Outdoor Recreation & Raptors

A Guide to Adaptive Management

under the Migratory Bird Treaty Act

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This document may be used in the development of recreation policy and wildlife conservation measures on public lands. Specifically, this information relates to rock climbing and the protection of raptor species.

Public land managers (federal, state, and local) may find that the information provided is useful as it explores the best-available science in the field of ornithology particularly in regards to Peregrine Falcons. Rock climbers, who recreate on public lands in close proximity to raptors federally protected under the Migratory Bird Treaty Act such as Peregrine Falcons, often experience access issues due to overly-restrictive public land closures.

This guide provides land managers and recreation groups with scientific information necessary to alleviate conflicts that may arise between public access and needs set forth by agency conservation measures. Therefore, the goal of this document is to provide knowledge that may lead to the implementation of adaptive management practices that enable government officials to uphold the public trust as it relates to natural resources and recreation.

The document contains a literature review of raptor-based science beginning in the 1960s into 2019, as well as Questions to be asked at the end of each section that may assist adaptively to manage the uncertainties of managing recreation and raptors.

A beta electronic workbook that accompanies this document is in development, available upon request.

Contents

INTRODUCTION

Falconry has introduced many of America's first climbers to the sport of climbing (Aulman 1992, Patagonia 2018, Sellinger & Disharoon 2018). By 2017, more than 1 million people throughout the United States were engaged in some form of outdoor rock climbing. Rock climbing's increased popularity coincides with a remarkable population growth of once-endangered raptor species that inhabit our climbing areas. This nexus between recreation and wildlife has resulted in conflicts despite climbers' pivotal role in recovering the Peregrine from the brink of extinction (Ratcliffe 1993:170).

Buffer zones have been routinely prescribed in management plans in the US since 1963 (Mathisen 1968). A "buffer zone" is defined as the minimum area around a nest that must be kept free of human intrusion to prevent harmful effects associated with disturbance. Work by Stalmaster and Newman (1978) on Bald Eagle habitat utilization recommended buffer zones as particularly useful during sensitive times of the year (Olendorff et al. 1980). Since 1997, the most common approach to managing Peregrines in the Western United States has been to designate circular primary, secondary, and tertiary management zones, with activities being most restrictive in the primary zones (USDA Forest Service 1977, USDI Fish and Wildlife Service 1977). However, there are few supporting records where observations of disturbance have been explicitly recorded for the standard distances being prescribed (White and Thurow 1985, Holmes et al. 1993, Ruddock and Whitfield 2007:3).

As early as 1995, Knight and Temple described four primary categories to be important factors for assessing restrictions that may facilitate management of recreation and wildlife (Knight and Temple 1995:328). These include: 1) spatial, 2) temporal, 3) behavioral, and 4) visual. In Pyke et al. 1997, Kathryn Pyke with the assistance of Heide Anderson and Tom Cade (Peregrine Fund), Jerry Craig (Colorado Div. Wildlife), Bob Hoffa (Jefferson County Open Space), Patrick Jodice (Oregon State University Dept. Fish & Wildlife) published recommendations for adaptively managing raptors in climbing areas. They listed five considerations for determining the spatial extent of restrictions (Pyke 1997:11). These include: 1) physical features as visual barriers, 2) physical features as sound barriers, 3) vertical height, 4) pattern of climbing use, 5) prior disturbance history & tolerance of raptors.

This document examines and builds on recommendations by Knight and Temple (1995), Pyke et al. (1997), Ruddock and Whitfield (2007). The following discussions can be summarized as:

1. Law and Policy
2. Eyrie Assessment of Site Resiliency,
3. Resiliency to Activities,
4. Response Sensitivity,
5. Seasonal Sensitivity, and
6. Adaptive Management.

Several red flags that appear to challenge conventional wisdom will be discussed in further detail. They include:

- Raptors do not instinctively associate noises as threatening (Edwards 1969:157, Stalmaster and Newman 1978:511, Gilmer and Stewart 1983, Holthuizen 1986, White and Thurow 1985:19, Ellis, Ellis, & Mindell 1991, Ruddock and Whitfield 2007:138). There would be little if any benefit to considering noise disturbances in designing your buffers;
- The periods of courtship, nest selection, and incubation are the most sensitive periods while disturbances are unlikely to result in nest abandonment once eggs have hatched with increased tolerance as the season progresses (White and Thurow 1985:16-18, Holthuizen 1986, Ratcliffe 1993:271-272, White 2012:5, Peterson 2018);
- In areas with multiple nesting opportunities and a history of movement, it may be beneficial to allow access until a ledge is chosen each season before designing and implement a closure. Tolerance in this species is highly likely, although it is dependent on the regularity and form of disturbance which occurs as non-intrusive 'background', especially once perceived as non-threatening (Ruddock and Whitfield 2007:141);
- Thomas Cade observed that there seems to be a minimum radius around eyries, perhaps 350 feet, which

is vigorously defended at all times by nearly all nesting Peregrines (Ratcliffe 1993:271-272);

- Influence of topography and tree density on visual disturbances at the eyrie ledge should be considered when establishing buffers (Camp et al. 1997, Pyke et al. 1997, Ruddock and Whitfield 2007:141);
- The height of the nest ledge above the vegetation should be considered when estimating distances (Ruddock and Whitfield 2007:136).

Each section concludes with a list of 'Questions to be asked' that will be useful for assessing the needs within your particular area. The intent of this document will be to provide guidance for establishing reasonable management buffers and expectations during sensitive periods using the "Best Available Science and Scholarship" so that land managers and recreation users can find consensus rather than compromises in making informed decision on when to enter into areas during periods that are potentially sensitive for raptors. This is an adaptive process. As such, it is recommended that any agreement on buffers be regarded as a starting point to the understanding of your area until further validation through monitoring occurs. This iterative cycle of decision making, monitoring, and assessment, repeated over the course of a project will lead gradually to a better understanding of resource dynamics and an adjusted management strategy based on what is learned (Williams & Brown 2012:vii).

LAW AND POLICY

On June 30, 1995, the U.S. Fish and Wildlife Service published an Advance Notice of intent (Notice of Intent) to remove the American Peregrine Falcon from the list of endangered and threatened wildlife. This proposal was promoted and supported by the majority of raptor biologist involved in Peregrine recovery (Millsap et al. 1998). Peregrine were removed from the endangered species list in 1999. Bald Eagles were later removed from the list in 2007. Both species have been classified by the International *Union for Conservation of Nature* (IUCN)[1] as a species of "*Least Concern*" (Birdlife International 2016).

Raptors enjoy limited protection under the Migratory Bird Treaty Act of 1918 (MBTA)[2]. Raptors, as with all migratory birds, are federally protected from hunting or collecting for commercial purposes, without a permit. Specifically, this Act implements the United States' obligations under four international avian protection conventions making it unlawful, except as permitted by regulations, to **"pursue, hunt, *take*, capture, kill, possess, sell, barter, purchase, ship, export, import, transport, or carry specified migratory birds or their nests or eggs."**[3]

While the MBTA is a clearly crafted Act, interpretations for usages of the word "take"[4] has been a point of contention. Conflicting opinion often obscures the lines between the Endangered Species Act ("ESA") and the MBTA. Future decisions of how to manage migratory birds that are not considered threatened will come from litigation in Federal courts and from Opinions issued by the US Department of Justice Solicitor General.[5]

Questions that arise during litigation have included liability under MBTA if death of a migratory bird occurs from:

1. A foreseeable result of an ultra-hazardous activity, such as pesticide manufacturing[6], or

[1] The International Union for Conservation of Nature (IUCN) is the global authority on the status of the natural world and the measures needed to safeguard it. The IUCN maintains a worldwide listing of threatened and endangered species known as the "Red List". The Unites States is a member country of the IUCN.

[2] as amended (16 U.S.C. § 703; "MBTA"). The original agreement between the US and Great Brittan (for Canada). The United States subsequently entered into similar agreements with four other nations (Canada, Mexico, Japan and Russia).

[3] 16 U.S.C. §§ 703, 704.

[4] An act that indirectly results in "take" that results from an activity, but is not the purpose of that activity. (*USF&W Regulations 50 C.F.R. 17.4 (2012), Solicitor General. USDI. Opinion M-37050, December 2017, USDI USF&W 2018, Trump Administration*). [16 U.S.C. Section 707(b) (2012) requires that the government prove a defendant knowingly acted in violation of the MBTA [United States vs. Pitrone, 115 F.3d 1, 6 (1st Cir. 1997)].

[5] Solicitor General is a politically appointed position, therefore issued Opinions can and have been influenced by each administration.

[6] United States v. FMC Corporation (1977).

2. All acts that foreseeably and directly cause migratory bird deaths "by any means or in any manner".[7]

In 2001, a Presidential Order [13186] amended the definition of "take" to include both "intentional and unintentional take"[8]. This broader interpretation of "take" was adopted by the US Fish and Wildlife Service in 2012 to include enforcement against "any taking", even if such taking was incidental to the carrying out of an otherwise lawful activity. MBTA encourages the intent of migratory bird convention by integrating bird conservation principles, measures, and practices into activities by avoiding or minimizing, to the extent practicable, both intentional and unintentional adverse impacts on migratory bird resources.[9] Consistent with the MBTA Presidential Order 13186 recognized and promoted economic and recreational values of birds, as appropriate and encourages developing partnerships with non-Federal entities to further bird conservation.

In 2017 the Solicitor General's Office issued Opinion M-37050 followed by guidance issued in a US Fish and Wildlife Service memo that narrows the scope of "take" to "only direct and affirmative purposeful actions that reduce migratory birds, their eggs, or their nests, by killing or capturing, to human control."[10] This narrow definition is supported by a growing majority of federal circuit courts. They have concluded that "take" does not include unintentional harm to migratory birds that occurs in the course of otherwise lawful commercial activities (Yung and Woodsmall, 2018) [11,12,13,14,15].

Raptor management under MBTA will continue to be influenced by Presidential Administrations and Federal Court decisions. Future discussions on "take" would be more pertinent to oil and natural gas activities than to recreation management plans. Pertinent to recreation management is "harassment" defined under ESA as an action that creates the likelihood of injury to an threatened or endangered species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering. MBTA does not protect against "harassment" that does not, or is unlikely to result in "take".

PERMITED TAKE

Legal harvest of wild-caught migratory Peregrine Falcons is permitted for licensed Falconry. The US Fish and Wildlife Service allows for a 5% annual harvest of Peregrine from the wild (USFWS 2008). Using the U.S. Fish and Wildlife Service harvest guideline, and an estimate of hatch-year Falcons (after mortality), Franke (2016) estimated the combined annual harvest limit in Canada, the United States, and Mexico could be conservatively set at 840 hatch-year Falcons without negative impact to the breeding population. Annual harvest permits are issued through State Fish and Game offices. Regulations on permitting harvest of wild-caught Peregrines can vary wildly from State to State.

CONCLUSION

Future decisions to "incidental take" will not affect the objectives or usefulness of this management guide which provides important steps for addressing NEPA's requirement to federal agencies for assessing "*potentially significant*" environmental impacts of their actions and consider "Best Management Practices" and mitigation measures as appropriate. Assessing probability and significance for harassment resulting in "take" will be important in the context of that actions effect on habitat characteristics, the recreational activity, how and where it occurs on the landscape, response and seasonal sensitivities of the raptors.

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[7] United States v. Moon Lake Electric 1999; United States v. Apollo Energy 2010.
[8] Executive Order 13186 of January 10, 2001 Sec. 2.a. (Bush G.W. Administration).
[9] Executive Order 13186 of January 10, 2001, Sec 2(a), Sec 3 (14 & 15), Bush, G.W. Administration.
[10] Opinion M-37050 2017:41 (Trump Administration).
[11] Seattle Audubon Society v. Evans (1991).
[12] Newton County Wildlife Association v. United States Forest Service (1997).
[13] 16 U.S.C. 707(b) (2012).
[14] United States v. Pitrone (1997).
[15] United States v. Citgo Petroleum Corporation (2015).

Whether impacts are "*significant*" depends on their "*context and intensity*"[16]. "*Context*" considers the setting of the proposed action, including the affected region, interests and locality; "*intensity*" refers to: the severity of impact, including:

- Beneficial and adverse impacts,
- Unique natural characteristics of the geographic area,
- The degree to which the effects of the action are likely to be highly controversial, uncertain, or pose unique or unknown risks,
- The degree to which the action may establish a precedent for future actions,
- The degree to which the action may adversely affect an endangered or threatened species or protected critical habitat, and
- Whether the action threatens a violation of federal law imposed for protecting the environment.

The measure of "*significance*" under MBTA for IUCN designated species of "Least Concern" will necessarily carry a higher burden of proof than protecting a threatened and endangered species under ESA. Under ESA bias was placed on proof of a "*not likely to effect*" or "*no effect*" of an activity before allowing that activity to occur. Bias under ESA favored for Type 1 statistical errors, while under MBTA bias will be placed on greater proof of "*direct effect"* favoring for Type 2 statistical error before an activity should be denied. Therefore to deny a recreational activity from occurring under MBTA should require a higher level of scholarship and science than that experienced under ESA authority.

Regulations on permitting harvest of wild-caught Peregrines can vary wildly from State to State and is outside the scope of this guide. We recommend before assisting in any harvest activities:

1. Know the person you are assisting,
2. Verify they possess a current license for Falconry that specifically includes Peregrine,
3. Verify they possess a current harvest permit that specifically includes Peregrine and specific to the State you are in,
4. Become familiar with the terms of your State's permit process so you understand the legal limits of your assistance,
5. Know what you are doing or seek guidance.

[16] 40 C.F.R. § 1508.27(b)(1) – (10). https://www.law.cornell.edu/cfr/text/40/1508.27

EYRIE ASSESSMENT OF SITE RESILIENCY

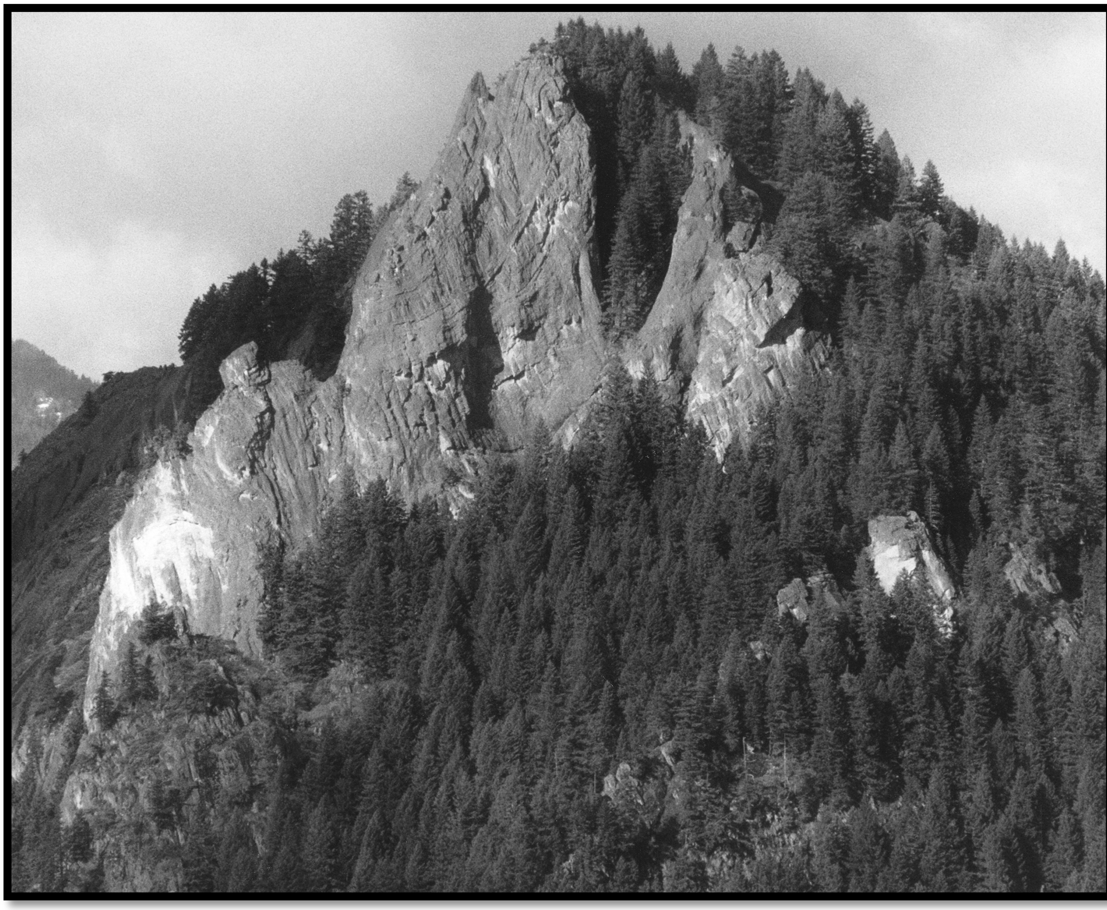

FIGURE 1. EYRIES LOCATED ON SOLID CLIFFS OR STRUCTURES, INACCESSIBLE TO PREDATORS, WITH AN OPEN VIEW FOR HUNTING FROM THE NEST LEDGE WILL OFFER AN ADVANTAGE FOR RAISING YOUNG IF THERE IS AN ABUNDANCE OF PREY NEARBY.

How raptors and other animals function in their environment is primarily driven by their interactions between the habitats they occupy, the individual's experiences, needs and fitness, and behavioral strategies of the species. The dynamics of the habitat in which raptors occupy are key factors in their stability (Nattrass & Lusseau 2016). Eyrie (nesting) assessments look at the potential of a site to attract and support nesting raptors. It is clear that some of the ideas of what constituted suitable habitat needs reexamination in light of the rapid expansion in Peregrine populations into urban habitats around the world. This increase in population involves not only the occupation of what we would traditionally consider high quality cliff habitat, but also the use of lower quality habitats as populations increase and quality nest sites become taken and adapting to cliff-surrogates, such as quarries and buildings (Ratcliffe 1993:169, Newton 1998:4).

Habitat quality can be defined according to its inherent ability to sustain a population long term, without net immigration. It is the replacement rate and the difference between reproduction and mortality, which determines whether a population can persist (Newton 1991:82). Nesting places, where breeding is most successful, are preferred and competed for, and that many birds moved to such 'high-grade' places as they aged (Newton 1991, Anderson, D. et al. 2019). Other places classed as low-grade are occupied sporadically and largely by young birds breeding for the first time. Newton (1991) found that young birds occupying lower quality sites later in life, move to the 'high grade' places where breeding success is higher.

Rodenhouse et al. (2006) identifies two essential features of site-dependence as:

1) Environmentally caused differences in suitability for reproduction and/or survival, among sites, and
2) Pre-emptive site occupancy, with the tendency for individuals to initially select or move to sites of higher suitability as they become available.

They found that these two features, acting together, generate a negative feedback when less suitable sites are used as population size increases. Further, when population size decreases, only sites of high suitability are occupied (Ratcliffe 1993, Rodenhouse et al. 1997). The risk and magnitude of having a site-dependent negative feedback will depend on the distribution of suitable sites (Rodenhouse et al. 2006). Wightman & Fuller (2006) found that nest sites with certain habitat characteristics are used more consistently and through time these sites are associated with higher, more stable productivity than lower quality sites. Call (1979:32) has identified four important criteria to nesting ledge selection. These include:

a) Site location in relation to suitable habitat for prey species,
b) Freedom from unaccustomed disturbances perceived as threatening,
c) Freedom from terrestrial predation,
d) Cliff height above tree canopy, continuity, and degree of unobstructed view from scrape or nest ledge, and
e) Relatively permanent or solid substrate and freedom from excessive deposition of rock and soil onto the eyrie ledge.

These same features attract Falcons to urban bridges and buildings in spite of varying levels of disturbance. Observed movements from rural to urban areas suggest that Peregrines may be selecting urban areas based on higher prey abundance, higher density of breeding birds, and an absence of most natural predators (Kauffman et al. 2003:1806).

