Southern Oregon University

Honeycombs Peregrine Monitoring: A Trial Adaptive Management Program for Raptor Management at Climbing Areas

A project submitted in partial satisfaction

of the requirements for the degree of

Master of Outdoor Adventure

and

Expedition Leadership

by

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December 2020

Southern Oregon University

Graduate Committee Approval

of a project submitted by

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This project has been read by each member of the following graduate committee and by majority vote has been found to be satisfactory.

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Abstract

Each year, between eighty-five and one hundred rock climbing areas in the United States are subject to closures to protect cliff-nesting raptors during their breeding season. In some of these areas, lack of available information and often a lack of resources on the side of land managers has led to the persistence of large blanket closures which neither accurately reflect the specific needs of the birds nor allow for optimal recreational access to these areas for climbers and other user groups. This thesis project implemented a trial adaptive management plan for raptor management at the Honeycombs climbing area in southern Oregon in order to assess the effectiveness of that model and suggest improvements so that it might be utilized by local climbing organizations and land managers to design more accurate, site-specific closures nationwide. A Geographic Information System (GIS) - modeled viewshed approach, followed by validation monitoring, was used to predict and then refine the size and scope of the closures by reducing potentially threatening disturbances during sensitive periods. The trial was successful in drastically reducing the size and length of the closure at the Honeycombs for the 2020 nesting season (allowing for eighty-five percent of climbing routes to remain open) while still allowing the nesting pair to fledge four young. This project highlighted the incredible opportunity that raptor management presents for members of the climbing community and land managers to cooperate and strengthen their relationship.

Keywords: adaptive management, viewshed, validation monitoring, rock climbing

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Chapter 1: Introduction

Rock climbers experience the world in ways that most others do not. As they ascend cliffs and rocky outcroppings in some of the most beautiful places on earth, climbers find themselves in unique, breathtaking positions and are able to push their bodies and minds to unimaginable limits. The flow, the Zen, the single-mindedness of being out there alone on a rock face can be intensely therapeutic and incredibly rewarding for these "conquerors of the useless[1]" - but oftentimes, they are not at all alone. Indeed, all across the United States, climbers share many of these same cliffs with a variety of raptor species who also call these crags their home. The same precarious perches that produce so much pleasure for climbers also provide ideal nest sites for a few species of falcons and eagles to raise their young. During their breeding season, these birds are extremely territorial and can be quite sensitive to disturbance in some cases. It is imperative, therefore, that climbers respect and help protect their avian neighbors during these critical breeding periods.

Since 1963, closures of climbing areas have been enforced in order to ensure the successful breeding of cliff-nesting raptors (Mathisen, 1968). While there are a few examples of climbing areas with robust management plans that allow for more precise, nuanced raptor closures (e.g., Yosemite National Park, Zion National Park, and Smith Rock State Park), in many cases these closures are not informed by the best available science, and often result in overly restrictive public land closures (White & Thurow, 1985; Holmes et al. 1993; Ruddock & Whitfield, 2007). Lack of available information and often a lack of resources on the side of land managers has led to the

[1]This is a phrase often attributed to Yvon Chouinard from the film "180 Degrees South: Conquerors of the Useless (2010)." Chouinard refers to himself and other climbers as such in the film, and it is a label that many in the climbing community wholeheartedly embrace. The original usage of the phrase is attributed to Lionel Terray, a French climber whose mountaineering memoir is titled "Les Conquérants de l'inutile."

persistence of large blanket closures which neither accurately reflect the specific needs of the birds nor allow for optimal recreational access to these areas for climbers and other user groups. Understandably, this situation can be a source of tension between land managers and the climbing community. However, the very necessity of these closures presents a wonderful opportunity for collaboration between the two groups. Climbers are perfectly poised to assist in the fine-tuning of these closures because of their vested interests in both protecting and preserving access to the wild spaces in which they recreate. Therefore, the goal of this study is to aid in the creation of adaptive management practices which protect the raptors, while also optimizing access to these natural resources and fostering better relationships between climbers and land managers across the country.

Theoretical Foundations

This thesis project seeks to use the best available science to aid in the creation of a national standard for assessing climbing areas with cliff-nesting raptors and implementing closures in those spaces. In collaboration with the Access Fund (a national climbing advocacy group), the Bureau of Land Management, and the Southwestern Oregon Climber's Coalition, a trial ***adaptive management*** plan for raptor nesting closures, which draws largely on the work of southwestern Oregon climbing developer and advocate, Greg Orton, will be implemented during the 2020 peregrine falcon breeding season at the Honeycombs crag east of Glide, Oregon. An adaptive management plan is one which promotes flexibility in the decision-making process and allows for adjustment in the face of uncertainty. It is intended to be an iterative process whereby decision outcomes are continually monitored and evaluated to determine whether they are achieving

objectives. This style of approach is critical in managing ecosystems as it accounts for natural variability and ensures adaptation to a changing environment (Fischman & Ruhl, 2016). In the case of raptor management, this means that closures must be reassessed each breeding season in order to ensure their accuracy.

This trial will involve assessing the quality of existing nesting sites in the area, and then stratifying the landscape and the viewsheds of the nesting sites using GIS software. A ***viewshed*** is the geographical area that is visible from a specific location, accounting for the various obstructions or screening caused by topography or vegetation (Camp et al. 1997). The viewshed approach is fundamental to this project as it will help to reign in the larger blanket closures currently in place in some locations by focusing only on the areas that are visible to the birds, as it is generally accepted that the birds are not easily perturbed by auditory disturbances (White & Thurow, 1985; Ruddock & Whitfield, 2007; Ellis et al., 1991). Once the breeding season has begun, nesting sites will then be monitored in order to observe nest site selection, to assess disturbance levels from various assessment points (both inside and outside the viewshed), and to determine when chicks have fledged (left the nest ledge). This monitoring will help inform the duration, size, and scope of the closures. The aim is to then assess the effectiveness of this model and make any necessary improvements so that this tool can be implemented by local climbing organizations (LCOs) and land managers at climbing areas nationwide.

Research Question

How can an adaptive management plan for establishing effective raptor nesting closures which both ensure the breeding success of the birds while also optimizing recreational access for climbing best be carried out at the Honeycombs climbing area, and then how can that plan be adjusted and implemented on a national scale?

Chapter 2: Literature Review

In researching raptor nesting closures and the science behind them, one of the first observations is the dearth of literature on the subject – and therein lies the issue. Few scientific studies exist that specifically address the impacts of disturbance caused by outdoor recreation (especially climbing) on the breeding success of cliff-nesting raptors, and therefore land managers have little data on which to base seasonal raptor restriction decisions. This lack of information has led to substantial discrepancies across the country on the criteria for which these restrictions are made, and it is the purpose of this study and the current aim of the Access Fund to rectify this situation by educating both land managers and climbers on how to better manage raptor nesting closures at climbing areas across the country.

This research drew largely from the ProQuest Central and JSTOR databases using the following keywords: ***peregrine falcons, cliff-nesting raptors, raptor nesting closures, adaptive management, climbing management guidelines,*** and ***viewsheds***. This literature review will be organized thematically, then, in order to provide an overview of the basic subject matter involved and to help the reader understand the need for this research. First, this review will cover the troubled history of cliff-nesting raptors in America and some of their basic biology in order to set the scene and provide an understanding of the complex context in which these closures exist. Next, the history of raptor nesting closures in the United States and existing management plans will be assessed. Then, the concept of adaptive management and its benefits will be addressed. Finally, there will be an overview of current guidelines and best practices for raptor nesting closures, including a discussion of the resilience of raptors to human disturbance and an introduction to viewsheds.

History of Cliff-Nesting Raptors in North America

While this thesis project is meant to inform future decisions about nesting closures for all species of cliff-nesting raptors across the country, the peregrine falcon will be the main focus of this literature review because it is the species of concern for this particular study at the Honeycombs crag. Furthermore, it is important to note that the peregrine falcon and its turbulent history played a pivotal role in shaping the course of conservation efforts in this country. Understanding the story of the peregrine falcon is fundamental to understanding not just the story of raptor management in the United States, but also wildlife management and conservation more generally.

The peregrine falcon (*Falco peregrinus*) is a crow-sized raptor species known for its incredible speed as well as its incredible recovery from the brink of extinction. Peregrines prey upon medium-sized birds including doves, pigeons, various waterfowl, and songbirds. While soaring at great heights, peregrines will locate their prey from above and execute incredibly fast stoops (nose-dives), snatching their unsuspecting prey from above with their sharp talons. These nose-dives have been recorded at speeds of more than 200 miles per hour, and there is speculation that the birds might be capable of reaching even greater speeds under ideal conditions (Ponitz, 2014; Tucker, 1995). For this reason, peregrines have found favor among falconers throughout human history and are regarded as one of the most noble birds in falconry. Humans first harnessed the hunting prowess of the falcon thousands of years ago, and falconry was practiced from the Middle East to Japan long before the Christian era (Ratcliffe, 1993, p. 12). While many birds were flown in medieval times, it was the peregrine that was most highly prized by the princes and noblemen of Europe. The peregrine's relationship with mankind has not always been so affable, however. As the use of guns for hunting and the management of game preserves came into

existence, falcons quickly lost their status of veneration and came to be considered vermin. Because of their interference with the hunt, falcons were ruthlessly annihilated by hunters and gamekeepers from the eighteenth century through the early twentieth century (Cade, 1982, p. 51). Thankfully, this is no longer the case, but even while these human enemies accounted for thousands of deaths, the falcon populations remained largely unchanged by these human causes of death. This all changed with the introduction of a harmful chemical known as DDT.

During the 1960s, the ornithological community observed a drastic decline in the peregrine population. By 1965, the peregrine was all but extirpated east of the Mississippi in both the United States and Canada; not a single occupied nest was found that year in the east (Berger et al., 1969, p. 171-172). The situation in the west was nearly as bleak, with only 33% of all known nest sites in the Rocky Mountains still occupied (Enderson, 1969, p. 76). Further investigation revealed that this was directly related to the adverse effects of Dichlorodiphenyltrichloroethane (DDT) on the bird's reproduction and survival. DDT is an insecticide that was widely used throughout North America from the 1940s into the 1970s. DDT is a crystalline chemical compound known as an organochlorine that acts on insects by opening sodium ion channels in their neurons, which causes them to fire spontaneously, leading to spasms and eventually death (Dong, 2007). This harmful chemical made its way up the trophic ladder to the peregrine as they ate smaller birds that had fed on poisoned insects. DDT quickly accumulated in the fatty tissue of the birds and led to significant thinning of the eggshells produced by the female peregrines. The thin eggshells were then easily broken during normal incubation activities and resulted in a rapid decline of the species (Hickey, 1969). Before the use of DDT in the 1940s, it is estimated that there were between 7,000 and 10,000 traditional peregrine nesting territories in North America, of which between eighty and

ninety percent were occupied in any given year. By 1975, there were only 324 confirmed nesting pairs on the entire continent (Cade et al., 1988, p. 137-8). This precipitous plummet in population signaled a call to action for many in the conservation community - fortunately for the peregrine, that call was answered.

