State of California
Department of Fish and Game

M e m o r a n d u m

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Subject: Additional Information Regarding Department of Fish and Game's Recommendation to Retain Large Old Trees on Timber Harvesting Plan 1-08-063 SMO "Lagomarsino"

The purpose of this memo is to provide the California Department of Forestry and Fire Protection (CAL FIRE) with additional information regarding Timber Harvesting Plan (THP) 1-08-063 SMO and the Department of Fish and Game's (DFG) recommendation to retain all large old trees within the project area. DFG provided the basis for this recommendation in our Pre-harvest Inspection (PHI) Report dated July 21, 2009.

Background

During the PHI, DFG staff observed a total of 44 redwood trees with old-growth characteristics within a 10-acre patch of large old trees. Many of these trees are likely over 200 years old. Although this 10-acre patch does not meet the Forest Practice Rule (FPR) § 895.1 definition of Late Succession Forest (LSF) due to its size, it possesses all other characteristics of LSF including the presence of multiple canopy layers, large decadent trees, snags, and large down logs. Some trees within the 10-acre patch possess multiple wildlife tree characteristics, including large and rotting basal hollow cavities, reiterated tops, and/or large spreading limbs. Of the 44 large old trees observed and recorded, 14 (32%) were marked for harvest. The majority of these 14 trees possessed a diameter at breast height (dbh) of 60 inches or more and 7 were observed to possess multiple beneficial wildlife tree characteristics. Many of the large old trees marked in each clump were observed to be of similar size to the largest trees in that clump not marked. Three clumps were observed to possess only one large old tree each, which was marked for harvesting.

The following discussion is intended to illustrate the importance and value to wildlife that this 10-acre patch provides due to its late-seral habitat elements.

Importance of Late-seral Habitat Elements

Late-seral forest habitats provide unique and ecologically significant habitat features. Late-seral forest habitats are characterized by the presence of specific features or "habitat elements." The principal structural components of old-growth forests are individual large old trees, snags, and logs (Bingham and Sawyer 1991; Franklin and others 1981; Franklin and Spies 1991; Maser and others 1988). The importance of these elements is reflected in the FPR definition of “Late Succession Forest Stands.” Mature forest stands with late-seral habitat elements have greater structural diversity and thus provide greater habitat value than stands without such elements. Other beneficial characteristics of late-seral forest habitats include multi-layered canopies, broad range in tree ages and sizes, and abundant shade tolerant species (Noss 1999).

Large Old Trees

Large-diameter living trees are important wildlife elements for species which utilize forested habitats. Much of the habitat value of these elements is provided by dominant canopy position and the presence of structural characteristics including cavities, reiterated crowns, platforms, dead tops, and basal hollows (Mazurek and Zielinkski 2004). According to Mazurek and Zielinski (2004), individual legacy trees support a greater number and diversity of wildlife species than non-legacy trees of merchantable size. They also found that legacy trees were used more often for nesting, roosting, resting, and foraging than non-legacy trees.

Due to increased light availability resulting from pre-dominant or dominant canopy position and crown injuries attendant to age, older conifers may develop multiple resprouted trunks arising from other trunks and branches. In comparison to older trees, young second-growth conifers tend to have relatively simple architecture: a single main bole with a crown comprised of small diameter horizontal lateral branches. Due to their long-life and resistance to wood-decay fungi, redwoods most often manifest benefits to wildlife as upright, mostly living trees. Their complex crowns promote biological diversity by providing a substrate for organic material accumulation, humic development, and crevice cover (furrowed bark) for nesting and bole-foraging birds. Thus, elevated soils form and create habitat for vegetation and terrestrial fauna, as well as food sources for birds (Sillett and Pelt 2000).

In the redwood region, large-old Douglas-fir have particular value as habitat elements due to their susceptibility to cavity decay and their tendency to develop large limbs, accumulate moss, and thus yield complex crown structure at a younger age than redwood. Large diameter branches and furrowed or loose bark are also important features of individual habitat elements (Franklin 2002).

