

Lessons from the Cascade Head Biosphere Reserve, Oregon, USA

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Abstract

Cascade Head Biosphere Reserve is Oregon's only biosphere reserve. It was one of the first group of U.S. biosphere reserves established in 1976 and is one of only two administered by the U.S. Forest Service among the 28 biosphere reserves that remain in the U.S. MAB network. With its complex social and ecological landscape, Cascade Head is a perfect place to test the biosphere concept. It is a microcosm, and its lessons learned about how to create a resilient relationship between humans and nature apply anywhere. Five themes describe the evolving relationship between people and nature at Cascade Head: resistance, research, restoration, reconciliation, and resilience. Unique aspects of the history of UNESCO biosphere reserves in the United States are not widely recognized in the literature, but can help explain their current relationship to the rest of the world network. Cascade Head provides lessons about the periodic review process required by the UNESCO Man and the Biosphere Program, the problems with rigid models of zonation in biosphere reserves, and the complexity of stakeholders and governance. Three overarching

lessons from Cascade Head stand out. One is the critical role of individuals and the importance of inspired, value-based, individual action. A second is that despite decades of research, ecological mysteries still abound, and the need for research to underpin decisions will never end. Finally, the Cascade Head story shows the importance of worldviews – how we think about the human-nature relationship – in shaping individual and collective actions.

Keywords: Biosphere reserves, history, U.S. Forest Service

Introduction

The international network of biosphere reserves coordinated by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Man and the Biosphere (MAB) Program, and the concept of the “biosphere” from which it arose, are important achievements in the history of ecology, conservation, and sustainable development. Biosphere reserves are supposed to be laboratories for understanding the human-nature relationship and models for other places to learn from as we all struggle toward a resilient relationship between humans and our home planet. Cascade Head Biosphere Reserve is Oregon’s only biosphere reserve. It is one of only 28 areas in the United States that remain part of the growing international network of 701 biosphere reserves in 124 countries. It was established in 1976, among the first group of 28 biosphere reserves in the U.S. MAB network, as a place to learn

how people could conserve and sustainably use the coastal temperate rainforest ecosystem of the Pacific Northwest.

With its complex social and ecological landscape, Cascade Head is a perfect place to test the biosphere concept, which holds that biodiversity conservation and human development are two sides of the same coin. The mosaic of multiple-use public lands managed by the Siuslaw National Forest and private timberlands in the 75 square mile watershed of the Salmon River demonstrate the linkages between forest management and restoration of wild salmon. Endangered species like spotted owls, marbled murrelets, and the Oregon silverspot butterfly share the landscape with vacationers, hikers, hunters, fishers, and mushroom pickers. One of Oregon’s five marine reserves is one of the core areas in the biosphere reserve, conserving the essential links between land and ocean. Lincoln City and Neskowin, hubs

of a thriving tourist industry, bookend the biosphere reserve geographically on the south and north. Native American tribes are slowly restoring their cultures in the Cascade Head area.

The Cascade Head Biosphere Reserve, like every biosphere reserve, is a microcosm. It is only a tiny part of our planet's thin and fragile living skin, but the efforts of many dedicated people to defend a balance between humans and nature there are illustrative and instructive. The lessons from Cascade Head apply anywhere. The Cascade Head Biosphere Reserve provides a case study that illustrates some important aspects of the unique history of the U.S. MAB program. It is a place where the original concept of biosphere reserves in the United States was implemented, then neglected, but survived and is being restored. It provides an example of how important the U.S. Forest Service (USFS) was in the initial

implementation of the concept of biosphere reserves in the United States. The Forest Service is now largely "missing in action" in the US-MAB network, but it still has highly relevant experience and lessons to teach.

The idea behind the development of the UNESCO Man and the Biosphere Program was that we need a network of places dedicated to monitoring and understanding the diverse ecosystems of the Biosphere and developing models and strategies for maintaining or restoring their resilience while still meeting human social, cultural, and economic needs. (I capitalize "Biosphere" here and hereafter when used as a proper noun for the singular and unique living skin of planet Earth.) Although each biosphere reserve is unique, they all face similar challenges and provide lessons for all the others.

This article grew from research conducted in the Cascade Head Biosphere Reserve from October 2018 to January 2019, while I was the Howard L. McKee Ecology Resident at the Sitka Center for Art and Ecology in Otis, Oregon. As an international ecological consultant, I have worked in 34 biosphere reserves in 17 countries, and I brought a comparative, global perspective to the experience at Cascade Head. Some material presented in this article is adapted from my forthcoming book, *The View from Cascade Head: Lessons for the Biosphere from the Oregon Coast*, which will be published by Oregon State University Press in the fall of 2020.

Historical Context of Cascade Head and the U.S. Biosphere Reserve Network

The relatively sparse scholarly literature on UNESCO biosphere reserves does not adequately recognize or reflect the unique aspects of their history in the United States.

