Response of wintering bald eagles to industrial construction in southeastern Washington

James M. Becker

Abstract Wintering bald eagles (*Haliaeetus leucocephalus*) use night roost trees located along the Columbia River shoreline at the Hanford Site in southeastern Washington state for daytime perching. The Hanford Bald Eagle Site Management Plan requires evaluation of nonroutine human activities that occur within an 800-m line of sight of roost trees. We monitored the effects of construction of a large industrial facility on eagle daytime use of roost trees located 460 m distant and in direct line of sight. No evidence indicated that construction activity negatively affected eagle use of roost trees, as measured by time spent perching, presence or absence, and flush response. The 800-m line-of-sight guideline might in some cases be overly protective of wintering bald eagles exposed to acute human activity, particularly if eagles are already habituated to less severe types of disturbance.

Key words bald eagle, construction, disturbance, *Haliaeetus leucocephalus*, Washington, winter

Bald eagles (*Haliaeetus leucocephalus*) winter along the Columbia River shoreline at the United States Department of Energy's (DOE) Hanford Site in southeastern Washington state. Eagles utilize night roost trees for daytime perching, during which time they are generally obscured from most human activities due to topography. The notable exception to this generality is roost trees at the 100-K Area, where eagles are in direct line of sight of human activities that occur in the vicinity.

The Hanford Bald Eagle Site Management Plan (BESMP; Fitzner and Weiss 1994) prescribed 800-m line-of-sight diurnal buffers around all roost trees for routine operation and maintenance activities, except in the 100-K Area, where eagles appear to be habituated to such activities. However, the effects of nonroutine activities of a larger scale require thorough evaluation (Fitzner and Weiss 1994).

The Cold Vacuum Drying Facility (CVDF; 43 m long × 15 m wide × 9 m high) was constructed from 1997 to 1998 in the 100-K Area, at approximately 460 m from and in direct line of sight of the adjacent roost trees. Construction required use of large cranes and other heavy equipment, increasing human presence and noise well beyond that of ongoing routine operation and maintenance activities. Consequently, we implemented a monitoring plan to evaluate the effects of construction on eagle daytime use of the roost trees, as measured by time spent perching, presence or absence, and flush response.

Study area

During this study, the Columbia River at the Hanford Site (Figure 1) was a regionally important refugium for wintering bald eagles. The period of residence of bald eagles on the Hanford Site generally was from early November until mid-March. The Columbia River was a major spawning area for fall chinook salmon (*Oncorhynchus tshawytscha*) and a wintering area for waterfowl (primarily mallards [*Anas platyrynchos*]), both of which were prey for wintering eagles. Most of the arboreal shoreline vegetation consisted of exotic trees, mostly white

Author's address: Pacific Northwest National Laboratory, P.O. Box 999, K6-85, Richland, WA 99352, USA; e-mail: james.becker@pnl.gov.

