



Managing Reclaimed Sand and Gravel Mines

ARE WE OVERLOOKING A SOLUTION TO A CRITICAL HABITAT NEED?

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Credit: John Litvaitis

▲ Sand and gravel mines such as this one in New Hampshire bring ecological disturbances, but they may be overlooked for the novel habitats they can provide, particularly for several at-risk species.

Throughout the Northeast, thickets contain a rich diversity of plants and animals, including many of conservation concern (Litvaitis 2003). In a region with limited public lands and dense human populations, though, maintaining these mixes of young forests, shrublands and open, xeric communities has been challenging (Askins 2001).

State and federal natural resource agencies have joined with non-governmental organizations to encourage thicket habitats through a number of efforts, including the Karner Blue Butterfly Recovery Plan, the Conservation Strategy for the New England Cottontail, the Young Forests Project and the recent designation of the Great Thicket National Wildlife Refuge, which will incorporate land

managed for early successional forests and shrublands in Maine, New Hampshire, Massachusetts, Connecticut, Rhode Island and southeastern New York. These efforts are encouraging; but we believe an overlooked landscape feature, widespread throughout the region, could provide important habitat for a variety of species: sand and gravel mines (SGMs).

SGMs are a common feature in human-dominated landscapes. They destroy habitat and fragment landscapes, and the sand and gravel extraction activities can cause direct wildlife mortality (M. Marchand, personal observation). However, SGMs also contain areas with brushy edges, bare and dry ground, relatively high ground temperatures, flowering annuals



and perennials, limited tall trees, boulder piles and rocky outcrops that are important to many species.

SGMs are characterized by nutrient-poor, xeric soils where vegetation is slow growing and relatively sparse (Řehounková and Prach 2008). As a result, compared to most northeast habitats, these sites require little effort to maintain them in an open condition. Reclamation efforts often involve importing a thin layer of organic top soil to support planted vegetation and leveling the topography. These actions seem laudable but they fail to restore an SGM to anything resembling its pre-mining condition, and by reducing or eliminating its bare ground, rugged topography and other features less available in surrounding habitats, they diminish the value it could hold for many species.

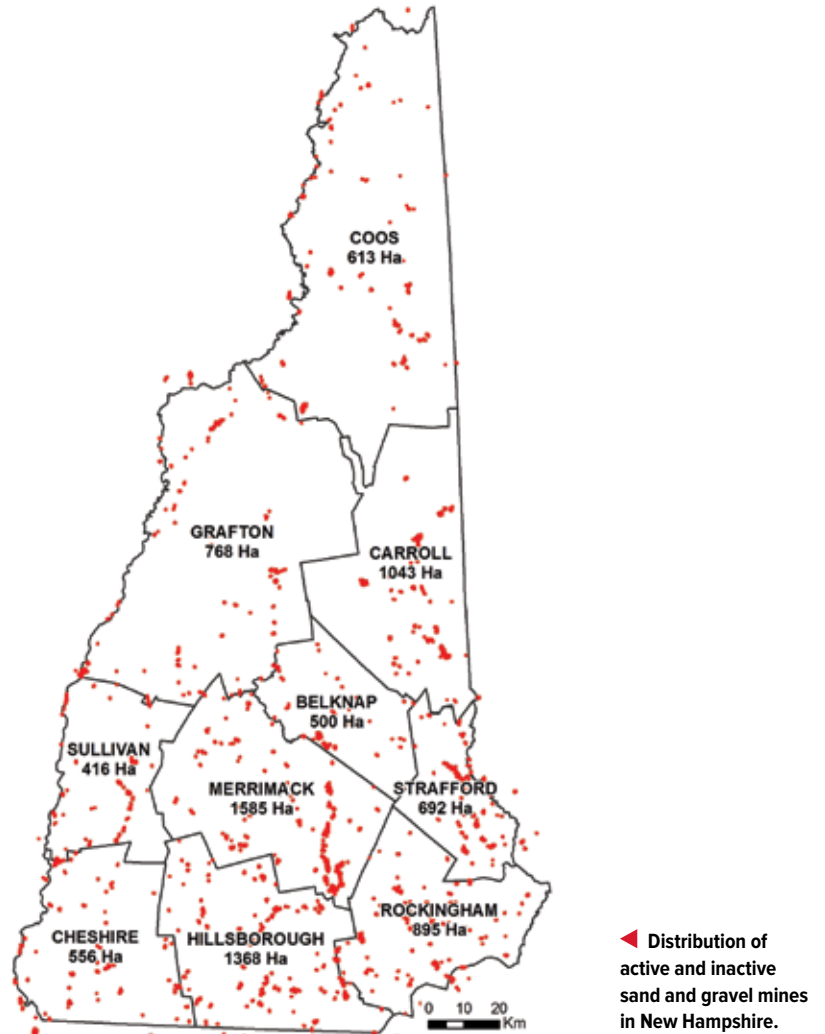
A greater appreciation of SGMs as a productive “novel habitat” could lead to a more effective response to the shortfall of thicket habitats. We looked at New Hampshire, where state-designated species of conservation concern have been detected at SGMs, to see if species associated with thickets appeared at SGMs and if alternative reclamation efforts could address their habitat needs.