Habitat Features – Worldwide, Peregrine Falcons select the most dominant cliffs or structures with respect to their surroundings (e.g., Cade et al. 1996:3-14, Brambilla et al. 2006, Rodríguez et al. 2007) and likely providing better hunting opportunities. Pairs occupying higher cliffs usually achieve greater hunting success rates (Ratcliffe 1993; Jenkins 2000). Jenkins (2000:243) found that Peregrines hunt with greater success close to their nest cliff during the critical stages of the breeding cycle when energy demands on males is greatest. He found that aerial hunts were less successful than hunts from the nest ledge (8% vs 16%, $p < 0.001$), and flush hunts where prey had to be flushed from dense vegetation were less successful than direct strikes at prey in open flight (4% vs. 15%, $p=0.001$) (Jenkins 2000, 240-241).

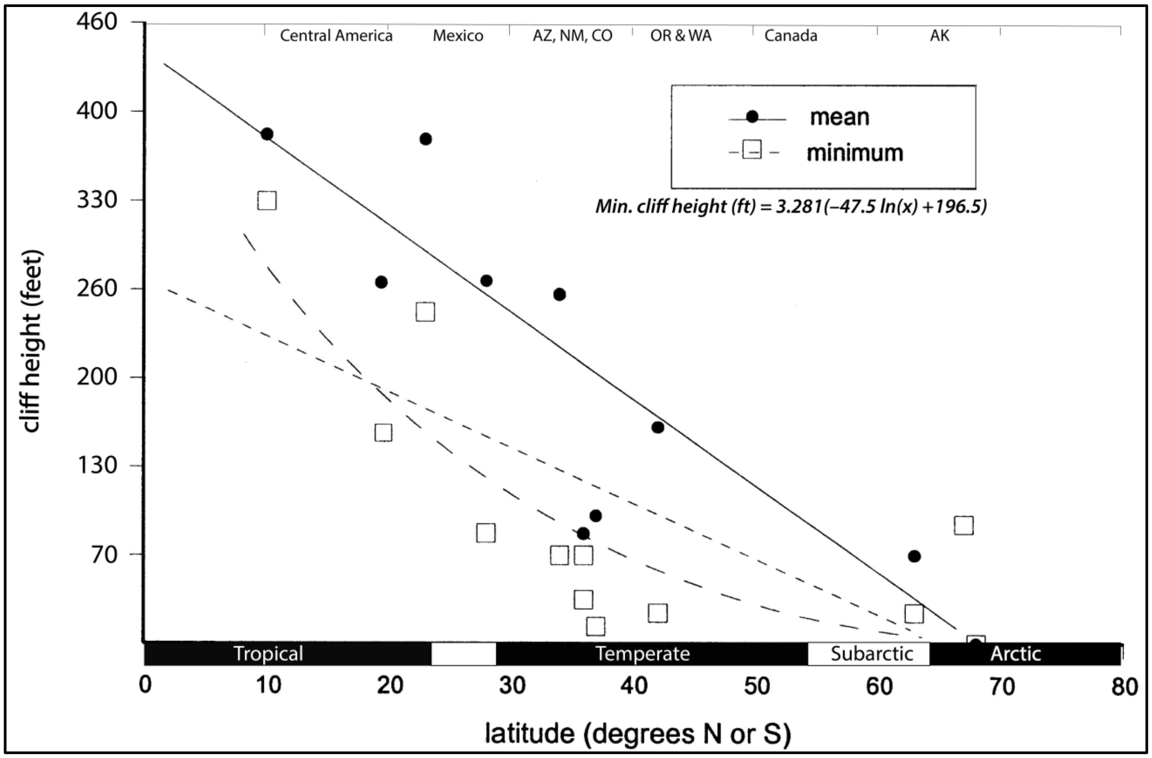

FIGURE 2. CLIMATIC INFLUENCE ON PEREGRINE NESTING HEIGHT DISPLAYED AS LATITUDE (X) VS CLIFF HEIGHT (ADAPTED FROM JENKINS AND HOCKEY 2001:361).

Peregrine pairs occupying high cliffs are likely to forage more efficiently, breed more successfully (e.g. Mearns & Newton 1988, Jenkins 2000), and achieve higher rates of adult survival and lifetime reproductive success, than pairs on low cliffs. Jenkins (2000:243) observed discrepancy between strike success and total elevation that may best be explained in terms of the Falcons' access to the prey base. Heights of cliffs used by Peregrines vary according to their availability, showing a preference for higher, more dominant locations with respect to the surrounding area (Hamerstrom et al. 1973, Pepler et al. 1991, Ratcliffe 1993, Gainzarain et al. 2000, Rodriguez et al. 2007). This fact is positively related with breeding success and foraging efficiency (Mearns & Newton 1988, Jenkins 2000).

The height of the cliff may also be more important in mid to late successional woodland areas, since a low cliff only 165 feet high would provide a limited vantage point over a 30 to 100-foot high canopy (Mendelsohn 1988:305). Ratcliffe (1993) suggested Peregrines can tolerate any number of people in the nesting haunt provided the eyrie is inaccessible. The heights of nesting cliffs should be considered and therefore be interpreted as distances at which the nearest human activity could occur without being perceived as a threatening and serious disturbance (Pyke 1997:11; Knight and Temple 1995; Homes et

al. 1993:465; Ratcliffe 1993:224; Knight and Cole 1913; Knight and Knight 1986; Russell et al. 1980; Skagen et al. 1980). The importance of cliff height is most likely related to:

a) Predator protection, through increased predator visibility and lower accessibility (Mearns and Newton 1988, Ratcliffe 1993),
b) Foraging opportunities, and
c) Importance of cliff height can be influence by climatic conditions and latitude (Jenkins & Hockey 2001:361).

CLIFF CHARACTERISTICS

Newton (1991), and Wightman & Fuller (2006) found a clear association between grade of nesting place (i.e. frequency of use) and breeding performance. He found that high-grade sites had earlier mean laying dates and a greater fledgling success than on low grade sites. Anderson (2019:11) found that prey availability and the distribution of prey resources close to the eyrie is most likely a critical element to nest selection.

Grade-A Cliffs: High quality – Grade A sites are high enough on cliff faces to afford consistent visibility and protection that will not change over time. Rice (1965) describes these cliffs as usually an almost sheer rock face, or closely spaced pinnacles over, 200 feet (>60m) high from the top to the wooded slope beneath and is part of a rocky escarpment at least 500 feet (150m) long, providing lookout points and cover for the Falcon, with more than one 'good' nesting ledge (Rice 1965:156). However, Jenkins &

FIGURE 3. EXAMPLE OF GRADE-A WALLS. THESE WALLS OFFER MULTIPLE SCRAPE OR NEST LEDGE OPPORTUNITIES WITH WIDE OPEN VIEWS FOR HUNTING AND ARE INACCESSIBLE TO MOST PREDATORS. PREFERRED NESTING HEIGHT WILL VARY DEPENDING ON THE RELATIVE CLIMATIC ZONE. PHOTO CURTESY SCOTT PETERSON.

Hockey (2001:361) found the optimum cliff height will vary by latitude and will not always include an expansive 200 feet. Primarily, in tropical and temperate climates Grade A cliffs are high enough over the surrounding vegetation that temporal changes in vegetation will not adversely affect hunting close to the eyrie. While in higher latitudes with cold temperatures, severe winds, and lower vegetation there may be an advantage eyries that are lower to the ground.

A "good" nesting ledge will be one that is protected by an overhang of rock from the direct rays of the sun and direct rain and that contains material, either rock products or soil, in which a slight indentation known as a "scrape" can be made by the Falcon to contain her eggs. In some cases the hen may occupy an existing stick nest to contain her eggs, but will not create one on her own (Rice 1965:156).

Grade-B Cliffs: Usually an almost sheer or jumbled rock face <200 feet high and less than 500 feet in width with at least one "good" nesting ledge and other possible 'fair' nesting ledges. The cliff is part of a rock escarpment of a less extensive nature than that known as an "A" cliff (Rice 1965:156). Again, the concept of optimum cliff height will need to be qualified to your location referencing. Grade B cliffs can be affected by temporal changes in vegetation that can adversely affect or enhance hunting close to the eyrie. Therefore, quality ratings for these cliffs can fluctuate between Grades B and C as the surrounding vegetation changes (Newton 1991:83). History is important in shaping fire behavior in mixed-severity landscapes, as patterns laid down by previous fires can play a significant role in shaping future fires. Like low-severity forests in the western United States, many dry mixed-severity types experienced significant increases in stand density during the 20th century, threatening forest health and biodiversity (Perry et al. 2011). You will often find high disturbance plant indicators or their remnants surrounding Grade B and C cliffs. For example, in the Pacific Northwest common indicators of a historically active fire

FIGURE 4. EXAMPLE OF GRADE-B WALLS. THESE WALLS OFFER WIDE OPEN VIEWS FOR HUNTING AND ARE INACCESSIBLE TO MOST PREDATORS. THESE CLIFFS ARE MADE UP OF SMALLER ROCK ESCARPMENTS OF A LESS EXTENSIVE NATURE THAN THOSE CONSIDERED AS CLASS "A" CLIFF. PREFERRED NESTING HEIGHT WILL VARY DEPENDING ON THE RELATIVE CLIMATIC ZONE. NOTE HOWEVER IN THIS PARTICULAR CASE THE SCRAPE OR NEST LEDGE IS LOCATED ON THE OPPOSITE SIDE OF THE MIDDLE PINNACLE WITH LIMITED VISIBLITY FROM THE EYRIE. IN THIS CASE THE EYRIE WOULD BE DOWN RATED TO CLASS C .

disturbance regime may include various species of ceanothus (approx. 10-20 years), knob cone pine (10-60 years), madrone (approx. 15-35 years), and chinquapin (roughly 20-150+ years). Such indicator species will become subdominant, eventually dying out, as there are interruptions to natural disturbance regime. Such interruptions can occur through programmatic fire suppression efforts or even well-meaning attempts to preserve existing habitat conditions around eyries. For this reason, a "let-burn" policy is recommended (Whitacre 1976) and/or harvest to open stands followed by treatments to remove fuel concentrations. Mosaic burn patterns such as those observed in Yellowstone National Park after the 1988 fire season result in an increase in vegetative diversity, which promotes bird diversity and abundance (USDI National Park Service 1991). Benefits have also been reported in California where avian prey can increase following a fire when their food supply increases (California Dept. of Forestry 1982) Increases in avian prey species after fire may benefit Peregrine Falcons in the area (Greater Yellowstone Coordinating Committee 1988). For more information on other fire return intervals departures for the western US refer to Safford et al. (2011), Buma et al. (2013), Oregon State University (2019), and Skinner (2019).

Grade-C Cliffs: These are short cliffs (relative to your latitude) consisting of one or more rock outcroppings, one or more of which contain a possible Falcon nesting ledge. It is usually part of a 300-foot wide or lesser escarpment of a more continuous nature, different from the contiguous "good cover" type present in "A" or "B" cliffs (Rice 1965:156). Small size cliffs with a vegetative screen over the lower portion can make it more difficult to defend adding to the concept of it being marginal nesting habitat (White 2012:2). Peregrines prefer to have big open spaces around and in front of the scrape site providing more defensible space and room for them to make defensive dives called stoops. Vegetation screening close to the scrape or nest ledge can lower the overall cliff quality grade (Hamerstrom et al. 1973). Grade C cliffs are often affected by existing vegetation that can adversely affect hunting close to the eyrie.

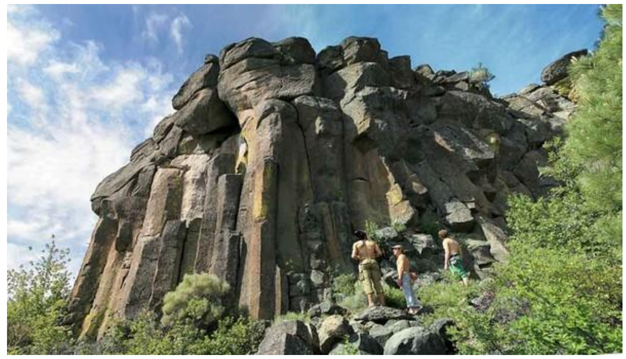

FIGURE 5. EXAMPLE OF GRADE-C WALLS. THESE WALLS ARE ACCESSIBLE TO PREDATORS WITH LIMITED SUITABLE SCRAPE OR NEST LEDGE OPPORTUNITIES. PREFERRED NESTING HEIGHT WILL VARY DEPENDING ON THE RELATIVE CLIMATIC ZONE (FIGURE 1). VIEWS FROM THESE SHORTER WALLS CAN BE AFFECTED SURROUNDING VEGETATION MANAGING. VEGETATION TO INCREASE VIEWS COULD UPGRADE-CLIFFS IN LEFT PHOTO TO CLASS B

Smaller cliffs or portions of the cliff offering at least one safe nesting site will typically be chosen over larger broken cliffs when they are less contiguous and more accessible to predation. For example, Ratcliffe (1993) found in the *Galloway Cliffs of Moher* some pairs scrape regularly in 50 to 65 foot high cliffs (Grade-B). He found that two broken escarpments of some 300 feet high were only occasionally used (Grade-C portion) though they are ideally located for regular nesting. The difference is that the smaller regularly occupied (Grade-B portion) crags offered at least one good nesting site safe from predators, whereas the taller broken cliffs do not (Ratcliffe 1993:169).

Higher grade-cliffs are those offering multiple nest sites with protection from predators and will offer greater overall resiliency than cliffs of lower quality (Wightman and Fuller 2006). Hickey (1969) noted in retrospect, that scrapes typically deserted by 1940, before the use of DDT, were located on cliffs that were “inferior” to the cliffs that remained occupied after 1940. Eyries on lower quality Grade-C cliffs were less difficult to locate and more easily accessible to predators, game wardens, and egg collectors.

FIGURE 6. GALLOWAY CLIFFS OF MOHER DISCUSSED IN RATCLIFFE (1993). PEREGRINES TYPICALLY REOCCUPY THE LOWER THIRD OF THESE CLIFFS. THE LEDGES AND LOOSE ROCK OF THE UPPER TWO THIRDS ALTHOUGH HIGHER PROVIDE LESS STABILITY AND ARE MORE ACCESSIBLE TO PREDATION. THESE CLIFFS PROVIDE EXCELLENT HUNTING OPPORTUNITIES FROM THE SCRAPE OR NEST LEDGE WITH WIDE OPEN VIEWS AND ABUNDANT PREY.

Those that were deserted by 1945 were, to a lesser degree, “inferior” to the last group that was not deserted until 1950 (Grade-B). Finally, the last to be deserted during the era of DDT contamination were the most “superior” (Grade-A) of all the eyries (Hickey 1969:157, Rice 1965).

> **"FROM THE BRIEF VISIT IT SEEMS THAT FOR SCAVENGER, AND PERHAPS PREDATOR, ACCESS IS INDEED EASY, SINCE THERE WERE NOT THE NUMEROUS FEATHERS, CARCASSES AND SO FORTH THAT ARE USUALLY FOUND AT "HIGH QUALITY" NESTING CLIFFS."**
>
> – Clayton M. White (2012:2)

A trend towards less optimum nesting habitats is partly a response to increasing recruitment pressure under the favorable balance between output and mortality, but must also involve some degree of adjustment to human disturbance (Ratcliffe 1993:169). In some of these less suitable sites where Peregrines are attempting to establish themselves, constructing or augmenting more suitable ledges can be an option climbers may be able to assist with. These scrape or nest ledges are typically described as having a minimum dimension of 12 inches high x 24 inches long x 16 inches (Call 1979:33). A few have been excavated into cliffs using shovels to make some of these less-than-ideal locations more suitable for nesting (Call 1979:32). Additionally, gravel can sometimes be added to provide for more suitable scrape sites on bare rock ledges.

Water Sources - Peregrines are dependent on a water source to sustain their prey base of small birds (Porter and White 1973). Higher Peregrine densities will occur where water bodies, ridges and coastal strips act as refugia and provide "highways" for movement of birds (Olsen and Olsen 1988:258). Ellis (1982) and Mendelsohn (1988:305) found that most nesting cliffs were within 3 miles of a permanent stream or pond) in dry habitats where water is limiting.

Aspect and Climate– In very warm climates, eyries tend to be located in protected positions where they would seldom, if ever, be exposed to direct sunlight to protect incubating females and nestlings from potentially lethal overheating (Beecham and Knochert 1975). By contrast, in cool climates eyries are often exposed to the sun, presumably for extra heating (Mendelsohn 1988:303, Ratcliffe 1988). In environments where weather conditions are particularly cold and windy scrape or nest ledges tend to be in lower positions (Jenkins and Hockey 2001:361). Zuberogoitia et al. (2015, 2018:61) found a strong correlation between nestling survival and weather conditions where eyrie quality and shelter capacity were important factors in nestling survival during severe cold-wet weather events in the spring (April and May).

TABLE 1. CRITERIA USED FOR DETERMINING OVERALL ROCK QUALITY BASED ON CLIFF CHARACTERISTICS. A HIGHER VALUE HAS BEEN ASSIGNED TO LESS FAVORABLE HABITAT CHARACTERISTICES. FINAL QUALITY RATING IS ESTIMATED AS A TOTAL AVERAGE.

Cliff Characteristics - QUALITY CLASS					
C	*value = 1*	*b*	*value = 0*	*a*	*value = -1*
	At least one outcropping with a single active or historical nesting ledge. Use of these lower grade ledges may vary from year to year and fledging success should be expected to be more sporadic with higher mortality than at other higher grade sites.		At least one outcropping with active or historical nesting activity and at least one “good” nesting ledges with other possible “fair” nesting ledges.		At least one outcropping with active or historical nesting activity and multiple “good” nesting ledges.
	Access to the top of the rock is not technical with easy rappel or scrambling access into the nesting ledge (<5.6).		Access to the top of the rock and into the nesting ledge requires a lower level of technical climbing experience (<5.10b).		Access to the top of the rock and into the nesting ledge requires technical climbing & aid experience (>5.10b).
	Smaller or broken cliff escarpments, providing fewer lookout points and less available air space for hunting coverage from the nest ledge than Grade A or B. Permanent features such as buildings or geologic features may restricts a boader view from the nest ledge.		Almost sheer or jumbled rock face <200 feet high and less than 500 feet in width with at least one “good” nesting ledge and other possible ‘fair’ nesting ledges. The cliff is part of a rock escarpment of a less extensive nature than that known as an “A” cliff.		Provides lookout points and quality hunting coverage for Peregrine from the nest ledge that is at least 200 feet above the surounding vegetation with over 250 feet of open rock face or man-made structure on either side of the nest ledge (minimum open face of 200 ft verticle and 500 ft horizontal).
	Weathering rock or soil above rock face results in periodic deposition of rock and soil onto the eyrie ledge.		Nest ledge may have poor substrate for drainage and holding eggs, but rock quality provides for relatively stable substrate, free from excessive deposition of soil onto the eyrie ledge. Peregrines will often move into stick nests of other species at these sites. Quality may descrees overtime as these nests degrade.		Rock (or made-made structual) quality provides for relatively permanent or solid substrate, good drainage, free from excessive deposition of rock and soil onto the eyrie ledge.
	The eyrie is greater than 3 miles of an open permanent or seasonal water source.		The eyrie is within 3 miles of an open seasonal water source, but greater than 3 miles from a permanent water source.		The eyrie is within 3 miles of an open permanent water source, particularly in dry habitats.
	The viewshed for 1/4 mile out is predominently covered in dense even age stands or late-successional vegetation.		Located near a flyway or open water source. The viewshed for 1/4 mile out is predominently covered in moderate to mixed density early & mid-successional vegetation.		Nest ledge overlooks a flyway or open water source. The viewshed for 1/4 mile out is predominently openings surrounded by moderately to mixed density early & mid-successional vegetation. This option would also apply to urban areas.
	Site fledges young less consitently than would be expected for a higher quality site. Young often disappear without explanation, possibly due to permitted take or predation from easy access, or mortality from exposure.		Regularly fledges young typically from a single ledge site each year. Use this selection if there are no monitoring records for this site.		Regularly fledges young each year. Nest ledge locations along the cliff face can change from year to year.
	Vegetative screening in front of eyrie ledge or over lower portion of the cliff resulting in a partial horizontal or vertical obstruction of view. May represent a Class-B site that has missed a disturbance cycle (i.e. fire) and is outsides its typical disturbance regime.		There is a clear unobstructed horizontal and vertical view from the nesting ledge. Maintaining disturbance cycles (i.e. fire) can be important to maintaining an open view from the eyrie ledge. Grade B cliffs can be affected by temporal changes in vegetation that can adversely affect or enhance hunting close to the eyrie.		There is a clear unobstructed horizontal and vertical view from the nesting ledge for both hunting and preditor detection. Maintaining a clear view from the nest ledge is not dependent on disturbance cycles.
	Scrape or nest ledge aspect and/or visual obstructions do not provide adequate solar exposure or protection to help young thermal regulate relative to latitude and climatic conditions.		The nesting ledge has suitable sun exposure and protection for most but not all of the nesting season to allow young optimum thermal regulate.		The nesting ledge has overhanging protection from rain with suitable sun exposure and protection to allow young optimum thermal regulation relative latitude and climatic conditions.
	COLUMN c TOTAL		COLUMN b TOTAL		COLUMN a TOTAL
	(a + b + c) / 3 = SITE RESILIENCY CLASS VALUE				

DENSITY CLASS

Multiple kinds of density dependent mechanisms can generate the feedback necessary to regulate population size or density (Sutherland 1996, Rodenhouse et al. 1997, Newton 1998, Anderson, D. et al. 2019). These mechanisms fall into three classes:

1. Those emphasizing the primacy of direct or indirect interactions among individuals (e.g., crowding, territoriality),
2. Those generated from environmental heterogeneity (e.g., source-sink, site dependence), and
3. Those arising from intrinsic differences among individuals (i.e., experience and community structure).