Timberlands devoid of large living trees will not generate any large snags or downed wood. Existing large snags and downed wood fill a distinct ecological role simply because of their size but will decay over time and eventually disappear from timberlands in the absence of large living trees (Franklin 2002). The value of snags and downed wood is discussed in more detail below.

Large old decadent trees that were once abundant as wildlife habitat prior to the extensive historic logging of late-seral redwood forests are now relatively rare and often scattered on commercial and non-commercial timberlands (Thornburgh and others 2000). These forest elements are considered irreplaceable features for wildlife habitat. Mazurek and Zielinski (2004) found that cumulative effects of the retention and recruitment of legacy and residual trees in commercial forest lands will yield important benefits to vertebrate wildlife and other species of plants and animals that are associated with biological legacies. Considering the habitat values that large old trees provide to a broad range of species harvesting such trees may be incompatible with FPR § 897(b)(1)(B).

Snags

Important characteristics of snags (standing dead or mostly dead trees) include density, diameter, height, and state of decay. Snags are important forest habitat features which provide for nesting, foraging, and roosting by a variety of bird species and denning for many mammal species (Bull 2002, Bull and others 1997). Many locally occurring forest species depend[1] on or utilize[2] snags, including arboreal salamanders, turkey vultures, birds-of-prey, band-tailed pigeons, owls, white-throated swifts, woodpeckers, olive-sided flycatchers, western wood-peewees, violet-green swallows, nuthatches, brown creepers, winter wrens, bats, raccoons, long-tailed weasels, skunks, and bobcats (CDFG and California Interagency Wildlife Task Group 2005).

Trees with cavities are essential for reproduction for wood ducks, kestrels, western screech and saw whet owls, and Lewis' and acorn woodpeckers. Locally occurring species which depend on or utilize trees with cavities include arboreal salamanders, turkey vultures, northern pygmy owls, white-throated swifts, pileated woodpeckers, northern flickers, purple martins, red-breasted nuthatches, bats, long-tailed weasels, and skunks (CDFG and California Interagency Wildlife Task Group 2005). Pileated woodpeckers excavate cavities of trees, creating habitat for a number of other species. As strong excavators, pileated woodpeckers are capable of excavating in sound dead wood (Schroeder 1982) and they play a critical role in creating habitat for secondary cavity users. For this role, they have been described as keystone habitat modifiers (Aubrey and Raley 2002). Species of the area which use pileated woodpecker cavities include Vaux's swift, various ducks, American kestrel, various small owls, hairy woodpeckers, northern flicker, brown creeper, bats, squirrels, woodrats, and ringtail. Pileated woodpeckers annually excavate new nest cavities (Bull and Jackson 1995), thus requiring a greater availability of snags than is used in a single season (Schroeder 1982). Nest trees are usually dead and within a mature or old stand of coniferous or deciduous trees, but may be in relict dead trees in younger forests (Bull and Jackson 1995). Nest sites are rarely reused (Bull and Jackson 1995). Pileated woodpeckers require large tall snags for nesting (Schroeder 1982). A U.S. Fish and Wildlife Service Habitat Suitability Index model (Schroeder 1982) for pileated woodpeckers models habitat suitability on the basis of canopy cover, density of large trees, density of large stumps, density of large snags, and average diameter of snags.

Birds and mammals select the largest snags available (Richter 1993). Large snags provide all functions of small snags, but small snags do not provide all functions of large snags. For example, small snags typically are not of sufficient size to provide suitable sized cavities for many primary excavators. Additionally, large snags have longer persistence and provide habitat for a longer period (Richter 1993). Most researchers have recommended minimum diameters greater than or equal to 20 inches dbh to achieve adequate habitat value (Richter 1993). Classification schemes exist for describing state of decay (Cline and others 1980). Snags in advanced stages of decay, often called "soft snags," provide foraging substrate and nesting sites for weak excavators. Soft snags are unlikely to remain standing between

[1] "Secondary importance" in WHR habitat element classification.
[2] "Preferred" in WHR habitat element classification.

harvest cycles and persistence is difficult to project. Snags in early stages of decay or “hard snags” tend to last longer (Richter 1993). Primary cavity nesters (e.g., pileated woodpeckers) prefer hard snags for nest sites (Richter 1993). Douglas-fir may take approximately 35 years to develop from dead trees to soft snags (Cline and others 1980).