Several critical events which helped facilitate a comeback for the species occurred at the beginning of the 1970s. The peregrine was placed on the endangered species list in 1970, the Environmental Protection Agency banned the use of DDT in 1972 (largely in response to the plight of the peregrine), the Endangered Species Act was passed in 1973 (providing federal enforcement of the existing list), and the first peregrine reintroduction efforts began in earnest in 1974 (U.S. Fish & Wildlife Service, 2006). Various strategies were implemented to assist in the recovery of the species, the most common and effective of which were the release of captive-bred juvenile birds into the wild and direct manipulation of the existing wild nesting populations (Cade et al., 1988, p. 132). This direct manipulation often took the form of removing the thin, fragile eggs of nesting wild birds and replacing them with wooden “dummy” eggs; later, those fake eggs were replaced with live young safely hatched under laboratory conditions. Accessing some of these nesting sites was no small feat, and it turns out that biologists called on the help of climbers in some cases to assist in these efforts. In fact, during the early 1980s, the National Park Service recruited climbers such as Rob Roy Ramey, Ken Yager, John “Yabo” Yablonski, and the self-proclaimed “conqueror of the useless” himself, Yvon Chouinard, to help reach the peregrine nests on some of the largest, steepest faces in Yosemite Valley, including the iconic walls of Half Dome and El Capitan (Snider, 2008; Stock, 2011). This involvement of climbers in the reintroduction of the peregrine highlights the role of climbers as conservationists and marked a

precedent of the climbing community's commitment to copacetic cohabitation with the cliff-nesting raptors. These reintroduction efforts (which continued until 1997) were remarkably successful and resulted in a complete recovery of the species, so much so that the peregrine was officially removed from the federal endangered species list in 1999; but this removal did not occur without a certain amount of debate in the ornithological community.

To this day, the peregrine falcon is still one of the most successfully recovered endangered species ever, and the International Union for Conservation of Nature (IUCN) now categorizes the peregrine as a "species of least concern (Birdlife International, 2019)." However, the decision to remove the birds from the endangered species list in 1997 was not unanimous. Even though the data showed that "recovery goals for population size [had] been met or exceeded in all major regions (Cade et al., 1997, p. 733)," there were those in the minority who contended that delisting was premature. Those in opposition, while undoubtedly well-intentioned, were displaying the same overly cautious, overly protective sentiments that still characterize many of the attitudes and decisions towards the management of peregrines today - the same sentiments that promote the use of large, circular closures at climbing areas. But, as Tom Cade, founder of the Peregrine Fund and preeminent raptor scholar noted: "If after 20 years of impressive increase in distribution and abundance, the American peregrine falcon cannot be judged fit for removal from the list of endangered species, then the purpose of the Endangered Species Act has, indeed, been turned into a mockery (Cade et al., 1997, p. 736). Cade and others like him believed that the protections granted under the Endangered Species Act were no longer necessary for a species that is now thriving by nearly every available measure, and it was understood that other federal and state laws already in place would provide ample protection for the species moving forward. As it turned out,

however, the removal of the peregrine from the endangered species list did little to simplify the situation.

Because of its removal from the list, the peregrine is no longer federally protected under the Endangered Species Act (ESA); however, peregrines, along with all other migratory birds in the United States, are protected under the Migratory Bird Treaty Act (MBTA) of 1918. The MBTA was originally intended to provide authority to prosecute hunters, falconers, and egg collectors for killing migratory bird species. Specifically, the MBTA states that "it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, *take* [emphasis added], capture, [or] kill" any migratory bird, unless otherwise permitted (Migratory Bird Treaty Act of 1918, 2017). While the MBTA is quite explicit in its wording, interpretations of the word "take" have been a point of contention, and conflicting opinions often obscure the line between the MBTA and the ESA. In 2001, a presidential executive order expanded the definition of "take" to include "unintentional take." By definition, "'unintentional take' means take that results from, but is not the purpose of, the activity in question (Executive Order No. 13186, 2001)." Then, in a complete reversal, the Solicitor of the Department of Interior issued Opinion M-37050 in 2017, followed by guidance issued in a U.S. Fish & 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 (U.S. Department of the Interior, 2017)." 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 activities (Yung & Woodsmall, 2018). To be sure, raptor management will continue to be

influenced by future administrations and federal court decisions, and the climbing community and land managers alike must be willing and able to adapt to these changes.

Assessment of Existing Raptor Management Plans

Before evaluating existing raptor nesting closures, a cursory understanding of the nesting habits of the birds is warranted. Peregrine falcons generally mate for life and will return to the same nesting area each year (Newton, 1990, p. 115-17, 125). However, there is a reserve of adults above the number that can find places to nest within the rather rigid, territorial system. These surplus adults, known as "floaters," are available to replace lost or moribund breeders each year; in a healthy population, these floaters may equal or even exceed the number of breeders (Cade, 1996, p. 91-93). Peregrines seek out nest sites, known as eyries, high up on the most dominant cliffs or structures with respect to their surroundings. Peregrines do not build their nests; they simply use their feet to scratch out a shallow bowl in the substrate of a ledge. The birds almost invariably select sites which have been previously used, and while any one cliff may contain several different sites, certain ledges may be especially favored by successive occupants, and some have probably been used for hundreds of years (Ratcliffe, 1993, p. 162-163). Pairs are also known to switch between alternative eyries throughout the course of their breeding years (Zuberogoitia et al., 2015). Furthermore, it is important to note that after the successful reintroduction of the species, peregrines have adapted to new and novel habitats such as man-made structures in urban areas (bridges, rooftops, etc.), raven nests on electric pylons, and osprey nests on channel markers (Cade et al., 1997). The breeding cycle of the peregrines looks the same from year to year with little variation, though the exact timing of the different stages is dependent upon the latitude and

elevation of the nesting site. In general, the breeding cycle of the peregrine falcon in most of the United States begins with courtship and nest site selection between late February and mid-March and ends with the fledging of the chicks in mid-June (Cade, 1982). The birds are more sensitive at different points throughout this cycle, and there are further considerations for management guidelines which will be addressed below.

Seasonal climbing restrictions to protect nesting raptors, including closures of portions of cliffs, have been implemented since the 1960s. The initial implementation of many of these closures occurred in the early 1990s while peregrine falcons were still protected under the ESA, and some of them effectively still operate as if the birds were still an endangered species "Buffer zones" have been routinely prescribed in wildlife management plans in the US since 1963 (Mathisen, 1968). However, there are few supporting records where observations of disturbance have been explicitly recorded for the standard distances being prescribed (White & Thurrow 1985; Holmes et al., 1993; Ruddock & Whitfield 2007). These buffer zones often take the form of large, circular closures that do not account for the variability in the landscape and the visual screening provided by physical features. As is the case with many ineffective management plans across the country, the persistence of these large, circular closures is often due to a lack of available staff, funds, and resources for the land managers (Cole, 2004). Furthermore, these circular closures with designated primary, secondary, and tertiary zones were originally implemented for resource extraction projects (timber, mining, etc.) but are now being indiscriminately applied to outdoor recreation as well (U.S. Fish and Wildlife Service, 1997). A routine blanket closure of a climbing area is simply the least resource-intensive decision for land managers. Furthermore, as Kathryn Pyke noted in the *Raptors & Climbers* handbook she produced for the Access Fund in 1997, "lack

of available information has led, in some instances, to managers making decisions in isolation with little or no consultation with other resource managers or the climbing community (Pyke, p. 8)." Decisions about climbing closures cannot be made in a vacuum, and they must be informed by current laws and policies as well as the best available science. Fortunately, there are examples of areas where land managers and climbers are working together to create effective, informed raptor nesting closures.

Yosemite National Park, Zion National Park, Smith Rock State Park, and Jefferson County, Colorado are all great examples of climbing areas with effective raptor management plans. Land managers in each of these locations implement raptor nesting closures based on the results of comprehensive monitoring programs which rely heavily on volunteers from the local climbing population. This monitoring involves observing which sites are selected by the birds early each season and then determining when the chicks have fledged from active sites. Once sites have been selected, those areas not occupied by the birds are then reopened to climbing. The restrictions are later lifted at the active sites once it has been confirmed that the site is no longer in use. This collaboration between the resource managers and the climbing community has greatly increased the effectiveness of the management plans and has improved relationships between the groups. Janice Stroud-Settles, the wildlife program manager at Zion National Park remarked that the "climber-biologist partnership in Zion has demonstrated that conservation and climbing can be closely integrated with results that are beneficial to both parties (Access Fund, 2019)." In fact, the 2019 raptor monitoring program at Zion was so impactful that the climbers involved came together to form the Zion Climbing Coalition, a chapter of the Southern Utah Climbers Alliance. The continued monitoring of the peregrine falcon population in the park will no doubt be a central tenet

of the group's operations moving forward. These examples are encouraging and help set a bar by which all other management plans should be assessed. The collaboration between climbers and land managers and the reliance on citizen science is exactly the kind of action that needs to take place in order to achieve the successful adaptive management of these remarkable birds and the amazing natural resources they inhabit.

A Discussion of Adaptive Management

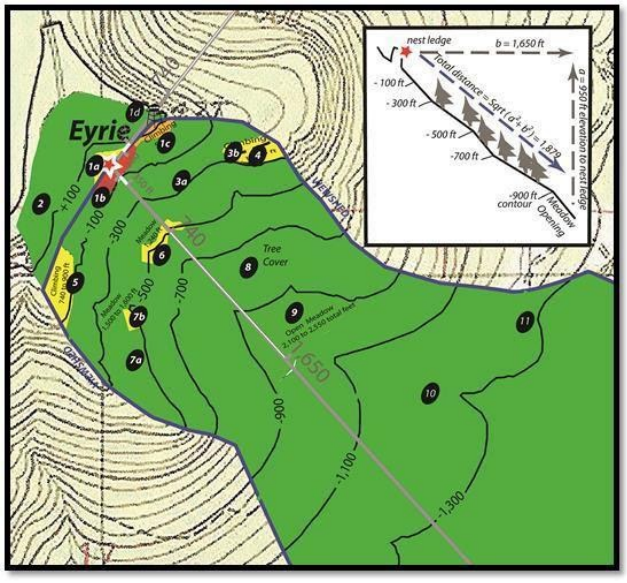
As defined by the U.S. Forest Service, "adaptive management is a system of management practices based on clearly identified intended outcomes and monitoring to determine if management actions are meeting those outcomes; and, if not, to facilitate management changes that will best ensure those outcomes are met or re-evaluated (U.S. Forest Service, 2008)." This strategy stems from the understanding that knowledge about natural resource systems is sometimes uncertain and can change. At the heart of adaptive decision-making is recognizing the existence of alternative hypotheses, and then assessing those hypotheses with monitoring data (Williams et al., 2009). It is clear to see, then, that managing raptor nesting closures is a prime example of a situation requiring adaptive management practices. Adaptive management is consistent with MBTA direction to develop and use principles, standards, and practices that will lessen the amount of disturbance caused by recreation. These practices are regularly evaluated and revised to ensure that they are effective in lessening the potential for the detrimental effect of recreation-related actions on migratory bird populations. Raptor closures are a continually moving target for land management agencies, and they must be reassessed each season in order to ensure their effectiveness and accuracy.

Best Management Practices: Sensitivity and Viewsheds

In order to determine best practices for an adaptive management strategy regarding raptor nesting closures, the sensitivity of the birds in question must first be understood. The primary goal of such a plan, of course, is to protect the birds and to ensure their successful breeding. This can be achieved, as has been mentioned previously, through more exacting measures than simply restricting access to vast swathes of cliff line every season. Original (and some current) guidelines for managing disturbances around eyries include both visual and auditory disturbances. However, studies have found a higher need for disturbance buffering within view of an eyrie ledge during nesting rather than from auditory disturbances (Stalmaster & Newman, 1978; Gilmer & Stewart, 1983; White & Thurow, 1985; Holthuizen, 1989; Ellis et al., 1991; Ruddock & Whitfield, 2007). Raptors may tolerate considerable noise close to their nests if they are familiar with it (Gilmer & Stewart 1983, White & Thurow 1985:19), and their response to auditory disturbances from forms of recreation such as climbing can be expected to be minimal and does not seem to limit their productivity (Edwards, 1969, p. 157; Stalmaster & Newman, 1978, p.511; Holthuizen, 1989; Ellis et al., 1991; Ruddock & Whitfield, 2007, p. 138). Furthermore, many prescribed buffer distances are imprecise (sometimes fractions of a mile in radius) and reflect the need to maintain flexibility for adjusting buffer zones to the viewshed using intervening terrain and vegetation screens which obscure activity from the eyrie and do not solicit a territorial response from the nesting birds.