Distance between eyries - As a general 'ballpark' reference distances between eyries relative to habitat quality may be as provided in Table 2 (Thomsett 1988:292, Peterson 2018).

TABLE 2. DENSITY CLASSES

DENSITY CLASS	SQ MILES/PAIR	PAIR/SQ MILE
Poor areas	>30	<0.03
Moderate areas	10 - 30	0.03 – 0.1
Exceptional areas	< 10	>0.1

One interesting study from Spain developed a predictive density regression formula for Peregrines (Gainzarain et al. 2002:69). After looking at nesting site availability, mean slope, cliff length, human density, latitude, and longitude as independent variables, they found nest-site availability by geologic substrate (index value of 1-3), cliff length (km), and latitude (degrees) to be the three primary factors in estimating population density of an area ($P<0.001$). In this study available prey was not considered a limiting factor because they were surveying sea cliffs where prey was adequately available close to eyries. Their study found a positive association of nesting Peregrine density with two variables reflecting cliff availability: the type of geological substrate and the length of seacliffs (Gainzarain et al. 2002:72). Showing a mean population density of 8.7 pair per 1000 km^2 (0.023 pair per mi^2) in regions where Peregrine populations are increasing and 2.9 pair per 1000 km^2 (0.008 pair per mi^2) in regions with few cliffs and declining populations.

TERRITORIALITY - Porter and White (1973) felt that breeding density was not tied tightly to climate or general productivity of the land. They suggest that, provided there are suitable nest sites, it mainly depends on topography and the presence of permanent water. Where quality nesting cliffs are plentiful, a bird's own territorial behavior appears to place an upper limit on breeding density (Wightman and Fuller 2006). This territorialism imposes a ceiling on numbers well below the level which food availability would allow for. As a result there will never be a tendency for the population to outgrow and depress its food supply. Whether food is abundant or scarce, Falcon density is in dynamic balance accordingly (Ratcliffe 1993:302). When nest densities are close together juveniles may switch nests. Anctil and Franke (2013) observed a juvenile (35 days) relocate and be accepted into a nearby nest 0.33 miles from its natal site.

SITE DEPENDENCE - Rodriguez et al. (2007:218) and Wightman & Fuller (2006) found a significant ($P<0.001$) eyrie success relationship between Falcon pairs and cliff quality. Site-dependence can theoretically regulate population size at levels below habitat saturation (Rodenhouse et al. 1997; McPeek et al. 2003). The primary influence on number of young fledged will be the abundance of game and habitat quality (Anderson, D. et al. 2019). Peregrine breeding success will be naturally limited either by the availability of suitable nesting sites or food supply (Newton 1988:770, Wightman & Fuller 2006). Dhondt et al. (1992) found that average clutch size often decreases when population density increases. They proposed a density-dependent capability to produce offspring occurs because as density increases proportionally more poor-quality sites (with smaller clutches) are occupied, not because the clutch size in all territories decreases.

> **"PEREGRINE BREEDING DENSITIES ARE NATURALLY LIMITED EITHER BY SUITABLE NESTING SITE AVAILABILITY OR FOOD SUPPLY."**
>
> *– Newton, 1988*

High quality Class A and B sites will have a history of movement to more than one suitable nest ledge. Zuberogoitia et al. (2015) found that breeding success decreases with the number of consecutive years that the same nest ledge was reused. In this study the number of fledglings in the previous season was the main factor, with successful pairs being more prone to move to a new year the nest season. Therefore Class-C eyries where nesting occurs in the same location each year can be expected to be less successful than eyries where pairs are prone to move each year.

COMMUNITY STRUCTURE– Martinez et al. (2008) suggest that interactions among the same species ("intraspecific") may be of less important than interactions with other species ("interspecific"). Raptor communities are usually composed of several mammal or bird eating species (e.g. eagle, red tail hawk, or Falcon) and at least one scavenging species, such as vultures or raven (Jenkins and Van Zyl 2005).

Findings by Rodriquez (2017) suggest that:

1) the probability of vulture occupation increased with the distance to raven nesting sites,
2) Falcons preferred to breed close to kestrels, and
3) Ravens settled close to Falcons.

Several studies have looked at interactions between ravens and Falcons nesting in close proximity. One study indicates that Peregrine productivity increases with proximity to raven nests, suggesting that both species could be benefitted; the Falcons, by getting vigilance of the territory and the ravens by getting protection against other species (Sergio et al. 2004). The other indicates that breeding success and productivity are lower for Peregrines coexisting with ravens, especially on cliffs with ravens and unregulated sport climbing occurring simultaneously near the same eyrie (Brambilla et al. 2004:429).

Martinez et al. (2008:17) found among the interspecific Nearest Neighbor Distances, the order of relative importance generally follows an expected order based on body mass. For many birds of prey, territories seem to be regularly spaced due to both "intra"- and "inter"-specific territoriality, a circumstance that can be interpreted as being a strategy towards minimizing energy expenditure and time allocated to territorial defense and foraging (Solonen 1993).

Gainzarain et al. (2002:72) found an abundance of suitable cliffs allowed Peregrines to coexist with potential predators (i.e. eagles) and reach good densities.

EXPERIENCE - Newton (1991) felt that part of the variation in success between cliff grade and nesting quality could be attributed to age of occupant. He found that first-year (inexperienced) birds typically established themselves on low-grade sites and more often had lower nesting success than older (experienced) birds that typically nested on high-grade sites (Newton I988). Sometimes young birds will select sites that seem to be somewhat marginal based on the usual pattern for the species. This may be because the more desirable sites are already occupied by established pairs, or the process may be partially a learning experience for newly breeding birds (Call 1979:24). Mearns & Newton (1988) found that from 1 to 5+ years reproductive performance improves as a female's age and laying becomes progressively earlier and clutches progressively larger. Looking at eagles, Margalida et al. (2008) found that fledging rates were highest when both pairs were greater than 4.5 years in age.

Katzner (2005) found that raptor males can provide females and offspring with alternative prey items when the staple prey is in short supply and that experienced males may be better than younger individuals at achieving this. Solonen (2009) and Zuberogoitia et al. (2018) suggest that shared parental responsibilities in Peregrine Falcons is conditioned primarily by climatic factors and secondly by male age and experience. This is because severe weather conditions may require the female to remain on the nest site for longer periods. Male raptors are responsible for bringing prey to the nest during the period when females are on the nest and less active. Some territories may have more, or at least more accessible, resources, thus helping breeding males to acquire the necessary food supplies or find better nest sites. This can be permanent (i.e. important prey populations) of occasional (high flow of migrants), but individual quality seems to be able to compensate for it on most occasions (Zabala & Zuberogoitia 2014:7). Males that fit poorly to the characteristics and prey of their territory may lose fledglings, while males skillful in exploring their territory can usually provide enough food to raise all their fledglings (Zabala & Zuberogoitia 2014:6).

FLOATER POPULATION - Territory breeding saturation can be expected to produce a contingent of nonbreeding adults (floaters) that buffer the breeding segment of a population against decline by filling territory vacancies as they occur. Large pools of floaters are associated with more stable populations (Newton 1998). Young birds that wait or unsuccessfully compete for territory will be more experienced with higher future success in breeding (Pen and Weissing 2000). This process of cohort limitation and buffering holds population numbers within a range of values known as Moffat's equilibrium (Moffat 1903). Territorial incursions by floaters may regulate population size by interfering with nesting activities, and floaters may usurp territories by evicting or killing breeders with territories (Penteriani et al. 2011). Penteriani, found that larger pools of floaters are associated with more stable breeding populations, even in cases where breeding output could be impacted through interference by floaters. Stalmaster and Newman (1978:511) found that juveniles had a significantly ($p<0.001$) higher tolerance to human disturbances than adults. This increased tolerance may give younger floaters an advantage for adapting to suitable nest sites in high disturbance areas.

TABLE 3. EXAMPLE OF A SITE RESILIENCY TABLE CORRELATING THE SITE QUALITY GRADE WITH DENSITY CLASS WERE A VALUE OF -1 WAS CONSIDERED TO HAVE A BENEFICIAL AFFECT ON PRODUCTIVITY, ZERO NEUTRAL, AND 1 NEGATIVELY AFFECTS PRODUCTIVITY. VALUES ARE LIMITED TO -1 THOUGHT 1.

		DENSITY CLASS		
		Exceptional = -1	Moderate = 0	Poor = 1
QUALITY GRADE	A = -1	**-1**	**-1**	**0**
	B = -0	**-1**	**0**	**1**
	C = 1	**0**	**1**	**1**
SITE RESILIENCY		***High to Very High***	***Neutral***	***Low to Very Low***
	value	*-1*	*0*	*1*

QUESTIONS TO BE ASKED:

A. What is your climbing area's Quality Grade (A,B,C) for Peregrine nesting?
B. How does your area rate for each feature?
C. What is the vertical height of the scrape or nest ledge above the vegetation?
D. How far is the next suitable cliff for nesting?
E. What density class based on the nearest active or recorded eyrie does the area fit under (Table 2)?

SUMMARY: Eyrie assessments look at the potential of a site to attract and support nesting raptors. Not all nesting sites or breeders can be expected to have the same success at fledging young. Failure to adequately assess your areas potential to successfully support and fledge young can lead to misinterpreting cause and affect relationships later on.

Over the past 50 years there has been a rapid expansion in Peregrine populations into urban habitats around the world. This increase in population involves not only the occupation of what we would traditionally consider high quality cliff habitat, but also adapting to cliff-surrogates such as quarries and buildings, or the use of lower quality cliffs as quality nest sites become taken.

Whether in a rural or urban setting components to high quality (Grade-A) nesting sites are the same. High enough to afford consistent visibility, protection, and hunting close to the eyrie. Optimum structure height will vary by latitude as Falcons occupy lower positions as climatic factors become increasingly more severe. High quality sites also offer more than one suitable nest ledge. Low quality (Grade C) nesting sites will have limited visibility close to the eyrie offering poor protection and hunting from the nest ledge. Grade B cliffs can be affected by temporal changes in vegetation that can adversely affect or enhance hunting close to the eyrie. Therefore, quality ratings for these cliffs can fluctuate between Grades B and C as the surrounding vegetation changes.

Young inexperienced birds will typically established themselves on low-grade sites and more often have lower nesting success than older (experienced) birds that typically nested on high-grade sites. Reproductive performance improves (between 1 and 5 years) as birds age. Females lay progressively earlier in the season and clutches become progressively larger. More experienced males become better hunters during lean periods. Peregrine breeding success will be naturally limited either by the availability of suitable nesting sites or food supply and as population density increases proportionally more poor-quality sites (with smaller clutches) are occupied, not because the clutch size in all territories decreases.

Understanding the potential for your site to support nesting populations is the first step in assessing what occurs at your eyrie. It is also the first step in determining how sensitive or resilient your eyrie is to disturbance or ecosystem and environmental change.

RESILIENCY TO ACTIVITY

FIGURE 7. HUMAN BEHAVIOR, PREDICTABILITY, FREQUENCY & MAGNITUDE, TIMING, AND LOCATION CAN ALL INFLUENCE HOW RAPTORS RESPOND TO DISTURBANCES NEAR THE EYRIE. IN THIS EXAMPLE ACTIVITY WITHIN THE VIEWSHED IS INFREQUENT BUT WELL BELOW THE NESTING LEDGE AND OUTSIDE THE AREA OF RESPONSE.

Tolerance in this species is highly likely, although it is dependent on the regularity and form of disturbance which occurs as non-intrusive 'background', especially once perceived as non-threatening (Ruddock and Whitfield 2007:141). Resilience of raptor populations to anxiety causing disturbance encompasses both the magnitude of the disturbance's effect as well as the time it will take an individual within the population to recover. The magnitude of the effect will depend on the rate at which the disturbance will cause changes in individuals. Slow conditional changes will increase the resilience of the individual or population and younger raptors will adapt more quickly than the older population.

Some of the most pressing current questions in the field of resilience research including:

a. How do we define resilience?
   The ability to coexist with human activity and its environment.
b. What are the most important determinants of resilience?
   Human Behavior, Predictability, Frequency & Magnitude, Timing
c. What are the most effective ways to enhance resilience?
   In the following section we will discuss Response Sensitivity and methods to enhance resiliency by managing the four determinants listed in question (b).

The size of any closure should depend on the response of the Peregrines to climbers or other recreation in the area. Responses are typically influenced by the topography of the nesting cliff and surrounding vegetative screening which limit the area within view of the eyrie, referred to as the "viewshed" (Camp et al. 1997). Nesting raptors will be more sensitive to people within the viewshed above their eyrie than to people below or across from it. Peregrines, in particular, may be tolerant of climbing or other recreation close to the eyrie if it is occurring when they choose the spot (Cade et al. 1996:68). Several determinant factors influencing a bird's tolerance will be whether or not the disturbance occurs within view of the eyrie, past exposure to the disturbance, distance, and age or adaptability of the Peregrine. With this in mind, in areas with multiple scrape opportunities (Grade A & B cliffs), it may be beneficial to continue use until a nest ledge is chosen each season before designing and implementing a closure.

FIGURE 8. ACCESS TO EYRIES FOR MONITORING PURPOSES, PERMITTED REMOVAL FOR FALCONRY, OR ROCK CLIMBING, WITH REASONABLE PRECAUTIONS TAKEN TO MINIMIZE DISTURBANCE, SHOULD HAVE NO LONG-TERM EFFECTS.

Desertions are usually the result of prolonged disturbances at sensitive times of the year which keeps the bird off the eyrie for several hours, and sometimes happens when rock climbers spend a long time on a route close to the ledge (Ratcliffe 1993, Mearns and Newton 1988). Even so, there are signs that on larger more open cliffs [Grade-A & B cliffs] Peregrines are adapted to even this degree of intrusion. For example, broods have been successfully reared on several unregulated much-climbed cliffs (Ratcliffe 1993:224) and in active rock quarries (Ruddock and Whitfield 2007:137).

Even access to eyries for monitoring purposes, rock climbing, or other recreation with reasonable precautions taken to minimize disturbance, should have no long-term effects (Olsen & Olsen 1988, Cade et al. 1996, White et al. 2002, Ruddock and Whitfield 2007:137). In fact, there is no evidence supporting the concern that normal non-threatening recreational disturbances during the non-breeding season will cause resident Peregrines to experience disturbance of a significantly different type or of greater severity than that experienced by many other species exposed to recreational activities like hiking and rock climbing (White 2012:4).

Peregrines and other raptors have been found to successfully raise and fledge young in high disturbance areas such as in active rock quarries, on city structures, and rural recreation areas (Bird et al. 1996). In active climbing areas, many do not seem disturbed by climbing that does not directly approach the scrape (Cade et al. 1996:67). In fact, a little over two decades ago, Peregrines chose to nest on the Fremont Bridge in Portland, Oregon, becoming the state's first recognized urban Falcons. This is one of the States busiest Interstate highway bridges (Muldoon 2011). Professional opinion would have considered such a high disturbance urban site as a “poor” and unlikely choice. Yet, between 1994 and 2010, the Fremont Bridge has successfully fledged 50 young. Now there are as many as four bridges with eyries in Portland alone. These are not anomalies. In the right location, bridges offer protection from the elements, predators, and good visibility for hunting from the nest ledge. While, disturbance from high traffic and pedestrians is consistent or predictable (Cade et al. 1996:3-14).

There is a tendency for Peregrines to become accustom to non-threatening human presence (Holroyd and Bird 2012:10, Kauffman et al. 2003, Romin and Muck 2002:22, Knight and Temple 1995, Ratcliffe 1993:169, White and Thurow 1985:19 & 20, Gilmer and Stewart 1983, Call 1979:16). Yet, White et al. (2002) and Ruddock & Whitfield (2007:137) found that pairs breeding in remote locations can be more reactive to human intrusions than birds that have habituated to urban, or frequently visited sites. Habituating raptors to increased disturbances associated with land use, human activities, or construction prior to the breeding season could allow a pair to “choose” an acceptable scrape or nest ledge considering the disturbance (Romin and Muck 2002:22). White and Thurow (1985:20) observed several pairs of the Peregrine Falcons and golden eagles occupying and successfully raising young at new nest sites only a few hundred meters from areas of high disturbance (e.g., at blasting, construction, quarrying, and mining sites, and at airports). Why? Factors that can have an effect on or allow raptors to adapt include human behavior, predictability, frequency & magnitude, and timing. Timing can include time of day or season.

FOUR DETERMINANTS OF RESILIENCY

Human Behavior - Although virtually unstudied, the behavior of recreationists can have a profound influence on wildlife response (Klein 1993). Depending on the context, speed can influence wildlife response. Rapid movement directly toward wildlife frightens them, while movement away from or at an oblique angle to the animal is less disturbing (Knight and Cole 2013:72). Slow moving disturbances in any spatial context appear to elicit a milder response from wildlife in general. For example Burger (1981) found humans that slowly approach waterfowl flushed fewer birds than did humans moving rapidly.

Predictability – In general, predictability of a given activity will shape a raptor’s response to it. When animals perceive a disturbance as frequent enough to be expected and nonthreatening, they show little overt response (White and Throw 1985:20, Knight and Cole, 2013:72). On the other hand, If wildlife perceive a disturbance as predictable and threatening (e.g. active persecution), they react quite differently. Feeding bald eagles were more vigilant and fed less in areas where active persecution occurred than in sites where birds were not harmed (Knight and Knight 1986). Peregrine nesting in active quarries were tolerant of disturbance, although their reactions depended on whether disturbance occurred inside or outside quarry-working hours (Ruddock and Whitfield 2007:137).

Frequency & Magnitude– The degree to which a disturbance has an impact will depend on its frequency and magnitude. A number of studies have compared reproductive success of birds at frequently visited nest sites with those that were infrequently visited. In general, nest sites visited more often in their study exhibited lower reproductive success (White and Throw 1985:20, Knight and Cole 2013:72). However, desertions are usually the result of prolonged and threatening disturbance which keeps the bird off the eyrie for several hours. It can happen when rock climbers spend a long time on a route close to the scrape (White and Throw 1985:21). Even so, there are signs that on big cliffs [Grade A cliffs] Peregrines are adapted to even this degree of intrusion where broods have been reared on several unregulated frequently climbed cliffs (Ratcliffe 1993:224).

