will break the back of a sustainable wolf-deer predator-prey ecological community on Prince of Wales Island" (Statement p5) presented in the Statement. We acknowledge that the Big Thorne Project increases the likelihood of low wolf populations occurring on Prince of Wales and associated islands. We concur that there are complex interactions among deer habitat, snow, roads, deer population abundance, wolves, and humans which were evaluated in the USFS EIS and Record of Decision.

ADFG and Hayward (USFS) argue that the evidence fails to suggest a substantial risk of island-wide predator/prey collapse or loss of sustainable populations of deer and wolves in the context of active regulation of deer and wolf harvest. The conservation fabric developed in the 1997 and 2008 Forest Plans is still intact and a sound regulatory framework is in place to modify harvest of deer and wolves. Furthermore, agencies are aware of the need to develop more-objective approaches to estimate population characteristics of deer and wolves and are collaborating to that end.

USFWS and Logan (USFS) believe that some uncertainty remains, and that there is some risk that the scenario presented in the Person Statement could occur if the responsible management and enforcement agencies do not protect adequate deer winter habitat and restrict wolf harvest, both legal and illegal, to a sustainable level. While the conservation strategy was designed to provide a high probability of maintaining viable and well-distributed populations of wolves and deer, a need exists for information related to its effectiveness in maintaining sustainable populations. Agencies are actively developing more-effective approaches to estimate population characteristics of deer and wolves and are collaborating to that end. These Task Force members recommend that until better estimates of these isolated populations exist, any actions that can reduce the level of risk should be considered. This could include modification of wolf harvest regulations, increased enforcement effort, access management, and conservation of important winter habitat for deer.

These views vary in degree and may be most clearly characterized as alternative perspectives of uncertainty and alternative assessments of the strength of evidence and evaluation of risk.

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Table A: Points Matrix

Points Matrix – Product of Meeting March 5 & 6, 2014					
Topic Category	**Quote**	**Page/#**	**Examined in EIS?**	**Tiered from Forest Plan?**	**Additional Comments**
Predator/prey dynamics	A minimum density of 13 deer/ mi^2 is important to reduce the risk of unstable predator-prey dynamics and provide for predators and subsistence hunters.	P2, #7	Extensively: deer habitat capability (not predator/prey dynamics)		Not part of a timber sale EIS?
	The project will cause immeasurable and permanent harm to those hunters and create an intractable management dilemma of trying to sustain deer in the face of dwindling habitat quality, predation, and human demands	P6, #13c	Subsistence determination confirms	Within the range of effects disclosed by the Forest Plan	
	The cumulative effects of 60 years of clear-cut logging plus the Big Thorne project could result in the ecological collapse of the predator-prey system	P7, #13d	Cumulative effects analysis reached a different conclusion, and disclosed risk and measures to reduce risk; consistent with the Forest Plan	100-year Forest Plan analysis did not project a collapse at biogeographical province scale	Framed as a conclusion
	Big Thorne logging, if it goes forward, will remove the most important remaining deer winter habitat in many of the affected watersheds, which will further reduce the abundance of deer in the project area (especially following severe winters), perhaps for decades to come. As a result, the predator-prey relationship between wolves and deer on Prince of Wales is likely to collapse.	P15, #31	Extensive analysis of effects on deer habitat across the entire analysis area; reached a different conclusion; consistent with Forest Plan	100-yearForest Plan analysis did not project a collapse at biogeographical province scale	

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Points Matrix – Product of Meeting March 5 & 6, 2014					
Topic Category	**Quote**	**Page/#**	**Examined in EIS?**	**Tiered from Forest Plan?**	**Additional Comments**
	OGRs are the only lands that may serve as population sources for wolves, but they are too small	P17, #34h	Extensive analysis especially for Honker Divide. Came to a different conclusion.	100-year Forest Plan analysis did not make the same conclusion at the Forest Plan level. Dr. Person's contention that OGRs are the exclusive area providing wolf refugia and therefore positive population growth was not an assumption of the Forest Plan	The Plan assumes and was analyzed such that the "matrix" and other lands also contribute to wildlife (wolf/deer) habitat and thus sustainability.
	OGRs are not sufficiently large to encompass wolf pack home ranges (Person and Brinkman 2013). The average home range of wolf packs on the Prince of Wales Archipelago is 300 km2 (115 mi^2, [Person and Logan 2012]) or 73,800 acres. The largest contiguous OGR in the Prince of Wales Archipelago is 45,000 acres. Consequently, no OGRs completely protect any wolf pack within the Prince of Wales Archipelago	P17, #34j	Examined the size of OGRs and wolf pack home range sizes and tiered to the Forest Plan in evaluating the effect of OGRs on wolf pack mortality	OGRs were not designed to completely protect a wolf pack. The Forest Plan relied on the combination of elements to conserve wolves (regulations, deer, roads, Standards & Guidelines; den-site no harvest buffers)	Honker OGR complex is 200,000+ acres (complex vs contiguous)