This is partly because descriptions of the history of the MAB program often begin in the mid-1970s, when the first biosphere reserves were designated, and earlier foundations of the biosphere concept and its implementation are left out of the story (Ishwaran et al., 2008; Price et al., 2010; Matar and Anthony, 2018). Some scholars have reached somewhat deeper into the history of the concept and its implementation (Reed and Massie 2013, Reed 2016), but not from an explicitly U.S. perspective. Key aspects of the unique history of the U.S. MAB program are illustrated by the experience of Cascade Head, and that history holds important lessons for other UNESCO biosphere reserves.

A brief review of the history of the biosphere *concept* will first be useful. The term “biosphere” was first used in something like its modern sense by the

Austrian geologist Eduard Seuss, in his book *Das Antlitz der Erde*, or *The Face of the Earth*, published in 1885. The term and concept were promoted by a Ukrainian biogeochemist, Vladimir Vernadsky, in a 1926 book, *The Biosphere*, which was translated from Russian to French in 1929, and soon after to English. Frank Golley, an American ecologist and historian of ecology, describes Vernadsky's book as "a scientific expression of a global system of man and nature, which was an antidote to the virulent nationalism that was being expressed at the time, especially in Europe" (Golley, 1993).

Biosphere reserves owe a debt to the work of Vasily V. Dokuchaev (1846-1903), a pioneering Russian geologist and geographer who laid the foundations of soil science. Dokuchaev was instrumental in creating a unique Russian conservation philosophy and model of protected areas, called *zapovedniks*, a word perhaps best

translated as "nature preserves." Through the 1890s, Dokuchaev argued that setting aside areas of pristine natural ecosystems that can be compared with managed ecosystems, such as agricultural lands or managed forests, was ultimately important for economic development because they act as scientific controls to study how human actions affect ecological processes. *Zapovedniks* should be closed to all economic activities, he thought, and scientists should study their natural functioning.

In the United States, the *zapovednik*-like model of "nature preserves" exists to a certain extent in U.S. Forest Service Research Natural Areas and in some private nature preserves like those of The Nature Conservancy. But the philosophical foundations of nature conservation in the United States are, in general, based more on scenic, spiritual, and recreational values,

growing out of the writings and philosophies of people like Henry David Thoreau, John Muir, John Burroughs, and Teddy Roosevelt, in contrast to the utilitarian, scientific foundation of *zapovedniks*.

In the late 1930s, with the Dust Bowl disaster continuing, Aldo Leopold – another founding father of U.S. conservation philosophy – understood the value of *zapovednik*-type nature reserves. In a 1938 essay titled “Engineering and Conservation,” Leopold cited the research of John E. Weaver, a botanist, prairie ecologist, and professor at the University of Nebraska, and wrote that “While even the largest wilderness areas become partially deranged, it required only a few wild acres for J.E. Weaver to discover why the prairie flora is more drought-resistant than the agronomic flora which has supplanted it” (Leopold, 1991). The answer was that wild prairie plants had more complex, and more

efficient, root systems, as Weaver discovered by studying the ecological processes in a small patch of undisturbed native prairie. Leopold expanded his vision of the value of preserving, studying, and learning from wild ecosystems in his 1939 essay “A Biotic View of the Land.” He again cites Weaver, saying, “Professor Weaver proposes that we use prairie flowers to reflocculate the wasting soils of the dust bowl; who knows for what purpose cranes and condors, otters and grizzlies may some day be used” (Leopold, 1991).

In 1934, during the same decade as the Dust Bowl and Leopold’s musings, the U.S. Forest Service established the Cascade Head Experimental Forest within Oregon’s Siuslaw National Forest. One purpose was to experiment with silvicultural techniques for the expanding timber industry. Part of the experimental forest was further protected as the Neskowin Crest Research Natural

Area in 1941 – a “reference” ecosystem for learning how coastal temperate rainforests function. The Neskowin Crest Research Natural Area was, in essence, an American *zapovednik*, perfectly in line with Dokuchaev’s concept.

The International Council of Scientific Unions launched a ten-year program of international cooperation to better understand the functioning of ecosystems at large scales in 1964. Called the International Biological Program (IBP), it was modelled on the success of the International Geophysical Year of 1957-58. Science was coming to be seen as a tool for easing the tensions of the Cold War, and chipping away at geopolitical and ideological walls. In 1968, with concern about environmental threats exploding, UNESCO organized a “Biosphere Conference” in Paris, using the word “biosphere” for the first time in international deliberations. A retrospective

on the legacy of the conference (UNESCO-MAB, 1993) stated that “The single most original feature of the Biosphere Conference however was to have firmly declared that the utilization and the conservation of our land and water resources should go hand in hand rather than in opposition, and that interdisciplinary approaches should be promoted to achieve this aim.” The biosphere concept was used to argue against the idea that biodiversity conservation and human development are incompatible or contradictory.