Ratcliffe (1993) suggested that nesting in public places where disturbance is frequent and predictable may actually be a benefit to the Peregrines. Beyond a certain level, the proximity of people can become a safety factor in itself – if the birds are in too public a place, there is a much reduced chance that any individual will attempt to interfere with them. The crucial point is the degree to which Peregrines learn that human presence no longer spells danger, and may even spell advantage. This changed conditioning is likely in places close to people (Ratcliffe 1993:170).

TABLE 3. EXAMPLE OF CRITERIA USED FOR DESIGNATING ACTIVITY CLASS. ACTIVITY CLASSES WITH THE MOST POTENTIAL FOR NEGATIVE EFFECTS ARE RATED HIGH (VALUE = 2) AND THOSE WITH THE LEAST POTENTIAL ARE RATED NEUTRAL (VALUE = 0).

Activity Class[17]		
HIGH value = 2	**LOW to MODERATE** value = 1	**NEUTRAL** value = 0
"Activity" that could potentially be perceived as threatening occurs in a non-predictable manor in space and time.	"Activity" in this class would generally be perceived as non-threatening and are new but frequent enough for potential habituation.	"Activity" in this class would generally be perceived as non-threatening and occurs in a predictable manor, timing and location offering a high potential for habituation.
Human activity frequent within sight of scrape or nest ledge.	Human activity occasionally within sight of scrape or nest ledge.	Human activity unlikely within sight of scrape or nest ledge.
Exposed activity is level with or above the elevation of the nest ledge.	Exposed activity is above ground level and below the elevation of nest ledge.	Exposed activity is at ground level.
High recreation use; activity within view likely to occur during courtship (Feb. – Early March).	Moderate recreational use; climbing within view unlikely during courtship (Feb. – Early March).	Low recreational use or snow pack; climbing within view unlikely during courtship (Feb. – Early March).
Road traffic with little visual buffering.	Road traffic with some vegetation buffering within sight of scrape or nest ledge.	Few drivable roads and/or extensive vegetation buffering within sight of scrape or nest ledge.
Habitat altered with high traffic roads or numerous human developments.	Habitat slightly altered; Moderately used roads and some human developments.	Rarely used roads, no roads, or roads with controlled access. Light if any human developments.
Activities in this area occur on a random schedule for period of long duration (1/2 hr. or more).	Activities in this area can occur randomly at any time and of short duration (<1/2 hr.).	Activities are nearly constant or occur on a schedule.

Timing – The impacts of disturbances are not consistent throughout the breeding season. The period of greatest sensitivity to disturbance occurs during nest selection and incubation (White and Throw 1985:16,18, Gotmark 1992:102). Holthuizen (1986) monitored the effects on Peregrine reproduction from activities in a high use recreation site under construction. These disturbances included construction, blasting, traffic, and people walking, equivalent to 24,000 visitors occurring 130 to 200 feet below eyries between March and June. He was unable to measure an effect on reproduction when compared with the studies control.

The effect of prolong disturbances occurring on cliffs near eyries is inconclusive (Cade et al. 1996:68). In many cases when the Peregrines chose to reoccupy a cliff where climbing is actively occurring, many do not seem disturbed by climbing that does not directly approach the nest (Cade et al. 1996:67). However, Cade cautions there may be a greater concern where Peregrines establish territories early in the spring before hiking, rock climbing, and other recreational activities begin. With this in mind, in areas with multiple nesting opportunities and a history of movement between multiple nest opportunities, it may be beneficial to allow access until a ledge is chosen each season before you design and implement a closure.

[17] This evaluation table contains seven evaluation criteria (reading downwards) with three options (across). For this example, select one of the three options for each of the seven criteria and record its value (0, 1, or 2). The final activity class value is the averaged sum of all selected values rounded to the nearest whole number (0, 1, or 2).

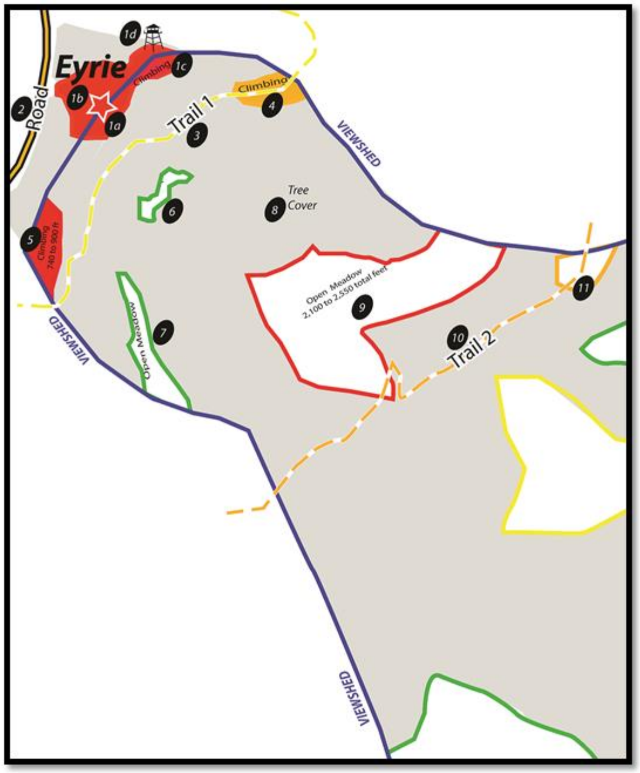

FIGURE 9. EXAMPLE OF ACTIVITY CLASS STRATEFIED OVER A VIEWSHED.

Two general approaches are currently used to minimize the effects of recreational disturbance on wildlife. They include:

1. Deny human access to sensitive areas by instituting closures. This approach is generally only used in cases where critically endangered or sensitive and special status species occur. Because species that fall in this category often have large spatial requirements, closures are difficult to enforce and unpopular with recreationists.
2. Design management schemes that allow recreationists and wildlife to coexist.

The latter approach ensures outdoor resources and wildlife remain accessible to people at levels tolerable to wildlife. In order to make sound decisions managers must know how recreational activities affect particular species and at what intensities and times during the species' annual cycles such activities can be harmful (Knight and Temple 1995:327). Peregrines are one of several species that can become accustomed to the effects of at least some human disturbance, as witnessed by its occupation of high disturbance habitats such as working quarries and urban centers, both historically and as recovering populations expanded (Ruddock and Whitfield 2007:141).

QUESTIONS TO BE ASKED:

A. What activities take place within 1/2 mile of the eyrie?
B. Which activities are ongoing or new and how frequently or predictably do they occur?
C. Which activities occur within sight of the scrape or nest ledge?
D. Which activities are likely to occur during courtship (Feb. – Early March).

E. What access routes and corridors such as roads and trails are used and how frequent or predictable is that use?
F. How is the land within a mile of the eyrie being maintained or altered?

SUMMARY: Tolerance in this species is highly likely, although it is dependent on the regularity and form of disturbance which occurs as 'background', especially once perceived as non-threatening. *The ability to coexist with human activity are determined by the human behavior and the predictability, frequency & magnitude, timing of that disturbances caused by that behavior.* Responses of nesting Peregrine are typically influenced by the topography of the nesting cliff and surrounding vegetative screening that define an eyrie's "viewshed". Raptors may or may not be tolerant of climbing close to the eyrie if it is not occurring when they choose the spot. Therefore, in areas with multiple scrape opportunities (Grade A & B cliffs), it may be beneficial to continue recreational activities until a nest ledge is chosen each season before designing and implementing your closures, or even assessing a need for a closure. When animals perceive a disturbance as frequent enough to be expected and nonthreatening, they show little overt response. The crucial point at which this occurs is the degree to which raptors learn that human presence no longer spells danger, and may even spell advantage. This changed conditioning is likely in places close to people.

The period of greatest sensitivity to disturbance occurs during nest selection and incubation, however in many cases when the Peregrines chose to reoccupy a cliff where climbing is occurring, many do not seem disturbed by climbing that does not directly approach the nest, while there may be greater concern where Peregrines establish territories early in the spring in some areas before hiking, rock climbing, and other recreational activities begin.

RESPONSE SENSITIVITY

FIGURE 10. RIDGES AND TREE CANOPY CAN PROVIDE ADEQUATE VISUAL SCREENING TO ALLOW FOR RECREATIONAL ACCESS WITHOUT DISTURBING NESTING RAPTORS.

VISUAL & AUDIO DETERMINATIONS

Original guidelines from the 1980's for managing disturbances around eyries include disturbances from both visual and audio sources. However, studies have found a higher need for disturbance buffering within view of an eyrie ledge during nesting rather than from audio disturbances (Edwards 1969, Stalmaster and Newman 1978, Gilmer and Stewart 1983, White and Thurow 1985, Holthuizen 1986, Ellis, Ellis, & Mindell 1991, and Ruddock and Whitfield 2007). Raptors may tolerate considerable noise close to their nests if they are familiar with it (Gilmer and Stewart 1983, White and Thurow 1985:19). Their response to audio disturbances from climbing and other forms of recreation can be expected to be minimal and would not appear to limit raptor productivity (Edwards 1969:157, Stalmaster and Newman 1978:511, Holthuizen 1986, Ellis, Ellis, & Mindell 1991, Ruddock and Whitfield 2007:138). Craig (2002) adds emphasis to the fact that buffer distances are somewhat imprecise (fractions of a mile) and reflect the need to maintain some flexibility to adjust buffer zones to the viewshed using intervening terrain and vegetation screens that obscure the activity.

Visual Buffering

Within buffer zones, resource use may be legally or customarily restricted, often to a lesser degree than in the adjacent protected area (e.g. nest sites) so as to form a transition zone. A buffer zone can also be designated as a protected area or physical features and be assigned a separate risk and management rating than the area surrounding it depending on the conservation objective. Suter and Joness (1981) noted that a clear line of sight is an important factor in a raptor's response to a particular disturbance. While, few studies have experimentally confirmed the need for buffer distances commonly prescribed in any traditionally assigned Management Zones using circular buffers (White and Thurow 1985, Holmes et al. 1993*,* Ruddock and Whitfield 2007). The role of visual buffers is an important concept as it can result in reduced spatial restrictions by separating critical wildlife areas from threatening disturbances.

Impacts of human activities on wild animals are often reduced when animals are visually shielded from the activity (Suter and Joness 1981; Postovit and Postovit 1987; Knight and Temple 1995; Pyke 1997:11; Richardson and Miller 1997:637; Knight and Cole 2013). White and Thurow (1985:19) reported that raptors tolerate considerable noise close to their scrape or nest ledges when humans are not visible or otherwise obviously associated with it. Trails and other non-threatening activities can be compatible in close proximity to an eyrie or perch if that activity is visually buffered by vegetation or topographic features (Ratcliffe 1993, Knight and Temple 1995).

Reactions are typically influenced by the topography of the nesting cliff and surrounding vegetative screening. Nesting Falcons are much more sensitive to people above their eyrie than to people below or across from it. Components of visual screening for wildlife include the juxtaposition of the animals in relation to the vegetation screen with the location of potential danger. When vegetation screening is near the source of disturbance (as opposed to near the eyrie), it allows Peregrines to use areas closer than usual to the disturbance (Batten 1977). At the same time, visual screening close to the eyrie can create obstructions (Figure 11) at the scrape site making it more difficult to defend (White 2012:2) to the point of lowering quality grade of the eyrie (Hamerstrom 1973).

Open unobstructed views from the nesting ledge offer a capability to hunt from the immediate eyrie surroundings. Suitable hunting close to the eyrie lowers the energetic costs of distant foraging trips, minimize the risk of feeding competition, and enhance the efficiency of scrape and mate guarding during the breeding season (Jenkins 2000, Sergio et al. 2004:823).

FIGURE 11. EXAMPLE OF A VIEWSHED FROM A NESTING LEDGE. THIS EYRIE HAS A LIMITED VIEWSHED SCREENED HORIZONTALLY, VERTICALLY, AND AT THE DISTANCE OF POINT "A" BY THE ADJACENT PINNACLE, BLUFF (A) AND DENSE FOLIAGE. THESE VISUAL OBSTRUCTIONS REDUCE THE NEED FOR BUFFERING. LEFT PHOTO WAS TAKEN LOOKING OUT FROM THE EYRIE LEDGE.
QUALITY ASSESSMENT: THE NESTING LEDGE LACKS SUFFICIENT SUBSTRATE TO ALLOW FOR CREATION OF A "SCRAPE" TO HOLD THE EGGS WHICH HAS RESULTED IN EGG LOSS. THIS LACK OF SUBSTRATE, VISUAL SCREENING CLOSE TO THE LEDGE, AND SHADING DURING WET-COLD PERIODS CAN ALL REDUCE THE INHERENT QUALITY OF THE NESTING LEDGE FOR FLEDGING YOUNG.

VIEWSHED MANAGEMENT

Knowledge of the viewshed provides a more accurate landscape assessment of a raptor's needs. When birds are shielded from disturbances by vegetation (Stalmaster and Newman 1978) or topographical features such as cliffs, flushing distances are reduced. A Geographic Information System (GIS) assisted viewshed approach, followed by validation monitoring has been shown to be an effective tool for reducing the potential threatening disturbances during sensitive periods (Camp et al. 1997, Richardson and Miller 1997:634-635). The use of viewsheds provides a manager with a realistic understanding of spatial requirements. The viewshed approach to spatially managing disturbance can require less protected area than a traditionally prescribed circular Management Zone strategy (Camp et al. 1997).

Viewshed Buffer Distances

A common method used to prescribe viewshed-buffers involves one or two measures of disturbance distance: 'alert distance' and 'flight initiation distance'. Alert distance is the distance between the disturbance source and bird to the point where the bird changes its behavior in response to the approaching disturbance source. The flight initiation distance is the point at which the bird flushes or otherwise moves away from the approaching disturbance source. Deciding on appropriate buffer distances can be contentious. Expert opinion has typically been used as a stopgap in research and as a bridge between empirical evidence and policy. A 2007 review of prescribed buffers suggested that professional judgment is frequently misused by not being a temporary measure, with insufficient validation (Ruddock and Whitfield 2007:4).

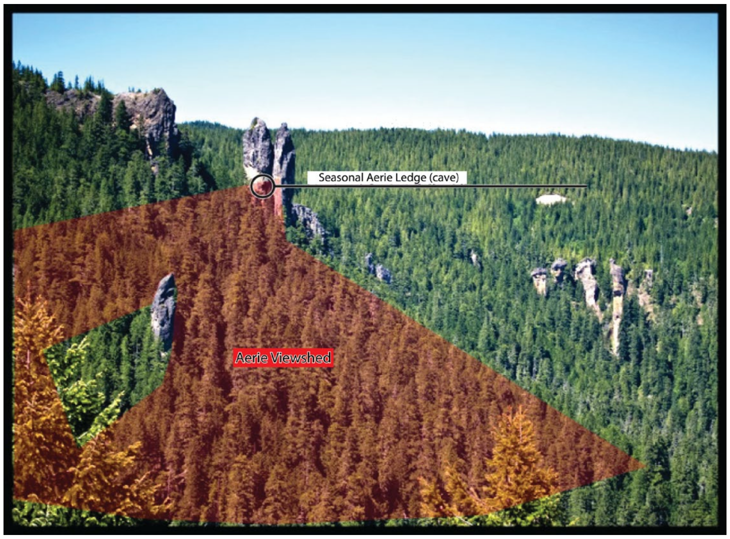

FIGURE 12. DETERMINE THE VIEWSHED ABOVE TREE CANOPY.

Recommendations for a traditionally prescribed circular Management Zone buffers around breeding sites were being made without objective justification. Given the shortage of empirical field studies therefore, Ruddock and Whitfield (2007) recommend that findings from their survey be regarded as “preliminary until further validation has been undertaken”.

> **“EXPERT OPINION IS FREQUENTLY MISUSED BY NOT BEING A TEMPORARY MEASURE AND WITH INSUFFICIENT VALIDATION.”**
>
> – Ruddock and Whitfield, 2007

The results of their survey found wide variability of opinion when looking at ‘alert’ and ‘flight initiation’ distances in response to disturbances. Eighty percent (80%) placed the alert distance for Peregrine during incubating at an average of 740 feet from a range of opinion that varied from 35 feet to a ½ mile. The average alert distance showed slightly greater sensitivity during chick rearing at 1,020 feet and ranged from 490 feet to a ½ mile (Figure 13).

The most common method used to estimate a minimum approach distance is to observe the reactions of the Peregrine to the approach of a single disturbance source, typically a pedestrian. Ratcliffe (1993) suggested flushing in the presence of humans does not typically occur “until at close range”. Ruddock and Whitfield (2007:16) emphasize that disturbance distances according to “expert opinion” tend to be slightly higher than comparable empirical observations and so the lower limits of the distance categories in their tables should probably be preferred as a starting point. Ruddock and Whitfield (2007:136) note that the heights of nesting ledge above the ground or above the vegetation, when present, should be considered and included within the distances at which the nearest human activity could occur without incurring serious disturbance (e.g. viewshed-buffer distance minus scrape height above vegetation, refer to Figure 13 and Figure 14).

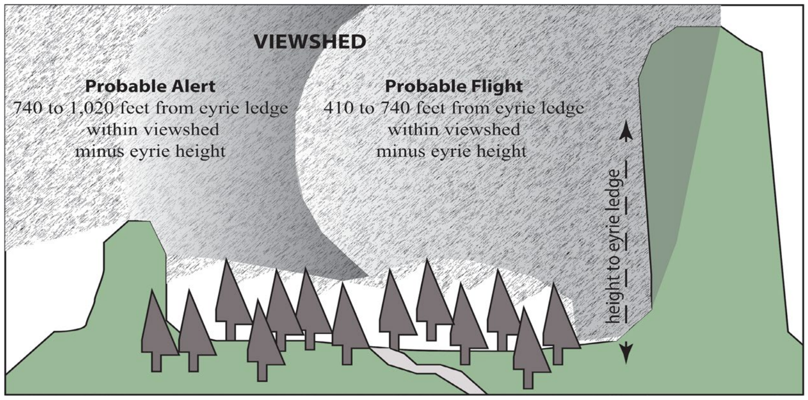

FIGURE 13. EXAMPLE OF A VIEWSHED WHERE VEGETATION AND GEOGRAPHIC SCREENS ARE SUBTRACTED FROM THE VIEWSHED. THE HEIGHT OF NEST LEDGE ABOVE THE VEGETATION SHOULD BE CONSIDERED WITH THE DISTANCES AT WHICH THE NEAREST HUMAN ACTIVITY COULD OCCUR WITHOUT INCURRING SERIOUS DISTURBANCE (E.G. VIEWSHED-BUFFER DISTANCE MINUS SCRAPE HEIGHT ABOVE VEGETATION).

Thomas Cade observed that there seems to be a minimum radius around eyries, perhaps 350 feet, which is vigorously defended at all times by nearly all nesting Peregrines (Ratcliffe 1993:271-272). Brambilla et al. (2004:429) suggest while climbers are in view they should stay at least 650 feet from either side of a scrape site from the beginning of breeding season until eggs are laid (February 15 – March 15). White and Thurow (1985:21) found that 90% of the time flushing did not occur when researchers were 820 feet (250 m) from the nests of Ferruginous Hawks and would be an adequate buffer for human disturbances of short-duration. Stalmaster and Newman (1978:512) found when birds were approached through heavy vegetation, flight distances were significantly ($p < 0.0001$) shorter than distances recorded in open areas. Diminished response was probably due to a raptor's reliance on visual identification of the disturbance before flight. They recommended 250 to 300-foot viewshed-buffers where vegetation efficiently reduces line-of-sight contact to allow closer presence of human activity.

