



BUILDING BETTER FOREST ROADS

BY MADE IN BODIN

There is a good road in Bellows Falls, Vermont. Actually, it's a network of roads providing access to Dr. Walter J. Griffiths's woodlot. The woodlot is on a hill above the village and is managed for red oak. The roads are not steep. They were designed to keep the grade to a minimum. They are crowned so rainwater and snowmelt runs off to the sides, not down the middle. They are well drained, with culverts sized correctly for the amount of water that flows through, even in spring. Depending on the season, they are heavily – and politely – used by hikers, bikers, and cross-country skiers from the village below.

Summer finds most of the road network in cool, deep shade. There are a few places where the roads are open to the sky and sun, much like in the surrounding landscape. Bears, moose, and coyotes cross these roads. Raptors keep watch from the trees beside them.

Until recently, a good road meant only that it was good for drivers, cars, and other vehicles. Road engineers have learned a lot about how to design this type of road in the last 50 years. It's only very recently though, that any attention has been paid to making a road good for both vehicular travel and the natural world. A good

road, as far as the natural world goes, is one that keeps in place as many of the existing natural systems as possible and has the least impact on the plants and animals that live nearby. Not only does Griffiths's road allow access for vehicles, it also ensures continuity of the natural systems.

Highways and other big roads are usually built by states or cities, but there are several reasons for landowners to build new roads on their own property. Two of the most common are for access to a new house and to allow trucks to get from an existing road to a log landing and back. Skid trails can also be road-ish, so many of the rules of good roads apply to them also.

One of the best sources for advice on how to build a road with minimal impact on the natural world is your state's water quality laws. These laws aim to minimize two of the biggest impacts that small roads have on the landscape: erosion and sedimentation.

When snowmelt or heavy rains meet a poorly designed road, the water can wash away parts of the road, its ditches, and the adjacent banks. The resultant sedimentation pollutes streams and changes the nature of the streambed, filling in gravel beds – where fish such as trout lay their eggs – and the holes where fish keep cool.

All of the northern New England states and New York have laid out “best management practices” for logging jobs. These practices are designed to preserve water quality, and many, if not most of them, address the building of temporary and permanent roads and provide information, such as the size and placement of culverts, helpful to anyone planning a road.

A copy of these best management practices (or acceptable management practices, depending on the state) is available free from your county or district forester. Some states’ booklets are more detailed than others, but all provide a reasonable place to start.

Tradition also provides some good advice, particularly about the temporary roads used in logging. For example, logs were traditionally hauled out in winter, when the ground is frozen and the fragile topsoil is protected from the trucks’ and skidders’ tires by a layer of snow or ice. And even though logging has become a year-round profession, there are some woodlots that simply have to be worked only in winter.

Tradition, however, also celebrates some now-questionable road-building practices. “Sunlight is nature’s gravel” is one old saying that suggests the wider the corridor, the drier the road. While bigger may be better for keeping some roads passable, the resident plants and animals would benefit more from a road cut the width of a lane rather than a boulevard.

It’s only in the last 10 or 15 years that the science of road ecology has sprung up to provide road engineers and other road builders with scientific information on the impact roads have on natural communities. Road ecologists can give some direction on how to build roads that have the least impact on the natural world while still remaining safe for humans.

While there has long been research on the effect of roads on various animals and natural communities, it is only recently that these scattered studies have been brought together to create a body of knowledge about roads in general. In part because the field of road ecology is so new, this body of knowledge is not systematic.

For example, there have been studies on the relative impact of logging roads in the Pacific Northwest, but not in the Northeast. There have been studies on roads’ effects on black bears in New York’s Adirondacks and in western North Carolina, but not in New England. Sometimes generalities have been drawn from extensive research, sometimes from just a handful of studies, and sometimes the results from one small study are all we have.