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	The term "old-growth" reserve is misleading since reserves may contain as little as 50% productive old growth (POG). The liberal criteria used to define POG assure that much of it is of little value to deer during a snowy winter. Moreover, because of the extensive fragmentation and logging of most of the highest volume old-growth forest on the Prince of Wales Archipelago and in some cases the gerrymandering of OGR boundaries or locations that has occurred in individual logging projects, lands aggregated into OGRs do not necessarily contain the best or even adequate winter habitat for deer and hence wolves	P18, #34m	Interagency OGR report and effects analyses in FEIS and ROD	OGR composition is defined by Forest Plan to meet multiple wildlife objectives	
See Attachment 1, Point 1 for details	Indeed, an incremental reduction in deer habitat capability likely will result in a much larger effect on the predator-prey system owing to the nonlinear dynamics that characterize predator prey- habitat interactions (Person et al. 2001; Person 2001; Bowyer et al. 2005; Person and Brinkman 2013)	P20, #34o	Extensive analysis of deer habitat and deer but non-linear dynamics are not addressed (did not have the 2013 paper)		Examined in supporting narrative – Attachment 1, Point 1.
Human access and behavior	Person and Logan (2012) concluded that after road closures in GMU 2 prescribed in the Forest Service's Access and Travel Management plan approximately 71% of roaded landscapes will still be accessible to hunters and trappers	p13, #27	Extensive analysis acknowledging tradeoffs including the vulnerability of wolves to hunting and trapping	Tiered, and acknowledged the high road densities	

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Topic Category	**Quote**	**Page/#**	**Examined in EIS?**	**Tiered from Forest Plan?**	**Additional Comments**
	Person and Logan 2012 significantly underestimates the amount of the project area that is already accessible to hunting and trapping activities *[see P13 #27]*. More plausibly, the percent of the project area readily accessible to hunters and trappers actually exceeds 80%	P13, #27	Examined the influence of roads/access for hunters/trappers, and assumed a greater percentage of the area would be accessible		Verify later if all closed roads were analyzed as being "accessible" to hunting/trapping
See Attachment 1, Point 2 for details	I also concluded that persistently low deer numbers or even the perception of low numbers would increase the risk of unsustainable take of wolves by hunters and trappers attempting to boost deer populations, an activity facilitated by easy access to shorelines by boat and to island interiors by vehicles using roads. If this occurs on widespread areas on the Prince of Wales Archipelago, the viability of wolves would be at risk	P14, #29	Take of wolves is considered in the analysis but the argument that increased take of wolves would occur in response to low deer numbers was not addressed directly		Examined in supporting narrative – Attachment 1, Point 2.
	it is not enough to maintain a sufficient deer population for wolves because hunters rely on those deer as well, and they can be expected to kill wolves legally or illegally to protect that resource. The situation is further compounded by the extensive road network already in existence, as well as the new roads into previously remote areas approved under the Big Thorne decision. This road system greatly facilitates human access and eliminates refuge for wolves	P15, #33	Deer densities, road densities/network, human access via roads, and refuge for wolves (in OGR discussion and elsewhere) dealt with in Forest Plan. Regarding killing wolves to protect deer, see number 15.		
	In addition, conflict between hunters and wolves for deer may increase, resulting in demands by deer hunters for predator control and also a heightened illegal take...	P19, #34o	Acknowledged reduced availability of deer to hunters and wolves but did not examine potential increased wolf take	Acknowledges need to provide deer for both wolves and humans (18 deer/mi^2)	

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Topic Category	**Quote**	**Page/#**	**Examined in EIS?**	**Tiered from Forest Plan?**	**Additional Comments**
See Attachment 1, Point 3 for details	Prince of Wales Archipelago WAAs are highly connected for deer hunter access by the extensive network of roads and marine waterways. Hunting effort by individuals from throughout the Prince of Wales Archipelago is easily transferable from one area to others as one becomes more depleted than others, likely causing a deer deficit in one area to have a far ranging indirect effect, weakening the predator-prey system the Prince of Wales Archipelago-wide	P20, #35	Effects on deer habitat, deer abundance, and human harvest of deer thoroughly analyzed and disclosed. However, potential for shifting geographic area of deer harvest not addressed directly.		Examined in supporting narrative – Attachment 1, Point 3.
Wolf mortality See Attachment 1, Point 6 for details	when about 40% of a pack's total home range is logged and roaded, there is a very high risk that mortality (mostly from hunting and trapping) will exceed reproduction and the pack area becomes a population sink. Indeed, even when as little as 25% of a pack's home range is logged, the ratio of reproduction to mortality is very close to one. Sinks are only maintained by immigration of wolves from other areas, which, as explained below, is not likely to happen on Prince of Wales Island given the population's isolation and small numbers	P3, #8	See above sections on OGRs, road densities, etc. Analysis did not deal with the 25-40% thresholds for logging in home ranges but it did analyze the issue in a different way.	FP considered the 25/40% thresholds during 2008 Forest Plan Revision along with road density.	Examined in supporting narrative – Attachment 1, Point 6.
	the data showed how vulnerable packs are to access via roads, even for the pack occupying the Honker Divide OGR because that OGR is simply too small to encompass their home range.	P4, #9	Addressed in #7, and see above sections on OGRs, road densities		

