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| **CMP - CCNet Adaptive Management Case Study Template** |
| **Case Study Title:** TNC Cascade Head Preserve and Salmon River Watershed |
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| **Summary:** This case study summarizes over 25 years and multiple cycles of adaptive management and planning implemented at The Nature Conservancy’s Cascade Head Preserve. It also includes a multi-stakeholder planning effort using the CMP Open Standards that encompassed the entire surrounding Salmon River watershed and nearby marine environment. |
| **Public Overview of Case Study:** See the following Miradi Share record: <https://www.miradishare.org/projectDetails/tnc-thenatureconserva-2014-00009/> |
| **Setting the Scene:** Natural areas managers often work in degraded systems and face uncertainty about how to restore them. Imperiled species require immediate actions for improving habitats even when ideal techniques are unknown. Additionally, individual natural areas are surrounded by a diversity of land uses and ownerships that can have consequences for management of the natural area. This case study shows how adaptive management addresses this dilemma. The Salmon River is approximately 25 miles long, originating on Saddleback Mountain (in Lincoln County, Oregon) at about 3,000 feet in elevation; the Salmon River watershed encompasses 75 square miles (approximately 50,000 acres). While the mouth of the Salmon River and its estuary are protected by a special congressional designation called the Cascade Head Scenic Research Area, other areas of the watershed are dominated by dense rural residential and small commercial developments, and the upper watershed is predominantly private industrial timberland.  Cascade Head Preserve is located on a basaltic headland rising from sea level to 365 meters (m) at the mouth of the Salmon River estuary on the central Oregon coast. Steep, south-facing slopes harbor remnant coastal prairie surrounded by Sitka spruce/western hemlock forest (*Picea sitchensis/Tsuga heterophylla*). It also harbors several endemic species, including the Federally-Threatened Oregon silverspot butterfly (*Speyeria zerene hippolyta*).  The Oregon silverspot butterfly, has been the focus of much of The Nature Conservancy’s activity at Cascade Head. Historically occurring in coastal grasslands from southern Washington to northern California, the butterfly has been reduced by habitat loss to just four remaining populations, including the one at Cascade Head. This population, one of the largest in the 1980s, is now severely at risk.  Our efforts to recover the silverspot at Cascade Head illustrate our use of adaptive management through the Open Standards. We began by developing a conceptual model of its life cycle and the factors that might limit its population. Silverspot larvae feed almost exclusively on *Viola adunca*, the western blue violet, an early successional species. *Viola* species require disturbance for seedling germination and to stimulate growth, and they often inhabit marginal sites. Without disturbance, violet populations decline. Adult butterflies typically gather nectar from plants in the *Asteraceae*, such as goldenrod. We also constructed a conceptual model of succession and disturbance regime of the grassland to identify critical ecological processes that maintain butterfly habitat. These conceptual models helped us to identify an altered fire regime and invasive non-native plants as key threats to Oregon silverspot habitat and led to the development of management goals for the butterfly population. To meet these goals, we embarked on research to compare alternative management options. Reintroducing the historic disturbance regime (fire, in this case) is often the best approach to habitat restoration. However, we were uncertain how effective fire would be under current conditions since non-native species had been introduced to the site during the decades of fire suppression.  To reduce this uncertainty, we did a field experiment from 1994 to 1999 to compare two management options; fall burning and fall mowing followed by raking, with an unmanaged control. We wished to know how butterfly resources (nectar and food plants) and the overall plant community, especially invasive non-natives, responded to these treatments. The most striking treatment effect was a tenfold increase in violet seedlings in the burned treatments compared to a 29% decrease in the control and no change in the mowed plots. Other than *V. adunca* and some nectar species, only three other species, all non-natives, were significantly influenced by treatments increasing in abundance with burning. Thus, fall burning has both positive and negative effects, at least over the short-term.  