Viewsheds are the geographical areas that are visible from specific locations, accounting for the various obstructions or screening caused by topography or vegetation. An understanding of the viewshed provides a more accurate landscape assessment of a raptor's needs. When birds are

shielded from disturbances by vegetation (Stalmaster & Newman, 1978) or topographical features such as cliffs, the distances at which the birds are flushed (caused to take flight) are reduced significantly. The use of a Geographic Information System (GIS)- modeled viewshed approach, followed by validation monitoring has proven to be an effective tool for reducing potentially threatening disturbances during sensitive periods in the breeding cycle (Camp et al., 1997; Richardson & Miller, 1997, p. 634-635). The use of viewsheds provides land managers with a realistic understanding of the spatial requirements and territorial response patterns of the nesting birds. The viewshed approach to spatially managing disturbance can decrease the size of traditionally prescribed circular buffer zones and help determine closures which optimize recreational access (Camp et al., 1997). This understanding of the viewshed as an important predictor of territorial response sensitivity to disturbance will greatly inform the design of this project.



This is an example of a viewshed map created by Greg Orton for the peregrine nest ledge at a climbing area in southern Oregon known as Acker Rock. This photo was taken from Orton's "Outdoor Recreation & Raptors: A Guide to Adaptive Management Under the Migratory Bird Treaty Act" (see Appendix A).

Chapter 3: Project Design

The express purpose of this project is to implement a trial adaptive management plan for raptor nesting closures at the Honeycombs climbing area for the 2020 peregrine falcon breeding season in order to assess the effectiveness of that plan so that it might be adopted by the Access Fund as a new national standard for climbing management plans across the country. This trial adaptive management plan is the product of years of research conducted by southwestern Oregon climbing developer and advocate, Greg Orton, in conjunction with representatives from the Access Fund and various raptor experts. Orton has worked tirelessly to synthesize the best available science (sifting through more than one hundred sources from leading experts) into a management strategy which seeks to both protect the birds and optimize climbing access. In addition to many other contributions, Orton has developed an incredibly extensive, yet user-friendly online spreadsheet form to aid in the development of raptor management plans at individual climbing areas. This tool, entitled "Prescription Workbook to Outdoor Recreation & Raptors: A Guide to Adaptive Management Under the Migratory Bird Treaty Act," provides a five-step process for assessing the peregrine habitat and the potential for disturbance from recreation. The workbook, once completed for a certain area, provides recommendations for seasonal closures and also includes a section to record monitoring results which then refine those closure recommendations further. *In short, the primary objective of this project is to test the effectiveness of Orton's workbook at the Honeycombs climbing area this year.* The specific design and implementation strategies involved in completing this objective will be discussed below. It is worth noting that, as with all adaptive management plans, the design of this project is constantly changing and evolving

as new information comes to light. This project is itself an iterative process which must adapt and adjust in order to meet the goals and objectives as set forth in this document.

Design and Implementation Strategies (Timeframe and Budget)

In essence, the design of this project is inherently linked to the natural breeding cycle of the birds. It is helpful to think of the timeline of this project, then, in three distinct phases (each with their own individual parts): preseason, nesting season, postseason. Initial assessment of the eyrie habitat and stratification of the landscape surrounding the climbing area must be completed prior to the arrival of the nesting birds in order to determine appropriate assessment points and to create preseason recommendations for closures (effectively, the hypothesis). Then, during the nesting season, validation monitoring will be implemented in order to test that hypothesis and make necessary changes to the closures. Finally, an analysis of the model and the monitoring protocol will be completed and recommendations for improvements will be made once the chicks have fledged. Orton's prescription workbook and the tutorial he has created for it will aid in the organization of the various steps in this process as well.

Preseason assessment.

The first step in creating a new management plan or adapting an existing management plan is to stratify the landscape and gather data during the preseason. If the management team is already acquainted with the area, this will streamline the process. The locations of the eyries which have been historically inhabited by the resident nesting pair should be known. Additionally, knowledge of the various climbing zones and an understanding of the use patterns of the various zones is

important in stratifying the landscape and selecting assessment points. High-impact areas should be noted as well as areas that are particularly ambiguous as regards their potential for disturbing the nesting birds (e.g., areas which are close to the nest site but outside the viewshed). If the management team is unfamiliar with the area, then much more preliminary research must be done before visiting the site for the first time. Reach out to the local climbing community, the local climbing organization (if the area has one), and the local land managing agency for more information if necessary.

Following Orton's workbook, the first step (see STEP_1) in this preseason assessment is to access the known eyries in the area and assess the quality of each of those habitats. [**Note: If there is more than one known eyrie in the area, a workbook must be completed for each of the known eyries.]** Some of these eyries may be more difficult to access than others - individuals should exercise caution and use proper climbing/rappelling techniques when accessing these areas if necessary. It is helpful to bring printed copies of Orton's workbook in order to gather precisely the data for which it asks. Once at the eyrie, record all the necessary information (GPS coordinates, elevation, etc.) and take photographs of the "scrape" as well as the view from the ledge in order to represent the viewshed. Filling out STEP_1 will also involve assessing the quality of the cliff by answering questions about its characteristics and recording elevations, slope averages, and height of the surrounding vegetation. Completing these assessments of the eyries will aid in understanding the quality of these sites and their potential for attracting mating pairs and successfully fledging young.

Following along with the workbook, steps 2 and 3 involve selecting assessment points from which to later measure the birds' responses to disturbances during their breeding cycle and

stratifying the landscape. These assessment points should include access vectors (roads, trails), high-use areas (popular climbing routes), and any other existing facilities (bathrooms, campgrounds, etc.). Special attention should be paid to areas which are questionable in their propensity for disturbing the birds. Areas which are proximal to the nest, yet shielded by the natural topography of the cliff or vegetation (i.e., outside the viewshed) have the potential to provide the most interesting insights for management. Each assessment point should be given its own unique label or description, and its GPS coordinates, elevation, whether or not it is inside or outside the viewshed, and whether the view of it from the nest ledge is obstructed or unobstructed should be recorded in accordance with the workbook design. Once these assessment points have been identified and recorded, STEP_3 should be filled out in order to better assess their use patterns. This preseason assessment may require multiple visits in order to gather all the necessary data. Once all the data has been collected, use the instructions provided in the workbook and its tutorial to construct maps for each of the nest sites with their viewsheds and the various assessment points highlighted. This may require the assistance of an individual with GIS experience.

The final preseason step (STEP_5) of the workbook is a table for recording fledge dates from monitoring records for the area. The workbook calculates an average probable fledge date within a ninety-five percent confidence based on those historical fledge dates. If there is uncertainty about the existence of such records, be sure to contact the land manager(s) or local Bureau of Land Management or Fish and Wildlife Service authorities to inquire about past monitoring activities in the area. This information will be helpful in predicting the rough timeline of the breeding cycle and can be useful in planning the upcoming monitoring season. If no records

exist, the workbook will default to an average fledge date range for subalpine elevations of June 15th to July 1st (Cade, 1982).

Once all of the steps have been completed, the "RESULTS" sheet in the workbook will calculate preseason closure recommendations based on the information provided. The formulas and calculations (which are explained in great detail in Orton's "Workbook Mechanics" document) completed within the workbook predict the response levels expected at each assessment point during each stage in the breeding cycle and produce closure recommendations based on those predictions. These preseason predictions, therefore, represent the hypothesis which will then be tested through validation monitoring during the breeding season.

Nesting season monitoring.

For the purposes of this management plan, the nesting season of the birds can be broken into three distinct phases: courtship to nest selection, egg laying to hatching, and hatching to fledging. Each of these phases represents a unique period in the breeding cycle marked by significant events. The selection of the nest site will determine which specific closure recommendations from the workbooks to implement, whereas the confirmation of chicks having fledged will mark the end of the seasonal closure period for the entire cliff. Each of these phases can be expected to have varying levels of response to disturbance. The purpose of this validation monitoring is to measure the responses from the birds during each of these periods to evaluate the accuracy of the preseason closures and inform changes in those closures in real time throughout the season. These closure updates will be communicated to the climbing community via MountainProject and through signage at the Honeycombs in coordination with the landowner,

John Blodgett. The Southwestern Oregon Climbers Coalition will also aid in the dissemination of information concerning the current management plan and necessary closures. The "MONITORING" sheet in the workbook provides instructions for monitoring and space to record monitoring results which will then be measured against the preseason closure recommendations.

This validation monitoring should begin as soon as the nesting pair are confirmed to be in the area; it can safely be assumed that the courtship period will have begun by February 15th in subalpine locations (Brambilla, 2004). In addition to observing and recording the routine behavior of the birds, this validation monitoring requires that disturbances be created at the various predetermined assessment points in the climbing area. The first step in achieving this will be to select an observation point from which there is a clear line of sight to each of the nest sites. Hopefully one can be found which has a view of each of the known eyries being monitored; however, of course, once a nest site has been selected, only that site will warrant further observation. At least one observer should remain at the observation point while other individuals access each of the assessment points. Simply walking around to each of the assessment points should be enough to determine a response level from the birds. If an assessment point can only be accessed via climbing or rappel, be sure to access those points appropriately and measure the response.

Responses are measured on a scale from "0 (No Response)" to "3 (Defensive)." A "1 (Alert)" is characterized by a continuous verbal response without flight, a "2 (Flight)" is a response involving flight, and a "3 (Defensive)" is a response which escalates to defensive flight directed around or at the disturbance directly. When monitoring, it is important to visually verify cause - and effect when interpreting vocal responses. Peregrines make calls and sounds of different styles

and durations for various reasons - calls of brief duration are routine and should not serve as the basis for management actions (White, 2012: 4). This is why it is important to have someone constantly observing from afar. While there is little reason to believe that this validation monitoring will have adverse effects on the breeding success of the birds, there is also no reason to continue to elicit responses from the animals once one has been recorded at a specific assessment point. However, as responses are known to vary at different seasons, each assessment point should be tested during each phase of monitoring regardless of the results from previous phases. It is important to have data from each period to better understand the sensitivities of the birds at these key junctures. Additionally, it is expected that a minimum of five days of monitoring will be conducted for each of the three phases in order to achieve a reliable pool of data from which to later draw conclusions for the management plan. Once it is determined the chicks are old enough to regulate their own temperature, the nest may be entered to age the chicks. Once that age has been entered into the monitoring section of the workbook, the fledge date will be predicted and the closure recommendation will be adjusted automatically. As noted above, the final step in monitoring is to confirm that the chicks have successfully fledged from the nest - any remaining closures should be lifted once the young have fledged (Cade, 1996).

Postseason analysis.

Once the monitoring period has ended, the results from the season will be analyzed and the effectiveness of Orton's workbook will be evaluated. The workbook itself provides meaningful feedback by comparing the monitoring results to the preseason closure recommendations and measuring the difference through statistical analysis. It is beyond the scope of this project and the

capacity of this researcher to explain in detail the mathematics involved in these analyses; those seeking answers can consult the "Workbook Mechanics" document created by Orton (see Appendix A). The results of this trial adaptive management plan will be shared with and evaluated by several organizations, including the Access Fund, Hawkwatch International, and the Peregrine Fund, among others. Recommendations for future management plans and suggestions for improvement will be considered based on the results and the experience gained throughout the monitoring process. The goal, then, is to eventually compare results from multiple site assessments in the future and continue to evaluate and adapt this plan as needed, as any good adaptive management plan should.