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Topic Category	**Quote**	**Page/#**	**Examined in EIS?**	**Tiered from Forest Plan?**	**Additional Comments**
	The construction of roads associated with logging projects also increases the risk of wolf mortality by legal and illegal harvesting. Roads offer convenient pathways for wolves through logged watersheds, but they also provide access to humans, increasing risk of death of wolves from hunting and trapping	P12, #24	Addressed in #7, and see above sections on OGRs, road densities		
	Person and Russell participated in a study that demonstrated a strong positive linear relation (r = 0.89) between road density less than or equal to 0.9 km/km^2 (1.5 miles/mile^2) and wolf harvest rates (Person and Russell 2008). We determined that densities greater than 0.9 km/km^2 likely resulted in unsustainable losses of wolves	p12, #25	Analyzed road densities and wolf mortality, acknowledged the high road density, and tiers to the Forest Plan	Road density in the wolf Standards & Guidelines	
	87% of mortality of wolves on Prince of Wales Island was from hunting and trapping (Person and Russell 2008).	P13, #26	Wolf mortality was analyzed extensively and this publication thoroughly examined in the wildlife report		
	We concluded that annually, about 50 to 95 wolves are legally taken (including required reporting of the kill), but that illegal take may at times equal the legal harvest on Prince of Wales (Person and Russell 2008).	P13, #26	Yes, analyzed in discussion of wolf mortality		

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Wolf popn. Sinks	On Prince of Wales Island, more than 50% of the island is already at or approaching levels of logging that will strongly increase the risk that the island will only be capable of supporting wolf packs that function as population sinks	P6, #13b	Examines the consequences of the extent of logging, road densities, the pattern of wolf mortality, but doesn't directly analyze a population sink. Note: Person's "sink" is mortality exceeds reproduction. Did analyze local rates of mortality.		
	Our work demonstrated that a ratio of deer to wolf of 170-180 deer to one wolf is needed for a 95% probability of equilibrium between the populations. (Person et al. 1996).)	P11, #23		Incorporated in the Forest Plan Standards and Guidelines	
See Attachment 1, Point 4 for details	As deer numbers inevitably decline on Prince of Wales Island as a consequence of on-going logging and the still pending succession debt of past logging (Person and Brinkman 2013), subsistence and recreational hunters increasingly will perceive competition from wolves for deer. Legal and illegal take of wolves can be predicted to increase as a result, particularly in areas accessible by roads or boats (Person et al. 1996; Person 2001)	P11, #23	Extensive analysis of deer habitat and deer including succession debt (did not have 2013 paper prior to signing of ROD). Also extensive analysis of wolf mortality. Last part of statement pertains to what was addressed in number 15.		Examined in supporting narrative – Attachment 1, Point 4.

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	I presented an analysis based on empirical survival and reproductive data from telemetered wolves. This analysis indicated that when more than approximately 40% of a wolf pack home range on Prince of Wales Island is comprised of logging and roads that allow access for hunting and trapping, the area likely becomes a population sink in which mortality exceeds reproduction. The analysis showed that the ratio of reproduction to mortality for wolf packs was perilously close to one to one when as little as 25% of the home ranges were logged and/or provide road access	P14, #30	See above sections on OGRs, road densities, etc. Analysis did not deal with the 25-40% thresholds for home range logging but it did analyze the issue in a different way. (also see comment 20)	FP considered the 25/40% thresholds during 2008 Forest Plan revision, along with road density.	
Deer habitat	They [Big Thorne & Log Jam] will remove the last high quality winter range for deer in the central portion of Prince of Wales Islands	P4, #10	Extensively analyzed the consequence on deer winter range and reached a different conclusion.		
	cumulative effects of the Big Thorne and Log Jam timber projects along with previous logging over 60 years, has and will erode the resilience of deer to severe winter, predation, and hunting. In addition, land transfers to Sealaska Corporation and Alaska Mental Health Trust Authority, will reduce more deer habitat on other parts of the island such that the level of habitat loss within Big Thorne and Log Jam has been and will be duplicated in most of the Prince of Wales Archipelago.	P4, #10	Analyzed the long term effects of timber harvest including consequences for deer winter habitat, predation, and hunting; also examines the cumulative effects of forest management on non-NFS land	Examined in the development of the Forest Plan; acknowledged these assumptions regarding land transfers	
	The Big Thorne project will harvest much of the best remaining mid and low elevation deer winter habitat in this part of Prince of Wales Island	P6, #13b	Extensively analyzed the consequence on deer winter range.		