Following the Biosphere Conference, UNESCO established the Man and the Biosphere Program in 1971. It combined the environment-and-development perspective of the conference and the large-scale, long-term, ecosystem-ecology research of the IBP, and sought to establish a network of places, distributed around the diverse ecosystems of the Biosphere, where we can

monitor, study, assess, and respond to the changes that humans are causing.

Two events in 1972 significantly affected U.S. participation in the MAB Program.

One, the U.N. Conference on the Human Environment, was held in Stockholm, Sweden, where international deliberations about how to save the Biosphere continued. The second, the Moscow Summit between President Richard Nixon and Soviet General Secretary Leonid Brezhnev, was a major step toward Cold War détente. Following the Summit, U.S. and Soviet scientists were tasked with finding ways to work together on issues of mutual interest. The ecosystem research already mounted under the IBP and the proposal for an international network of biosphere reserves seemed to be a place to start.

It just so happened that in 1973, a forest ecologist from Oregon named Jerry

Franklin, who had risen through the ranks of the U.S. Forest Service, was posted to Washington, DC, to serve as director of the Ecosystem Studies Program at the National Science Foundation. At NSF, Dr. Franklin was chosen to lead a U.S. delegation to work with the Russians to establish biosphere reserves in the two countries. He and his Soviet counterparts (grounded in the *zapovednik* concept) had a similar conception of what “biosphere reserves” should be about, Franklin told me in an interview. “We didn’t want to establish more of the same old ‘protected areas,’” but rather places to test models of the biosphere concept. The U.S. Forest Service’s network of experimental forests, ranges, and research natural areas, spread across the diverse ecological landscapes of the United States, were logical places to anchor some biosphere reserves, in Franklin’s view.

The Cascade Head Experimental Forest, Research Natural Area, and private lands to the south, including the Salmon River estuary, were designated as the Cascade Head Scenic Research Area (CHSRA) in 1974 – a unique designation within the National Forest System – by the U.S. Congress. The management objective of CHSRA was: “To provide present and future generations with the use and enjoyment of certain ocean headlands, rivers, streams, estuaries, and forested areas, to insure the protection and encourage the study of significant areas for research and scientific purposes, and to promote a more sensitive relationship between man and his adjacent environment.” As such, the goals for CHSRA meshed well with the objectives of the UNESCO-MAB Program, just at the time the first US biosphere reserves were being selected.

The first group of 28 biosphere reserves in the United States, including Luquillo in the U.S. territory of Puerto Rico, were designated in 1976. Of those, 12 were on lands managed by the U.S. Forest Service, and three more on experimental ranges, formerly managed by the Forest Service until their management was passed to the U.S. Department of Agriculture’s (USDA) Agricultural Research Service. Those 15 biosphere reserves comprised a bit more than half of the original group. The remaining 13 were centered around national parks or wildlife refuges managed by the U.S. Department of Interior. The predominance of Forest Service sites among the first group of 28 U.S. biosphere reserves shows Dr. Jerry Franklin’s fingerprints on their selection. Two sites in Oregon, Cascade Head on the coast and the H.J. Andrews Experimental Forest in the Cascades – at both of which Franklin had worked and conducted research since the

late 1950s – were among the initial group of U.S. biosphere reserves.

In 1995, at its meeting in Seville, Spain, the UNESCO MAB Program adopted the Seville Strategy and Statutory Framework, which formalized the requirements for being considered a biosphere reserve and mandated a periodic review every ten years (Price, et al. 2010; UNESCO-MAB, 1996).

This development, standardizing and formalizing the concept, and centralizing and tightening UNESCO oversight, is often described in the literature as a positive inflection point in the history of the international network of biosphere reserves (Price et al., 2010; Reed and Massie, 2013; Reed, 2016). It came, however, at a bad time for U.S. biosphere reserves. As Vernon (Tom) Gilbert, a former National Park Service scientist and proponent of the U.S. MAB Program explained, “In the mid-1990s opponents of the United Nations (UN) and

some members of the U.S. Congress alleged that biosphere reserves were part of a conspiracy by the UN and the White House to take control of lands in the U.S.” This sensationalized campaign gained support in Congress, which attached amendments to appropriation bills that “prohibited agencies from funding the MAB program, and it was essentially abandoned” (Gilbert, 2016).

At the 4th World Congress of Biosphere Reserves, held in Lima, Peru, in 2016, UNESCO developed an action plan to implement its MAB Strategy 2015-2025, which, among other things, required all biosphere reserves to implement “... an effective periodic review process so that all members of the network adhere to its standards.” Only a handful of US biosphere reserves had ever undertaken a periodic review at that point. Eighteen of the 47 then-existing US biosphere reserves chose *not* to conduct a periodic review when pressured to

do so after the Lima meeting, and were withdrawn from the UNESCO-MAB World Network of Biosphere Reserves. Of the 18 that withdrew, a disproportionate share – two-thirds (12/18) – were USFS or Agricultural Research Service-led biosphere reserves.