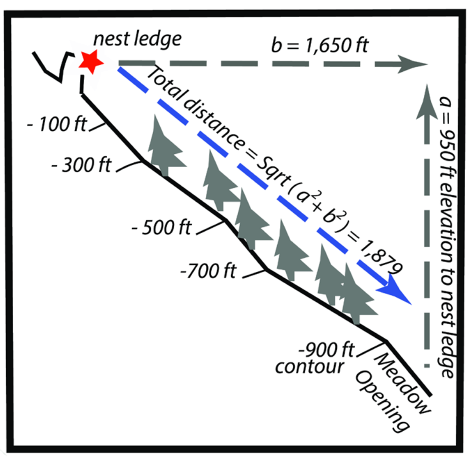

FIGURE 14. ESTIMATING SLOPE DISTANCE USING CHANGE IN ELEVATION (A) AND HORIZONTAL DISTANCE (B).

Ratcliffe (1993) suggested Peregrines can tolerate any number of people in the nesting haunt provided the eyrie is inaccessible. Holthuizen (1986) found that 8,000 users visiting between March and June had no effect on reproduction where eyries were 130 to 200 feet above the study area. Ratcliffe (1993) found that certain individuals can be wary about going back to the eyrie if a human is visibly closer than 1,600 feet or 0.31 mi, and others will return while an intruder is still on the cliff quite close at hand, especially if the weather is cold or wet (Ratcliffe 1993:224). But, he also notes, "Peregrines do not readily desert their eggs and seldom do so as a result of people visiting their eyries" (e.g. during banding operations).

TABLE 4. REFERENCE RESPONSE CLASSES FOR UNOBSTRUCTED AND OBSTRUCED VIEWS FROM THE NEST SITES. ALL ASSIGNED DISTANCES SHOULD BE TEMPORARILY ASSIGNED UNTIL SUFFICIENTLY VERIFIED THROUGH MONITORING. *DISTANCES = EYRIE HEIGTH ABOVE CANOPY + HORIZONTAL DISTANCE.*

Unobstructed View	Defensive				Flight		Alert	
	35 ft	160	250	350	490	740	1,020	1,650
Obstructed View		Alert				Neutral	1,020	
	Response Class values for matric analysis: Defensive = 2, Flight = 1, Alert to no response (neutral) = 0							
	Total Distance = (elevation above or below nest ledge) + (horizonal distance)							

White (2012) noted that it is not unusual for even quality nesting sites to experience some turnover of breeders occupying the eyrie. Often, females will move between eyries every few years, and while males tend to be more loyal to a particular site, they may also move. There is a rather large body of literature on the movement of Falcons from one nesting site to another (White 2012:5). Some Falcons may move on an annual basis while others may remain for their life spans (White 2012:5).

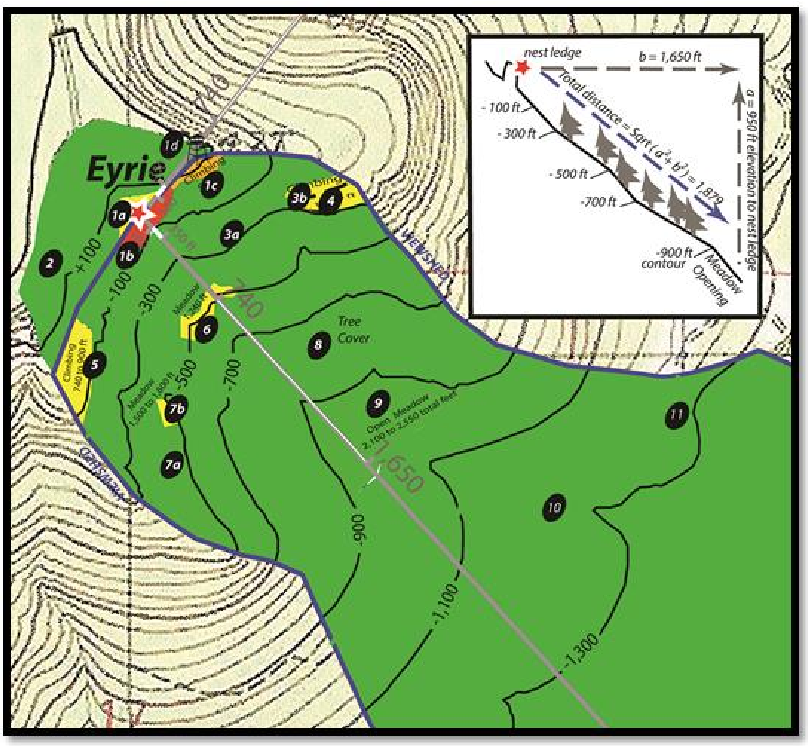

FIGURE 15. EXAMPLE OF A RESPONSE SENSITIVITY MAP FOR AN EYRIE VIEWSHED BASED ON ELEVATION, DISTANCE, AND COVER.

QUESTIONS TO BE ASKED:

A. Which activities occur within sight of the scrape or nest ledge?
B. Which sites identified in Exercise 2 are within 350 feet of the eyrie ledge after considering for elevation changes?
C. Which sites are within 740 feet of the eyrie ledge after considering for elevation changes?
D. Which sites are within 1,650 feet of the eyrie ledge after considering for elevation changes?
E. Which sites identified in questions B through D are in view of the nesting ledge?

SUMMARY: Raptors are most sensitive to visual disturbances within view of an eyrie ledge during periods of courtship, egg laying, and nesting. They do not instinctively associate noises with a threat. Trails and other non-threatening activities can be compatible in close proximity to an eyrie or perch during sensitive periods, if that activity is visually buffered by vegetation or topographic features.
Buffer distances are somewhat imprecise (fractions of a mile) and reflect the need to maintain some flexibility to adjust buffer zones to the viewshed using intervening terrain and vegetation screens that obscure the activity. When birds are shielded from disturbances by vegetation or topographical features such as cliffs, flushing distances are reduced. Flushing in the presence of humans does not typically occur until at close range of roughly 350 feet within the viewshed or as close as 35 feet when disturbance is outside the viewshed. The height of the nesting ledge above the ground or vegetation when present should be considered and included within the distances at which the nearest human activity could occur without incurring serious disturbance (Figure 14). Table 4 displays a listing of potential responses and approximate distances depending on whether or not the disturbance is within view of the eyrie ledge. Buffers that exceed 1,650 feet in the viewshed or 250 feet outside the viewshed even during the most sensitive times should be questioned.

It is not uncommon for Peregrines to move their nest site from one year to the next. Some Falcons may move on an annual basis while others may remain for their life spans. However, once eggs are laid they will stay at that ledge until the young have fledged.

SEASONAL SENSITIVITY

FIGURE 16. THREE PEREGRINE CHICKS BEGINNING TO DEVELOPE THEIR PIN FEATHERS.

In order to make sound decisions the public and managers must know how recreational activities affect particular species, including what intensities and at what times during the species' annual cycle various activities are harmful (Knight and Temple 1995:327). Considering components of resiliency using qualitative assessments of 1) eyrie quality & density, 2) resiliency to activity, and 3) response sensitivity, collectively enables a more complete and better focused assessment of needs and management priorities that can be stratified over the landscape. Once this stratification has been made the next step is to consider seasonal sensitivities during four stages of eyrie use to determine how these areas can be temporally managed.

Mid-February to early March – *Courtship* - February through early March is the period when migratory raptors arrive at the cliff and courtship takes place. During this period we can expect a moderate to high risk that disturbance could cause abandonment or movement to another site. That said, it usually takes repeated disturbance at close range and/or major disturbances for extended periods to reach a threshold that would cause site abandonment. Abandonment may only result in relocation to another site. Repeated nest entry by researches during these times has never been documented to cause nest site abandonment.

TABLE 5. SEASONAL SENSITIVITY LEVELS USING A TYPICAL REFERENCE TIMELINE FOR TEMPERATE REGIONS WARMER THAN SUBALPINE.

Reference Season	Behavior	Seasonal Sensitivity
February	Arrival at cliff if migratory pair.	Moderate-High
Early-March	Courtship and start of Copulation.	
Mid-March	Egg Laying, incubation starts when last or second to last egg is laid.	Moderate
Early April	Incubation period.	
Mid-April	Hatching, *(normally occurs a week or two later at higher subalpine elevations).*	Low
	Chick rearing.	
May		
	Fledging, Young on cliff face or close by two weeks after fledging.	
June	Young start to disperse from cliff area.	Very Low
July		
	Activities are independent of the nesting site.	
July 15 through January 30		none

Low Sensitivity – no effect of reproduction.
Moderate Sensitivity - response without site abandonment, possible effect on reproduction.
Moderate to High Sensitivity - it usually takes repeated disturbance at close range and/or major disturbances for extended periods to reach a threshold that would cause site abandonment. Abandonment may only result in relocation to another site.
High Sensitivity – probable site abandonment.

Falcons can be particularly sensitive to disturbances and scrape site abandonment from the time they are courting and selecting a nesting ledge (e.g. mid to late February through early March) until a scrape or nest ledge is selected (e.g. early-March) and the male begins bringing in prey.

Mid-March to early April (April or later in subalpine habitats)- *Incubation* - Once a ledge has been chosen, Ratcliffe (1993) noted that Peregrines with eggs well advanced in incubation (e.g. mid-March through early-April) are usually eager to return to them after being disturbed. Depending on the perceived level of threat, breeding Peregrines can become slightly sensitive during courtship, more resilient during the egg laying period (e.g. mid to late March), and even less sensitive during approximately 35 days of incubation (White 2012:5, Peterson 2018). As a general rule, the period from mid-February through early-April is typically considered to be a sensitive period for eyries below subalpine. Nelson (1988) found that in years with small broods the parents (especially males) are less stressed by the breeding effort and experience lower mortality over the following winter. In years with large broods, breeding stresses are particularly significant and mortality of breeders over the winter is higher. The average breeder produces approximately the same number of well-nourished offspring whether its reproductive life spans a period which has small broods, large broods, or a mixture of both (Nelson 1988).

Ratcliffe (1993) found that this is a period when certain individuals can be wary about going back to the eyrie if a human is visibly closer than 1,600 feet or 0.31 mi, while others will return while an intruder is still on the cliff quite close at hand, especially if the weather is cold or wet (Ratcliffe 1993:224). Thomas Cade observed that there seems to be a minimum radius around eyries, perhaps 350 feet, which is vigorously defended at all times during nesting (e.g. mid-March through mid-June) by nearly all nesting Peregrines (Ratcliffe 1993:271-272).

Ellis, Ellis, and Mindell (1991) measured responses to disturbance resulting in three primary levels of responses, summarized as:

1. sometimes, noticeably alarmed birds,
2. Occasionally, flight, and
3. Most often, evoked only minimal responses.

They found that even though they were able to measure these responses, they were never associated with reproductive failures to sites in their study area. They found that Falcons fledged young and returned to their eyries the following year when subjected to low-level aircraft during the courtship and incubation phases (e.g. early-March & early-April) when adults were considered most likely to abandon.

Brambilla et al. (2004:429) suggest rock climbers in the viewshed should stay at least 650 feet from either side of a scrape site from the beginning of breeding season until egg-laying (e.g. mid-February through mid-March). Cade found that mid-March through early-April Peregrines do not readily desert their eggs and seldom do so as a result of people visiting their eyries during surveys (Ratcliffe 1993:271-272).

Mid-April to early June –Nest - abandonment unlikely (White and Thurow 1985:18). Holthuizen (1986) found that blasting activities (47.0 to 49.6 dB) conducted once eggs were hatched (e.g. after mid-April), had only minor effect on productivity (chicks per scrape site) in the construction (3.0), control (3.5), and blasting (3.3) locations. Recreational activities unlikely to result in any form of "take".

Late May to Mid-June – Rearing to *fledging* – Once young are 3 to 4 weeks old brief visits to nests by researchers did not result in abandonment (White and Thurow 1985:18). Young will leave the nest roughly 40 days after hatching, but are often able to sustain flight as early as 35 days in age (Anctil and Franke 2013). Any remaining closures should be lifted once the young have fledged from the nest (Cade 1996:68, Peterson 2018). Eyries fledging young late in the season (e.g. July and beyond) may suggest that there has been second or perhaps even third clutches. This can be an indicator that they are losing eggs or nestlings (White 2012:2). Loosing eggs or nestlings is often as a result of nesting in a marginal site. Over time a marginal site is not likely to produce many offspring.

> **"I CANNOT THINK OF ANY LEGITIMATE RECORD OF FALCONS ABANDONING YOUNG DURING BROOD RAISING FOR ANYTHING OTHER THAN NATURAL CASES SUCH AS LOSS OF FOOD RESOURCES THAT MAY HAPPEN TO FALCONS FEEDING ON SEABIRDS. THERE ARE NO RECORDS, SO FAR AS I KNOW, OF PAIRS ABANDONING YOUNG BECAUSE OF HUMAN DISTURBANCE. THERE IS A SMALL CHANCE THAT EGGS MAY BE ABANDONED DURING INCUBATION, MORE SO DURING EARLY INCUBATION, BUT A HIGH PROBABILITY THAT PAIRS MAY ABANDON A NESTING LEDGE IF DISTURBED DURING LEDGE OR NESTING "SCRAPE" SELECTION AND LATE COURTSHIP."**
>
> – Clayton M. White (2012)

While the value of a marginal site might be enhanced by a closure during the breeding season, such a closure would not reduce or eliminate the effects of severe weather or predation from natural predators that have access to the upper scrape site. Second or third clutches are not the norm and rarely occur on higher quality sites. Falcons will typically change ledges or move to an alternative cliff after a nest failure (Cade et al. 1996:25).

The length and period of seasonal closures can be assigned based on the assessed sensitivity over the landscape. For example, activities rated in a "high" activity class within 350 feet and in view of the eyrie ledge may warrant access restrictions until the young have fledged (February 15 – July 1), while the same activity screened from view may only warrant restricted access during the more sensitive reproductive periods of February 15 through April 15 (Stalmaster & Newman 1978:512, Holthuizen 1986, Ratcliffe 1993:271-272, 224). Conversely, activities in a "low" activity class, such as trails or parking areas, within 350 feet and in view of the eyrie ledge may only warrant restricted access during the more sensitive reproductive periods (February 15 – April 15) (White 2012:5, Peterson 2018), while the same activity screened from view may not warrant any restricted access at all. In addition when considering eyries with multiple opportunities for nesting and high priority access needs it may be beneficial to allow for nest selection while activity is occurring before assessing the need for seasons restrictions (Cade et al. 1996:25, White 2012:5).

TABLE 6. EXAMPLE SENSITIVITY EVALUATION & PRESCRIPTION WORKSHEET WITH SENSITIVITY VALUES AND CORRESPONDING PRESCRIPTIONS FOR SEASONAL CLOSURES.IN THIS EXAMPLE SITE RESILIENCY INCORPORATES BOTH SITE QUALITY AND DENSITIY CLASS AND GENERATED A NEUTRAL VALUE (0)..

Site No.	Site Description	Site Resiliency Class	Site value	Activity Class	Class value	Response Class	Class value	Sensitivity value	Seasonal Closure Recommendations
			(a)		(b)		(c)	(a+b+c)	
1a	Eyrie Back-climbing Area	High	-1	Low to Mod.	1	Alert	1	1	February 15 - April 15
1b	Eyrie Front-climbing Area	High	-1	Low to Mod.	1	Defense	3	3	February 15 - June 15
1c	Eyrie Side-climbing Area	High	-1	Low to Mod.	1	Neutral	0	0	Open
1d	Lookout Rental	High	-1	Neutral	0	Alert	1	0	Open
2	Upper Ridge Road	High	-1	Neutral	0	Alert	1	0	Open
3a	Trail 1, within canopy	High	-1	Neutral	0	Neutral	0	-1	Open
3b	Trail 1, through opening	High	-1	Neutral	0	Flight	2	1	February 15 - April 15
4	Climbing Area	High	-1	Low to Mod.	1	Flight	2	2	February 15 - May 15
5	Climbing Area	High	-1	High	2	Neutral	0	1	February 15 - April 15
6	Open Meadow	High	-1	Low to Mod.	1	Flight	2	2	February 15 - May 15
7a	Open Meadow	High	-1	Low to Mod.	1	Flight	2	2	February 15 - May 15
7b	Open Meadow	High	-1	Low to Mod.	1	Alert	1	1	February 15 - April 15
8	Tree Covered Slope	High	-1	Low to Mod.	1	Neutral	0	0	Open
9	Open Meadow	High	-1	Low to Mod.	1	Neutral	0	0	Open
10	Trail 2	High	-1	Low to Mod.	1	Neutral	0	0	Open
11	Open Meadow	High	-1	Low to Mod.	1	Neutral	0	0	Open

QUESTIONS TO BE ASKED:

A. What monitoring records are available for this and nearby eyries?
B. How successful have these eyries been in fledging young?
C. Are there monitoring records of other ledges or rock faces in the area being used for nesting that are not currently being used?
D. What date does courtship typically begin? (If unknown default to March 1 for below subalpine habitats),
E. What is fledge date within 80% Confidence based on records? (If unavailable default to June 15 below subalpine habitats).

SUMMARY: Once your landscape has been stratified and you have considering 1) eyrie quality & density, 2) resiliency to activity, and 3) response sensitivity, the next step is to consider seasonal sensitivities. Generally the beginning of breeding season until egg-laying (e.g. mid-February through mid-March) is considered to be the most sensitive period, while mid-March through early-April Peregrines do not readily desert their eggs and seldom do so as a result of people visiting their eyries during surveys. Young will leave the nest roughly 40 days after hatching. Any remaining closures should be lifted once the young have fledged from the nest. Lifting closures (≤3,000 foot elevation) can typically be planned for July 1, unless monitoring shows otherwise. The likelihood of adverse effects from disturbances in the viewshed becomes extremely remote after June 15. Therefore any closures preassigned to be carried beyond July 15 without verification from that season's monitoring should be questioned.

ADAPTIVE MANAGEMENT

FIGURE 17. CLIMBERS, BOY SCOUTS, BIRD WATCHERS, AND PRIVATE TIMBER COMPANY COMING TOGETHER IN ADAPTIVE MANAGEMENT OF THE CALLAHANS CLIMBING AREA, OREGON.

Adaptive management is a system of management practices based on clearly identified intended outcomes and monitoring to determine if management actions are meeting those outcomes; and, if not, to facilitate followed by management changes that will best ensure those outcomes are met or re-evaluated (US Forest Service 2008). It is extremely important that the process of adaptive management be "interest-based" rather than "positional" (Hurley 2012). At the heart of adaptive decision making is recognizing the existence of alternative hypotheses, and then assessing these hypotheses with monitoring data. This strategy stems from the recognition that knowledge about natural resource systems is sometimes uncertain and can change (Williams & Brown 2012:37). An important part of any first decision is to design management actions that will produce information and allowing for possible adjustments during a second adjustment phase (Bormann et al. 1994, Ruddock and Whitfield 2007, Williams & Brown 2012). Adaptive management is consistent with MBTA direction to develop and use principles, standards, and practices that will lessen the amount of unintentional take. These practices are regularly evaluated and revised to ensure that they are effective in lessening potential for detrimental effect of recreation related actions on migratory bird populations.

Recommendations here-in provide a starting point for "Best Practices" using the most current "Best Available Science and Scholarship". Adaptive management proposals using Best Practices should identify the adjustments that may be made when monitoring during project implementation indicates an action is not having the intended effect (Williams & Brown 2012). Such proposals should clearly define the monitoring goals and insure responsible officials are apprised on whether management strategies are having their intended effect.

"ADAPTIVE MANAGEMENT REQUIRES ONGOING ADJUSMENT OF STANDARDS AND GUIDELINES."

–USDA Forest Service, 2002

Adaptive management is an open process of decision making in which stakeholders are directly engaged and decision-making authority is shared among one another (Williams & Brown 2012:31). Climbers can benefit from working with biologist they can trust. Managers and biologists can benefit from working with climbers as well. Because communication between groups is likely to be a bottleneck in the strategy, special efforts are needed to improve communication skills of individuals and agencies. Beyond the obvious need for clear, two-way interactions, effective communication necessitates and demands timely feedback from the receiver to the sender on the form and value of the information (Bormann et al. 1994).