While it’s still in relative infancy, the science of road ecology has shown that some of the biggest impacts that narrow, lightly-traveled roads through forested areas have are erosion and sedimentation. Besides minimizing those, the two most important pieces of advice the science of road ecology has for builders of small forest roads are, first, to maintain the tree canopy over the new roads as much as possible, and second, to close no-longer-needed roads to vehicle traffic and return them to their natural state as quickly as possible.

Actually, “Don’t build a road if you don’t have to” is the first piece of advice from Richard T.T. Forman, a professor of landscape ecology at Harvard University and a leader in bringing together diffuse studies into the coherent science of road ecology. “Minimize road length to save nature and save money,” he says.

On those necessary roads then, the narrower the road and the smaller the break in the tree canopy, the better. The more qualities your road shares with the surrounding forest, the less impact it will have on the surrounding natural community. The shade the canopy provides is a key quality.

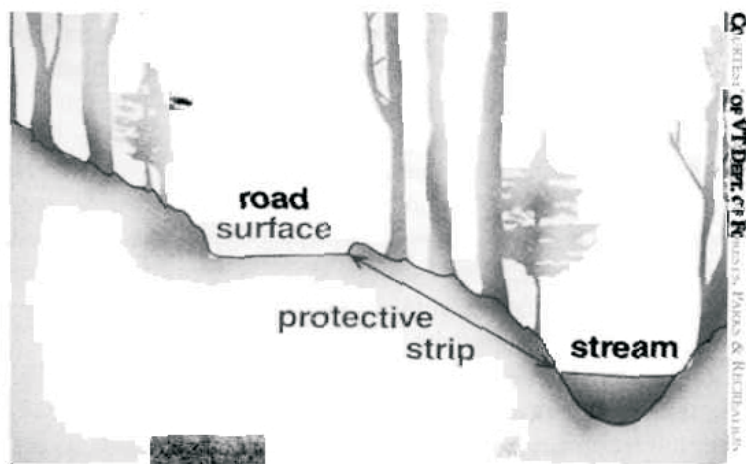
When the forest canopy is broken, a new type of community called a forest edge is created. Edge habitats are by no means bad. They are as important as any other natural habitat and are home to many popular animal species, including many game species. It is just that in most places, even in northern New England, roads are slicing forests into ever edgier pieces. While species that prefer edge habitats thrive when a road breaks the forest canopy, some forest-interior species can suffer.

“Certain species of birds are very vulnerable at the edges of forests,” says Scott Jackson, a road ecologist and wildlife biologist with the University of Massachusetts Extension, Amherst. Some of these edge-sensitive species are susceptible to nest predators such as chipmunks, raccoons, and crows – all edge species.

Once upon a time, land managers tried to create as much edge habitat as possible, sometimes by purposely maintaining otherwise temporary roads built for logging. Forman believes a road should be maintained for driving from here to there. Creating edge habitat, he says, should be done thoughtfully, not as an inherent part of road building.

Habitat fragmentation is a problem that is related to the “edge effect.” A forest crisscrossed with gaps in the canopy created by roads can discourage some species of birds, such as the hermit thrush, from nesting in the area. “These birds seem to be able to size up the forest patch and decide if it’s big enough for them to nest there,” says Jackson. When there is a gap in the forest canopy, such as the gap made by a road, they may look elsewhere, and with more roads, there is simply less habitat for these species.

Roads also create barriers to animal movements. Highways give an obvious example of how a road can create a physical barrier to animal travel. We’ve all seen roadkill. But roads also create a mental barrier which has effects that aren’t seen. You don’t see the bear that didn’t try to cross the road, but it still didn’t get to the other side.



A “best management practice” keeps an undisturbed area of vegetation between a road and any stream, pond, or wetland.

Big animals don't seem to have any trouble crossing small woods roads (although some may avoid areas where there are many roads), but research done on forest roads in the Northeast suggests that some small animals do have trouble.

Phillip deMaynadier, who now works for the Endangered Species Group of the Maine Department of Inland Fisheries and Wildlife, did his doctoral study on whether forest roads created a physical or psychological barrier to the movement of frogs and salamanders. He found that a larger, well-traveled logging road in his study did have an impact on the salamanders (but not the frogs) that lived near it, while the smaller road had no recordable effect.

