

Lehigh Gap: A Story of Degradation and Reclamation

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The Lehigh Gap, located along the Kittatinny Ridge in eastern Pennsylvania, has been subjected to massive ecological pressures and changes to its landscape over the last century. The landscape of the gap has witnessed both destruction and rebirth, and its bird communities have been significantly impacted. In the late 1800s and early 1900s, the Lehigh Gap served as a beautiful vacation destination, with lush forests lining the water gap and dramatic geological features protruding through the canopy. However, the incursion of industry has had detrimental effects on this picturesque landscape. Beginning in the late 1890s, the New Jersey Zinc Company began zinc smelting operations in the town of Palmerton, which sits just north of the gap. Decades of smelting resulted in substantial ecological repercussions. Sulfur dioxide in the air and the deposition of both acid precipitation and heavy metals killed the vegetation on much of the mountainside near Lehigh Gap. With no roots left to hold the ground in place, the mountainside eroded away until most of the topsoil had been washed into the Lehigh River below. Boulders and contaminated rocky substrate remained.

The landscape sat in this condition for many years despite numerous attempts at revegetation. Most plants would not grow in the polluted dirt that remained, and there was not enough soil to support the growth of new trees. Even though many experts believed it was impossible to revegetate the slopes, a group of concerned naturalists who ran the local hawkwatch had a dream of a healthy, green mountain. What was then called the Wildlife Information Center purchased nearly 800 acres on the western side of the river and developed a plan to establish a grassland on the polluted land by using native, warm-season grasses. These grass species are known to tolerate extreme conditions, including heavy metal contaminated soil, so the hope was that they would survive in an environment where little else could.

Planting efforts began in 2003. Over the next few years, tractors, trucks, and airplanes were used to

spread the grass seeds first in test plots and then across the hillside, hoping that the seeds would land in small pockets of dirt. Sure enough, the grass took root and after several years, a grassland ecosystem was developing. Eleven years later, the Wildlife Information Center has evolved into the Lehigh Gap Nature Center, which maintains the grassland and promotes further conservation efforts as well as research and education about the success story at the Lehigh Gap, which is currently the only federally-listed Superfund site to be converted into a publically accessible wildlife refuge.

The scientific record of the birds in this changing landscape over the past century consists of two studies conducted 80 years apart. Rehn (1903) published an article in *Cassinia* with an annotated list of bird species that resided in the area before the damaging effects of the zinc smelting operation and other ecological pressures that arose during the 1900s. Reed (1984) visited the gap and conducted his own surveys during the summers of 1982 and 1983, by which time industrial pollution had accumulated for many decades. In the present paper, I compare the species lists in these two publications, separated by decades of habitat destruction and restoration, and offer some speculation on the effects of industrialization on the bird life of the Lehigh Gap.

Rehn (1903) birded in the Lehigh Gap during the summer months of 1900 to 1903, when the zinc operation was in its early stages. He wrote of the ridge being “wholly clothed with forest,” a picture that is hard to imagine today. He described stands of old-growth eastern hemlocks (*Tsuga canadensis*) near the summits, and dense second-growth deciduous forest predominated by American chestnut (*Castanea dentata*) trees on the lower slopes. In these forests, Rehn found birds such as Ruffed Grouse (*Bonasa umbellus*), Rose-breasted Grosbeaks (*Pheucticus ludovicianus*), Worm-eating Warblers (*Helmitheros vermivorum*), and a host of other woodland species. He remarked at how the Lehigh Gap was situated within a transition zone from more northern species like Black-capped Chickadees

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(*Poecile atricapillus*) and Rose-breasted Grosbeaks to southern birds like Worm-eating Warblers and Yellow-breasted Chats (*Icteria virens*). While the ridges themselves were forested, the lowlands along the river were covered with rich farmland, where Rehn encountered Northern Bobwhites (*Colinus virginianus*), Purple Martins (*Progne subis*), and Eastern Meadowlarks (*Sturnella magna*).

Eight decades later, Reed (1984) returned to the same area using Rehn's (1903) observations as a starting place for his own surveys. By 1982, the Lehigh Gap resembled nothing like what Rehn described. What was once forest was now a moonscape, with the occasional stand of scraggly hemlock, black gum (*Nyssa sylvatica*), or sassafras (*Sassafras albidium*). Furthermore, the predominant tree in the forests at the beginning of the 20th century—the American chestnut—could no longer be found, save for a few saplings struggling to survive to fruiting age (Hepting, 1974). The chestnut blight, a devastating fungus that first appeared in the Americas in the early 1900s, killed off the old chestnuts decades before Reed began his work. Much of the forest was destroyed and that which remained had changed drastically. Reed (1984) mentioned that the north slope (most dramatically affected by the pollution) held very few species compared to what Rehn (1903) had seen in the same location.