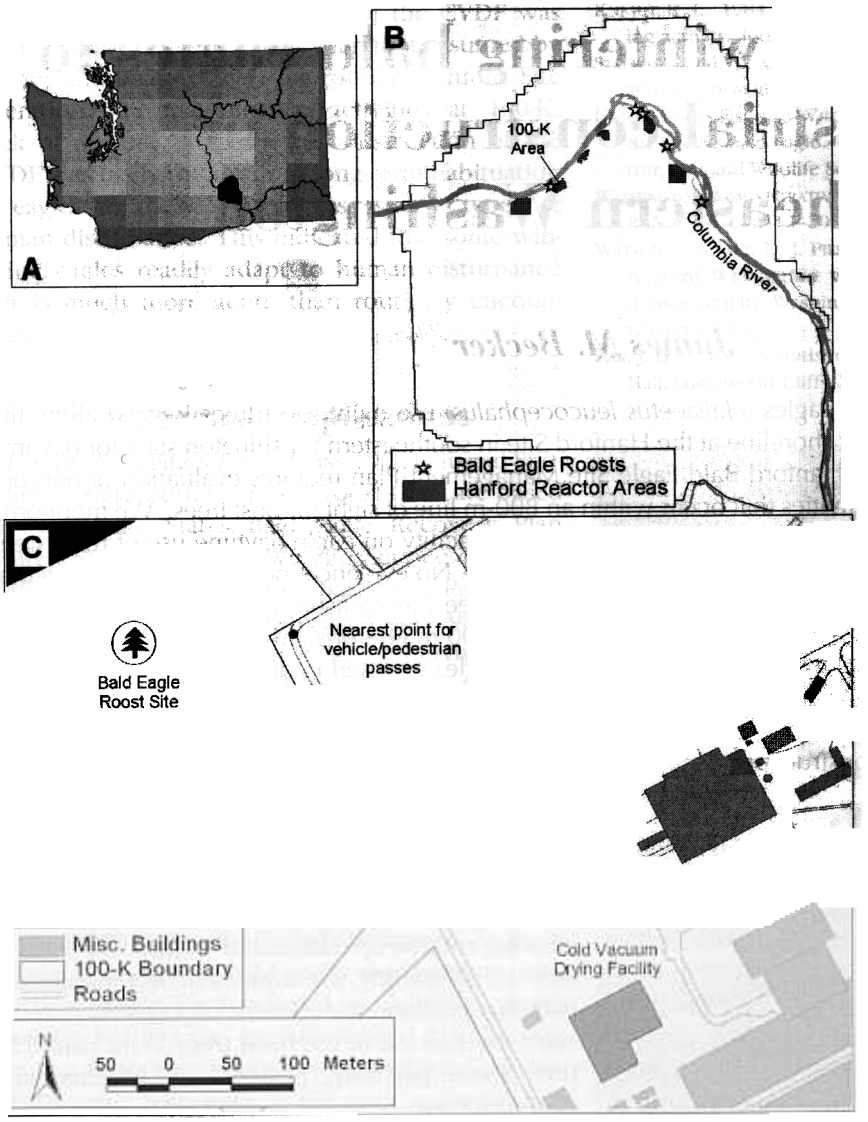


Figure 1. Location of the Hanford Site in Washington state (A), reactor areas and major bald eagle roosts (B), and the Cold Vacuum Drying Facility (CVDF) and nearby roost trees at the 100-K Area (C).

poplar (*Populus alba*), black cottonwood (*P. trichocarpa*), black locust (*Robinia pseudoacacia*), and Siberian elm (*Ulmus pumila*). These trees were planted as windbreaks or shade trees prior to the establishment of the Hanford Site Nuclear Reservation in 1943 and provided night roost and daytime perch sites for eagles (Fitzner and Weiss 1994).

During the 1960s nuclear reactor construction activity and operation were considerable (Fitzner et al. 1980). However, operation of the nuclear reactors ceased by the early 1970s. Since that time, bald eagle use of the Columbia River shoreline has generally increased (Fitzner et al. 1980). Current locations of major roost sites are provided in Figure 1.

The topography and location of facilities along the Hanford side of the Columbia River helped shield eagles using roost trees from most routine human activities. The reactors and associated facilities were located above the river on bluffs that ranged from 9–21 m in height. This height and the location of the facilities back from the edge of the bluffs minimized the line-of-sight effect human activity might have had on bald eagles. Additionally, in the absence of irrigation water since 1943, many of the trees have died and fallen. Since few trees remained along the river, perches at elevations subject to line-of-sight effects at the reactor areas were scarce. However, the 100-K Area was a notable exception, as eagles that perched in the adjacent group of roost trees (Figure 1) were in direct line of sight of human activities that occurred in the vicinity (Fitzner and Weiss 1994).

Methods

Construction of the CVDF at 100-K commenced the week of 17 November 1997. We conducted regular 2-hr observational monitoring surveys 3 days per week (2 on weekdays [during construction] and 1 on the weekend [no construction]) between 21 November 1997 and 14 March 1998. We stratified the 2-hr survey periods to occur within 3-hr time blocks (morning [0700–1000 hrs], midday [1000–1300 hrs], and afternoon [1300–1600 hrs]).

Stratification ensured that the 3 time blocks would be similarly represented in both weekday surveys (9 2-hr surveys between 0700 and 1000 hrs, 7 between 1000 and 1300 hrs, and 9 between 1300 and 1600 hrs) and weekend surveys (4 2-hr surveys between 0700 and 1000 hrs, 5 between 1000 and 1300 hrs, and 3 between 1300 and 1600 hrs). Consequently, a difference in use of roost trees between workdays and weekends could not be attributed to differences in the time of day that surveys were conducted; instead, such a difference could be attributed to construction activities.