According to the “Department of Fish and Game Snag Resource Evaluation” (Richter 1993), a mean value of three snags per acre should be retained across the landscape. Likewise, Hunter (1990) suggests that two to four large snags per acre may be adequate to maintain most wildlife populations. Richter (1993) and Hunter (1990) also highlight the importance of retaining mature green trees to replace snags as they decay and fall. For example, Hunter (1990) recommends retaining patches of old forest distributed among younger stands. Protecting the old and large diameter conifers in patches of old forest will ensure large snags are continuously recruited.

Downed Woody Debris

Large downed logs provide breeding, feeding, and cover functions for many species of wildlife, particularly small mammals, reptiles, and amphibians. Size of logs is positively correlated with the range of wildlife species using them, types of uses provided, and the duration or habitat value derived from the log. Therefore, recruitment for large downed logs in the form of green trees should focus on the largest trees available so that habitat will be provided to the highest diversity of species as possible. Downed logs also provide humid and thermally stable microhabitats for amphibians and reptiles. Hollow logs are derived from hollow trees and only originate from live trees infected with heart-rot fungi (Bull and others 1997). Hollow trees take many years to develop and are therefore usually developed in large diameter trees.

Locally occurring species which depend on or utilize downed logs include newts and salamanders, western toads, California ground squirrels, western gray squirrels, deer mice, dusky-footed woodrats, coyotes, gray fox, raccoons, long-tailed weasels, skunks, and bobcats (CDFG and California Interagency Wildlife Task Group 2005).

Late-seral Forests as Carbon Sinks

Luyssaert and others (2008) found that old-growth forests remove carbon even when fully mature, and old forests are better than forest plantations at dependably removing carbon dioxide from the atmosphere. Carbon is sequestered for long periods in old-growth ecosystems, both in trees and down woody debris. Perhaps more importantly large amounts of carbon are sequestered in the soils and old tree root systems of old-growth forests, where undisturbed they act as underground carbon reservoirs.

Recommendation

The THP provides no supporting evidence that habitat elements lost from harvesting 14 large old trees will be created in other trees by the next harvest cycle. Based on site conditions, DFG believes creation of old-growth characteristics within existing second-growth trees is impossible in a 10- to 15-year time frame. Replacing the structural conditions and functional wildlife values of any harvested existing legacy trees with current second-growth redwood would likely require 200 years or longer (Noss 1999). Planned harvest rotations on most commercial forestlands do not permit trees to mature to their age of maximum value to wildlife (Mazurek and Zielinkski 2004). Selection silviculture does not automatically provide adequate wildlife tree retention and recruitment. While selection forestry maintains a cover of standing green trees, without measures that ensure long-term retention of individual trees, trees are usually harvested before they develop beneficial habitat characteristics. Recruitment may be interrupted through thinning or felling of stems in the upper size classes. In one case study, Kenefic and Nyland (2000) found reductions in snag and cavity tree density occurred following selection treatments.

Gellman and Zielinski (1996), Hunter and Mazurek (2003), and Hunter and Bond (2001) found that fire-derived basal hollows provide particularly high wildlife habitat value. In another study of the habitat value provided by legacy trees, Mazurek and Zielinski (2004) found the presence of a basal hollow to add the greatest habitat value to legacy trees. The presence of legacy redwoods with basal hollows is rare in private timberlands and the formation of new basal hollows is even rarer given that most fires on private lands are suppressed (Finney 1996). Trees with basal hollows are of extremely high value and are an irreplaceable habitat feature. Therefore, trees with high wildlife value providing late-seral habitat elements within the THP area that are lost during this harvest and that were lost during the previous harvests will likely never be replaced, particularly if the trees being harvested are in excess of 200 years old and possess basal hollows.