Among the 28 U.S. biosphere reserves that remain in the program, about two-thirds now are centered on landscapes or seascapes administered by the Department of Interior (mainly the National Park Service). After initially playing a major role in the U.S. MAB program, the U.S. Forest Service can now only count Cascade Head in Oregon and Luquillo in Puerto Rico as its contribution to the network. It can lay a partial claim to two other US biosphere reserves that were originally established on USFS Experimental Ranges, Jornada in New Mexico and San Joaquin in California, now

administered by the Agricultural Research Service.

The story of how the U.S. Forest Service came to play such an important role in the early history of the U.S. MAB program raises questions about some of the generalities expressed in the literature about the history of the international MAB network. For the U.S. at least, it is probably not accurate to conclude that biosphere reserves were “...essentially designated through identifying existing sites of high biodiversity value(s)” or that the biosphere reserve concept initially had a “conservation focus” (Matar and Anthony, 2017; Ishwaran et al., 2008). In fact, the first U.S. biosphere reserves were selected to integrate nature conservation, human and economic development, and scientific research – and especially, perhaps, those sites centered on U.S. Forest Service lands.

The Five “Re”s: Themes from Cascade Head

The important milestones in the evolving relationship between people and nature in the Cascade Head ecosystem can be described by a handful of words with the prefix “re”: resistance, research, restoration, reconciliation, and resilience. These five themes are common elements of efforts to heal the human-nature relationship anywhere. They represent another way of telling the story of biosphere reserves and describing their three intertwined functions: conservation; development; and research, monitoring, and education. (For reasons that are not clear, the MAB Program calls the third of these “the logistic function” or “logistic support.”)

Resistance

Conservation of nature always requires resistance to human actions that destroy or degrade natural habitats, overharvest or

overexploit valuable species, and otherwise threaten biodiversity. Resistance to actions that would have damaged or destroyed the natural ecosystems of Cascade Head was an initial, critical element in its story. First came resistance against the greedy, unsustainable logging being promoted by Oregon companies and politicians, which motivated President Theodore Roosevelt and his first Chief of the U.S. Forest Service, Gifford Pinchot, to protect the area as part of a new national forest in 1907. In 1974, resistance to unregulated vacation home and tourism development motivated the creation of the Cascade Head Scenic Research Area. And, in 1976, resistance to the view that human social and economic development and the conservation of nature are opposed and contradictory led to Cascade Head being designated a UNESCO biosphere reserve. Resistance to the decline in populations of gray whales that use the marine environment at Cascade Head led to their protection by

the United States in 1937. The Oregon silverspot butterfly, which lives in the coastal meadows of Cascade Head, and populations of coho salmon that inhabit the streams and rivers of the area were protected by the U.S. Endangered Species Act.

Research

Research at Cascade Head has led to some important and widely relevant discoveries. That research was only possible because the forces that had damaged ecosystems in many other places had been resisted there. A large part of Cascade Head, already within the Siuslaw National Forest, was designated an experimental forest in 1934, and part of that was further protected as the Neskowin Crest Research Natural Area in 1941 – a “reference” ecosystem for learning how coastal temperate rainforests function. The role of red alder in fixing atmospheric nitrogen and banking it in forest soils is only one of many economically important

discoveries made at Cascade Head. Examples of the curiosity of scientists and the serendipity of their research are common, and the long-term ecological monitoring that has occurred provides a valuable baseline for future research, including research to understand the effects of climate change.

Restoration

Restoration of natural ecosystems is another hallmark of the Cascade Head story. The Cascade Head Scenic Research Area Act of 1974 provided a legal framework and some funding for the U.S. Forest Service to begin removing dikes and tide gates and restoring natural tidal flows to areas of the Salmon River estuary that had been converted to dairy pastures starting in the 1930s. This estuarine restoration, carried out in stages beginning in 1978, created a kind of ecological experiment through which, decades later, fish biologists could study the

use of the restored salt marshes by juvenile coho and Chinook salmon. When the salt marshes were reopened to the tides, juvenile salmon of both species began to feed in them immediately and to an unexpected extent, and those fish made a significant contribution to the numbers of adult salmon returning to spawn years later. The natural life-history diversity in Salmon River salmon began to re-emerge because of the restoration of the estuary. Ecological restoration and research at Cascade Head were linked in a positive feedback loop.

The Cascade Head area is also a case study of cultural restoration among the indigenous peoples of the area. The Confederated Tribes of Siletz Indians and the Confederated Tribes of Grand Ronde both present remarkable stories of determination and persistence in restoring and reviving their cultural practices and indigenous knowledge.