Using GIS data, we found SGMs represented about 0.35 percent of New Hampshire landscape, individual mines ranged from less than 0.5 to 262 hectares and about 54 percent of their areas was idle — either actively or passively reclaimed. SGMs were most abundant in the southern seven counties, where more construction and roads generate more demand for sand and gravel.

Species at sand and gravel mines

We identified a group of species, including some of state or federal conservation concern, that are likely to use one or more of the terrestrial features that characterize SGMs. Other species use SGMs, including tiger beetles (*Cicindela* spp.) and common night hawks (*Chordeiles minor*), but few records of their occurrences within the state limited an evaluation of them.

Our list of species we suspect benefit from SGMs included turtles, such as Blanding’s (*Emydoidea blandingii*) and wood turtles (*Glyptemys insculpta*); snakes, including the northern black racer (*Coluber constrictor*) and eastern hognose (*Heterodon*



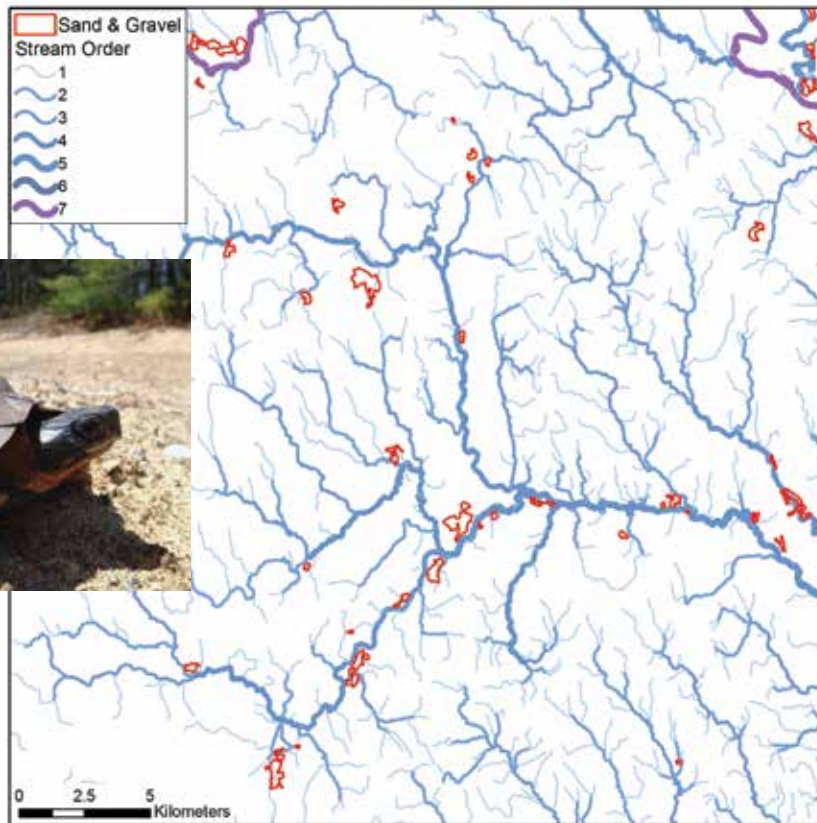
Considerations for Thicket-Dependent Species at Inactive SGMs