Only three to five percent of original old-growth forest remains, which is mostly found within a patchy mosaic of second- and third-growth forests (Thornburgh and others 2000). The majority of forest stands within the Santa Cruz Mountains are second-growth and do not possess old-growth characteristics. The dominance of second-growth trees throughout the Santa Cruz Mountains is due to the harvesting of old-growth trees in the late 1800s and early 1900s. This turn-of-the-century harvesting created a regional scarcity of late-seral forest habitat and large old trees, which are even more uncommon on managed timberlands. Loss of the large old trees and their late-seral habitat elements within the 10-acre patch of large old trees on-site will further decrease the overall value and diversity of habitat provided for wildlife resources throughout the Santa Cruz Mountains.

DFG believes that harvesting and mitigation as proposed in this THP in conjunction with the last entry and foreseeable future entries will further contribute to the cumulative significant adverse permanent loss of late-seral habitat elements and high quality wildlife trees on this property. Under the current plan, it is possible that almost all of the large old trees within the 10-acre patch of large old trees could be harvested before the existing second-growth on-site develops into similar type large old trees. This eventual loss of the majority of large old trees on-site will also curtail any recruitment for snags and large woody debris and ultimately eliminate much of the late-seral habitat elements currently present on-site. Given this loss of existing large old trees coupled with the lack of recruitment of late-seral habitat elements within the THP area, the THP does not appear to comply with FPR § 897(b)(1)(B and C). To comply with the FPRs and avoid significant adverse impacts, all trees exhibiting old-growth characteristics, all large woody debris, and all snags should be retained.

If you have questions or comments regarding this memorandum, please contact Ms. Terris Kastner, Environmental Scientist, at (408) 365-1066; or Mr. Richard Fitzgerald, Coastal Habitat Conservation Supervisor, at (707) 944-5568.

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References

Aubrey KB, Raley CJ. 2002. The pileated woodpecker as a keystone habitat modifier in the Pacific Northwest. USDA Forest Service. Technical Report PSW-GTR-181.

Bingham BB, Sawyer JO, Jr. 1991. Distinctive Features and Definitions of Young, Mature, and Old-Growth Douglas-Fir/Hardwood Forests. In: Ruggerio LF, Aubry KB, Carey AB, Huff MH, Brookes MH, Agee JK, Anthony RG, Franklin JF, Noon BR, Raphael MG and others, editors. Wildlife and Vegetation of Unmanaged Douglas-fir Forests. USDA Forest Service General Technical Report PNW-285. p 363-378.

Bull EL. 2002. The value of coarse woody debris to vertebrates in the Pacific Northwest. Pages 171-178 in: Proceedings of the Symposium on the Ecology and Management of Dead Wood in Western Forests. Laudenslayer WF, Jr. , Shea PJ, Valentine BE, Weatherspoon CP, Lisle TE, editors. Reno, Nevada. Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.

Bull EL, Jackson JA. 1995. Pileated Woodpecker (*Dryocopus pileatus*). In: Gill FB, Poole A, editors. The Birds of North America: Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Bull EL, Parks CG, Torgersen TR. 1997. Trees and logs important to wildlife in the interior Columbia River Basin. USDA, Forest Service. General Technical Report PNW-GTR-391. 55 p. http://www.fs.fed.us/pnw/pubs/gtr391/.

CDFG, California Interagency Wildlife Task Group. 2005. California Wildlife Habitat Relationships System [personal computer program]. Version 8.1. Sacramento, California: California Department of Fish and Game.

Cline SP, Berg AB, Wright HM. 1980. Snag characteristics and dynamics in Douglas-fir forests, western Oregon. Journal of Wildlife Management 44(4):773-786.

Finney, M.A., 1996. Development of fire scar cavities on old-growth redwood. Pp. 96-98 in J. LeBlanc (Tech. Coord. & Ed.), Proceedings of the conference on coast redwood forest ecology and management. U.C. Coop. Extens. 170 pp.