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	Because so much winter range for deer has been logged, deer are not resilient to effects of both predation and severe winters. As a result, a bad winter could cause a significant decline in deer and the population remains low owing to predation and hunting (Person and Brinkman 2013).....	P6, #13c	Disclosed the effect of logging on deer response to severe winters; did not directly examine the consequences of a potential low density deer population equilibrium	In the development of the 2008 Forest Plan, the analysis considered this potential.	
	Deer, wolf, and humans in this region therefore exist in predator-prey relationship that depends in large part on the habitat provided by the Tongass National Forest	P10, #20	Disclosed and discussed in a variety of contexts		
	Deer rely on old-growth forest habitats in the Tongass for their survival because these forests provide important winter habitat (Wallmo and Schoen 1980). Less snow accumulates in these old-growth forests, and deer can still find forage during the winter months. Low elevation, high volume old-growth forests provide the best winter habitat for deer (Schoen and Kirchhoff 1990). The logging of old-growth forest can therefore result in declines of deer populations, because with fewer acres of high quality winter habitat, fewer deer can survive the winter	P10, #21	Disclosed and discussed in a variety of contexts	Acknowledged and well analyzed in the Forest Plan	

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	In 2011, Brinkman et al. published a study in which they estimated a mean deer density decline in three watersheds in north-central Prince of Wales Island of 32% over a three year period, from 13.1 deer/km^2 in 2006 to 8.9 deer/km^2 in 2008, which the authors attributed to severe winters (Brinkman et al. 2011). Deer populations in unlogged areas (12 deer/km^2) were substantially higher than in recently logged areas (10 deer/km^2) and areas that were logged more than 30 year ago (7 deer/km^2)	P11, #22	Disclosed and analyzed in EIS; cited same paper and data/relationship		
	Big Thorne logging, if it goes forward, will remove the most important remaining deer winter habitat in many of the affected watersheds, which will further reduce the abundance of deer in the project area (especially following severe winters), perhaps for decades to come	P15, #31	Disclosed particularly in the analysis of deer habitat under different snow conditions.		
See Attachment 1, Point 5 for details	only 36% of the historic (before industrial logging) habitat capability for deer (winter carrying capacity during an average snow year) is protected within OGRs and other lands deferred from logging (Albert and Schoen 2007). In addition, a recent analysis of the amount of landscape-scale highvolume old growth on northern Prince of Wales Island has documented that this unique forest community (which is important as deer winter range in deep snow winters) was reduced by 93.8% from 1954 to 2004 (Albert and Schoen 2013)	P18 #34m	Analyzed and disclosed the changes in important deer winter habitat; analysis not limited to the strata as defined in the 2013 paper (?). Note: amount of deer winter habitat in OGRs was a consideration in reviewing biologically preferred locations for small OGRs	The status of winter deer habitat was disclosed and analyzed.	Examined in supporting narrative – Attachment 1, Point 5.

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	If a timber sale project results in deer habitat capability below 18 deer/mi^2, the likelihood is that predator-prey dynamics will become more erratic and the resilience of deer to predation, hunting, and winter weather is reduced	P19, #34o	Analyzed and disclosed in an analysis of both deer and wolf dynamics.	This concept was recognized and integrated into the Forest Plan Standard and Guidelines	
	I specifically advised the Forest Service that the deer guideline should be applied at the scale of a wolf pack home range (300 km^2) and not at larger scales such as a biogeographic province. This means running the deer model at a scale of one or two wildlife analysis areas (WAAs) to best approximate an area the size of a wolf pack's home range	P20, #34p	Analysis was accomplished at the scale of individual WAAs and consequences were disclosed.		
Wolf popn. Trend	Wolf populations in the Big Thorne project area have declined rapidly in recent years	P5, #13a	Analyzed and disclosed.		
	The population of wolves on Prince of Wales Island has declined substantially since the middle of the 1990s, especially within the north-central portion of Prince of Wales Island. I estimated the wolf population on the Prince of Wales Archipelago during autumn 1995 to be approximately 300-350 animals (Person et al. 1996; Person and Russell 2008)	P8, #15	Correct. Acknowledged/recognized in the EIS.		
	During 2000-2004, I estimated 250-300 wolves, again based on aerial counts within my study area on the Prince of Wales Archipelago	P8, #15	Correct. Acknowledged/recognized in the EIS.		