Limitations and Ethical Issues

The major limitations surrounding this project involve matters of scale. Given that this project will be conducted at a single climbing area for a single season, it is difficult to extrapolate this information and apply these management recommendations to other climbing areas with entirely different conditions and circumstances (terrain, elevation, climate, use patterns, size, raptor species, etc.). The design of this project, however, is based on the best available science and is meant to be applicable to all areas where raptor nesting and climbing coincide. Furthermore, it is important to note that this is the first iteration of this management plan. The intent is for this plan to eventually be implemented by climbing areas nationwide. While it is outside the scope of this particular thesis project due to time constraints, this research will continue as more climbing areas test this adaptive management plan next season.

The one potential ethical issue that this project raises centers around the potential for disturbing the birds during validation monitoring. The foundation of any adaptive management strategy is monitoring. To make monitoring useful, choices of what ecological attributes to monitor and how to monitor them must be linked closely to the management situation that motivates the monitoring in the first place (Williams & Brown 2012:64). This validation monitoring is meant to produce feedback for identifying likely future adjustments and the information needed to make those adjustments (Bormann et al. 1994). It is essential to create these minor disturbances for the birds so that their breeding success can be ensured in the creation of future climbing closures. As discussed earlier in the literature review, it is extremely unlikely that these isolated events will negatively affect the birds' reproductive success in any meaningful way, let alone cause them to abandon their nest. It usually requires repeated disturbance at close range and/or major disturbances for extended periods to reach a threshold that would cause site abandonment, and abandonment may only result in relocation to another site. The most sensitive period will be prior to hatching; once the young have hatched, the risk of nest abandonment is greatly diminished, even more so once the young can thermally regulate themselves (around twenty days old). For example, researchers often repeatedly enter nest sites during the breeding season and there has never been a documented case of abandonment caused by this activity (White and Thurow 1985, p. 16-18; Holthuizen, 1989; Ratcliffe 1993, p. 271-272; Peterson, 2018). As for legal considerations, even in the extremely unlikely case that this project caused nest site abandonment or resulted in any other form of "take," that take would be considered "incidental take" because it is not the purpose of that activity and would therefore not be unlawful (Opinion M-37050, 2017).

It is important to keep in mind that the ultimate aim of this project is to decrease the amount of stress placed on the birds during this sensitive period.

Resources and Contributors

Fortunately, this is not a particularly resource-intensive project. Aside from the climbing gear needed to access some of the sites at the Honeycombs, only a few items are needed to complete this project. One of the most important resources is a device capable of recording GPS coordinates and elevations. I have personally used a GPS application on my iPhone called GAIA as well as my Garmin inReach Mini and a Garmin eTrex Vista HCx GPS device to record this information. A barometric altimeter may also prove useful for determining elevations on cliffsides, however it is unlikely that it will be any more accurate than GPS devices. The other major requirement is a spotting scope and/or a pair of binoculars to aid in observation of the birds during the monitoring process. As concerns budget, the only expenditures for this project involve personal transportation and occasional accommodation for the researchers. All additional personnel required for the implementation of this trial adaptive management plan will be volunteers.

This project could not be completed without the aid and support of several individuals and organizations. Greg Orton is the primary driver and director of this project and has contributed countless hundreds of hours to furthering this research. Retired USFWS wildlife biologist and master falconer, Dave Peterson, has contributed greatly to the design of this project and will continue to provide meaningful insight drawn from decades of experience in the field. Katie Goodwin and Taimur Ahmad of the Access Fund have been helpful consultants and will be

instrumental in disseminating information about raptor management and helping to implement this management model at climbing areas across the country. Monitoring volunteers and invested community members include Harold Hall, Peter Tidball, Daniel Scott, Mike Perez, and Jake Potaski. Additional consultants include BLM wildlife biologists Steve Godwin, Liz Gayner, and Erich Reeder as well as Sarah Stock and Crystal Barnes of Yosemite National Park. Special thanks to Dr. Jamie Trammell in the Environmental Science Department at Southern Oregon University (SOU) for GIS guidance and the loan of a GPS device and to my brother, Ben Maness, for his assistance with drawing the territorial response maps for this project.

Chapter 4: Project Narrative

***Author's Note:** I thought it would be prudent to include a brief narrative of the project in order to give the reader a better understanding of the timeline of events and to highlight some of the major developments that occurred during the monitoring period.*

The seeds of this project were sown back in October 2019 when I first met Greg Orton. As soon as I arrived in Ashland to begin the Master of Outdoor Adventure and Expedition Leadership program at Southern Oregon University, I began sampling the local climbing in earnest, and I did so with one of Orton's guidebooks in hand. I quickly learned that Orton had done a lot of the bolting and route development in the region and that he was one of the founders of the local climbing organization, the Southwestern Oregon Climbers' Coalition (SWOCC). However, I did not know about Orton's work with raptor management until I was introduced to him by Willie Long, the Outdoor Program Coordinator at SOU. After exchanging a few emails with Orton, I quickly became deeply interested in his project and was excited by the opportunity to help him in his mission to improve the management of raptor nesting closures at climbing areas nationwide. He needed someone to do a trial run of his adaptive management plan at the Honeycombs, and I needed a thesis project in which I felt personally invested - it was a match made in heaven.

I first met with Orton at the Honeycombs in mid-October of last year, and we set straight to work with our preseason assessment. We accessed each of the three known nest ledges and recorded their coordinates and elevations; we also took pictures of the ledges themselves and the view from each of the ledges in order to help document their viewsheds. Two of these nest ledges required rappelling in from above, while a third required climbing a three-pitch route a couple hundred feet off the ground. We also began selecting and recording some of the assessment points

from which we would later measure responses during the breeding season. I returned a few more times during the fall season to finish gathering data for our preseason assessment. During that first visit to Roseburg, Orton and I also visited Dave Peterson, a retired USFWS biologist, raptor expert, and master falconer at his home outside Roseburg. Peterson provided a wealth of knowledge about the history of the peregrine falcon in North America (he was directly involved in the recovery effort of the species back in the 1990s), the breeding cycle of the birds, and monitoring best practices; he remained a crucial source of information and provided invaluable mentorship throughout the course of this project. Additionally, I met with two biologists from the Roseburg BLM office, Liz Gayner and Erich Reeder, in November to discuss their monitoring protocols and to obtain their monitoring records from previous years at the Honeycombs site. They were extremely cooperative and very forthcoming with information, and I consider my work with them to be a great example of the way that climbers and land managers can collaborate in order to achieve a common goal.

The winter brought its colder temperatures and provided my peers and I with a much-needed break. Already by the end of January, I began hearing the first reports that the peregrines had returned to the Honeycombs. This news came from Harold Hall, another longtime local climber and Orton's most constant route-developing partner. Harold was a frequent companion of mine during my monitoring trips to the Honeycombs and was my most reliable source of monitoring information when I could not get out there myself. Additionally, Harold provided me with lodging, food, and lots of wisdom on many occasions during my time in the Roseburg area, and I am forever grateful for his kindness and hospitality. I first returned to the Honeycombs myself in mid-February and was pleased to witness the birds in the early stages of

their courtship. Knowing the location of the previously occupied eyries, we were able to make some preseason closure recommendations for a couple of sites that the three nests shared in common as being potentially disruptive. We shared this information on the Mountain Project page for the Honeycombs. Over the course of the next few months, I made the trek from Ashland to the Honeycombs (a two and a half hour drive) another seven times and spent a combined total of about seventy-five hours in the field. I felt privileged to observe the different milestones of the birds' breeding cycle over the course of my visits, from the period of nest selection right through to the fledging of the young. Fortunately for all parties involved, my presence was mostly unobtrusive and only twice did I solicit a "defensive" response from the birds. I like to imagine that I formed a relationship of mutual respect with the birds as I measured their response from the various assessment points, always respecting their boundaries whenever they made it clear that I was crossing the line.

While it was difficult to tell before the female was actually incubating the eggs, it became quite clear by mid-March that the birds had selected the same nest ledge that they had used the previous year. Once confirmed, we updated the closure recommendations to reflect the results from the workbook for that particular nest ledge. The actual scrape was tucked back into a large "hueco" or hole in the rock, so it was nearly impossible to see the female sitting on the eggs from any vantage point; however, in April we witnessed one or both of the birds landing on the ledge and disappearing back into the hueco and observed what appeared to be several food exchanges between the male and the female on the ledge. Later, our fledge dates would confirm that the eggs were laid sometime in early April, and this would certainly explain the more agitated temperament of the birds during this period. Unfortunately, it was during this time of early April that the

landowner decided to close the Honeycombs to the public in light of the COVID-19 pandemic. I was fortunate enough to receive permission to continue my research, but the travel restrictions and general climate during that time made it difficult for me to get up there at times. Additionally, the COVID-19 closure (which lasted until early June) precluded us from disseminating and observing the effectiveness of our real-time closure updates via Mountain Project and the SWOCC social media presence.

Of course, the closure of the crag did not negatively affect the birds, and they continued right along with the raising of their young. The chicks hatched sometime in early May, and we first heard their cries on May 25th during a routine monitoring visit. Once it was deemed acceptable to enter the nest, we were pleasantly surprised to find four healthy chicks, two aged at approximately 28 days and another two about a week younger. By June 12th we were able to confirm that all four chicks had successfully fledged! Coincidentally, the lifting of the COVID closure coincided roughly with the fledging of the peregrines, and climbers and hikers alike were able to enjoy the entirety of the Honeycombs crag much sooner than the arbitrary July 31st (and in some cases, August 31st) date prescribed under many current management plans (addressed in greater detail in the following chapter).

In addition to carrying out the monitoring and implementing the trial adaptive management plan at the Honeycombs this year, I spent a great deal of time working on and editing various documents related to raptor nesting closures with Orton and the Access Fund. I spent countless hours editing, offering feedback, and experimenting with Orton's workbook as well as the Workbook Tutorial and Workbook Mechanics documents partnered with the spreadsheet itself. I have worked with Orton and our friends at the Access Fund, Katie Goodwin and Taimur Ahmad,

to edit Orton's comprehensive literature review, "Outdoor Recreation & Raptors: A Guide to Adaptive Management Under the Migratory Bird Treaty Act," as well as an updated guide for the climbing community produced by the Access Fund titled, "Climbing and Raptors - A Handbook for Adaptive Raptor Management." Furthermore, I coordinated with the landowner of the Honeycombs to communicate updates about the closures and I met with members of the Southwestern Oregon Climbers Coalition to educate them about the raptor nesting closures and how they can get involved. All this is to say that my involvement with improving the management of raptor nesting closures nationwide extends beyond the trial plan completed at the Honeycombs and fulfilment of this master's thesis project.

Chapter 5. Project Evaluation/Results

As stated in Chapter 3, the express purpose of this project was to implement a trial adaptive management plan for raptor nesting closures and to assess the effectiveness of that plan so that it might be adopted by the Access Fund as a new national standard. Therefore, it is clear to see that the evaluation of the project is indeed a major component of the project itself. Furthermore, any formal project evaluation involves measuring that project's success in meeting its stated goals. In the case of this project, those goals were threefold: 1) to protect the raptors and ensure their breeding success, 2) to optimize recreational access to the climbing area in question, and 3) to foster better relationships between climbers and land managers. Each of these will be addressed in turn below.