Unfortunately, adopting an adaptive management strategy can be hampered by a widespread belief among agency specialists and decision makers that adaptive management does not constitute a significant departure from the agency's past practices, and involves little more than occasionally changing management actions (Williams & Brown 2012:31). It can also be hampered by a belief that monitoring will be time consuming and expensive for an agency. At a minimum, it will be necessary for agency's to rethink the notions of risk and risk aversion, and establish conditions that encourage and reward learning (Williams & Brown 2012:31). Opposition to delisting of the American Peregrine Falcon occurred largely from organizations that "commonly use litigation to further their environmental agenda and individuals who had made a career working on Peregrine restoration"[18] (Burnham 2005:5, Cade et al. 1997). That same opposition continues today in an effort to maintain many of the archaic circular closures and timelines adopted during the 1990s.

Historically one of the key issues preventing dialog in managing Peregrine in climbing and other recreational areas has been an over reliance of Decision Makers on "Expert Opinion" or "Professional Judgment" not backed by relevant or current "best available science and scholarship". Ruddock and Whitfield (2007) found that 'expert opinion' has typically been used as a "stopgap in research as a bridge between empirical evidence and policy". They found it was "frequently misused by not being a temporary measure and with insufficient validation." The need to keep objective, unbiased science, however relevant to societal problems, free from political alliances is critical (Burnham 2005).

"EVERYONE IS ENTITLED TO HIS OWN OPINION, BUT NOT TO HIS OWN FACTS."

– Daniel Patrick Moynihan, 2018

Given the divisiveness and bias of past practices used for managing Peregrine while under the Endangered Species Act, it is predictable that perceptions of trustworthiness and credibility will continue as key stumbling blocks to any collaborative discussions. Trust cannot be legislated; it only develops over time and through experiences with others (Burnham 2005:6). A critical tool to insure constructive group discussion is to use your first meeting to agree on how information will be prioritized.

One strategy would be to agree on an order of relevance when presenting facts. An example, in order of relevance, would include:

1. *Information presented and supported by Peer reviewed literature with support from study results (e.g. best available science and scholarship or compound sequential hypothesis).*
2. *Information presented and supported by Peer reviewed literature without direct support to study results (e.g. best available professional opinion, or sequential hypothesis).*
3. *Information provided within a Specialist's area of expertise without providing reference (e.g. Specialist's opinion or dual-process hypothesis).*
4. *Information provided outside a person's area of expertise without providing reference (e.g. public opinion or positional hypothesis).*

In approaching a biologist or resource manager, climbers and local recreation groups will need to consider four

[18] Peregrine Fund. 2005. Burnham testimony to the US Congress.

primary variables (Knight and Gutzwiller 1995):

1. Who is delivering a message,
2. Whether you or they are perceived to be trustworthy or credible,
3. Current attitudes, and
4. How involved you or they are in the topic.

For the near term, recreation groups and agency managers need to recognize that some biologists will be unable to make the transition from imposing restrictions under ESA authority to a more flexible balanced adaptive approach of management under a less restrictive MBTA. At the same time, managers and biologists reaching out to climbers need to recognize one single approachable recreationalist or climber may not represent your best approach to reaching your climbing or outdoor communities.
State and Federal Agencies may resist making the transition from denying access under ESA to management schemes designed to allow recreationists and wildlife to coexist under the MBTA.
By continuing to practice and enforce obsolete policies adopted under ESA these agencies may violate public trust; risking conflict that is not supported under the MBTA authority (US District Court 1991, 1996, 1997, USDJ 2017). Failure to respond and update past decisions places agencies in an extremely weak, if not, indefensible position.

Most if not all Peregrine management policies and closures currently enforced are time sensitive. For example the USDA Forest Service, NEPA decisions such as FEISs (Final Environmental Impact Statements) have a 3-year shelf life[19], while Land Resource Management Plans (LMRP or Forest Plans) and Resource Management Areas in these plans have a 15-year life[20]. For the Forest Service in particular these LMRPs are tasked with providing direction for assuring coordination of multiple-uses including outdoor recreation, range, timber, watershed, wildlife and fish, and wilderness with sustained yield of products and services. As such, they are never actually “completed,” or “final,” as the National Forest Management Act (NFMA) requires Plans to be maintained, amended and revised[21]. Most importantly, Federal land management doctrines for ecosystem approaches to adaptive management require ongoing adjustment of standards and guidelines regulating land uses rather than long-term Land Resource Management Plans (USDA Forest Service 2002).

In order for appropriate changes to take place it may be necessary for Local Climber Organizations (LCO) to partner with other local recreation groups in submitting written requests to Federal and State resource managers (i.e. Forest Supervisor or District Ranger) and for State and Federal Supervisors to outreach to climbers (e.g. Access Fund, Outdoor Recreation Advisory Group, and your Local Climbing Organizations), requesting the development of an updated Climbing and Recreation Plan and possibly amendments to existing or outdated Land Resource Management Plans in your area (Attarian and Keith 2008).

Attarian and Keith (2008) provides helpful ideas that can be applied when establishing a cooperative Climbing Management Plan. These ideas can be applied to the following list of objectives::

1. Provide a GIS schematic assessment of your climbing area that may prove helpful in examining the effects of climbing activity on resource values;
2. Compile information on various climbing management issues related to natural resources. Each topic should:
    a) Identify and address primary issues,
    b) Cite relevant literature and research,
    c) Identify examples of well-defined methods and management techniques developed and successfully implemented by various resource management agencies and climber organizations across the nation to help address climbing management concerns, and

[19] 36 CFR 5050.4B Chapter 14 1401(c)
[20] 36 CFR 219.11(c)
[21] 16 USC 1604(a) and 1604(f)

   d) Address specific philosophies and tools used by land managers to respond to specific recreation and climbing issues such as visitor capacity, recent increases in climber visitation, and the development of new climbing routes.

3. If present, develop a schematic assessment of a climbing area in relation to cultural resource concerns,
4. Identify social impacts and climbing, identifying unique and sometimes controversial climbing environments (i.e. cultural sites and unique habitats), and present a short summary on climbing and economic considerations, and
5. Develop clearly stated goals and objectives, defining the scope and longevity of the Climbing Management Plan, and conducting a thorough review of climbing activity by including sanctioned representatives from the relevant user groups and LCOs.

QUESTIONS TO BE ASKED:

A. Is there a management biologist familiar with your area who is interested in working with you?
B. Do you have access to a knowledgeable raptor biologist?
C. Are you working with a recreation specialist familiar with your area?
D. Is there an area manager (e.g. District Ranger, Forest Supervisor…) interested in working with your group or organization?
E. Have you established a priority for how new information will be considered?
F. Is there someone familiar with your area to advocate for recreation and climbers?
G. Have you made contact with the Access Fund?
H. If existing past monitoring information is not being made available to you are you able to make a Freedom of Information Act (FOIA) request?
I. Is there a history of a seasonal closure at your area? If so,
   a. If federal government, is it a voluntary closure or enforced CFR closure?
   b. Is there a monitoring plan, and is it monitored each season?
   c. Is the closure lifted each season two weeks after the young have fledged?
   d. Are people expert in the recreational activity being monitored (e.g. climbers) involved in the monitoring?
J. Have you approached the area manager concerning the need to develop a Climbing Management Plan?

SUMMARY: Adaptive management is a system of management practices based on clearly identified intended outcomes and monitoring to determine if management actions are meeting those outcomes; and, if not, to facilitate management changes that will best ensure those outcomes are met or re-evaluated. Adaptive management is an open process of decision making in which stakeholders are directly engaged and decision-making authority is shared among one another. A key element to Adaptive Management is monitoring. Unfortunately, adopting an adaptive management strategy can be hampered by a widespread belief among agency specialists and decision makers that adaptive management does not constitute a significant departure from an Agency's past practices, and involves little more than occasionally changing management actions. Finally, the ultimate success or failure for conservation of all species will not be dictated or accomplished by government alone. The participation of state governments and local communities are critical. Opportunities for Tribal involvement may exist. Private sector involvement, commitment, cooperation, and leadership are crucial and will ultimately determine the success or failure for adaptive management of outdoor recreation and raptors under the Migratory Bird Treaty Act.[22]

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[22] Burnham (2005:10). Original quote:" We believe the ultimate success or failure for conservation of all species will not be dictated or accomplished by government alone. The participation of state governments and local communities are critical. Opportunities for Tribes may exist depending upon species range. Private sector involvement, commitment, cooperation, and leadership are crucial and will ultimately determine the success or failure of saving many endangered [sic. list] species."

MONITORING

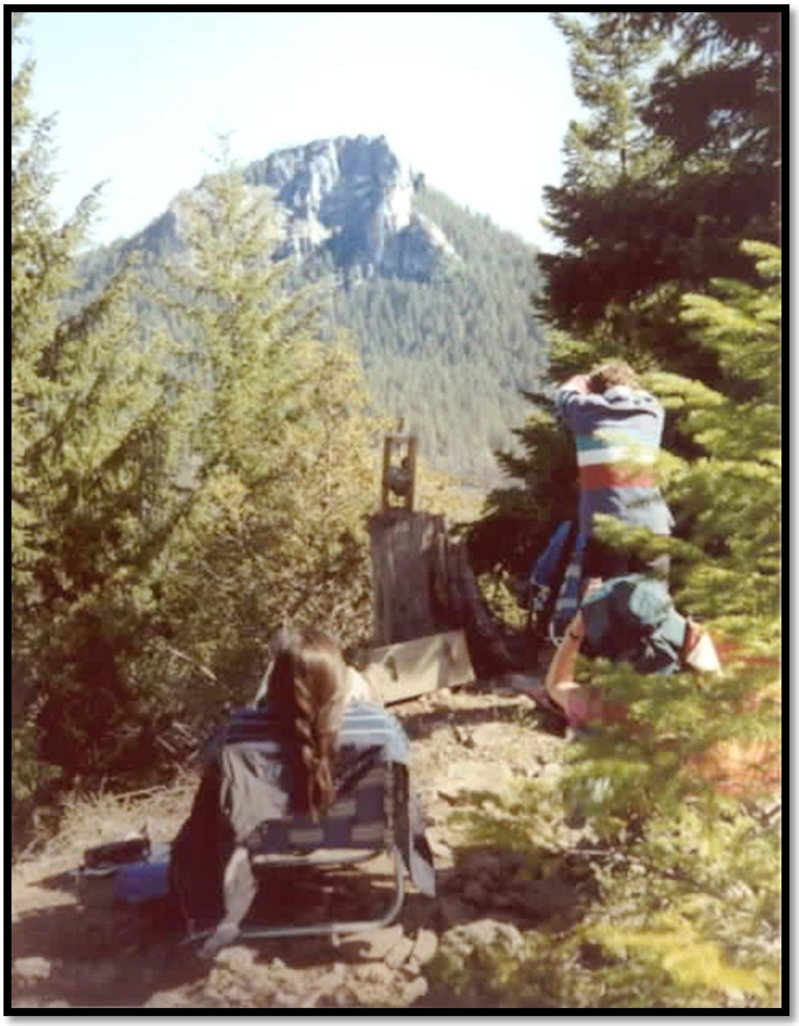

FIGURE 18. VOLUNTEER CLIMBERS MONITORING DISTURBANCE CLASS ACTIVITY AND RESPONSE.

VALIDATION - The backbone of any adaptive management strategy is monitoring. To make monitoring useful, choices of what ecological attributes to monitor and how to monitor them (frequency, extent, intensity, etc.) must be linked closely to the management situation that motivates the monitoring in the first place (Williams & Brown 2012:64). Your monitoring should produce feedback for identifying likely future adjustments and the information needed to make them (Bormann et al. 1994). At the same time, monitoring is important enough that it should be an emphasis of your recreation group for soliciting grants and providing volunteer support. For a more complete guide to monitoring refer to *Guide to management of Peregrine Falcons at the eyrie* Cade et al. (1996).

The primary need for any monitoring plan is to state explicitly what your group would like to learn from monitoring (Hutto and Belote 2013). A successful monitoring program must include:

- Adequate funding,
- Manage and make the data and results available,
- Meet formally with decision makers to discuss and incorporate monitoring results into an adaptive management cycle, and
- Mentor public interest.

Interagency Monitoring Working Group recommendations for monitoring include *implementation* (achieving standards and guides), *effectiveness* (attaining goals), and *validation* monitoring (testing assumptions lacking cause-and-effect relations) (Bormann et al. 1994:11). Typically Peregrine and Eagle monitoring has focused around enforcement of closures and number of young ledged. However, increasing populations or stable ones with high density probably do not warrant management to increase reproductive success or to redistribute young (Cade et al. 1996:6). Most agency monitoring plans fail to adequately validate underlying assumptions for the closures being enforced.

The primary purpose of validation monitoring is to:

a) *Inform partnerships and the responsible official during implementation whether the action is having its intended effects,*
b) *clearly identify the adjustment(s) that may be made when monitoring during project implementation indicates that the action is not having its intended effect, or is causing unintended and undesirable effects, and*
c) *Strengthen our understanding of probable causal relationships.*

Correlational studies and validation monitoring are often a good first step at identifying probable causal relationships. Ideally they generate hypotheses regarding causality and then these hypotheses can be experimentally tested under more controlled situations (Cole 2004). If you have worked through the questions at the end of each section in this document you are on your way to setting up a constructive monitoring program for your area. Ideally you are able to find a biologist familiar with Peregrine monitoring who's willing to work with you. If not, Access Fund should be able to help you get started.

One objective maybe to test assumptions behind seasonal closure prescriptions by actively testing disturbances created within mapped Activity Areas with Response Sensitivity during different periods of the year. Does the evidence from your monitoring support the need for the prescribed closure? Design tests capable of differentiating among competing explanations for observed phenomena or relationships.

When monitoring, be careful to visually verify cause and effect when interpreting vocal responses. It is not uncommon to assume a raptor's vocal response is to your presence only to find them chasing another bird from their territory, on visual inspection. Vocal responses may be given when someone, or something, is within some 300 feet or so of the cliff, or for many other reasons. These calls may have several meanings such as, to alert a mate, to indicate that the territory is taken, defense against the intruder, etc. One must be careful in putting meaning to a call. Typically, during the non-breeding season, Peregrines will make a call or series of calls for a short period and then fly to a nearby location and observe the activity without exhibiting any further signs of distress. It is rare for the calls to last more than a few seconds. Calls of this brief duration are routine and should not serve as the basis for management actions (White 2012:4).

If there is a need to do so, physical entry into a nest site for the purpose of monitoring should take place 2 weeks after hatching once they can thermal regulate and before the young have developed pin feathers and can leave the nest. Age at first flight varies from 5 to 6 weeks (Cade et al. 1996:3). For at least a week before they would naturally fly, young Peregrines still developing their pin feathers are readily frightened into premature flight if the scrape is visited, sometimes with disastrous results. Flights grow stronger and more frequent within a day or so from fledging, but the family normally remains near the cliff for a few days, roosting fairly close around though seldom actually at the scrape ledge (Ratcliffe D. A. 1993:238-240).

Fledglings will do a good deal of calling to the parents, and the intensity of the treble whine seems to denote the level of hunger. Calls from the young during this period are easily misinterpreted as response to a threat rather than fledglings demanding attention. About a week after fledging the young begin to chase each other a good deal and play 'hunting games' in the air, soaring and circling near the scrape cliff and then stooping at each other somewhat in the manner of adults engaging in courtship flight. Other bird species in the area, including predators such as crows and buzzards are often 'buzzed' both in the air and at rest. For a time the youngsters indulge in mock attack at a variety of birds without attempting to strike prey, but in a few weeks they begin to attack passing birds in view of the nest ledge (Ratcliffe D. A. 1993: 241). As the young grow stronger and more skillful they and parents move increasing farther from the eyrie during the day (Ratcliffe D. A. 1993:243).

Monitoring for responses to disturbances during the nesting season will be important to determining the success or questioning the need of any management closure. After a decision has been made whether to modify your Best Management Practices, future decisions will be required in continuing the adaptive management process. If the decision is to adjust, adaptive management must be applied to these modified practices or set of standards and guides. This process will include cycling through the adaptive management system testing the continued efficacy of these new standards and guides. If an adjustment is not made, further monitoring or research may be necessary or a decision made to forgo further information-gathering on this issue. Either way, input from managers, scientists, and the public should be included (Bormann et al. 1994:21).

QUESTION TO BE ASKED:

A. How has monitoring helped our understanding of probable causal relationships between Site Resiliency, Activity Class, and Response Class?
B. How effective are buffers and seasonal prescriptions at balancing the need for public access with the needs of raptors where they are most sensitive?
C. Does active validation monitoring support the need for closures as prescribed?
D. What evidence is there that prescriptions are not resulting in intended effect, or are causing unintended and undesirable effects?
E. What prescription adjustment(s) may be recommended specific to time and place?

Several issues, typically outside the scope of most local climbing and recreation organizations, are correlations between raptors with the effects of climatic influences from climate change, bioaccumulation of toxins from environmental chemical contamination, and infectious diseases. Peregrines will continue to be valuable indicators of the environment into the future (Cade et al. 1996:6). While these issues should not directly affect the day to day management of your area they can provided for interesting partnerships between your organization and researchers.

CLIMATIC INFLUENCES – Perhaps the most important factor that induces Peregrine breeding, in particular, is availability of prey such as urban habitats and migratory flight paths with hunting opportunities close to the eyrie (Thomsett 1988:290, Anderson et al. 2019). The recent phenomena of drought, global warming, and other aspects of climate change may affect the Peregrine Falcon's food supply. This effect may be more positive, with increased natural disturbances such as wildfire, by creating more open early successional habitat near eyries for hunting. Similar changes, however, may be having adverse effects in drier habitats in the Southwestern US where increased fire events and burn severities may decrease habitat diversity in arid ecosystems that rarely see large scale fires.

QUESTION TO BE ASKED:

A. How diverse is the habitat surrounding the eyrie?
B. How far do nesting Peregrine travel to hunt or how long are they away from the scrape when hunting?
C. What opportunities are there for managing for vegetation screens or relocating travel routes where recreation activities occur?
D. What opportunities are there for managing for openings in vegetation within the viewshed for hunting close to the eyrie and away from recreation activities?

TOXIN BIOACCUMULATION – DDT use was stopped in 1972 the United States. However, areal spraying of ¾ pounds per acre of DDT was carried into 1974 on over 400,000 acres of forests in Oregon, Washington, and Idaho (Graham et al. 1975). With an environmental half-life of approximately 30 years Peregrines, osprey, bald eagles, and pelicans all began showing improvements a decade later and continued improving (Fyfe et al. 1988, Peakall & Kiff 1988, Walker et al. 2003, Franke et al. 2011:9, Baril et al. 2015). By 1988, Cade (1988:481) found that egg shell thinning was no longer influencing reproductive rates at the larger scale. Even Peregrines migrating to Latin America where DDT is still in use (at lower levels than where applied in the US), DDT/DDE blood levels have decreased (Henny et al. 1996, Henny et al. 2009).

More recently, there has been a global concern over bioaccumulative and toxic chemicals of global concern including lindane, dieldrin, and chemicals found in flame retardants (Anderson, C. et al. 1996, Guerra et al. 2011, Guerra et al. 2012, Yan et al. 2013, Yu-Xin et al. 2013). Raptors appear to be the most sensitive (reproduction, behavior, growth & development) to flame retardant chemical exposure (Guigueno and Fernie 2017). As yet, no other chemical pollutants have been found to interrupt reproduction in Peregrine to the degree that post-war applications of DDT 1946 through the '60s. Guigueno and Fernie (2017:414), found overall, reproductive success was less frequently impacted than behavior, either due to altered brain or altered hormone status or both, but that individuals can compensate for altered behavior. They recommend that future studies continue to measure changes in growth, development, and reproduction. Assessing the ecological risks of toxic chemicals is most often based on individual-level responses such as survival, reproduction or growth. Such an approach raises questions with regard to translating these measured effects into likely impacts on natural populations (Forbes et al. 2002).