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	The Final Environmental Impact Statement (FEIS) for Big Thorne says that during a 2010 Alaska Board of Game meeting in Ketchikan, "ADF&G reported that anecdotal observations by state and Federal biologists, trappers, and hunting outfitters/guides suggested the wolf population had declined to as few as 150 wolves in GMU 2,"	P8, #15	Quote from EIS, so this is disclosed information.		
	I estimate that in the mid-1990s, at the time the TLMP conservation strategy and viability assessment were being developed, the Big Thorne project area had the habitat to support 45-50 wolves, making up approximately 3 separate packs and a portion of a forth pack	P9, #16	Number of packs were discussed in the analysis for the EIS.		
	In the Fall of 2012, we determined through DNA hair trapping and radio-collaring work that there were approximately 29 wolves in the Big Thorne project area and only two remaining packs in the area. Changes in pack structure are a reflection of turmoil and disturbance (Ballard et al. 1997). One of the packs is large; the other is so small it that it appears to be struggling to raise a successful litter of pups. The large group had two breeding females and covered an area that used to encompass the Honker Divide and Ratz Harbor wolf packs. Both females were killed last year; one was trapped legally and the other trapped illegally	P9, #18	Yes, analyzed in discussion of wolf mortality. This specific information was not disclosed and comes from an ongoing study designed to explore methods for estimating abundance. Note: this is an unpublished progress report; disclosure could have confounded the results of the ongoing wolf field project.		

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	In the Spring of 2013, based on our field work we could only account for six to seven wolves left in the Big Thorne project area. During the 2012 hunting season, trappers killed at least fifteen wolves in the Big Thorne project area, but that only accounts for legal, reported take. A few of these wolves could have been dispersing wolves (i.e., wolves travelling through the area and not a part of the resident packs), but the vast majority are likely to have been resident wolves.	P10, #19	Yes, analyzed in discussion of wolf mortality This specific information was not disclosed and comes from an ongoing wolf interagency study designed to explore methods for estimating abundance. Note: this is an unpublished progress report; public disclosure could have confounded the results of the ongoing wolf field project.		
	The current decline in wolves on Prince of Wales Island, including the Big Thorne project area, is caused primarily unsustainable hunting and trapping, which are facilitated by access provided by road development	P12, #25	Evaluated and disclosed.		
	Wolves can sustain about 35-38% total annual mortality (Person and Russell 2008). Natural mortality is about 5% (Person 2001; Person and Russell 2008), therefore, harvest mortality cannot exceed 30-33% without compromising sustainability	P12, #25	Recognized and disclosed.	Recognized and used as part of the Forest Plan development.	
	By 2010, there was evidence that the wolf population had greatly declined at least within the north-central portion of Prince of Wales Island (Person 2009-2012), which includes the Big Thorne	P13, #28	Disclosed and evaluated.		

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Points Matrix – Product of Meeting March 5 & 6, 2014					
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Isolation and genetics	Genetic and telemetry data indicate that the wolf population on the Prince of Wales Archipelago is an isolated population from other wolves throughout the Tongass (Person 2001; Weckworth et al. 2005; Person and Russell 2008), which complicates management of the population because it is not buffered by immigration and has limited genetic diversity	P8, #14	Acknowledged the genetic status stated in the literature, within the EIS. The analysis approach acknowledges the geographic status of GMU2.		
	the wolf population is genetically distinct and isolated from other wolves in the Tongass and, as a result, if wolves on Prince of Wales Island are extirpated or reduced to a small population, rescue or recolonization by dispersing wolves from the mainland is unlikely	P16, #33	The EIS does not explicitly disclose that if wolves on POW are "extirpated or reduced to a small population, rescue or recolonization by dispersing wolves from the mainland is unlikely".	Was acknowledged in the development of the Forest Plan FEIS.	
	The cumulative effects of 60 years of clear-cut logging plus the Big Thorne project could result in the ecological collapse of the predator-prey system and result in wolf numbers well below minimum viability both demographically and genetically, which would eventually result in their extirpation or extinction within the Prince of Wales Archipelago.	P7, #13d	Didn't directly address the question of genetic viability.	Was acknowledged in the development of the Forest Plan FEIS and made determination that wolf population was "viable and well-distributed" (NFMA requirement).	