Reconciliation

Reconciliation is a term more commonly associated with social justice – such as in the post-apartheid racial healing process in South Africa – but a lot of healing is needed between humans and the Biosphere too. “Biosphere reserves are about reconciling all people with the lands and waters,” Eleanor Haine-Bennett, director of the Canadian National Committee for the UNESCO-MAB Program, told me in an interview. From Cascade Head we can begin to actually see some ecological “restorative justice.” For example, beavers have come back to Fraser Creek, now restored to its old channel after it was rerouted around Pixieland, a short-lived amusement park built on filled marshland along the Salmon River in the late 1960s. From Cascade Head, we can envision how restoration of the functioning natural ecosystems of a place can lead

toward reconciliation of “all people with the lands and waters.”

Resilience

Resilience is a final “re” word in the lexicon of Cascade Head. Our home planet is dynamic and changeable, and old ideas of ecological “stability” have given way to a more sophisticated view of the dynamic balance – the resilience – of ecosystems.

Think of resilience as the kind of balance it takes to ride a wave on a surfboard, not to stand still on a rock. On a planet prone to chaos, life has so far found adaptive pathways to survival, but humans have caused and accelerated global changes that now stress ecosystems in ways that threaten our own existence. If we are to survive much longer, we must rebuild the resilience of the ecosystems we have degraded. At Cascade Head, as everywhere else in the Biosphere, resistance, research, restoration,

and reconciliation can lead us on a path toward a more resilient future.

Periodic Review

The periodic review process, part of the Seville Strategy and Statutory Framework, was introduced two decades after the first U.S. biosphere reserves were designated (UNESCO-MAB, 1996). The current version of the process, dating from 2013, is rigorous and detailed; the current periodic review form runs to 43 pages and more than 100 questions (UNESCO-MAB, 2013). The process can be expensive and also time-consuming, especially if serious stakeholder consultations are conducted. “Determining compliance [with UNESCO-MAB statutory requirements] appears to be the dominant purpose of periodic reviews...” (Reed and Eguny, 2013) and many biosphere reserves see it as “an imposed procedure to overcome by BR [biosphere reserve] stakeholders” (Matar and Anthony, 2017). Perceptions like

these, combined with a lack of clear positive incentives for conducting a periodic review and remaining in the MAB network, may partly explain why 18 of 47 U.S. biosphere reserves chose not to conduct periodic reviews and to drop out of the MAB program in 2017.

Why did Cascade Head submit a periodic review and stay in the MAB network, and the H.J. Andrews Experimental Forest, a former biosphere reserve, decline and drop out? I discussed this issue with stakeholders at Cascade Head, and with senior scientists from the USFS Pacific Northwest Research Station and the Andrews Experimental Forest.

At Cascade Head, the letter requesting a periodic review from the U.S. State Department's point-of-contact for the UNESCO-MAB program was sent to the manager of the Cascade Head Experimental

Forest. He was overextended with responsibilities and saw no benefits from, or incentives to, conduct a periodic review; but he checked with the District Ranger at the Hebo Ranger District in the Siuslaw National Forest, in whose administrative territory the experimental forest and Cascade Head Biosphere Reserve were located. The District Ranger discussed the issue with her staff, and two hydrologists who had been involved in estuarine restoration in the Salmon River estuary wanted to take on the periodic review task. The local Salmon Drift Creek Watershed Management Council was willing to contribute to the effort. Through a combination of pride and persistence, a small team completed the Periodic Review Report, which was approved by UNESCO-MAB in September, 2016 (Cascade Head Biosphere Reserve, 2016). The team was clearly motivated by their desire to share what they perceived as a wealth of

knowledge that had been accumulated at Cascade Head over the past 40 years.

At H.J. Andrews Experimental Forest, managers and scientists saw few reasons to conduct a periodic review and remain in the program. The experimental forest was already world-famous for its research on forest hydrology, forest biodiversity, and the relationship of forests and aquatic ecosystems; it had been well-funded for decades by the Long-Term Ecological Research Program of the National Science Foundation. Preparing a periodic review was seen as a burden with little benefit, even though the cutting-edge research being done at the Andrews was squarely at the intersection of biodiversity conservation and sustainable development.

According to Reed and Eguny (2013) "... the periodic review process can also be considered an opportunity for learning

within and beyond the national and international networks." Echoing Bouamrane (2007), Matar and Anthony (2017) suggest that periodic reviews should shift to become "a collective learning process engaging multiple stakeholders and used for adaptive management." A periodic review system that provided incentives for biosphere reserves to share their stories and lessons with other biosphere reserves, rather than to conform to rigid standards, would be welcomed at Cascade Head. The fact that periodic reviews are not treated as public documents and are not widely available publicly – through the UNESCO-MAB website, for example – decreases their value in this regard.