INFECTIOUS DISEASES – Since 2000 there have been several reported outbreaks of highly pathogenic H5N1 avian influenza virus causing mortality in wild waterfowl. A major outbreak of the N5H1 virus occurred in 2005 in western China and N5H8 virus during a 2014-15 outbreak in North America, causing mortality of more than a thousand birds. Outbreaks in waterfowl are likely to be carried onto raptors that hunt or scavenge medium-sized birds, such as vultures and Peregrine Falcons, than in raptors that hunt small birds and do not scavenge (Van den Brand et al. 2015). A study in Germany found 2 Peregrines (n = 6) and 12 vultures (n = 36) tested positive for the H5N1 virus (Van den Brand et al. 2015). Another study conducted in the US (Minnesota, Virginia, Maryland, and Texas) found 22 Bald eagles (n=406), 1 Peregrine (n=472), and no vultures (n=29) affected with the N5N1 virus (Redig and Goyal 2012). Several studies from both Germany and North America suggest increasing immunities in wild bird populations (Webster 2016, Krone et al. 2018).

Continued monitoring of environmental contaminants and the spread of the H5N1 & H5N8 viruses will be important in assessing the health of our planet. Environmental contamination from persistent chemical pollutants is a health issue for both humans and raptors. Peregrines are an excellent sentinel species for monitoring both H5N1 and environmental organic contaminants because they are at the top of the food chain and consume avian prey from the aquatic and terrestrial environments. Recreation groups soliciting for grants and climbers working with a qualified research biologist can play an essential role in accessing nest sites to band and collect samples (e.g. blood, feather, egg) used to track bioaccumulative toxics and viruses.

QUESTION TO BE ASKED:

A. Do you have a researcher or biologist you can work with qualified and interested in banding & collecting blood samples for biotoxin and H5N1 virus monitoring?
B. Do you have the interest and ability to solicit funding grants or fund raisers to fund monitoring in your area?

Assessing the ecological risks of toxic chemicals is most often based on individual-level responses such as survival, reproduction or growth (Forbes & Calow 2002). Such an approach raises the following questions with regard to translating these measured effects into likely impacts on natural populations.

C. To what extent do individual-level variables underestimate or overestimate population-level responses?
D. How do toxicant-caused changes in individual-level variables translate into changes in population dynamics for species with different life cycles?
E. To what extent are these relationships complicated by population-density effects?

SUMMARY: The backbone of any adaptive management strategy is monitoring. It is strongly stressed that any agreement on buffers be regarded as a starting point until further validation has been undertaken through monitoring. Your monitoring should produce feedback for identifying likely future adjustments and the information needed to make them. Most agency monitoring plans fail to adequately validate underlying assumptions for closures they enforce. Correlational studies and validation monitoring are often a good first step at identifying probable causal relationships. Monitoring for responses to disturbances during the nesting season will be important to determining the success or questioning the need of a management closure in some areas. Ideally, input from managers, scientists, and the public should be included in your monitoring and evaluation process. After a decision has been made whether to modify your Best Management Practices, future decisions will be required in continuing the adaptive management process.

DEFINITIONS

ADAPTIVE MANAGEMENT – [USDA Forest Service 2008, 40 CFR parts 1500–1508. 220.5.] – "A system of management practices based on clearly identified intended outcomes and monitoring to determine if management actions are meeting those outcomes; and, if not, to facilitate management changes that will best ensure that those outcomes are met or re-evaluated. Adaptive management stems from the recognition that knowledge about natural resource systems is sometimes uncertain. An adaptive management proposal must clearly identify the adjustment(s) that may be made when monitoring during project implementation indicates that the action is not having its intended effect, or is causing unintended and undesirable effects. Such proposals must also describe the monitoring that would take place to inform the responsible official during implementation whether the action is having its intended effect."
https://www.fs.fed.us/emc/nepa/nepa_procedures/includes/fr_nepa_procedures_2008_07_24.pdf
https://www2.usgs.gov/sdc/doc/DOI-Adaptive-Management-Applications-Guide-27.pdf

Best Available Science – [USDI NPS 2016] "Best available sound science and scholarship is up-to-date and rigorous in method, mindful of limitations, peer-reviewed when appropriate and required, and delivered at the appropriate time in the decision-making process in ways that allow NPS managers to apply its findings. Sound science and scholarship is a body of knowledge that draws upon a broad and often interdisciplinary community of practitioners, both within and beyond the Agency." https://www.nps.gov/policy/DOrders/DO_100.htm

Critical Habitat – "for a threatened or endangered species means — (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the Endangered Species Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species" ESA Sec. 3 (5A). "Except in those circumstances determined by the Secretary, critical habitat shall not include the entire geographical area which can be occupied by the Threatened or Endangered Species (ESA), Sec. 3 (5C). (USDI F&WS 2013 http://www.fws.gov/endangered/laws-policies/definition-of-harm.html)

Eyrie – An eyrie is the nest of a bird of prey such as an eagle or hawk. Eyries are perched high, in tall trees or on cliffs.

Harassment - actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering. Protected against under ESA restrictions but not under the MBTA.

Harm – Under the Endangered Species Act: "any act which actually kills or injures fish or wildlife, and emphasizes that such acts may include significant habitat modification or degradation that significantly impairs essential behavioral patterns of fish or wildlife" ESA 64 FR 607277 November 8, 1999, (USDI F&WS 2013. http://www.fws.gov/endangered/laws-policies/definition-of-harm.html). "Harm" is a defined term contained in the definition of "take" under the federal Endangered Species Act (White 2012:5).

Least Concern - The International Union for Conservation of Nature's Red List of Threatened Species™ is the world's most comprehensive inventory of the global conservation status of plant and animal species. It uses a set of criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. Under IUCN criteria a species is considered of "Least Concern" when it has been evaluated against its criteria and does not qualify for *"Critically Endangered", "Endangered", "Vulnerable",* or "*Near Threatened*". The primary driver of extinction risk in raptors is range size, as species with small ranges are at much greater risk of extinction (Buechley et al. 2019). IUCN's assessment has been that the Peregrine species have an extremely large range, and hence does not approach the thresholds for Vulnerable under UCNI's range size criterion.[23] They conclude that the Peregrine population "trend appears to be stable, and hence the species does not approach the thresholds for Vulnerable under UCNI's population trend criterion"[24]. UNCI states, "[Peregrine] population size is extremely large, and hence does not approach the thresholds for Vulnerable under the population size criterion"[25]. For these reasons the species has been evaluated by the IUCN as of *"Least Concern".*

Normal Fledge Date – as used in this document refers to average fledge date upper limit ($p = 0.2$) using all available fledge data for a given eyrie when available, or when unavailable data from eyries within a similar geographic range.

Scrape – Peregrines lay their eggs in a nest depression called a "scrape." To make the nest scrape, a Falcon pushes its feet backward while lying on its breast to create a small depression in the substrate. Peregrines build scrapes not only on ledges, but also when using the nests of other birds. No material is added to the scrape.

Sensitive Species – The following two definitions are taken from the USDA Forest Service and Oregon Department of Fish and Wildlife:

USDA Forest Service – "those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced byhttp://www.fs.fed.us/r6/sfpnw/issssp/documents/ag-policy/20021200-fs-sensitive-species-key-policies.pdf):

a. Significant current or predicted downward trends in population numbers or density;
b. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution." USDA Forest Service (FSM 2670.5 [19], Bosch 2002

Oregon Department of Fish & Wildlife – "refers to wildlife species, subspecies, or populations that are facing one or more threats to their populations, habitat quantity or habitat quality or that are subject to a decline in number of sufficient magnitude such that they may become eligible for listing on the state Threatened and Endangered Species List". **635-100-0040 Sensitive Species List,** http://www.dfw.state.or.us/OARs/100.pdf

1. For the purpose of prioritizing conservation actions to prevent species from becoming eligible for listing as threatened or endangered species, the category of sensitive species is established. "Sensitive" refers to wildlife species, subspecies, or populations that are facing one or more threats to their populations, habitat quantity or

[23] This criterion includes extent of occurrence <20,000 km^2 combined with a declining or fluctuating range size, habitat extent/quality, or population size and a small number of locations or severe fragmentation.
[24] UNCI Vulnerable population trend criterion is >30% decline over 10 years or three generations.
[25] UCNI criterion for vulnerable population size is <10,000 mature individuals with a continuing decline estimated to be >10% in 10 years or three generations, or with a specified population structure.

habitat quality or that are subject to a decline in number of sufficient magnitude such that they may become eligible for listing on the state Threatened and Endangered Species List. The sensitive species list shall be updated by the department every 5 years, distributed to state and federal resource agencies, and made available to any member of the public upon request.

2. A wildlife species shall qualify for inclusion on the sensitive species list if:
    a. Its numbers are declining at a rate such that it may become eligible for listing as a threatened species; or
    b. Its habitat is threatened or declining in quantity or quality such that it may become eligible for listing as a threatened species.
3. A wildlife species shall qualify for removal from the sensitive species list if:
    a. Its numbers are not or are no longer declining at a rate such that it may become eligible for listing as a threatened species; and
    b. Its habitat is not or is no longer threatened or declining in quantity or quality such that it may become eligible for listing as a threatened species.

Take – A direct, affirmative and purposeful act," to pursue, hunt, take, capture, kill, possess, sell, barter, purchase, ship, export, import, transport, or carry specified migratory birds or their nests or eggs". Unless permitted by regulation, the MBTA prohibits the "taking" and "killing" of migratory birds. 1918. [50 C.F.R. 10.12 (2013)] MBTA https://www.fws.gov/laws/lawsdigest/migtrea.html. ESA Sec. 3 (19), USDI F&WS 2013 http://www.fws.gov/endangered/laws-policies/section-3.html
Note: Under Executive Order 13186 of January 10, 2001 "Incidental Take" was included in the definition of "Take", but rescinded by Solicitor General. USDJ. Opinion M-37050, December 2017 and USDI USF&W 2018 Memo.

> **Incidental-Take** – An act that indirectly results in "take" that results from an activity, but is not the purpose of that activity. (*USF&W Regulations 50 C.F.R. 17.4 (2012), Solicitor General. USDI. Opinion M-37050, December 2017, USDI USF&W 2018*). [16 U.S.C. Section 707(b) (2012) requires that the government prove a defendant knowingly acted in violation of the MBTA [United States vs. Pitrone, 115 F.3d 1, 6 (1st Cir. 1997)].

Threatened Species – "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" ESA Sec. 3 (20), USDI F&WS 2013 http://www.fws.gov/endangered/laws-policies/section-3.html

APPENDIX A.1: WORKBOOK TUTORIAL

The following field sheets are part of a 5-step process to assess Peregrine eyrie habitat and potential for affects from activities close to the eyrie. The information you provide in these sheets can be entered directly into an MS-Excel workbook which is companion to ***Outdoor Recreation and Raptors a guide to Adaptive Management under the Migratory Bird Treaty Act***. Note that all criteria in the field sheets apply equally to man-made or natural structures. Summary tables and prescription recommendations provided in the Results section of this workbook are provided as recommendations considering the information you provide in the first 5-STEPS. The intent of this workbook is to incorporate the information provided in the Adaptive Management Guide to help facilitate consensus in an interdisciplinary team setting. In the MS-Excel workbook hovering your cursor over cells with red tags in upper right corner will display instructions and a listing of references. A Beta version of this workbook is available upon request. For more information contact: gortonumpqua@gmail.com.

TABLE 7: TABLE LISTING THE 5-STEP PROCESS USED TO GENERATE SEASONALLY SITE-SPECIFIC PRESCRIPTIVE RECOMMENDATIONS FOR MANAGING RECREATION ACTIVITIES NEAR EYRIES.

Prescription Workbook to Outdoor Recreation & Raptors		*Reference chapters & page numbers in Outdoor Recreation & Raptors, a guide to Adaptive Management under the Migratory Bird Treaty Act*	
STEP 1:	CLIFF QUALITY	Eyrie Assessment of Site Resiliency	pages 12 - 21
STEP 2:	STRATIFYING THE LANDSCAPE	Resiliency to Activities	pages 23-31
		Viewshed Management	pages 31-34
STEP 3:	SITE CHARACTERISTICS	Resiliency to Activities	pages 23-31
STEP 4:	DISTANCES (Automated)	Response Sensitivity	pages 28 - 34
STEP 5:	FLEDGE DATE	Fledge Date - Statistical Probability	page 50
RESULTS:	RESULT SUMMARY TABLES AND RECOMMENDATIONS for PRESCRIPTION	Seasonal Sensitivity	pages 34 - 38

Step-1: Cliff Quality Assessment.

Eyrie assessments look at the potential of a site to attract and support nesting raptors. Habitat quality can be defined according to its propensity to sustain a population long-term without net immigration. It is the replacement rate and the difference between reproduction and mortality, which determines whether a population can persist. Begin by creating a base-map for the eyrie and its surroundings. Make this map broad enough that all disturbance areas you wish to assess can be added to your base map (refer to Figure 19). Include elevation to your base-map with 1:24,000 scale (i.e. USGS) or better (Lidar) scale Digital Elevation Model (DEM) generated contours. However, regardless of your map accuracy, site-specific field measurements using an altimeter, GPS, and range finder will be necessary to obtain the appropriate level of vertical accuracy, if not also horizontal accuracy on cliffs. Such accuracy maybe better obtained through volunteer public participation than within a managing agency.

TABLE 8: STEP-1A. MEASUREMENTS AROUND THE EYRIE. ENTER THE FOLLOWING ELEVATIONS AS FEET ABOVE SEA LEVEL, A ROUGH AVERAGE ESTIMATE OF THE GROUND SLOPE FROM THE BASE OF THE EYRIE OUT 200 TO 800 FT, A ROUGH AVERAGE ESTIMATE OF THE VEGETATION HEIGHT THAT IS DENSE ENOUGH TO OBSTRUCT VIEWS FROM THE EYRIE LEDGE OUT 200 TO 800 FT FROM THE BASE OF THE EYRIE, THE LENGTH OF THE SLOPE USED TO MAKE THESE ESTIMATES (BETWEEN 0 TO 800 FT), AND THE LATITUDE (IN DECIMAL DEGREES, IN THE WGS84 DATUM) WHERE THE EYRIE RESIDES. THESE VALUES CAN ALL BE ESTIMATED FROM MAPS FOR A ROUGH INITIAL EVALUATION. HOWEVER, ACCURATE SITE SPECIFIC NUMBERS MEASURED IN THE FIELD WITH ALTIMETER AND/OR GPS AND RANGE FINDERS WILL BE REQUIRED FOR APPROPRIATE ACCRURACY.

CLIFF TOP ELEVATION	1,500	feet above sea level		
NEST LEDGE ELEVATION	1,400	feet above sea level		
CLIFF BOTTOM ELEVATION	1,200	feet above sea level		
AVG. SLOPE FROM BASE OF CLIFF	45%	percent slope 200 to 800 ft from cliff	150	downhill length of foot slope (ft) from nest cliff (0 to 800 ft).
Avg. GROUND VEGETATION HEIGHT	120	feet high vegetation 200 to 800 ft from cliff base		
LATITUDE	43.2165	degrees (example: 43.2165)		

TABLE 9: STEP-1B. SPECIES SPECIFIC RAPTOR NEST DENSITY. CHOOSE ONLY ONE OPTION IN THE FIRST COLUMN THAT BEST REPRESENTS EYRIE. PLACE AN "X" IN ONE OF THREE CHOICES VERTICALLY. LEAVE BLANK IF UNKNOWN UNTIL MORE INFORMATION HAS BEEN COLLECTED. WHEN LEFT BLANK THE WORKBOOK DEFAULTS TO A 10 TO 25 MILES/PAIR DENSITY. A STATE OR AGENCY BIOLOGIST SHOULD BE ABLE TO PROVIDE A REASONABLE ESTIMATE FOR YOUR AREA.

DENSITY CLASS	
X	< 10 miles/pair

Step-2: Stratify the Landscape.

Using the base-map created in Step-1, identify at a minimum, the following items:

- Identify the extent of the area within view of the nest ledge (½ to 1 mile from the eyrie).
- Significant changes in vegetation that creates visual screens or openings when viewed from the eyrie.
- Significant structural features (i.e. ridges, rock outcrops, structures) that create visual screens when viewed from the eyrie.

TABLE 10: STEP-1C. CLIFF (OR STRUCTURE) CHARACTERISTICS. CHOOSE ONLY ONE OPTION PER ROW THAT BEST REPRESENTS YOUR EYRIE. PLACE AN "X" IN ONE OF THREE CHOICE HORTIZONTALLY. IF UNKNOWN, LEAVE A ROW BLANK UNTIL MORE INFORMATION IS AVAILABLE.HOWEVER, BY YOUR FINAL ASSESSMENT IT IS IMPORTANT THAT YOU SELECT ONE OF THE THREE OPTIONS IN EACH ROW THAT IS A "BEST FIT" THAT PREPRESENTS THE CHARATERISTICS OF YOUR EYRIE.

Cliff Characteristics					
				X	At least one outcropping with active or historical nesting activity and multiple "good" nesting ledges with a history of eyrie movement between ledges.
		X	Access to the top of the rock and into the nesting ledge requires a lower level of technical climbing experience (<5.10b).		
		X	Almost sheer or jumbled rock face <200 feet high and less than 500 feet in width with at least one "good" nesting ledge and other possible 'fair' nesting ledges. The cliff is part of a rock escarpment of a less extensive nature than that known as an "A" cliff.		
				X	Rock (or made-made structual) quality provides for relatively permanent or solid substrate, good drainage, free from excessive deposition of rock and soil onto the eyrie ledge.
				X	The eyrie is within 3 miles of an open permanent water source, particularly in dry habitats.
		X	The viewshed for 1/2 mile looking out from nest ledge is predominently covered in moderate to mixed density early & mid-successional vegetation.		
				X	Regularly fledges young each year. Nest ledge locations along the cliff face can change from year to year.
		X	There is a clear unobstructed horizontal and vertical view from the nesting ledge. Maintaining disturbance cycles (i.e. fire) can be important to maintaining an open view from the eyrie ledge. Grade B cliffs can be affected by temporal changes in vegetation that can adversely affect or enhance hunting close to the eyrie.		
				X	The nesting ledge has overhanging protection from rain with suitable sun exposure and protection to allow young optimum thermal regulation relative latitude and climatic conditions.

- Locate all recreational feature points and polygons (i.e. campgrounds, facility rentals, restrooms, public use areas, and vertical route locations) and access vectors (i.e. trails, roads) to be accessed.
- Create a reference point map layer that intersects all the features listed above. These points will receive a unique number and identity. Any feature may require more than one assessment point where intersection conditions change significantly. A trail crossing from vegetative screening through a meadow opening is an example of a significant condition change that would qualify for an additional point assessment.