Protection of the Raptors

In the simplest of terms, we can measure the success of meeting this goal against the breeding success of the peregrines at the Honeycombs site for the 2020 season. The birds returned to the area, selected a nest ledge, and remained at that ledge for the entirety of the season. The pair fledged a total of four young, exceeding the national average of ~1.75 (White, 1994, p. 275). Furthermore, since the Bureau of Land Management began monitoring this site back in 1996, they have not reported more than two birds fledging in any given year (monitoring data provided by the Roseburg BLM office). It is clear, then, that the prescribed closures put into effect this year did not negatively affect the reproductive success of the birds. While it could be argued that the closures related to the COVID-19 pandemic created a disruption in the normal use patterns experienced at the Honeycombs, it is worth noting that the landowner and some of his close friends (as well as

this researcher) continued climbing at the site throughout the closure. Additionally, the validation monitoring, while eliciting a few defensive responses from the birds, was clearly not nearly intrusive enough to cause nest abandonment.

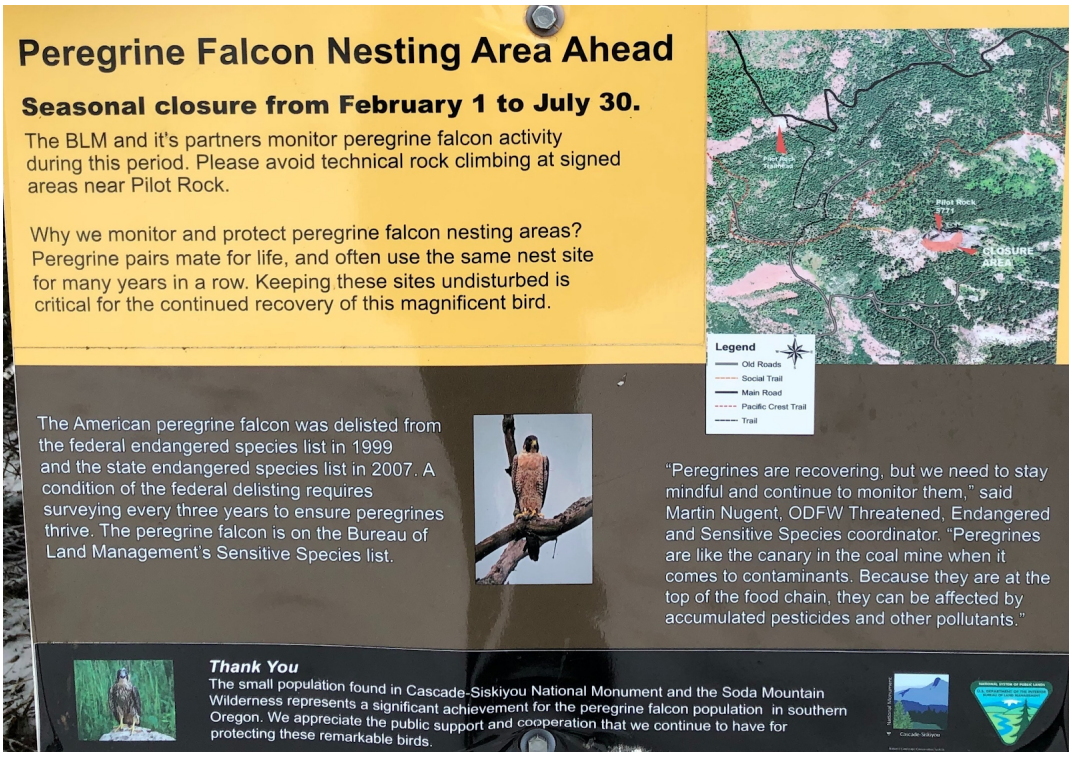
Naturally, the primary purpose of any management plan involving raptors is to protect and prevent the persecution of those powerful plumed predators. This was the reason the first climbing closures were implemented back in 1963, and it remains the driving force behind closures to this day. However, as we come to better understand the birds' actual territorial requirements (both temporally and spatially), we can begin to balance those against the secondary goal of optimizing access for climbers and other recreational user groups. Therefore, the achievement of these two goals are inherently tied together and the protection of the birds will naturally be considered when evaluating the goal of optimizing recreational access.

Optimization of Recreational Access

To assess the effectiveness of this management plan in achieving the goal of optimizing access, it is necessary to establish a baseline of current management practices to which it can be compared. Only by understanding the status quo can one fully appreciate the improvements made under this program. Of course, climbing areas are found on a multitude of different land jurisdictions from state and national parks, national forest, wilderness, private land, or a combination of several jurisdictions, and each of those are managed quite differently. However, in the case of much of the western United States (and particularly in southern Oregon), many climbing areas are found on either national forest or BLM land. Therefore, these two land

managing agencies and their management practices will provide the most pertinent standards to measure our project against.

While the site that is the subject of this research happens to be on private land, that land is adjacent to BLM land and the resident peregrines have been monitored by the Roseburg BLM district office since 1996. When asked how the BLM would manage a seasonal raptor closure at the Honeycombs, BLM wildlife biologist Liz Gayner responded that they would "minimize human disturbance with the potential to disturb nesting falcons within one mile of active peregrine falcon nest sites between February 1 and August 30." Acker Rock, another nearby climbing area with nesting peregrines, is located within Umpqua National Forest and climbing is closed for the entire area between January 1 and July 31 each year (U.S. Forest Service, 2020). Pilot Rock, located south of Ashland, Oregon in the Cascade-Siskiyou National Monument, is yet another climbing area in southern Oregon with nesting peregrines. This site is managed by the BLM and all of the technical rock climbing routes are closed from February 1 to July 30 (see image of sign on the trail to Pilot Rock below).



This sign states that the peregrine falcon is on the BLM sensitive species list. That may have been the case when the sign went up, but as of 2019, the peregrine falcon is no longer on the BLM sensitive species list for Oregon and Washington (https://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/) Additionally, the post-delisting monitoring under the ESA has been completed for the peregrine falcon (https://www.fws.gov/policy/library/2014/2014-22925.pdf) .

These three management plans provide perfect examples of the overly-restrictive closures that continue to exist across the country. It is clear that these closures are being handled as if the peregrine were still protected under the ESA, and the management plans have obviously not been reassessed under the MBTA. Furthermore, these management plans are based on opinion, or the professional judgment of wildlife biologists or other officials, not on scientific observation. Professional opinion, no matter how reputable the source, is not scientific fact That is why the aim of this project has been to initiate the scientific research necessary to create a precedent of adaptive management which meets the needs of both the birds and the outdoor recreation community. The

research conducted this season at the Honeycombs significantly reduced both the spatial and temporal scale of the closure there through scientific observation and analysis.

Spatial scope of closures.

The trial adaptive management plan implemented at the Honeycombs site this season was successful in significantly reducing the size of the closure as compared to the BLM or USFS recommendations. Of the eighteen assessment points used to measure responses from the nesting birds, all of which were well within half a mile of the nest, only three elicited defensive responses throughout the entire breeding season (see Appendix B for maps of the responses). This monitoring data helped to determine a closure which still allowed access to more than eighty-five percent of the climbing routes at the Honeycombs climbing area, including an area colloquially known as the "Welcome Wall." The "Welcome Wall" and the routes found on it are on the east side of the North Comb, the same formation on which the birds chose to nest this year. In fact, many of the climbing routes found on this wall are well within the 350 foot range which Thomas Cade suggested was vigorously defended at all times by nearly all nesting peregrines (Ratcliffe, 1993, p. 271-2). And yet, climbing occurred continuously on these routes for the entire breeding season, and not once did this researcher or any climbers interviewed report any response from the birds. However, it is important to note that the Welcome Wall is outside the viewshed; it is completely shielded from view from the nest ledge as it is around the corner of the formation on a completely different cliff face. This is a perfect example that illustrates one of the main findings of this whole project: distance alone is not a reliable predictor of responses from nesting peregrines and should not be used as the sole determinant of closures.

More than simply managing the closures for the Honeycombs for this season, the monitoring conducted helped to further refine Orton's model and offered great insight into the variables most useful in predicting territorial responses. Using distance alone as a predictor resulted in over-predicting defensive responses by 29%, alert responses by 12%, and under-predicting non-responses by 88%. Effectively, our hypothesis, which was largely based on distance, was not upheld. When it comes to managing wildlife, it is always important to account for as many variables as possible, and it is rare that one lone variable will account for the activity of any species. There are several more factors to take into account when creating a management plan for raptor nesting closures, as explained by Orton in his summary of results from the season:

> In determining our potential to incite territorial responses by an adult Peregrine during three phases of nesting activity (Courtship & Nest Selection, Egg Laying to Hatch, Chick Rearing to Fledge) we determined that distance by itself was not a good predictor of response. Along with pattern of use, side screening was determined to be a useful predictor of response prior to a nest ledge being selected when there is more than one suitable nest ledge to select from. However, once a nest ledge selection has been made nesting raptors establish well defined territorial boundaries over the area within view of the nest ledge, referred to as the viewshed. Together, side screening and distance became primary predictors of territorial responses within the viewshed (see Appendix A).

These findings will be incorporated into Orton's model and will increase its accuracy in calculating preseason closure recommendations at other climbing areas. The timing of those closures will be discussed in the next section.

Temporal scope of closures.

As a result of the monitoring efforts at the Honeycombs site, all climbing restrictions were lifted on June 26th, 2020. This end date was an astounding 64 days earlier than the closure suggested by Gayner, and at least 34 days sooner than the other local management plans

recommended. This is a substantial improvement and allowed for a return to unfettered recreation 1-2 months earlier than might have otherwise been possible under current management plans. Fortunately, closures are more frequently being lifted early in places where the land managing agency is able to monitor the nesting sites, often with assistance from volunteers in the local climbing community. For example, the United States Forest Service manages climbing closures related to peregrine nesting at a dozen different sites in North Carolina. These closures are in place from January 15 to August 15. This year, however, the agency lifted closures on June 29th (U. S. Forest Service, 2020). While this was certainly welcome news for the local climbing community, the fact that they were able to lift the closures more than one month early suggests that the Forest Service needs to reevaluate these standing closures.

As has been noted previously, at subalpine latitudes, peregrines can be expected to fledge their young by mid-June (Cade, 1982). Accordingly, Orton's workbook defaults to a fledge date of June 15th with July 1 representing approximately two weeks past fledging. The model currently includes this two-week buffer after fledging to allow for any residual activity at the nesting site; limiting access into the closure areas until two weeks after the young fledge is generally considered a Best Practice (Peterson 2018). This default recommendation for the closure end date is refined in Orton's workbook when fledge date records for the eyrie in question are available. An average probable fledge date is automatically calculated within a 95% confidence interval based on monitoring records for the area once they are entered into the workbook. Furthermore, on a seasonal basis, the predicted fledge date (and therefore closure end date) is further refined once the age of the chicks has been determined.

Therefore, it is recommended that the default end date for raptor nesting closures at the Honeycombs be July 1st. That closure can then be extended if necessary based on historical fledge data for a given area or in the rare case of an abnormal breeding season (i.e., first brood failure, a second clutch, etc.). An end date that accurately reflects the biological reality of the birds' breeding cycle should be the standard, not an overly-conservative projection meant to accommodate the most extreme of anomalies. Having to work backwards from closure end dates like July 30, August 15, or even August 30 each year and lift closures "early" should not be the norm. Additionally, in areas such as the Honeycombs, with multiple nesting opportunities and a history of movement between them, it may be beneficial to allow for nest selection to occur while regular human activity is occurring before implementing a closure each year (Cade et. al., 1996, p. 25; White, 2012, p. 5). This would allow the birds to select a nest site based on the use patterns of human recreation and would likely increase their resiliency to disturbances which are already taking place. This would further reduce the total length of the closure in such areas. With a robust adaptive management plan in place, land managing agencies and local climbing organizations should be able to work together to monitor their resident birds and manage these closure start and end dates effectively each year. Based on the experience of this researcher at the Honeycombs climbing area this year, this level of collaboration between climbers and land managers is highly achievable and can only work to strengthen the relationship between both parties.