First, there were fewer numbers of salamanders (deMaynadier studied redback, blue-spotted, and spotted salamanders and red-spotted newts) near the edges of the wider road, which deMaynadier feels may have been an edge effect. Second, adult salamanders were less likely to cross this road while migrating to their hibernation sites and much less likely to cross during their normal home-range wanderings.

The difference between the roads, says deMaynadier, was canopy cover. The center of the bigger road had only 17 percent canopy closure while the smaller road had a 42 percent canopy closure. In other words, it didn't take much more shade, or even total shade, to make the narrower road "invisible" to salamanders.

While deMaynadier didn't study the annual spring migration that brings so many amphibians onto even busy roads for a honeymoon massacre, he did study the fall migration toward hibernation sites and believes the two are similar. He found that the number of salamanders crossing the larger road during fall migration was 32 percent less than expected from the movements of other salamanders in the study.

To minimize the impact of any forest road, deMaynadier recommends leaving large-crowned hardwood trees next to it, first because they provide more canopy shade than conifers, but also because they provide an annual dose of leaf litter, which further helps the road blend in with the surrounding forest.

DeMaynadier notes that his study points out the importance of not building roads within 500 feet of a vernal pool – the average migration range of vernal-pool-breeding salamanders like the ones in his study.

Why go through the trouble of building a road that salamanders are willing to cross? First, says deMaynadier, salamanders

make good sentinel species, exposing problems in a natural community before larger, more glamorous animals are affected.

Also, says Jackson, salamanders and other small animals are near the bottom of a food web that connects all the living things in the forest. Just because they are small, slimy, and largely unseen doesn't diminish their role. A road that is good for salamanders is good for the animals that eat salamanders, the animals that eat those animals, and so on.

Once you've built a lovely road it can be hard to say goodbye, but that is exactly what road ecologists such as Forman and Jackson recommend you do when a temporary road, such as one to a log landing, has served its purpose.

Might you do less harm to the surrounding area if you re-use the same road the next time around? Jackson says maybe. If you've done an excellent job on planning, drainage, and the rest and you are sure you will want to travel the same route the next time around, then the benefits of maintaining the road to use again may outweigh the drawbacks.

One significant drawback is increasing human access. "If not number one, I would put it near the top of the list," Forman says.

It's hard to deny the principle that a road means more people. If you must hike to your favorite pond, you are almost certain to be alone. Build a road to it, and all sorts of people start showing up.

"We *do* want people to get out into nature," says Forman. "Society fundamentally depends on nature. It's a good thing to get people out there." The trick is not to let every temporary road turn into permanent access to an otherwise remote area.

The solution, he says, is effectively closing temporary roads to vehicle traffic when their job is done. Forman acknowledges that, in this country at least, this is a politically sensitive issue. "In Canada they seem to know how to do it. I've seen wonderful examples," he says. "In the U.S. you say, 'close the road,' and there is a public outcry and people hire lawyers."

The other solution is to carefully plan where to build the roads in the first place. Roads built for recreational access should be at the perimeter of what Forman calls "the big, green blob," leaving the interior wild for the few hardy souls willing to travel beyond the road, he says. Similarly, other road networks can be planned with a goal of keeping large areas free of roads.

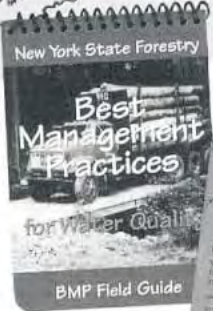
Forman is not against roads. In fact, he's all for them. He knows that many new roads will be built and believes that is a good thing. He just wants those roads to do the most good for people and the least harm to the environment.

There is a special joy in walking, or even driving, down a forest road and seeing plants and animals that are usually only found deep in the forest. Building a forest road that keeps even the salamanders and the trout happy will probably do a pretty good job of keeping you happy too.

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