Appendix A

Points Matrix – Product of Meeting March 5 & 6, 2014					
Topic Category	**Quote**	**Page/#**	**Examined in EIS?**	**Tiered from Forest Plan?**	**Additional Comments**
Summary Points	several factors have materialized since its adoption in 1997 that were not addressed in the 2008 amendment to the plan. … they are: (1) the precipitous declines in the numbers of wolves on Prince of Wales, (2) new information regarding the levels of illegal take as compared to legal take, (3) lack of an accurate road closure inventory, with reported closures often not effective at preventing access, and not providing the actual mitigation and/or protections that the Forest Service assumed they would when it adopted TLMP, and (4) the scientific knowledge that the OGRs simply are not large enough or adequately composed for a viable wolf population.	P21, #36	All these points are individually addressed above. Within the range of effects disclosed in the Forest Plan (excepting #1).	These summary points are all in regards to the Forest Plan (not Big Thorne issues)	
Broad Conclusions	The combined effects of Big Thorne and the other logging on wolves within the Prince of Wales Archipelago likely will be the collapse of a sustainable and resilient predator prey ecological community	P5, #11	The EIS examined wolf viability and concluded that Big Thorne may result in local declines in wolf numbers, "although wolf population viability has a high likelihood of being maintained" (Big Thorne ROD).	Demonstrated consistency with the Forest Plan.	
	I have concluded that the Big Thorne timber sale, if implemented, represents the final straw that will break the back of a sustainable wolf-deer predator-prey ecological community on Prince of Wales Island, and consequently, the viability of the wolf population on the island may be jeopardized	P5, #13	The EIS examined wolf viability and concluded that Big Thorne may result in local declines in wolf numbers, "although wolf population viability has a high likelihood of being maintained" (Big Thorne ROD).		

Appendix A

Points Matrix – Product of Meeting March 5 & 6, 2014					
Topic Category	**Quote**	**Page/#**	**Examined in EIS?**	**Tiered from Forest Plan?**	**Additional Comments**
	the Big Thorne project puts the viability of the wolf population on the Prince of Wales and the surrounding islands (the Prince of Wales Archipelago) in doubt	P6, #13b	The EIS examined wolf viability and concluded that Big Thorne may result in local declines in wolf numbers, "although wolf population viability has a high likelihood of being maintained" (Big Thorne ROD).		
	The wildlife conservation strategy in the 2008 TLMP is inadequate to deal with these issues both at the project level and at the biogeographic province. The cumulative effects of 60 years of clear-cut logging plus the Big Thorne project could result in the ecological collapse of the predator-prey system and result in wolf numbers well below minimum viability both demographically and genetically, which would eventually result in their extirpation or extinction within the Prince of Wales Archipelago	P7, #13d	The EIS examined wolf viability and concluded that Big Thorne may result in local declines in wolf numbers, "although wolf population viability has a high likelihood of being maintained" (Big Thorne ROD).		
	Based on the impacts to wolf and deer habitat and populations described above, Prince of Wales Island, including the Big Thorne project area, is at a tipping point with regard to a viable predator-prey dynamic between wolves and deer. The wolf populations on Prince Wales have been declining precipitously, and wolves are already facing the possibility of extinction on Prince of Wales Island	P14, #31	The EIS examined wolf viability and concluded that Big Thorne may result in local declines in wolf numbers, "although wolf population viability has a high likelihood of being maintained" (Big Thorne ROD).		

Attachment 1. Perspectives on Elements Identified for Further Consideration in Table A

Background

The Interagency Wolf Task Force Team produced a table (Table A) that documents our evaluation of the Statement of Dr. David K. Person (hereafter "Statement") on the Forest Service analysis for the Big Thorne Project. The table produced by the Task Force demonstrates substantial overlap in the elements examined in the Statement and the Forest Service record for Big Thorne. Six analysis points from the Statement were highlighted by the Task Force that warrant further consideration. In this attachment we provide the Interagency Team perspective on these points (which differ from the 5 broad conclusions listed at the end of Table A).

Evaluation

Point 1: Statement quote: *Indeed, an incremental reduction in deer habitat capability likely will result in a much larger effect on the predator-prey system owing to the nonlinear dynamics that characterize predator prey- habitat interactions (Person et al. 2001; Person 2001; Bowyer et al. 2005; Person and Brinkman 2013).*