Improvement of Relations Between Climbers and Land Managers

One of the key observations of this thesis project was that there often seems to be either a lack of or simply poor communication between land managers and the climbing community. In the

past, this relationship has been acrimonious or even hostile, and in many cases today there is still a high level of distrust or at least misunderstanding between the two groups. This communication breakdown is particularly notable in the issue of raptor nesting closures. This researcher admits that his earliest exposure to the issue of raptor nesting closures involved much skepticism and bitterness toward the land managing agencies at his local crags. Climbers were outraged that standing closures were in place at areas where there were no nesting birds or that hiking trails (which were actually closer to the nests than any climbing routes) were left open while climbers were barred from activities that likely would not have negatively impacted the birds. On the other hand, conversations with wildlife biologists and other officials have revealed a deep misunderstanding of the realities of the rock climbing world and use patterns at various climbing areas. Fortunately, there is a perfect opportunity to improve communications and relationships by collaborating on this very issue. The cooperation of the BLM and the private landowner of the Honeycombs was crucial in the execution of this project, and all parties benefited from the interaction.

This researcher interacted with three individuals from the Bureau of Land Management: Liz Gayner, Erich Reeder, and Steve Godwin. All three of those individuals were open, forthcoming, and willing to contribute to the project. While she may not have shared the exact same vision about the management of the peregrine closures, Gayner compiled and shared the agency's fledge data on the Honeycombs site as well as several documents about peregrine falcon monitoring. Reeder was unable to conduct his own monitoring at the Honeycombs site, so this researcher shared his findings with him and filled out the annual monitoring report for the agency. Godwin was interested in the work and provided a lot of information about the peregrine closure at

Pilot Rock. Of the three, Godwin was the most supportive of reexamining the closures and was open to a more adaptive management approach. Simply having these conversations with these individuals opened a channel of communication that previously did not exist and helped clear up many misconceptions on both sides. Additionally, the private landowner of the Honeycombs was very agreeable and willing to help. That the landowner allowed this researcher continued access to the climbing area after closing it to the public speaks volumes as to his commitment to appropriately managing climbing on his land and protecting the interests of both the birds and the climbing community. This season, the Southwestern Oregon Climbers Coalition secured funding from the Access Fund to build a pit toilet at the Honeycombs - yet another example of the benefits that come from climbers and land managers working together. While this measure of success is difficult to quantify and inherently subjective, this researcher feels strongly that this project did much to foster better relationships between the local climbing community and these land managers, and that implementing this adaptive management plan will have similar results nationwide.

Chapter 6. Discussion

Impact, Effectiveness, and Efficiency

The most basic purpose of this project has always been to help further the discussion on managing raptors at climbing areas and to provide new information on which to base those management decisions - and by all accounts that purpose has been achieved. As addressed in the previous chapter, this project was successful in meeting the three goals of protecting the nesting raptors, optimizing recreational access to the area, and improving relations between climbers and land managers at the Honeycombs crag for the 2020 season. Of course, the vision is that this model can and will be implemented at climbing areas nationwide, and the fact that these three high-level goals were met this season suggests that they have a high likelihood of being met in future iterations, especially with the improvements which resulted directly from this season's work.

This was the first iteration of a new and revolutionary adaptive management plan, and as such it was intended to provide meaningful feedback and recommendations for future research. Throughout the season, minor adjustments and improvements were made to Orton's management model in real-time as new information was gleaned in the field. In addition to the various tweaks and modifications to the nuts and bolts of the workbook, this researcher's time in the field helped to further inform best practices for monitoring and measuring disturbances from nesting raptors, all of which have been captured in Orton's various documents for raptor management (see Appendix A). Furthermore, this trial has helped further our understanding of which factors are most reliable as territorial response predictors for cliff-nesting raptors (see discussion below). Concerning efficiency, seeing as this researcher, with no prior experience in biology or raptor management and

with limited assistance, was able to carry out this project suggests that it can be successfully replicated by other invested climbing community members in the future.

Summary

This project has shed light on the best practices for site-specific management of raptors at climbing areas and has shown that the size and length of climbing restrictions can be drastically reduced in some areas while still protecting the raptors. This trial adaptive management plan confirms that a viewshed-focused approach followed by validation monitoring is an effective means of reducing potentially threatening disturbances during sensitive periods in the breeding cycle of cliff-nesting raptors. However, it has also shown that consideration of the viewshed and horizontal distance alone are not enough when predicting territorial response. The results of this season's work have inspired Orton to further analyze which variables are the best territorial response predictors for nesting raptors and have prompted him to write a paper on the issue (see Appendix A).

As with any good science experiment, this project has raised as many questions as it has answered. Most of these questions concern the transferability of this model and whether or not it can effectively be implemented at other climbing areas across the country, especially at cliffs where species other than peregrines nest (i.e., prairie falcons and golden eagles). All of these questions will hopefully be answered as more folks answer the call to assist in the management of climbing and raptors at their local crags. Once again, this was the first trial of this management model, and as such it was intended to highlight issues and root out problems so that those might be corrected. Any changes that this project suggests have been captured in Orton's various documents and will

hopefully aid climbers and land managers in carrying out their own management plans in the future.

Plan for Dissemination and Correspondence

I, Will Maness, along with Greg Orton, had the wonderful opportunity to virtually present on our work with this project at the Access Fund's Climbing Advocacy Conference: A Global Perspective on Local Solutions on Saturday November 14, 2020. This conference, which consisted of over 400 registered attendees from all over the world this year, is the leading climbing advocacy and conservation conference, and the largest gathering of local climbing organizations focused on protecting access to climbing areas. We joined Robert Schorr of Colorado State University in presenting at our session titled "Conserving Cliffs Through Bat and Raptor Protection." During this presentation, we shared the results of our research at the Honeycombs and informed our participants on how to get involved with raptor management at their local crags. We urged everyone to reach out to their local land managers and begin conversations about how to partner with them in monitoring and improving the accuracy of their closures. We shared several resources, including a blank workbook and the workbook tutorial, and encouraged them to reach out to us to help them get started.

Of course, it is our hope that local climbing organizations will implement Greg's model at their local climbing area next year. The more places that try out this management plan, the more data we will have and the more refined this plan will become. Our vision is that Orton's model, or some later iteration of it, will eventually be the standard for designing raptor nesting closures across the country. However, the most important result of the conference was simply raising awareness.

If more climbers understand this issue and feel empowered to take the management of their climbing areas into their own hands as a result of our work, then I consider that a success. Additionally, the Access Fund will be publishing their latest guide on the subject entitled, "Climbing and Raptors - A Handbook for Adaptive Raptor Management" in the coming months. Both Greg and I assisted in the editing of this document, and we are confident that its publication will further broadcast the information that we have gleaned from this year's project.

I am encouraged by the level of cooperation and collaboration that I received from land managers during the fulfillment of this thesis project and by the level of interest my work has received from the climbing community. Any climber with whom I have discussed this work has been keenly interested and has asked about how they can get involved. This is an issue that affects so many climbers, and their willingness to help out is inspirational. I truly believe that this is an incredible opportunity to strengthen existing relationships and forge new ones between land managers and climbers by coming together to improve the management of our wild and wonderful spaces. Raptor management has the potential to bring together these two groups and can be a catalyst for a reexamination and improvement of existing climbing management plans. The increased cooperation and transparency that will surely come from this collaboration can only help to ensure the protection of our public lands, and I hope to continue to be involved in this work in the future.

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Appendix A. List of Related Unpublished Documents

Assessing Territorial Response Predictors for Nesting Peregrines at Honeycombs Climbing Area in Southwest Oregon.