With the use of binoculars, we observed eagles from inside a passenger vehicle adjacent to the CVDF construction site. We recorded the total number of minutes one or more eagles used roost trees during a 2-hr survey period. Numbers of minutes spent by eagles in roost trees during 2-hr surveys were non-normally distributed (Shapiro Wilk W test, $W=0.75$, $P<0.0001$; Zar 1984). Consequently, we ranked and analyzed these data nonparametrically using the Mann-Whitney test (Zar 1984) to evaluate differences between weekdays and weekends.

During the 2-hr survey periods, we recorded the number of times eagles flushed from roost trees in response to crane operation (e.g., during loud bouts of noise). We also recorded the number of times eagles flushed in response to vehicles and pedestrians passing on the road just inside the 100-K Area perimeter fence, at 117 m from and in direct line of sight of roost trees (Figure 1).

We conducted instantaneous surveys of eagle occurrence in roost trees prior to construction of the CVDF on weekdays from 16 December 1996 to 31 March 1997 and during construction on weekdays from 21 November 1997 to 19 March 1998. Instantaneous surveys consisted of an observer noting presence or absence of eagles in roost trees at any given time between 0700 and 1600 hrs. We compared frequencies of instantaneous surveys where eagles were present in and absent from roost trees prior to and during construction using 2-way chi-square contingency table analysis.

Results

The number of minutes per 2-hr survey eagles spent in roost trees was not significantly different ($U_{0.05\,(2),\,25,\,12}=141$, $P=0.77$) between workdays ($\bar{x}=82.4$, SE=9.3, $n=25$) and weekends ($\bar{x}=94.1$, SE=10.9, $n=12$). Based on the instantaneous surveys, we noted no difference ($\chi^2_{0.05,\,1}=0.47$, $P=0.49$) in eagle occurrence in roost trees prior to (eagles present in 69% of the surveys, $n=108$) and during (eagles present in 65% of the surveys, $n=172$) construction of the CVDF.

Roost trees at 100-K were used almost exclusively by adult eagles. Eagles flushed only once from roost trees, during a bout of loud noise caused by crane operation. At no other time was it apparent that eagles were flushed from roost trees as a result of construction activities. Eagles flushed from roost trees only once during a total of 38 pedestrian passes. Eagles did not flush during 28 passenger vehicle passes.

Discussion

Despite ongoing Hanford Site routine operation and maintenance activities (e.g., well drilling and sampling; surface radiation surveys and sampling; facility maintenance, decontamination, and demolition; river monitoring; security patrols; tours; archaeological and ecological studies) in the 100-K Area since 1952, the adjacent roost trees have been occupied by at least 2 adult eagles since the mid-1980s. This long-term residency suggests a higher degree of tolerance by these eagles for such human activity. This may explain the almost complete lack of flush response at 100-K from pedestrians and passenger vehicles that passed at 117 m and in direct line of sight of these roost trees.

In contrast, when approached by hikers in a forested environment, mean flush distance was 183 m for wintering bald eagles perched in shoreline trees in the Skagit River Bald Eagle Natural Area (Stalmaster and Kaiser 1998). The difference in habituation between Stalmaster and Kaiser (1998) and this study was one of several that have been noted in bald eagle tolerance to human activities (Knight 1984, Watson and Pierce 1998).

We found no evidence to demonstrate that construction of the CVDF negatively affected bald eagle use of adjacent roost trees, as measured by time spent perching, presence or absence, and flush response. Similar results have been reported from elsewhere, where bald eagles occurred in close proximity to construction activities. For example, in western Washington, residential construction did not adversely affect post-brooding behaviors—as measured by flush response—of nesting eagles located 20 m from the building site (Stalmaster and Kaiser 1998).

It appeared that construction of the CVDF was no more disturbing to eagles than that assumed by Fitzner and Weiss (1994) for routine Hanford Site operation and maintenance activities at 100-K. Lack of adverse effects from construction of the CVDF was likely the result of long-term habituation of eagles to these routine, less severe types of human disturbance. This indicated that some wintering eagles readily adapt to human disturbance that is much more acute than routinely encountered.