Response: The record demonstrates that the Forest Service focused extensive analysis on the consequences of reduced deer habitat capacity resulting from timber harvest in the Big Thorne project area. The record also demonstrates careful consideration of the complex interaction among deer habitat, roads, deer abundance, wolves as predators of deer, and humans as predators of wolves. The Forest Service analysis, however, did not directly refer to the nonlinear nature of predator/prey interaction which is highlighted in the Statement. The absence of direct reference to nonlinear dynamics does not appear to indicate a failure to consider nonlinear dynamics in the Forest Service analysis. The FEIS references Person (2001), Person et al. (1996), and Person and Boyer (1997) – local science available at the time of the FEIS analysis that considers these dynamics. Furthermore, the Forest Plan, to which the FEIS tiers, focuses considerable attention on the modeling results displayed in the above references. Finally, biologists, ecologists and wildlife managers universally recognize the nonlinear character of predator/prey relationships (e.g. functional and numerical responses of predators and topics related to density dependence, see for example National Research Council 1997). The Forest Plan notes that the relationship between habitat availability and wildlife populations is commonly understood to be linear up to some threshold (TLMP FEIS 2008, p. 3-293). For these reasons, we conclude that the analysis in the record indicates that nonlinear dynamics were considered implicitly through the consideration of the best available science. We acknowledge the importance of the idea that, an incremental decline in the extent of quality winter deer habitat, building on past reductions, has the potential for nonlinear consequences for deer abundance. The form of the nonlinear relationship is uncertain and could involve accelerated negative consequences as habitat is removed early or late in the process of habitat conversion.

Point 1 of the Statement (see reference above) references Person and Brinkman (2013) which was published after the analysis contributing to the FEIS. The discussion of succession debt and the complex predator/prey interaction contained in Person and Brinkmann (2013) has been the subject of frequent discussion among Forest Service biologists and partner agencies/organizations including Dr. Person in the past. These concepts helped motivate the thorough analysis recorded in the FEIS; they were foundational to the evaluation, and are

examined in the FEIS. Therefore, the consideration of nonlinear dynamics is not seen as significant new information regarding the potential outcome of the proposed action.

Point 2: Statement quote: *I also concluded that persistently low deer numbers or even the perception of low numbers would increase the risk of unsustainable take of wolves by hunters and trappers attempting to boost deer populations, an activity facilitated by easy access to shorelines by boat and to island interiors by vehicles using roads. If this occurs on widespread areas on the Prince of Wales Archipelago, the viability of wolves would be at risk.*

Response: The record demonstrates that the Forest Service analyzed human harvest of both deer and wolves. The Big Thorne analysis, and the Forest Plan FEIS to which it tiers, both recognize the role of State and Federal regulatory mechanisms in management of sustainable wolf harvests. The Forest Plan motivates the Forest Service to propulgate regulatory proposals to address management issues for deer and wolves.

The Big Thorne analysis includes a thorough evaluation of wolf mortality focused on hunting and trapping of wolves, including illegal take of wolves. Human behavior was considered in evaluation of the effects of roads on harvest of wolves. Furthermore, the subsistence evaluation included consideration of the potential for increased competition for deer, as well as effects on deer abundance and distribution, and disclosed that in combination with past, present, and reasonably forseeable future actions, the project may result in a restriction of subsistence use of deer, motivating the Forest Service to notify the appropriate State agencies, local communities, and Southeast Alaska Federal Subsistence Regional Advisory Council and State Fish and Game Advisory Committees. The evaluation tiers to the analysis for 1997 and 2008 Forest Plans (see 1997 Forest Plan FEIS pp. 3-355 and 3-360, 2008 Forest Plan FEIS Amendment pp. 3-284 and 3-285, and Forest Plan p. 4-95) which contends that State and Federal agencies will fulfill their responsibility setting and enforcing appropriate regulations, and conducting information and education programs with respect to wolf harvest. The rapid, coordinated response of State and Federal agencies in closing wolf harvest in Game Management Unit #2 in March, 2014 (closed 19 March 2014) is an example. . [These ideas are addressed again in 'Point #4"]

USFWS and Logan (USFS) offer a diferent perspective. They suggest that, based specifically on discussions with trappers on Prince of Wales Island at recent public meetings, the primary objective of many of the island's most effective wolf trappers is to increase deer abundance. However, direct evaluation of the potential for humans to increase their efforts to kill wolves specifically to improve deer abundance in response to declining deer populations was not evaluated in the Forest Service analyses, and may be considered new information. The Big Thorne and Forest Plan analyses rely on existing regulatory processes to address this issue.

Point 3: Statement quote: *Prince of Wales Archipelago WAAs are highly connected for deer hunter access by the extensive network of roads and marine waterways. Hunting effort by individuals from throughout the Prince of Wales Archipelago is easily transferable from one area to others as one becomes more depleted than others, likely causing a deer deficit in one area to have a far ranging indirect effect, weakening the predator-prey system the Prince of Wales Archipelago-wide.*

Response: The record demonstrates that the Forest Service thoroughly evaluated deer habitat, potential consequences for deer abundance, and considered deer harvest by humans (Woeck, B. 2012). While the potential negative consequences of shifts in the geographic areas used by hunters as a result of changes in the distribution of deer was not addressed directly, managers

generally assume that hunter effort will shift over time as a result of changes in a variety of factors in addition to perceived and real deer abundance (e.g. effective access -- snowpack, weather along the coast for beach access). The phenomenon of changes in hunter use patterns occurs across the U.S. as ungulate populations change over time and is well-known (and part of standard management consideration) by wildlife managers. Furthermore, buck-only regulation is used when needed throughout North America to reduce the impact of deer harvest on productivity of deer populations. Buck-only, and limited doe harvest regulations on Prince of Wales Island similarly reduce the impact of harvest on deer population growth. Therefore, the dire consequences of shifting focus proposed in the Statement are not seen as significant new information regarding the outcome of the proposed Big Thorne Project.