- Evaluate soil in the pit to determine the potential for natural vegetation. Wetness and soil texture are key variables that will determine regeneration. Encourage warm-season grasses and native shrubs to stabilize slopes. Xeric-adapted plants may not require topsoil amendments.
- Leave portions that have accumulated rock and boulder piles.
- Maintain or create variable topography such as mounds and berms for nesting turtles and exposed sandy slopes for nesting birds.
- Maintain, enhance or create seasonal standing water (*may require permitting*). These areas can be important breeding habitat for amphibians and function as staging areas for nesting turtles.
- Some thicket species, including many reptiles, are sensitive to collection or disturbance, so limit public use by not providing trails in areas where nesting may occur.



Credit: Joshua Megyesy

► Sand and gravel mines are often located near rivers and streams, offering possible benefits for turtles as nesting habitat.



platirhinos); shrubland-affiliated songbirds, including the alder flycatcher (*Empidonax alnorum*), brown thrasher (*Toxostoma rufum*), blue-winged warbler (*Vermivora cyanoptera*), chestnut-sided warbler (*Setophaga pensylvanica*), eastern towhee (*Pipilo erythrophthalmus*), field sparrow (*Spizella pusilla*), indigo bunting (*Passerina cyanea*), and prairie warbler (*Setophaga discolor*); and bees and other pollinators.

We plotted the locations of 1,305 independent occurrences of turtles and snakes obtained from the New Hampshire Natural Heritage Bureau that were collected since 1979 and found about 11 percent were within 500 meters of an SGM — a distance likely within the home range of large-bodied snakes and turtles. Consider-

ing that SGMs represent less than 0.5 percent of New Hampshire, reptiles seem to be selecting these habitats. The ability to regularly access or occupy an SGM may enhance a reptile's fitness. Among turtles, we suspect SGMs are mostly important for nesting habitat (Compton 1999).

Snakes, on the other hand, likely use SGMs for a variety of activities, including basking, hunting, nesting and possibly for winter hibernation if a boulder pile or outcrop provides access to sites below the depth that the ground freezes. During a 2010-2013 study of black racers in New Hampshire, telemetry locations of marked snakes were associated with higher ground temperatures, greater shrub densities, more rock cover and less canopy cover than randomly selected sites (M. Marchand and B. Clifford, New Hampshire Fish and Game Department, Concord, unpublished data). These features are frequently present at SGMs.

Bird use of SGMs was examined during the nesting season (R. Shoe and M. Tarr, University of New Hampshire, Durham, unpublished data). The presence or absence of the eight species was inventoried in 101 thickets, including SGMs, clearcuts, former



Credit: Alena Warren

► Promoting wildflowers can substantially increase the suitability of reclaimed sand and gravel mines for bees and other nectar-feeding insects.



agricultural fields and transmission line rights-of-way during 2015 and 2016. Four of the eight birds — brown thrasher, field sparrow, indigo bunting and prairie warbler — were most frequently found in SGMs.

Researchers recently completed an inventory of bee communities within 10 managed thickets in south-eastern New Hampshire and found abundance and species richness were greatest in SGMs, possibly because of abundant nesting habitat and wildflowers planted during reclamation (Milam et al. 2018).

In addition to bees, a variety of butterflies and moths may occupy reclaimed SGMs if suitable host plants are present. In the Northeast, more than 50 Lepidoptera species of conservation concern occupy thicket habitats (Wagner et al. 2003). Nearly half use scrub oak (*Quercus ilicifolia*) or lowbush blueberries (*Vaccinium angustifolium* and *V. pallidum*), plants well suited to SGMs, as larval host plants.