Management implications

The BESMP (Fitzner and Weiss 1994) diurnal 800-m line-of-sight buffers around roost trees are based on the Pacific States Bald Eagle Recovery Plan (United States Fish and Wildlife Service [USFWS] 1986) and Washington State's Bald Eagle Protection Rules (Washington Administrative Code 1986). This prescription might in some cases be overly protective of wintering bald eagles exposed to acute human activity, particularly where eagles are already habituated to less severe types of disturbance, as was the case in this study.

The USFWS is currently preparing a rule that proposes delisting the bald eagle. Should the bald eagle be delisted, federal and state protective prescriptions, including those in the BESMP (Fitzner and Weiss 1994), would likely be removed. In their absence, site-specific bald eagle management prescriptions might be developed to further promote recovery. In this case, we recommend that the size of buffer zones around roost trees be based on site-specific eagle responses to the most acute type of human disturbance, where such data are available.

Literature cited

FITZNER, R. E., D. G. WATSON, AND W. H. RICKARD. 1980. Bald eagles of the Hanford National Environmental Research Park. Pacific Northwest National Laboratory, Richland, Washington, USA.

FITZNER, R. E., AND S. G. WEISS. 1994. Bald eagle site management plan for the Hanford Site, south-central Washington. United States Department of Energy, Richland, Washington, USA.

KNIGHT, R. L. 1984. Responses of wintering bald eagles to boating activity. Journal of Wildlife Management 48:999–1004.

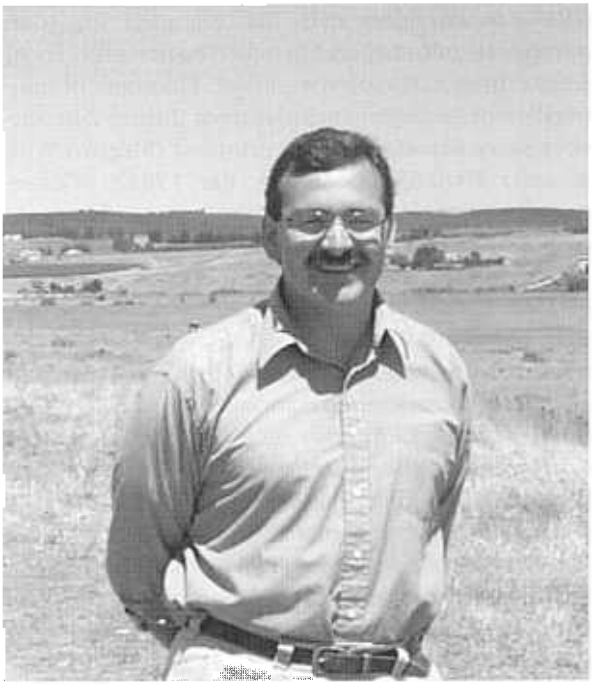
STALMASTER, M. V., AND J. L. KAISER. 1998. Effects of recreational activity on wintering bald eagles. Wildlife Monographs 137.

UNITED STATES FISH AND WILDLIFE SERVICE. 1986. Recovery plan for the Pacific bald eagle. United States Department of the Interior, Fish and Wildlife Service, Portland, Oregon, USA.

WASHINGTON ADMINISTRATIVE CODE. 1986. Bald Eagle Protection Rules. No. 232-12-292.

WATSON, J. W. AND D. J. PIERCE. 1998. Ecology of bald eagles in western Washington with an emphasis on the effects of human activity. Washington Department of Fish and Wildlife, Olympia, USA.

ZAR, J. H. 1984. Biostatistical analysis. Second edition. Prentice-Hall, Englewood Cliffs, New Jersey, USA.



James Becker is employed as a research scientist by Battelle, Pacific Northwest National Laboratory. He received his B.S. from Brigham Young University in range and wildlife ecology and his M.S. from the University of Washington in wildlife science. He served as a post-graduate fellow at the University of Munich in the Department of Wildlife Biology and Forestry. His interests include environmental impact analysis, ecological risk assessment, restoration of damaged ecosystems, and wildlife habitat enhancement.

Associate editor: *Euler*