Our first round of experiments resolved one critical uncertainty in our conceptual model for the grassland. A single fall burn of non-native grassland maintains the existing degraded community rather than restoring its native composition. However, through its positive effect on violets, burning might slow or reverse the decline of Oregon silverspot butterflies.  In light of a perilously low Oregon silverspot butterfly population, a documented decline in *V. adunca*, and the positive effects of burning on *V. adunca*, we decided to increase the scale of our burning in 1998 and begin using fire as a management tool. Using adaptive management best practices, we also implemented monitoring to track the effectiveness of this management in advancing our management objectives.  Our initial research raised concerns about whether prescribed fire would accelerate the increase of non-native species. Possible strategies to reintroduce fire without increasing non-natives include 1) altering the timing and/or intensity of burning to increase the abundance of natives while decreasing non-natives, and 2) identifying active restoration methods (e.g. adding a native seed mix, covering with landscaping fabric to shade out invasive species; alone or in combination and possibly in conjunction with fire) to decrease the abundance of non-natives. Therefore, while moving ahead with management-scale burns, in 2000 we added a new phase of research to test these non-native reduction strategies.  Results from our second round of research suggested that burning alone, even more frequent burning and burning in combination with mowing, will not meet our management objectives. Supplemental seeding of native species, possibly in combination with a shading treatment in areas dominated by invasive species, may be required to restore this grassland and its associated Oregon silverspot butterfly habitat.  In order for violets to respond to burning with an increase in seedlings, there must be seeds in the seed bank that can be stimulated to germinate by burning. After the first year of management-scale burns, our monitoring showed that some burned areas had violet seedling densities comparable to or higher than what was seen in the research plots. Other areas had much lower densities, although still higher than unburned areas. This variable response to burning suggests that it may be necessary to add violet seeds or plants in order to improve habitat quality sufficiently.  During the course of our studies, we burned about 60 ha to increase the number of violets at the site. And from 2010-2014, we planted around 28,000 violets to supplement some of the best remaining butterfly habitat. However, the Oregon silverspot butterfly population at Cascade Head has still not recovered. One possibility is that this butterfly population is being constrained by factors other than habitat quality. The large reduction in the number of breeding individuals after a population crash in 1993 and again in 1998 may have eroded the population’s genetic diversity.  To address this possibly, we conducted a captive-rearing program from 2002 through 2012 using female butterflies collected from another Oregon silverspot butterfly population that exhibited a different haplotype than the Cascade Head population. The females laid eggs and their larvae were raised to the pupal stage at the Oregon Zoo in Portland, OR and at the Woodland Park Zoo in Seattle, WA. We continued releases sporadically from 2000-2005 but from 2007-2012, we released > 500 adults each year. This increased the butterfly numbers back to levels seen prior to the 1993 crash. But this is a very expensive program we always intended as a stop-gap measure; not on-going management. So in 2012 we stopped releasing butterflies to see if the effects carried over into the following year without additional releases. Unfortunately, the number of butterflies seen in our monitoring transects returned to pre-release levels so it appears they do not.  There is also important biodiversity outside of the boundaries of our preserve, where there are a diversity of interests and types of management. In 2006, The Nature Conservancy identified the Salmon River area as an important place for the conservation of biodiversity in the Pacific Northwest Coast Ecoregion. To develop a shared vision and strategies for conservation and protection of the surrounding Salmon River watershed and adjacent nearshore environments, The Nature Conservancy brought together a diverse group of stakeholders who used the Open Standards to develop the Salmon River Conservation Action Plan (see pdf).  Participants in the process included community members, representatives of state and federal agencies, timber companies, conservation organizations, private landowners, scientists and academics. Over the course of seven months (December 2006 – July 2007), participants compiled information and data to profile the current condition of the area, defined the desired conditions that stakeholders envision for the basin and nearby ocean environments, and identified concrete steps that citizens, conservation organizations and conservation partners can take to realize that vision. See the [Miradi Share Record](https://www.miradishare.org/projectDetails/tnc-thenatureconserva-2014-00009/) for conceptual models, results chains, viability and threats tables, and measures results. |