Much of the farmland described by Rehn (1903) was also gone by the 1980s. Fields that once held bobwhites, meadowlarks, and martins had been converted to housing and commercial developments. While much of the habitat seemed to be disturbed, Reed (1984) managed to find seventy species on his surveys, 20 more than Rehn (1903) had seen 80 years prior. It is important to note that some of the species Reed encountered were introduced species such as European Starling (*Sturnus vulgaris*), House Finch (*Haemorhous mexicanus*), and House Sparrow (*Passer domesticus*), that were not well established in the region until after Rehn's work.

Fast-forward to the early 2000s, when the organization now known as the Lehigh Gap Nature Center began planting warm season grasses. As the grasses became established, native wildflowers filled in. Some were seeded and planted, while others simply popped up on their own. Small trees, particularly gray birch

(*Betula populifolia*), were able to grow as well. Tolerating the heavy metal contamination, gray birches formed brushy stands throughout the grassland, creating a unique mixed scrub-grassland habitat. A bird survey project began through this portion of the gap in 2006 to see which species were using the grasslands (Husic, 2007). Amazingly, after just a few years of being a grassland, the birds had discovered this habitat and were successfully breeding on the mountainside that had been inhospitable just a few years prior.

The birds found breeding here were not the old farmland species that Rehn (1903) had seen in the region one hundred years before. Eastern meadowlarks and purple martins were nowhere to be found, and northern bobwhites had disappeared (although this is true throughout much of the state; Klinger, 2012). Although these species had not returned, some species not previously recorded in the gap had established populations. Prairie Warblers (*Setophaga discolor*) had set up territories wherever small stands of birch grew and Common Nighthawks (*Chordeiles minor*) nested on rocks cloaked by the tall grasses. Even Blue Grosbeaks (*Passerina caerulea*), uncommon breeders so far north, had moved into the gap. Eastern Bluebirds (*Sialia sialis*) also took up residence in the prairie, nesting in snags and nest boxes on the nature center property. This is a species that both Rehn (1903) and Reed (1984) had reported as being quite uncommon at the Lehigh Gap. In fact, it was not until the fourth year of Rehn's study that he discovered this species within the gap. With the newly created grassland, bluebirds are now one of the more common species in the Lehigh Gap and can frequently be found along the trails at the Lehigh Gap Nature Center. Since the beginning of this most recent bird survey, 97 species of birds have been recorded in the Lehigh Gap during the months of June, July, and August, which is considerably higher than the totals of either Rehn (1903) or Reed (1984).

The Lehigh Gap may never again resemble what Rehn saw at the turn of the century. It will take hundreds of years before enough topsoil can be formed to support large trees; even then, American chestnuts will never be a prominent component of these woodlands. However, this should not detract from the importance of the revegetation work that is taking place. We will not see woodland birds in the polluted areas of the gap

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for a long, long time, and we have seen that the new prairie ecosystem does not support the grassland birds that historically lived near Lehigh Gap. Perhaps an initial goal of the grassland remediation effort was to once again provide habitat for birds like meadowlarks and martins, but it is clear that it should now have a different goal—one of supporting birds such as prairie warblers and blue grosbeaks, which depend on this declining habitat type.

Stories of ecologically valuable land being destroyed for development are far too common today. Most modern conservation efforts are aimed at protecting the natural world from being harmed in the first place by protecting key parcels of land from destruction and development. The conservation effort at the Lehigh Gap has been quite different. When the members of the Wildlife Information Center purchased the property, the damage had already been done. It was too late to protect the land. Instead, they took this devastated landscape and transformed it into a beneficial and sus-

tainable ecosystem. On a scientific note, the effect of habitat destruction on bird populations is well studied (e.g., Swift & Hannon, 2010), but we have few opportunities to see how landscape change that occurs over decades, and subsequent attempts at revitalizing the land, impact bird communities. The conservation work and historical records from the Lehigh Gap provide unique insight to this question.

The story of the Lehigh Gap has been one of change over the last one hundred and ten years. Natural succession as well as further reclamation efforts will continue this trajectory of change in the years to come. A new suite of birds will probably inhabit the gap a century from now—species different from what Rehn, Reed, and current observers have found. It will be key for researchers and birders in the future to take note of the birds living and breeding within the Lehigh Gap, to continue the legacy and further our understanding of the effects that both human-caused destruction and rejuvenation can have on bird populations.

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