Franklin JF, Cromack K, Jr., Denison W, McKee A, Maser C, Sedell J, Swanson F, Juday G. 1981. Ecological characteristics of old-growth Douglas-fir forests. Portland, Oregon: USDA, Forest Service, Pacific Northwest Forest and Range Experiment Station. General Technical Report PNW-118. 48 p.

Franklin JF, Spies TA. 1991. Composition, Function, and Structure of Old-Growth Douglas-Fir Forests. In: Ruggerio LF, Aubry KB, Carey AB, Huff MH, Brookes MH, Agee JK, Anthony RG, Franklin JF, Noon BR, Raphael MG and others, editors. Wildlife and Vegetation of Unmanaged Douglas-Fir Forests. USDA Forest Service General Technical Report PNW-285. Portland, Oregon: US Forest Service, Pacific Northwest Research Station. p 71-82.

Franklin, J.F., et al., 2000. *Threads of continuity: Ecosystem Disturbance, Recovery, and the Theory of Biological Legacies.* Conserv. Biol. In Practice. 1(1):9-16.

Franklin, J.F.; Spies, T.A.; Pelt, R.V.; Carey, A.B.; Thornburgh, D.A.; Berg, D.R.; Lindenmayer, D.B.; Harmon, M.E.; Keeton, W.S.; Shaw, D.C.; Bible, K.; Chen, J., 2002. Disturbances and structural development of natural forest ecosystems with silvicultural implications, using Douglas fir forests as an example. Forest Ecology and Management [For. Ecol. Manage.]. Vol. 155, no. 1-3, pp. 399-423.

Gellman, S.T., and W.J. Zielinski, 1996. *Use by Bats of Old-growth Redwood Hollows on the North Coast of California*. J. Mamm. 77(1):255-265.

Hunter ML. 1990. Wildlife, Forests, and Forestry: Principles of Managing Forests for Biological Diversity. Upper Saddle River, New Jersey: Prentice-Hall, Inc. 370 p.

Hunter, J.E., and M.L. Bond, 2001. Residual trees: wildlife associations and recommendations. Wildlife Society Bulletin 2001, 29(3):995-999.

Hunter, J.E., and M.J. Mazurek, 2003. *Characteristics of Trees Used by Nesting and Roosting Vaux's Swifts in Northwestern California*. West. Birds 34(4):225-9.

Kenefic, Laura S.; Myland, Ralph D. Habitat diversity in uneven-aged northern hardwood stands: a case study. Res. Pap. NE-714. Newton Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 4 p.

Luyssaert, S., Detlef-Schulze, E. Dorner, A., Knohl, A., Hessenmoller, D., Law B. E., Ciais P., Grace J. Old-growth forests as global carbon sinks. Nature, 455:7210(2008), p. 213-215.

Maser C, Tarrant R, Trappe JM, Franklin JF. 1988. From the forest to the sea: a story of fallen trees. Pacific Northwest Research Station, United States Forest Service. General Technical Report PNW-GTR-229. 153 p.

Mazurek, M. J. and W. J. Zielinski. 2004. Individual legacy trees influence vertebrate wildlife diversity in commercial forests. For. Ecol. and Manage. 193: 321-334.

Noss RF, editor. 1999. The Redwood Forest - History, Ecology, and Conservation of the Coast Redwoods. Washington, D.C. and Covelo, California: Island Press. 366 p.

Richter D. 1993. Snag Resource Evaluation (A Literature Review). California Department of Fish and Game, Environmental Services Division. Administrative Report 93-1. 32 p.

Schroeder RL. 1982. Habitat suitability index models: Pileated woodpecker. US Fish and Wildlife Service. FWS/OBS-82/10/39. 15 p.

Sillett SC, Pelt RV. 2000. A redwood tree whose crown is a forest canopy. Northwest Science 74(1):34-43.

Thornburgh, D.A., Noss, R.F., Angelides, D.P., Olson, C.M., Euphrat, F., Welsh, H.J. 2000. Managing redwoods. Pages 229-262 In The Redwood Forest: History, Ecology and Conservation of the Coast Redwoods. R.F. Noss (ed.) Island Press, Covelo, California. 339 pp.