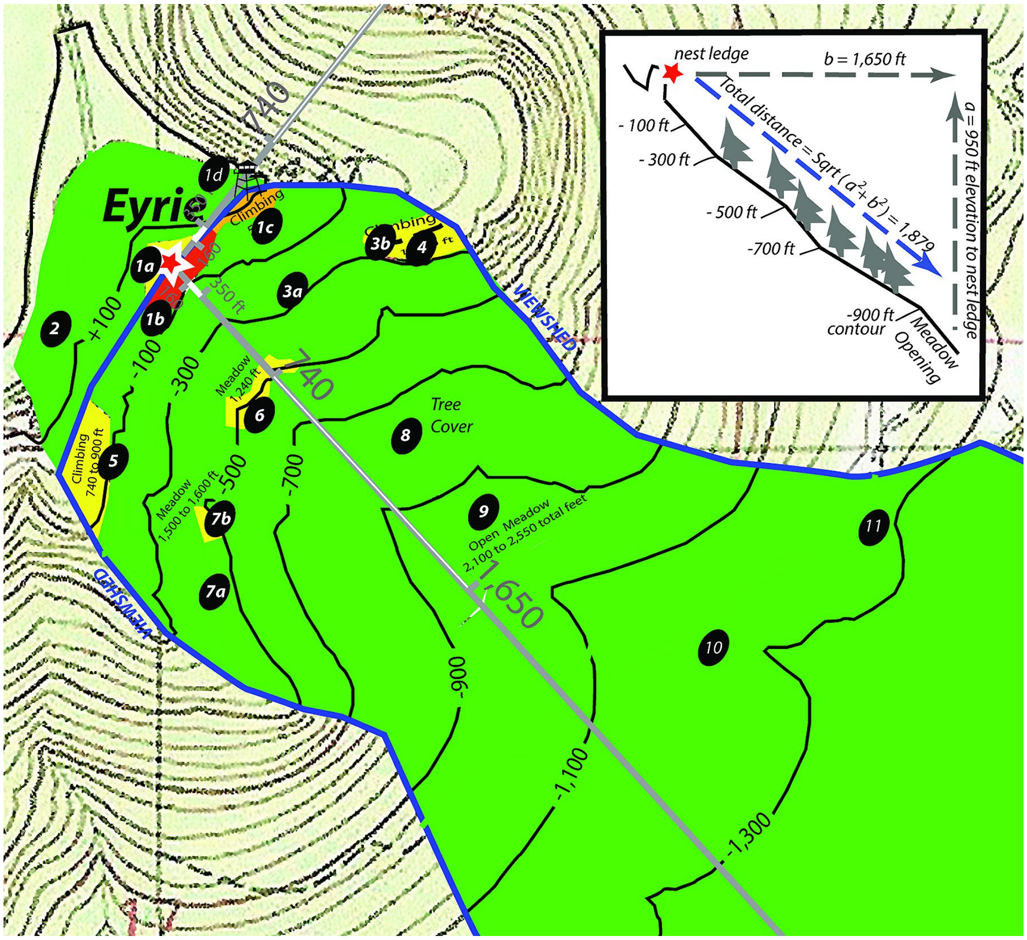

FIGURE 19. STEP-1 & 2. AREA & ACTIVITIES ASSESSMENT MAP. ON YOUR BASE MAP (REFER TO STEP 1) IDENTIFY THE VIEWSHED AS SEEN FROM THE NEST LEDGE INCLUDING LANDSCAPE FEATURES WITHIN THE VIEWSHED (VEGETATIVE OR STRUCTUAL SCREENS AND OPENINGS. IDENTIFY THE LOCATION AND ELEVATION OF ACTIVITIES AND POTENTIAL DISTURBANCES YOU WISH TO ASSESS.

Record each assessment point to be entered into the workbook for analysis (refer to Figure 19). For each point record a unique site number, label or brief description, elevation, horizontal distance from the nest ledge, and identify whether it falls within the viewshed and whether there is an unobstructed view of the nest ledge from this site. Total distance from the nest ledge is automatically calculated for you once entries are made into the workbook. Each workbook can accept a maximum of 45 unique assessment points. More than 45 points will require a separate entry and run of the remaining points. Entries from Step-1 would remain unchanged.

TABLE 11. STEP-2. ASSESSMENT POINT IDENTIFICATION TABLE. ENTRY TABLE FOR RECORDING MAPPING POINTS TO BE ASSESSED. NOTE THAT RECORDING LATITUDE AND LONGITUDE IS OPTIONAL.

Site No.	Lable or Brief Description	Latitude	Longitude	Elevation *	VIEWSHED *	Unobstructed view*	Horizontal Distance from nest ledge. *	Total Distance from nest ledge.
				ft. above sea level	X = Inside	X = unobstructed	ft.	
	EXAMPLES:	42.356	101.567	2,355	X	X	800	
1	Trail before eyrie			1,200			100	-224
2	Trail below eyrie			1,200	X	X	100	-224
2b	Trail after eyrie			1,200	X		200	-283
13a	Climbing Route 13, Pitch 1 & 2			1,300			250	-269
13b	Climbing Route 13, Pitch 3			1,400	X	X	250	250
9	Top of eyrie rock			1,550		X	100	180

Step-3: Site Characteristics.

Using Table 12 make five selections in columns 1 through 5, selecting one of three descriptions (A, B, or C) that is the "closest fits" the description for each individual site.

Step-4: Distances and Response Sensitivities.

The workbook automatically calculates distances and estimates response sensitivity for each Assessment Point once Steps 1-3 are entered. Continue to Step-5.

TABLE 12. STEP-3. READ DESCRIPTIONS A, B, & C IN EACH COLUMN AND PLACE THE LETTER OF THE DESCRIPTION THAT BEST FITS THE SITE LISTED ALONG THE FAR LEFT.

		FREQUENCY	VISIBILITY	REMOTE	DURATION	SEASONAL FREQUENCY
		.COLUMN 1	.COLUMN 2	.COLUMN 3	.COLUMN 4	.COLUMN 5
	A	Infrequent & Unpredictable (Monthly or less). Activities is spoatic or rare. May go a month or more between occurrances.	Activity exposed to the nest ledge is level or above the elevation of the nest ledge is likely to occur from use of this site.	Remote Location. This delineated area is within the nest ledge's viewshed in an completely remote location, at least 1 mile from common use areas (roads, trails, recreation sites, or buildings).	Daytime activity at this site typically occurs over long periods of time of one hour or greater (e.g. baseball game, rock climbing).	Seasonal periods of inactivity during courtship and incubation period (Feb. - Early March).
	B	Activity likely to occur once or twice a week (i.e. weekends).	Exposed activity is likely below (not level or above) the elevation of nest ledge.	Activities occurring in this area are screened from view of the nest ledge (vegetation, structure or other topographic feature) or outside the viewshed.	Daytime activities of mixed duration expected, or does not fit neatly into the other two descriptions.	Low and sporadic activity during the period of courtship and incubation period (Feb. - Early March). Example: a primarily local climbing area or trail used during dry periods in winter.
	C	Activities Frequent & Predictable (i.e. Daily). Activity in this area is on a scheduled (timing, duration, location & magnitude) or of continuous or nearly continuous use (high use urban & rural roads).	There is visual screening (e.g. vegetation, geologic feature, structures) beteen activity and the nesting ledge. Human activity that occurs within this delineated area is unlike within sight of the nest ledge.	Activity occurs outside viewshed or within viewshed it is in active urban or rual location & recreation areas where moderate to high use roads, trails, recreation sites, buildings, etc. are present.	Activities limited to nighttime hours, or of short duration (<1 hour) when passing through the area (e.g. driving, hiking, backcounty skiing, and jogging).	Consitent use most days throughout the year. Activities likely during courtship (Feb. - Early March). Example: Urban areas, busy campronds, popular trails, high use climbing areas.
Site No.	Site Lable	Choose A,B,orC	Choose A,B,orC	Choose A,B,orC	Choose A,B,orC	Choose A,B,orC
1	Trail before eyrie	A	C	C	A	A
2	Trail below eyrie	A	B	B	A	A
2b	Trail after eyrie	A	C	C	A	A
13a	Climbing Route 13, Pitch 1 & 2	A	C	C	A	A
13b	Climbing Route 13, Pitch 3	A	A	B	A	A
9	Top of eyrie rock	A	A	B	A	A

Step-5: Fledge Date.

Step-5 calculates the latest probable fledge date within a designated confidence based on monitoring records for the area. For each year on record enter the month, day and year of fledging (Table 13). The workbook will accept 30 fledge date records. In some cases when records are unavailable or incomplete, supplementing the table with a nearest neighbor eyrie can be helpful. Without fledge date information, the workbook will automatically default to an average fledge date of June 15 with July 1 representing two weeks past fledging.

TABLE 13: STEP-5. EXAMPLE OF FLEDGE DATE HISTORY.

Eyrie Fledge Date History

	Month	Day	Year
Example	June or 6	15	1995
1	6	15	
2	6	12	
3	6	17	
4	6	13	
5	6	18	
6			
7			

Results

Results are presented in four summary tables. These include 1) Eyrie Assessment, 2) Response Sensitivity and Activity Class Summaries, 3) Summary Table for Seasonal Closure Recommendations, and 4) Fledge Data Summary. To the right of each of these three tables is a listing of references.

TABLE 1. Eyrie Assessment

Site Class: A
Site Resiliency: Very High

	SITE FACTORS	RECOMMENDATIONS
perch hunting	*Cliff height over the terrain provides for good hunting from the nest ledge. Viewshed has a variety of vegetation cover or is in an urban setting offering optimum conditions for hunting close to the eyrie.*	*Look at opportunities for managing for moderate and open vegetation cover in accordance with the natural disturbance regime to increase foraging for prey in the viewshed.*
adequate prey	*Eyrie located near flyway above protective vegetation and abundant prey.*	
fledge, high	*Adequate thermal requlation, viewshed, prey availabilty, and protection from preditors make this a quality and resilient nesting site.*	
flexible nesting options	*There are multiple nest ledge opportunities that provide nesting raptors choice.*	*Apply appropriate buffers as needed later in the season once a site has been selected.*
low predation exposure	*There is a low risk of predation during nesting activities.*	
Adequate Thermal exposure	*There is adequate thermal exposure or protection as needed.*	

Table 2. Response Sensitivity and Activity Class Summaries. scroll left to see all of this table

Site No.	Site Description	Response Factor Summary			Response Class	Activity Class Factor Summary				
1	**Trail before eyrie**	-	0 to 350 ft.	Outside Viewshed	1	Activity occurs sporatically throughout week.	Within an urban or active rual location.	Out of view of nest ledge.	Of long duration.	Weather prevents access Feb. – March 15.
2	**Trail below eyrie**	-	0 to 350 ft.	Unobstructed View, Inside Viewshed	3	Activity occurs sporatically throughout week.	Within a rural location.	Exposed to & below nest ledge elevation.	Of long duration.	Weather prevents access Feb. – March 15.
2b	**Trail after eyrie**	-	0 to 350 ft.	Obstructed View, Inside Viewshed	1	Activity occurs sporatically throughout week.	Within an urban or active rual location.	Out of view of nest ledge.	Of long duration.	Weather prevents access Feb. – March 15.
13a	**Climbing Route 13, Pitch 1 & 2**	-	0 to 350 ft.	Outside Viewshed	1	Activity occurs sporatically throughout week.	Within an urban or active rual location.	Out of view of nest ledge.	Of long duration.	Weather prevents access Feb. – March 15.
13b	**Climbing Route 13, Pitch 3**	+	0 to 350 ft.	Unobstructed View, Inside Viewshed	3	Activity occurs sporatically throughout week.	Within a rural location.	Exposed to & level with or above nest ledge.	Of long duration.	Weather prevents access Feb. – March 15.
9	**Top of eyrie rock**	+	0 to 350 ft.	Obstructed View, Inside Viewshed	1	Activity occurs sporatically throughout week.	Within a rural location.	Exposed to & level with or above nest ledge.	Of long duration.	Weather prevents access Feb. – March 15.

Table 3. Summary table and Seasonal Closure Recommendations.

Site No.	Site Description	Site Resiliency Class	Site value *(a)*	Activity Class	Class value *(b)*	Response Class	Class value *(c)*	**Sensitivity value** ***(a+b+c)***	**Seasonal Closure Recommendations**
1	Trail before eyrie	Very High	-2	Low to Mod.	1	Alert	1	**0.5**	**Open**
2	Trail below eyrie	Very High	-2	High	2	Defense	3	**3.5**	**February 15 - June 17**
2b	Trail after eyrie	Very High	-2	Low to Mod.	1	Alert	1	**0.5**	**Open**
13a	Climbing Route 13, Pitch 1 & 2	Very High	-2	Low to Mod.	1	Alert	1	**0.5**	**Open**
13b	Climbing Route 13, Pitch 3	Very High	-2	High	2	Defense	3	**3.5**	**February 15 - June 17**
9	Top of eyrie rock	Very High	-2	High	2	Alert	1	**1.5**	**February 15 - April 15**

Table 4. Fledge data Summary

PRECISION/REPEATABILITY OF FLEDGE ESTIMATES	
Precision Category	95% Confidence Limits on Estimates, based on variance in Fledge dates.
High	within 10% of the mean

Average Fledge Date:	June	15
Last Statistical Fledge Date:	June	17
st Statistical Lifting of Closures:	July	1

Finally, the backbone of any adaptive management strategy is monitoring. It is strongly stressed that any agreement on buffers be regarded as a starting point until further validation has been undertaken through monitoring. Your monitoring should produce feedback for identifying likely future adjustments and the information needed to make them.

APPENDIX A.2: WORKBOOK WORKSHEETS

Table 14: STEP-1a. measurements around the eyrie.

CLIFF TOP ELEVATION		feet above sea level		
NEST LEDGE ELEVATION		feet above sea level		
CLIFF BOTTOM ELEVATION		feet above sea level		
AVG. SLOPE FROM BASE OF CLIFF		percent slope 200 to 800 ft from cliff		downhill length of foot slope (ft) from nest cliff (0 to 800 ft).
Avg. GROUND VEGETATION HEIGHT		feet high vegetation 200 to 800 ft from cliff base		
LATITUDE		degrees (example: 43.2165)		

Table 15: step-1b. species specific raptor Nest Density.

DENSITY CLASS	
	>25 miles/pair
	10 to 25 miles/pair
	< 10 miles/pair

Table 16: step-1c. Cliff (or structure) Characteristics.

Cliff Characteristics - QUALITY CLASS					
c		b		a	
	At least one outcropping with a single active or historical nesting ledge. Use of these lower grade ledges may vary from year to year and fledging success should be expected to be more sporadic with higher mortality than at other higher grade sites.		At least one outcropping with active or historical nesting activity and at least one "good" nesting ledges with other possible "fair" nesting ledges.		At least one outcropping with active or historical nesting activity and multiple "good" nesting ledges.
	Access to the top of the rock is not technical with easy rappel or scrambling access into the nesting ledge (<5.6).		Access to the top of the rock and into the nesting ledge requires a lower level of technical climbing experience (<5.10b).		Access to the top of the rock and into the nesting ledge requires technical climbing & aid experience (>5.10b).
	Smaller or broken cliff escarpments, providing fewer lookout points and less available air space for hunting coverage from the nest ledge than Grade A or B. Permanent features such as buildings or geologic features may restricts a boader view from the nest ledge.		Almost sheer or jumbled rock face <200 feet high and less than 500 feet in width with at least one "good" nesting ledge and other possible 'fair' nesting ledges. The cliff is part of a rock escarpment of a less extensive nature than that known as an "A" cliff.		Provides lookout points and quality hunting coverage for Peregrine from the nest ledge that is at least 200 feet above the surounding vegetation with over 250 feet of open rock face or man-made structure on either side of the nest ledge (minimum open face of 200 ft verticle and 500 ft horizontal).
	Weathering rock or soil above rock face results in periodic deposition of rock and soil onto the eyrie ledge.		Nest ledge may have poor substrate for drainage and holding eggs, but rock quality provides for relatively stable substrate, free from excessive deposition of soil onto the eyrie ledge. Peregrines will often move into stick nests of other species at these sites. Quality may descrees overtime as these nests degrade.		Rock (or made-made structual) quality provides for relatively permanent or solid substrate, good drainage, free from excessive deposition of rock and soil onto the eyrie ledge.
	The eyrie is greater than 3 miles of an open permanent or seasonal water source.		The eyrie is within 3 miles of an open seasonal water source, but greater than 3 miles from a permanent water source.		The eyrie is within 3 miles of an open permanent water source, particularly in dry habitats.
	The viewshed for 1/4 mile out is predominently covered in dense even age stands or late-successional vegetation.		Located near a flyway or open water source. The viewshed for 1/4 mile out is predominently covered in moderate to mixed density early & mid-successional vegetation.		Nest ledge overlooks a flyway or open water source. The viewshed for 1/4 mile out is predominently openings surrounded by moderately to mixed density early & mid-successional vegetation. This option would also apply to urban areas.
	Site fledges young less consitently than would be expected for a higher quality site. Young often disappear without explanation, possibly due to permitted take or predation from easy access, or mortality from exposure.		Regularly fledges young typically from a single ledge site each year. Use this selection if there are no monitoring records for this site.		Regularly fledges young each year. Nest ledge locations along the cliff face can change from year to year.
	Vegetative screening in front of eyrie ledge or over lower portion of the cliff resulting in a partial horizontal or vertical obstruction of view. May represent a Class-B site that has missed a disturbance cycle (i.e. fire) and is outsides its typical disturbance regime.		There is a clear unobstructed horizontal and vertical view from the nesting ledge. Maintaining disturbance cycles (i.e. fire) can be important to maintaining an open view from the eyrie ledge. Grade B cliffs can be affected by temporal changes in vegetation that can adversely affect or enhance hunting close to the eyrie.		There is a clear unobstructed horizontal and vertical view from the nesting ledge for both hunting and preditor detection. Maintaining a clear view from the nest ledge is not dependent on disturbance cycles.
	Scrape or nest ledge aspect and/or visual obstructions do not provide adequate solar exposure or protection to help young thermal regulate relative to latitude and climatic conditions.		The nesting ledge has suitable sun exposure and protection for most but not all of the nesting season to allow young optimum thermal regulate.		The nesting ledge has overhanging protection from rain with suitable sun exposure and protection to allow young optimum thermal regulation relative latitude and climatic conditions.

Table 11. STEP-2. Assessment point identification table.

Site No.	Label or Brief Description	Latitude	Longitude	Elevation *	VIEWSHED *	Unobstructed view*	Horizontal Distance from nest ledge. *
				ft. above sea level	X = Inside	X = unobstructed	ft.
Ex.	Trail -A through open meadow	42.356	101.567	2,355	X	X	800

Table 17. STEP-3.

	.COLUMN 1	.COLUMN 2	.COLUMN 3	.COLUMN 4	.COLUMN 5
A	Activities in area sporadically throughout the week.	Activity exposed to the nest ledge is within or above the elevation of the nest ledge is likely to occur from use of this site.	This delineated area is within the nest ledge's viewshed in an completely remote location, at least 1 mile from low use roads, trails, recreation sites, buildings.	Daytime activity in the area occurs over a long period of time (e.g. baseball game, rock climbing).	Moderate recreational use, particularly during courtship and early March. February through Early March. Example: Popular but sporatically used trails and climbing areas, may only receive use on weekends and holidays.
B	Timing of when activities occur are difficult to predict, but occur at least once a day.	Exposed activity is likely below (not level or above) the elevation of nest ledge.	This delineated area is within the nest ledge's viewshed in an rual location & does not fit neatly into the other two	Daytime activities of mixed duration expected, or does not fit neatly into the other two descriptions.	Low activity during courtship and incubation period (Feb. – Early March). Example: seasonal periods of inactivity.
C	Activity in this area is on a scheduled (timing, duration, location & magnitude) or of continuous or nearly continuous use (high use urban & rural roads).	There is visual screening (e.g. vegetation, geologic feature, structures) between activity and the nesting ledge. Human activity that occurs within this delineated area is unlike within sight of the nest ledge.	This delineated area is within the nest ledge's viewshed in an urban or rual location & recreation areas where moderate to high use roads, trails, recreation sites, buildings, etc. occur within 1 mile.	Activities limited to nighttime hours, or of short duration in this area (e.g. driving, hiking, backcounty skiing, and jogging).	High activity (consitent use throughout the day) within view use likely to occur during courtship (Feb. – Early March). Example: Urban areas, busy camprounds, popular trails, high use climbing areas that are actively used most days throughout the year.
Site No.	*Choose A,B,orC*	*Choose A,B,orC*	*Choose A,B,orC*	*Choose A,B,orC*	*Choose A,B,orC*

TABLE 18: STEP-5. EXAMPLE OF FLEDGE DATE HISTORY.

Eyrie Fledge Date History

	Month	Day	Year
Example	June or 6	15	1995
1			
2			
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