Outdoor Recreation & Raptors: A Guide to Adaptive Management under the MBTA

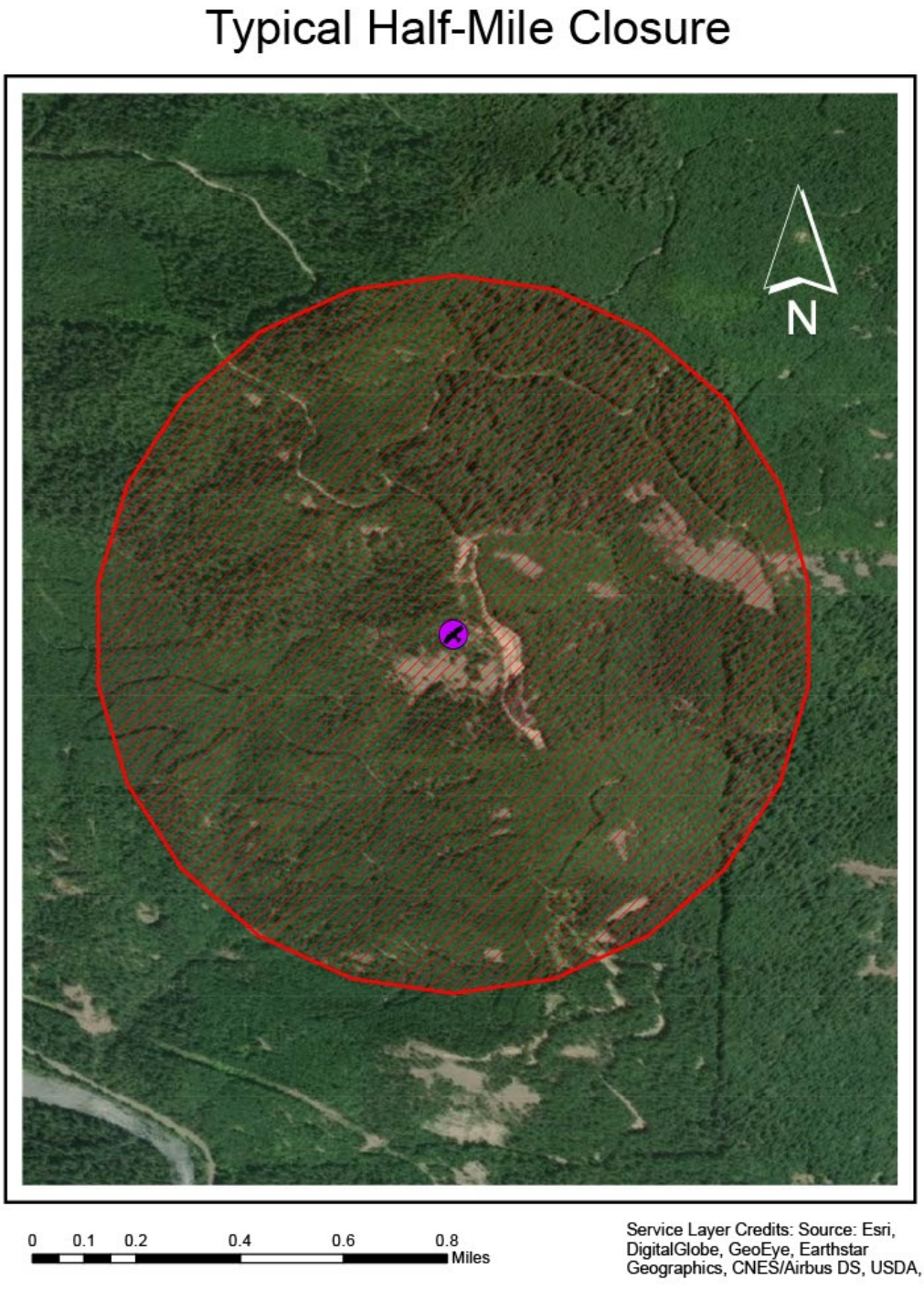
Blank Workbook

Completed Honeycombs Workbook

Workbook Tutorial

Workbook Mechanics

Appendix B. Honeycombs Territorial Response Maps



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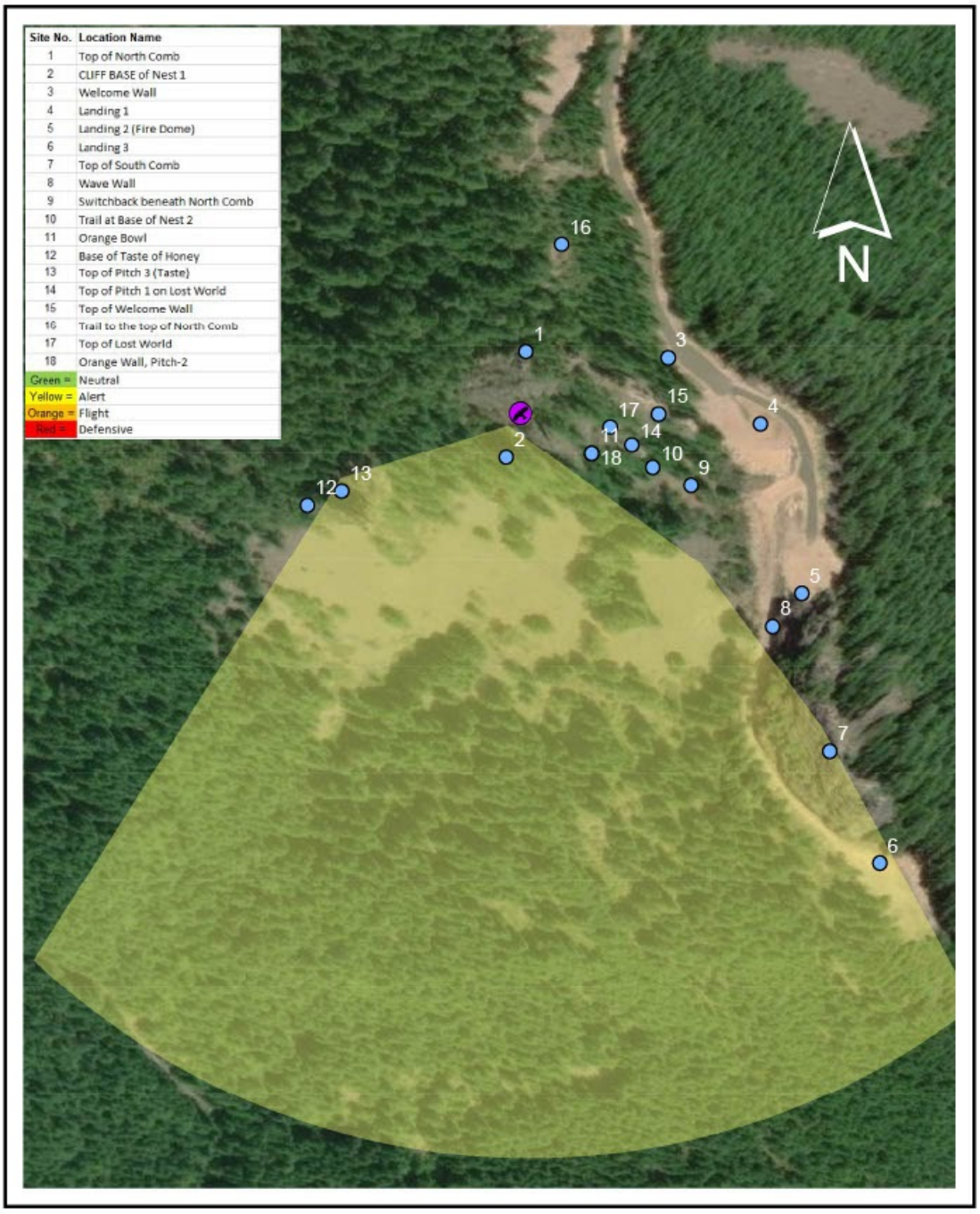
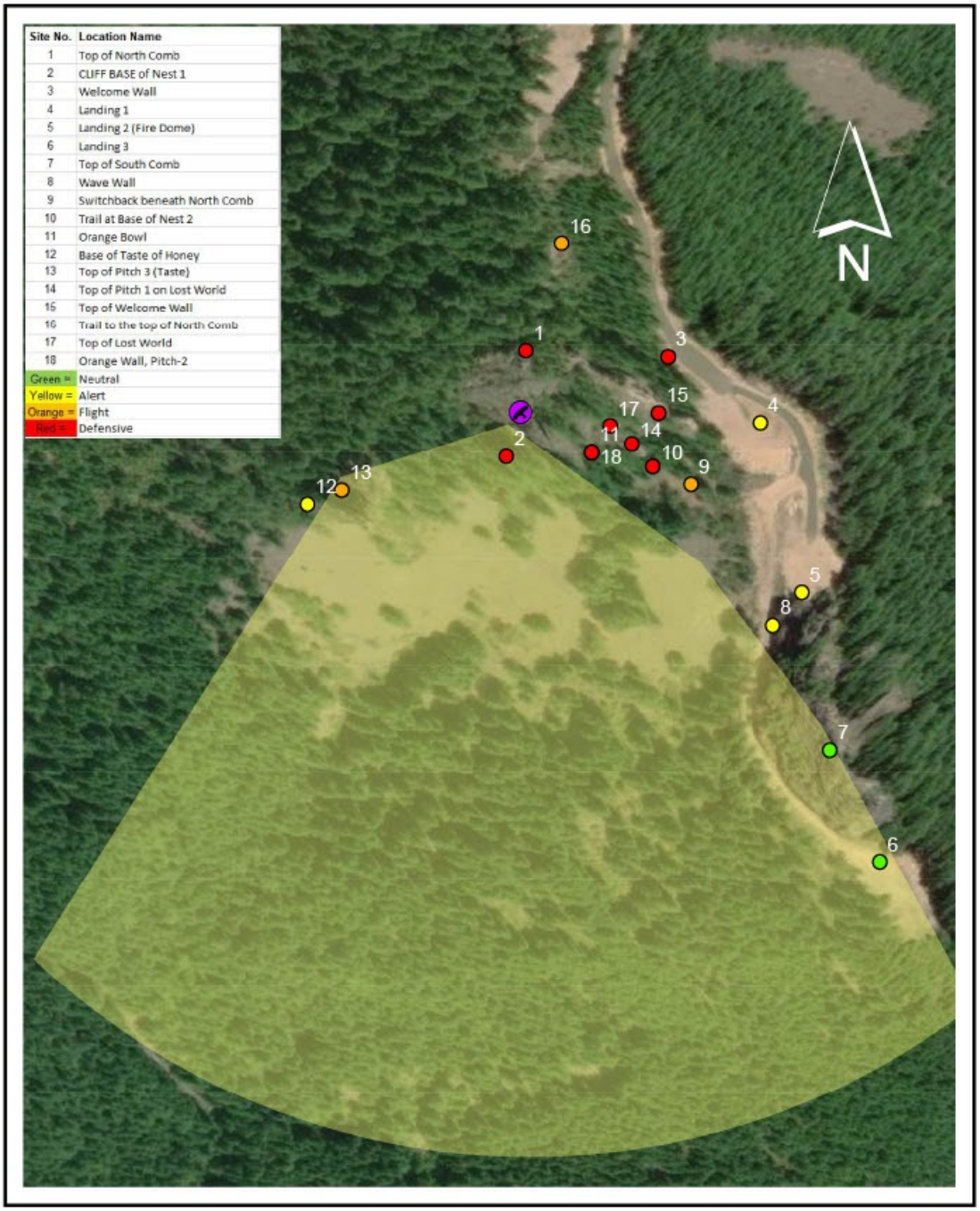
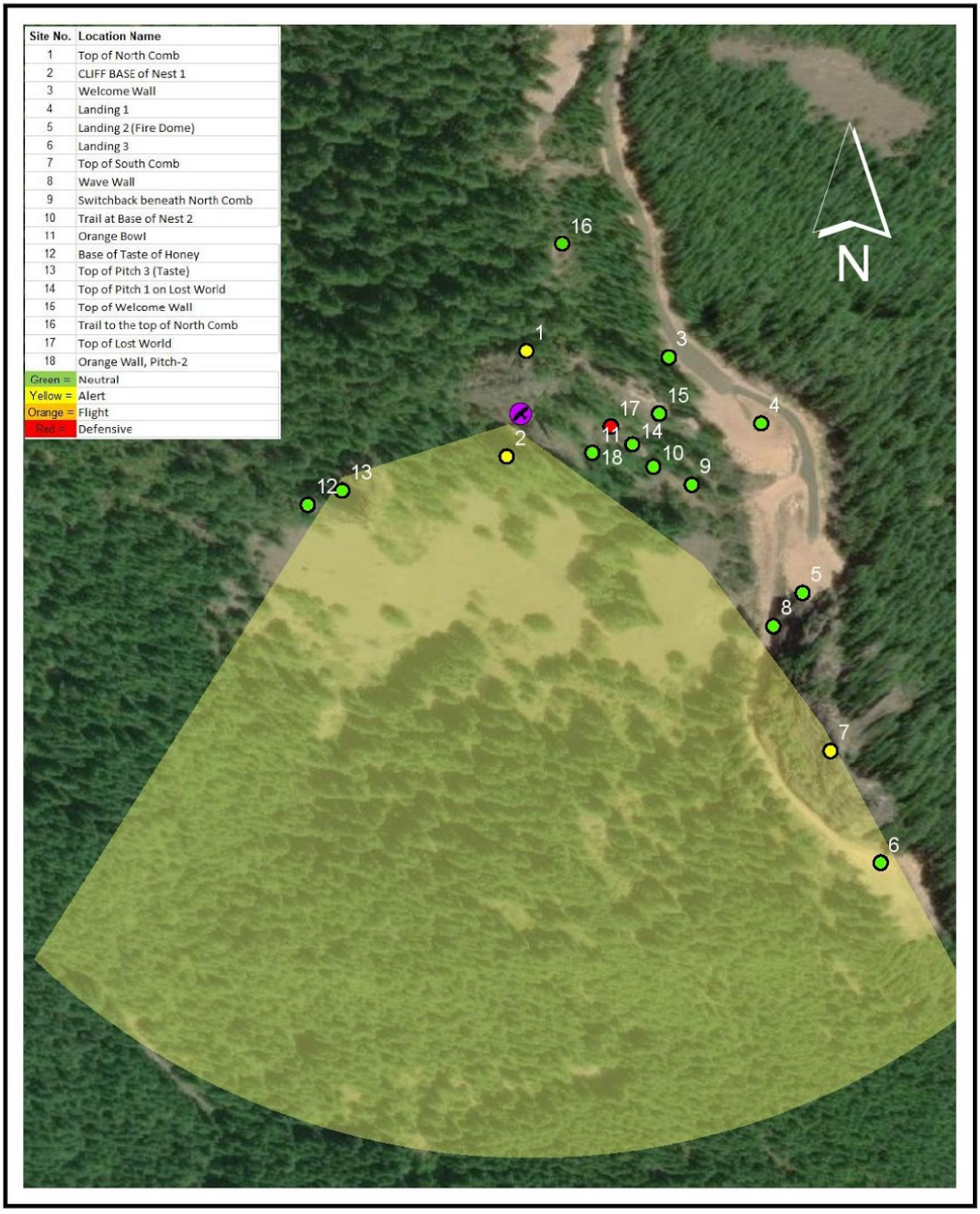


Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA,

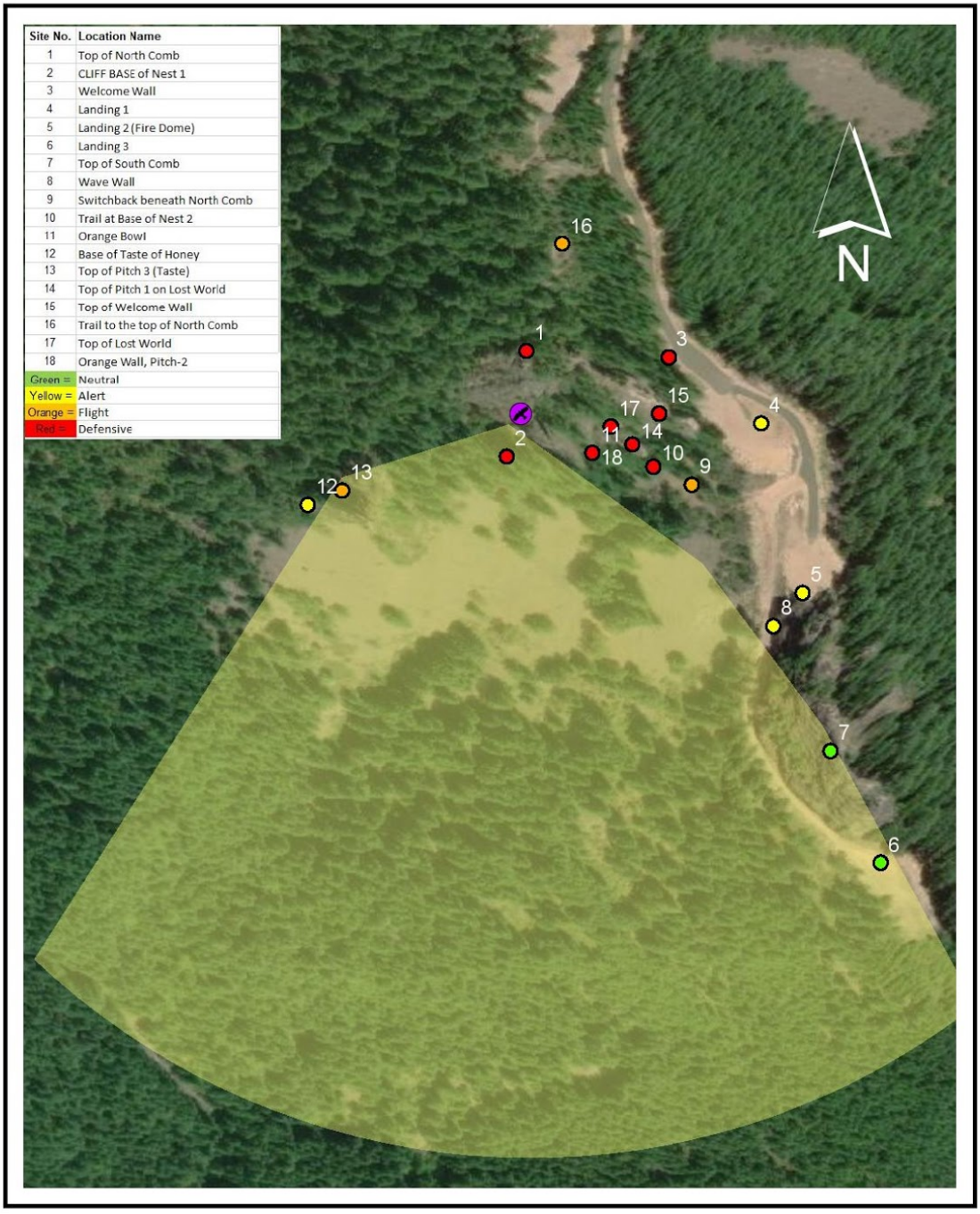
Predicted Courtship/Nest Selection Responses



Observed Courtship/ Nest Selection



Predicted Egg Laying/Hatch Responses



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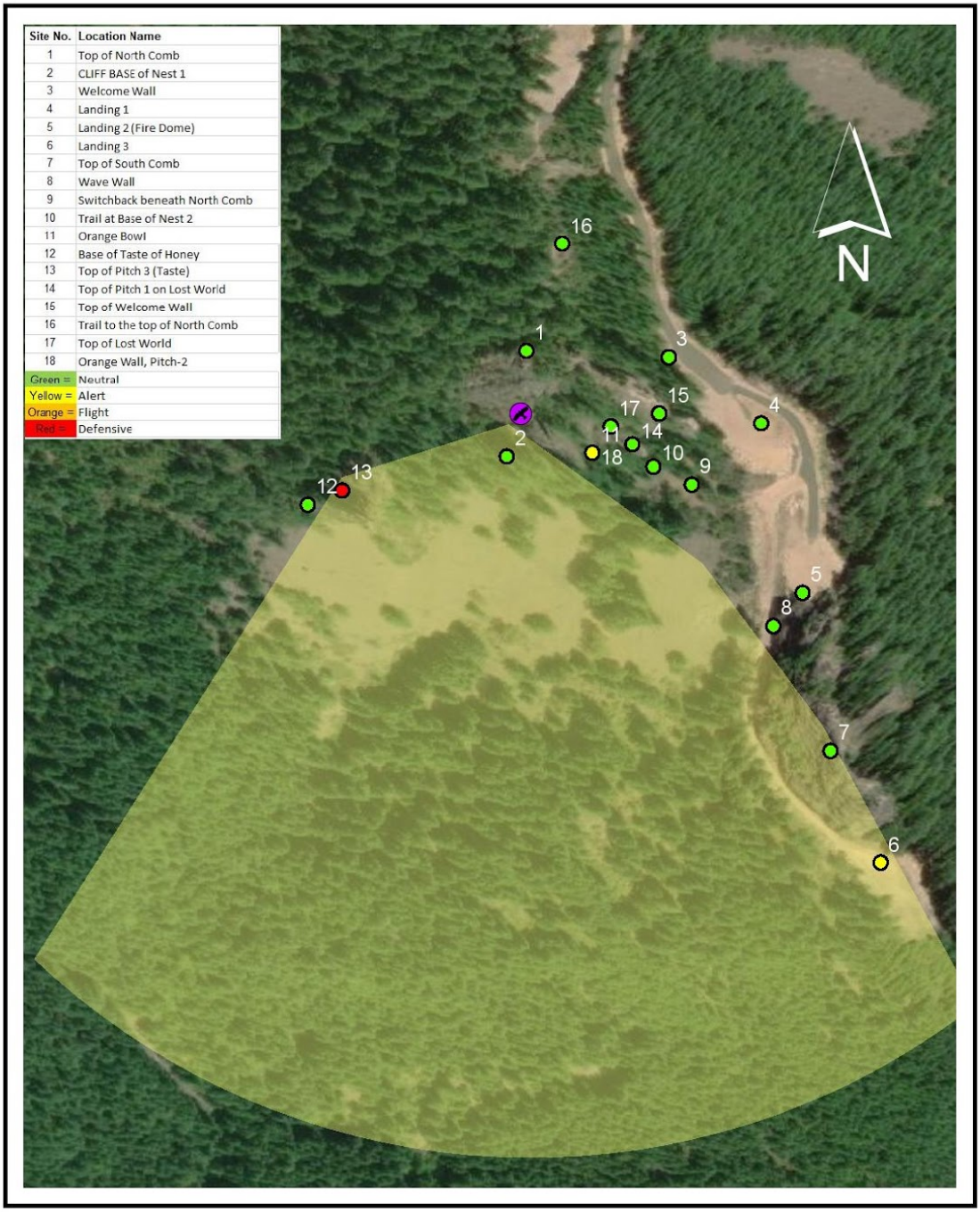
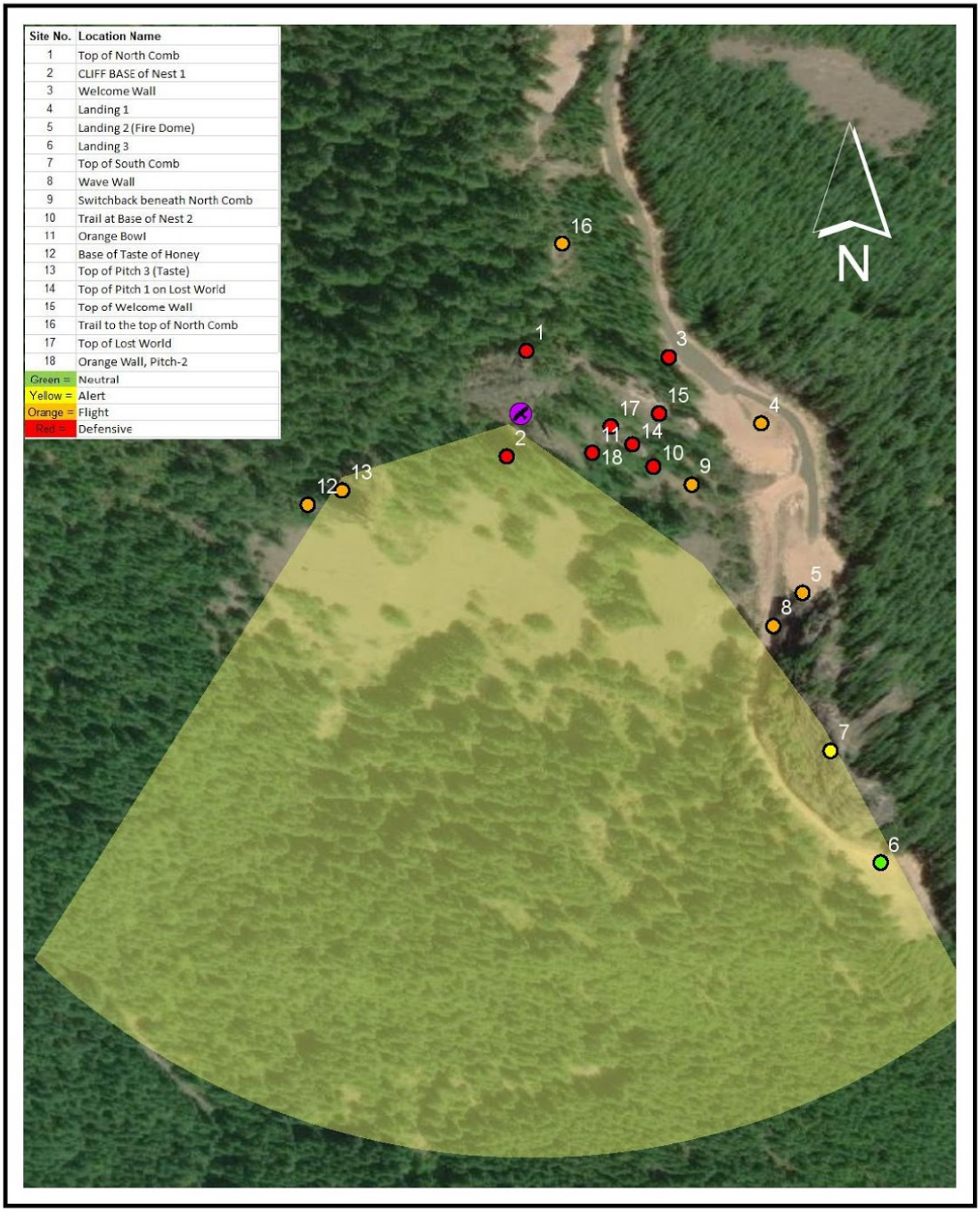


Predicted Hatch/Fledge Responses



Observed Hatch/Fledge Responses