Zonation

Biosphere reserves are supposed to be designed with the three zones, which are supposed to reflect and/or enable their roles in integrating conservation and development

(UNESCO-MAB, 2020a; Reed, 2016). As listed online on the UNESCO-MAB website (UNESCO-MAB, 2020a):

- “The core area(s) comprises a strictly protected ecosystem that contributes to the conservation of landscapes, ecosystems, species and genetic variation.
- “The buffer zone surrounds or adjoins the core areas, and is used for activities compatible with sound ecological practices that can reinforce scientific research, monitoring, training and education.
- “The transition area is the part of the reserve where the greatest activity is allowed, fostering economic and human development that is socio-culturally and ecologically sustainable.”

Idealized diagrams depicting the spatial arrangement of these zones usually show a

“bull’s-eye” arrangement, with the “core zone” surrounded by the “buffer zone,” which is in turn surrounded by the “transition area.” The idea underlying this model of zonation within biosphere reserves was to protect examples of undisturbed ecosystems in the midst of a human-modified, and often human-dominated, landscape – a worthy idea, but hard to implement in a simple way almost anywhere in the world.

Several problems arise with this idealized system. One is that definitions can be complicated, confusing, and can vary from country to country and place to place. Although the International Union for the Conservation of Nature (IUCN) has attempted to categorize protected areas, it is still not absolutely clear what is meant by “protected” or “strictly protected,” or what categories would manage for “activities compatible with sound ecological practices.”

Ideally, in order to advance the biosphere concept, *all* zones in a biosphere reserve – not only the core zone – should contribute “... to the conservation of landscapes, ecosystems, species and genetic variation.” For the same reason, *all* zones should be “used for activities compatible with sound ecological practices” (not just the buffer zone) and also foster “...economic and human development that is socio-culturally and ecologically sustainable” (not just the transition area). Research Natural Areas within the U.S. National Forest System and *zapovedniks* in the countries of the former Soviet Union would probably be considered “strictly protected” areas – but their objectives are also “scientific research, monitoring, training and education,” which is listed as appropriate for the “buffer zone” of a biosphere reserve. Even ecologically sound timber harvest, hunting, or fishing could be “compatible with sound ecological practices,” and therefore perhaps appropriate

in the “buffer zone,” not only the “transition area.” Matar and Anthony (2017) are correct in saying that biosphere reserves “cannot fit into only one category [of protected area] since their basic premise is inclusive of multi-management purposes within the functional zonation scheme.” They also correctly point out that over the decades since the Seville Strategy in 1996, the MAB Program has supported “a larger integration of the zones’ functions... meaning that conservation, sustainable development, and logistic support, can be implemented in all zones but with varying degrees, depending on the functional focus of each zone” (Matar and Anthony, 2017).

Zonation within the Cascade Head Biosphere Reserve provides a case study of the complexity of a real-life, not an idealized, situation. It is, in turn, a lesson about the need for flexibility in delineating and characterizing zones within a biosphere

reserve. When the Cascade Head Biosphere Reserve was established in 1976, it consisted only of the Cascade Head Experimental Forest and Cascade Head Scenic Research Area, with a total area of about 8,700 hectares. Although a zonation scheme apparently was not a requirement for biosphere reserves at the time, the area nevertheless had a complex, de facto zonation, encompassing a mosaic of multiple-use management objectives implemented by a score of land owners and land managers. The Neskowin Crest Research Natural Area, then 35 years old, was essentially strictly protected for scientific research. It was surrounded by the Cascade Head Experimental Forest, whose management objectives were to understand silvicultural and timber harvesting practices in order to foster both environmental sustainability and economic development. Both of those entities were located in the larger Cascade Head Scenic Research Area,

which included lands and waters under a combination of public and private ownership. A preserve managed by The Nature Conservancy was located within CHSRA; its management objectives were also close to strict protection (for biodiversity conservation, research, education and recreation). The other areas within and adjacent to CHSRA presented a complicated map of ownership and management authority.

The periodic review form used for Cascade Head Periodic Review in 2016 (UNESCO-MAB, 2013) required information about zonation, and that it be organized according to the three-zone system. The periodic review team updated and analyzed the land use and land management situation, and redefined the zones of the biosphere reserve. The entire seventy-five-square-mile watershed of the Salmon River was included in the overall boundaries, as were the new

Cascade Head Marine Reserve and adjacent Marine Protected Areas. In explaining this dramatic expansion of the biosphere reserve, the Periodic Review Report noted that the evolution of watershed-scale conservation efforts and a recognition of the important linkages between ocean and land argued for “a more integrated reserve area that includes a broader array of ecological and economic interests.”