Adaptive management techniques

We are not the first to identify the potential of idle mines as wildlife habitat. In addition to SGMs (e.g., Svedarsky and Crawford 1982), the value of reclaiming coal and other surface mines for wildlife is well established (e.g., Samuel et al. 1978). However, with the recent emphasis on restoring and expanding thicket habitats, we believe a renewed opportunity exists to modify these habitats in a way that benefits at-risk species and other plants and animals.

In New Hampshire, commercial earth excavations are subject to regulation by the Alteration of Terrain Bureau within the Department of Environmental Services. Towns may have additional requirements. Mines established after 1989 are subject to regulations that include reclamation once the site is no longer actively mined. The existing best management practices for reclaiming inactive SGMs are largely intended to address erosion, water quality and aesthetics.

Idle SGMs are converted to a variety of uses. Some are converted to commercial or residential developments. In other cases, rather than finance the reclamation process themselves, SGM owners have deeded them to towns or cities, which convert them to parks with baseball and soccer fields. In many cases, land is left over and could be reclaimed for wildlife habitat.

The first step in identifying SGMs as important wildlife habitat, we suggest, is to conduct a state-wide inventory and compare their distribution to

the distribution of species likely to benefit. Next, identify the resources available at each SGM. Do they have suitable nesting habitat near water? Do they have boulder piles? Can wildflowers and shrubs take root? Then rank the relative value of SGMs according to resource availability and presence of species that could benefit. A gravel pit may be a high priority, for example, if it has suitable



Credit: Brendan Clifford



Credit: John Litvaitis

▲ Northern black racers and other snakes find boulder piles at sand and gravel pits as suitable escape cover. Such features could also be used to construct overwinter denning sites for snakes.

◀ In addition to shrubland-dependent birds found breeding in sand and gravel mines, bank swallows (*Riparia riparia*) often construct nests in the steep slopes that result from sand excavation.



nesting habitat near water that a nearby turtle population could use.

So far, we have focused on terrestrial features, but because rock and sand deposits are often removed until ground water is encountered, many SGMs contain seasonal water bodies. Such ephemeral pools or ponds may provide breeding habitat for amphibians (Klimaszewski et al. 2016), nesting or foraging habitat for migrating waterfowl and shorebirds (Santoul et al. 2004) and staging areas for nesting turtles (Grgurovic 2006).

In southeastern New Hampshire, the Natural Resources Conservation Service participated in the reclamation of a town-owned SGM using a wide range of techniques that illustrate the value of adaptive reclamation. Rather than adhere to conventional protocol, the process focused on establishing a population of Atlantic white cedar (*Chamaecyparis thyoides*), a rare species in the state found in swamps and bogs with at least seasonal standing water. Subsequent monitoring revealed a wide range of resident and transient species using the site, despite intense deer browsing that mitigated the success of the cedar plantings.

What's next?

Ecologists are recognizing that lands modified to the extent that SGMs have been altered cannot be restored to their original state (Higgs 2017). Yet, these novel habitats can make substantial contributions toward maintaining biological diversity in human-dominated landscapes (Hobbs et al. 2013).

Our observations indicate that SGMs can be valuable habitats, despite the dramatic changes that have occurred. Of course, public safety and water quality may supersede wildlife habitat concerns during reclamation. It is also important to be sure species such as turtles are not attracted to sites near high traffic or intense development. By engaging with state agencies and local governments, however, wildlife biologists have an opportunity to restore some of these altered sites into landscapes that address regional habitat needs. ■



Credit: Don Keirstead



Credit: John Litvaitis

▲ This comparison of the reclaimed Old Mill sand and gravel mine from 2009 to 2017 shows the use of Atlantic white cedars as a focal species. Reclamation efforts included hauling in coarse organic material to improve the soil for the planted cedars and re-grading the pit floor to direct runoff to the seasonal pool that contained cedar seedlings. This also reduced runoff into an adjacent river. Side slopes of the pit were stabilized by hydroseeding a mix of warm-season grasses that did not require adding topsoil, and “rock veins” were positioned on steep slopes to limit runoff. A variety of trees, shrubs and wildflowers were then planted throughout the pit.



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