USFWS and Logan (USFS) present a different perspective. They suggest that arguments regarding common understanding of shifting harvest and the use of buck-only harvest misses the point being made in the Statement. With buck-only restrictions, deer hunting can become very difficult, and hunters will move to new areas. When that happens, managers can expect deer populations to decline (the buck segment, due to hunting, leaving the female segment to support the local wolves). Wolf control is also likely to be implemented by citizens. Local depletions of deer, therefore, can result in deer declines and wolf control in distant areas. Consequently the point made in the Statement does represent new information.

Point 4: Statement quote: *As deer numbers inevitably decline on Prince of Wales Island as a consequence of on-going logging and the still pending succession debt of past logging (Person and Brinkman 2013), subsistence and recreational hunters increasingly will perceive competition from wolves for deer. Legal and illegal take of wolves can be predicted to increase as a result, particularly in areas accessible by roads or boats (Person et al. 1996; Person 2001).*

Response: The point from the Statement quoted here integrates the ideas addressed in Points #1, 2, and 3 above. See narrative above for Points #1, 2, and 3, for background and analysis of the points contained in this portion of the Statement.

The idea that hunters may perceive competition from wolves resulting in an increase in legal or illegal hunting/trapping of wolves was not addressed directly in the Record. An expectation that wolf mortality may increase as a result of the Big Thorne Project was evaluated and considered, but the particular motivation for increased mortality described in this quote was not considered directly and may be considered new information.

Point 5: Statement quote: *only 36% of the historic (before industrial logging) habitat capability for deer (winter carrying capacity during an average snow year) is protected within OGRs and other lands deferred from logging (Albert and Schoen 2007). In addition, a recent analysis of the amount of landscape-scale highvolume old growth on northern Prince of Wales Island has documented that this unique forest community (which is important as deer winter range in deep snow winters) was reduced by 93.8% from 1954 to 2004 (Albert and Schoen 2013).*

Response: The record demonstrates that the Forest Service disclosed and thoroughly evaluated changes in the distribution and extent of old-growth forest that occurred in the project area and the associated bioregion. Similarly, the Forest Plan, to which the FEIS analysis tiers, carefully disclosed Forest-wide patterns of forest harvest. Evaluation of deer winter habitat in particular examined patterns of change in old-growth forest as a result of logging, based on multiple categories of old growth (to account for changes in forests most likely to influence forage in winters with deep snow). Albert and Schoen (2013) noted that high-volume old-growth forest

was disproportionally harvested – a pattern well documented in the FEIS and Forest Plan and known to all who analyze timber harvest data from Southeast Alaska. Neither the FEIS nor the Forest Plan analyzed the consequences of harvest using the same old-growth categories employed in Albert and Schoen (2013). The Statement cites a particular reference from page 780 (Albert and Schoen 2013) to characterize the loss of old growth through timber harvest. The specific classification of old growth employed in Albert and Schoen (2013) was published after the environmental analysis was conducted for the Big Thorne Project, but merely represents a different system for forest structural classification, not new information. Furthermore, the understanding provided by the analysis (disproportionate harvest of the highest volume stands, particularly in northern Prince of Wales Island where very little of the highest volume old growth originally present, remains) has been appreciated for years and was disclosed in the Forest Plan which was tiered to in the Big Thorne analysis.

Point 6: Statement quote: *My analyses indicated that when about 40% of a pack's total home range is logged and roaded, there is a very high risk that mortality (mostly from hunting and trapping) will exceed reproduction and the pack area becomes a population sink. Indeed, even when as little as 25% of a pack's home range is logged, the ratio of reproduction to mortality is very close to one. Sinks are only maintained by immigration of wolves from other areas, which, as explained below, is not likely to happen on Prince of Wales Island given the population's isolation and small numbers.*

Response: The analysis for Big Thorne and references there-in carefully evaluated and disclosed the consequences of forest management, including road building and timber harvest on wolf mortality indicating the strong positive relationship between increasing development and increasing wolf mortality. The analysis did not specifically highlight particular levels of development such as the 40% and 25% noted in the Statement, nor did the FEIS or ROD link these to the potential for a population sink. We are unaware of published science that demonstrates the population sink thresholds for these biological systems identified in the Statement. The Statement presents information in a different way that was not reported in analysis of Big Thorne.

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