In updating the zonation of the Cascade Head Biosphere Reserve, the Neskowin Crest Research Natural Area, the Reference Marsh (a never-drained area of saltmarsh), restored saltmarshes of the Salmon River estuary, and the Cascade Head Marine Reserve became the “core” protected areas. Rather than using UNESCO’s term “buffer zone,” the Periodic Review adopted the term “Zone of Managed Use,” and included CHSRA and the Experimental Forest, TNC’s Cascade Head Preserve, Westwind

Stewardship Group land that is under a conservation easement, and the Cascade Head Marine Protected Areas, where fishing and other activities are less strictly regulated than in the Marine Reserve itself. The Salmon River watershed, and parts of Lincoln City to the south and Neskowin to the north of Cascade Head, were designated a “Zone of Cooperation and Partnership” – a name chosen as an equivalent of “transition area,” and which indicates the aspirations of those who prepared the Periodic Review. In all, the Cascade Head Biosphere Reserve now encompasses about 34,000 hectares, or 130 square miles – relatively small for a biosphere reserve. The spatial arrangement of the zones bears little resemblance to UNESCO-MAB’s idealized bull’s-eye diagram, with “core” surrounded by “buffer” surrounded by “transition” zones.

Stakeholders and Governance

The mosaic of land ownership and management authority described above leads to a complicated situation regarding stakeholders and governance; what might be called the “stakeholder landscape” is very complex. One category of stakeholders includes agencies with administrative and legal responsibilities, such as the U.S. Forest Service, the Oregon Department of Fish and Wildlife, Salmon Drift Creek Watershed Council, the City of Lincoln City, Lincoln and Tillamook counties, Oregon State Parks, the U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration (NOAA), the U.S. Environmental Protection Agency, and the Confederated Tribes of Siletz Indians and Confederated Tribes of Grand Ronde. Other landowners and land managers are also important stakeholders: The Nature Conservancy, Cascade Head Ranch, the Westwind Stewardship Group, the Sitka Center for Art and Ecology, and commercial

timber companies such as Miami Corporation and Hancock Timber Resource Group. And then there are the nearby academic and research institutions with important roles and interests, including Oregon State University and its Hatfield Marine Science Center. This complexity isn’t unusual. Every biosphere reserve I have worked in around the world has a similarly complex ownership and management context.

Although the U.S. Forest Service is the Cascade Head Biosphere Reserve’s official administrative point-of-contact with the UNESCO-MAB program, it does not see itself as the “management authority” for the biosphere reserve. In fact, at least in the United States, biosphere reserves are multi-stakeholder, multi-landowner, multi-agency collaborations, and it is questionable whether any of their constituent organizations could be called a

“management authority.” Each administrative or land-owning partner in the biosphere reserve is bound by its own institutional mandates, which are often legal ones, and they do not and cannot operate under a single authority.

Matar and Anthony (2017) concluded that, in general, “... it is unclear whether local BR [biosphere reserve] authorities are using PR [periodic review] reports for any management purposes besides reporting to UNESCO-MAB Secretariat.” That is certainly true for Cascade Head; the periodic review was completed mainly to satisfy UNESCO-MAB requirements, and never intended for management purposes. The current periodic review form used to guide the process stipulates that one criterion for qualification as a biosphere reserve is that it should have “a management policy or plan for the area as a biosphere reserve” (UNESCO-MAB, 2013). The periodic

review form does ask for a justification of how the biosphere reserve meets this and other criteria, and it explicitly asks about “mechanisms for implementation,” including mechanisms to manage human use and activities, a management policy or plan, and the authority or mechanism to implement this policy or plan. The 1976 Cascade Head Periodic Review Report addressed this question by stating that one of the key partners, the Salmon Drift Creek Watershed Council, would “... lead a partnership effort. This effort will result in a Cascade Head Biosphere Reserve working group. This group will generate a management plan for the Biosphere Reserve area” (Cascade Head Biosphere Reserve, 2016). Broad participation by local stakeholders was stated as an aspiration for the process.

Given the reality of multi-stakeholder ownership and management authority,

creating a management plan for the Cascade Head Biosphere Reserve seems unrealistic. While it may be possible to strengthen communication and coordination among the diverse array of biosphere reserve stakeholders, imposing hard objectives on them would be impossible. A softer goal, such as developing a collaborative, shared “vision” or “mission,” seems more suited to reality than a “management plan.”

A necessary first step in generating broad stakeholder collaboration in the Cascade Head Biosphere Reserve is simply to raise public awareness of its existence. If you stopped an Oregonian on the street and asked them if they know about the Cascade Head Biosphere Reserve, the probability is high that you would draw a blank look, and a question: “The what?” Most local residents, and even many state and federal agency representatives who manage the fish, forests, and other natural resources in the

area, generally don’t know much about the Cascade Head Biosphere Reserve, if they are even aware of it. During various presentations I made as the Sitka Center’s Ecology Resident in the fall of 2018, including at the University of Oregon and at the Hatfield Marine Science Center, I conducted an informal poll of the knowledge about the biosphere reserve. In a sample of approximately 50 people, half were not aware that Cascade Head was a biosphere reserve. Of the half that were aware of its existence, only ten percent said they knew a lot about it.