| **Results and Lessons Learned:** We have shown that active adaptive management can advance our understanding even at a small site with a modest budget and limited staff. We have not learned how to recover the butterfly at Cascade Head, but we have eliminated some ineffective management actions: a single fall burn, a single fall mowing/raking, two consecutive fall burns, and one or two fall burns preceded by mowing. Without adaptive management we would likely have used the same management strategies that others have used, fire or annual mowing. Without adequate monitoring to provide information about how key components of the habitat were responding, the site could lose the components of native grassland, including violets, through the increasing density of invasive plants or lose nectar sources due to incompatible mowing practices. Alternatively, we might have delayed implementing ANY management until we had conclusive research results showing us what our management should be. That approach can result in loss of habitat that is already declining in quality.  Natural systems are complex; it is often challenging to sort through natural variability and confounding factors to identify the most effective path forward. Adaptive management is a structured process that helps managers define specific outcomes and focus efforts towards achieving those.  We found collaboration with key partners like Lewis and Clark College, Oregon Zoo, and U.S. Forest Service to be an effective way to stretch our resources to accomplish this work. Building teams of scientists and land managers through partnerships with local universities, NGOs, and natural resource agencies can increase the capacity of managers on a shoestring budget to do effective adaptive management. Using the Open Standards planning methods provides a compelling approach for bringing diverse stakeholders to the table and getting all land managers in an area on the same page and working towards shared goals using coordinated strategies. |
| **Scalability and Transferability:** Adaptive management recognizes that some type of management needs to move forward even as you continue to refine it, thus making incremental improvements that prevent the total loss of the habitat and associated rare species. Adaptive management is not just for high-budget projects, or for scientists armed with the latest mathematical models. It is a very important concept for conservation and land management that needs to be implemented at all scales and by a variety of managers. But at its heart, adaptive management is an ordinary, but structured way of probing management approaches to learn what will work best for the lands under our stewardship. It is also a process that continues for as long as active management is taking place. At Cascade Head we have been through four cycles of experiments and learning and we continue to use an adaptive management approach. Our case study illustrates the use of adaptive management and the Open Standards at scales ranging from a small natural area preserve to a whole watershed. |
| **Further Information:** See the [Salmon River Conservation Area Miradi Share record](https://www.miradishare.org/projectDetails/tnc-thenatureconserva-2014-00009/) for Open Standards information and several supplemental materials in the “Associated Files and Links” section. |

**Table of Key Words for Tagging Case Studies**

*These tags will be used to help other people find your case study on the web.*

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| **Key Words *(select all that are relevant)*** | **Put x if Relevant** |
| **Stages in Adaptive Management Cycle** |  |
| - Conceptualize the situation | X |
| - Plan actions and monitoring | X |
| - Implement actions and monitoring | X |
| - Analyze, use, adapt | X |
| - Capture and share learning | X |
| - Full cycle adaptive management | X |
| - Other: Stakeholder Analysis\_\_ | X |
| **Case Study Scale** |  |
| - Project-level | X |
| - Program-level |  |
| - Organizational-level |  |
| - Other \_Whole Watershed\_\_\_ | X |
| **Specific Tools/Approach Used** |  |
| - Evaluation / audit |  |
| - Evidence-based conservation | X |
| - Spatial conservation planning | X |
| - Structured decision making |  |
| - Status measures | X |
| - Effectiveness measures | X |
| - Passive adaptive management |  |
| - Active adaptive management | X |
| - Other \_Multi-stakeholder planning\_\_ | X |
| **Specific Topics Addressed:** |  |
| - Human wellbeing |  |
| - Climate change |  |
| - Community-based conservation | X |
| - Marine conservation | X |
| - Freshwater conservation | X |
| - Terrestrial conservation | X |
| - Other \_Rare Species Conservation\_\_ | X |