The 2007 UNESCO-MAB report *Dialogue in Biosphere Reserves* (Bouamrane, 2007) points out that:

Many biosphere reserves created before the Seville Strategy (1995) were not rooted in the participation or consultation of local and

native communities. ... In such cases, initiative for the creation of a biosphere reserve usually comes from a state institution (top-down approach)... In order to initiate the process of sustainable management, the construction of dialogue must be oriented towards the local legitimization of the biosphere reserve.

Cascade Head does not quite fit this description, but does not quite escape it either. At Cascade Head, the designation of the biosphere reserve built on the foundation of a political process that had led to the creation of the Cascade Head Scenic Research Area in 1974. That process was pushed by local stakeholders and led by Oregon politicians in the U.S. Congress, not by the U.S. Forest Service. In naming

Cascade Head one of the first U.S. biosphere reserves, the U.S. MAB Program piggybacked on the process among local stakeholders that had already begun. Now, even though Cascade Head Biosphere Reserve is one of the oldest in the U.S. MAB network, a robust stakeholder engagement and collaboration process is just beginning – but that does not negate the value of the experience gained in the 44 years since Cascade Head was designated as a biosphere reserve.

It will take a great deal of work to enable Cascade Head to live up to its potential as a laboratory and model, but there are several hopeful developments that may help. One is that in Oregon, the U.S. Forest Service has become a national leader in experiments in “collaborative management” on its lands (Butler, 2013; McLain et al., 2014; Davis et al., 2015; Davis et al., 2017). Although the U.S. Forest Service does not see itself as the

management authority for the Cascade Head Biosphere Reserve, it does manage a large proportion of its area, and could bring its experience with collaboration elsewhere in the state to planning and decision-making in the biosphere reserve. In fact, a collaborative process, convened by the USFS Hebo Ranger District, The Nature Conservancy, and the Westwind Stewardship Group, has been underway for the past two years at Cascade Head. It is a forum for a diverse group of relevant government agencies from federal, state, and local levels, along with interested NGO and private stakeholders, to discuss issues concerning public access, trails, camping, parking, and related topics, and to generate management options that would solve concerns about resource protection and growing recreational use. This informal planning process has been facilitated by an outdoor recreation planner, funded through a grant from the National Park Service's Rivers, Trails, and

Conservation Assistance Program. This group would be the logical foundation or nucleus for a steering or advisory committee for the biosphere reserve, if and when such a body is developed. Another recent positive development is the formation of a support group for the Cascade Head Biosphere Reserve, whose objectives include raising awareness about it, advocating for actions to strengthen it, and conducting educational activities within it – much-needed tasks given the current low level of awareness of its existence.

Conclusion: Lessons from Cascade Head

Several of the lessons from Cascade Head have been discussed above. One is that understanding the unique aspects of the history of U.S. biosphere reserves can help explain their current relationship to the rest of the World Network of Biosphere Reserves. Another lesson is that the current periodic review process is often seen as

burdensome and may have deterred some former U.S. biosphere reserves from remaining in the network, and reorienting the process toward shared learning among biosphere reserves would be beneficial. Still another lesson from Cascade Head is that rigid models of zonation do not often fit on-the-ground (or sea) reality, and ideas about zonation should move toward a more sophisticated and integrated view of how to manage landscapes and seascapes for social and ecological resilience. Finally, at Cascade Head there is no single management authority, and never will be. Governance there and in other biosphere reserves requires adaptive flexibility and collaboration among diverse stakeholders. The need is for principles and visions of resilience, not rigid requirements imposed from a “top down” level, whether international or national.

Three additional overarching lessons from Cascade Head stand out. One is the critical role of individuals, whose commitment, hard work, and love of place over many decades have made it such a rich laboratory and model. Their stories are unequivocal in showing the importance of inspired, value-based, individual action. The second lesson is that although ecologists now understand much about how nature works, ecological mysteries still abound. We don't fully understand the migratory traditions of gray whales, the causes of Sea Star Wasting Syndrome, the genetic diversity of the Oregon silverspot butterfly, the life histories of salmon, or the ecohydrology of forests. More research is needed to strengthen the scientific knowledge that underpins decisions about restoring ecosystems and maintaining their resilience in the face of the changes our species is creating in the Biosphere. A third big lesson is the importance of worldviews – how we think

about the human-nature relationship – in shaping our individual and collective actions. At Cascade Head we can read the history of changing worldviews in the landscape, and begin to imagine how a new, ecocentric worldview could create a resilient relationship between humans and nature here, and everywhere.

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