7 THREATS TO GRANTHAM'S NATURAL RESOURCES

This section provides an overview of threats to the natural resources in Grantham. Global or wide-ranging regional threats that cannot be addressed solely at the local level, such as global warming or acid rain deposition, are not included. Many of the topics discussed below are directly related to each other. For example, road and stream intersections are a direct result of new roads built because of sprawl development. Each threat included in this chapter is significant enough that it deserves its own discussion and can be addressed at least partially, at the local level.

For a complete list of threats to wildlife and wildlife habitat in New Hampshire, see Chapter 4 of the New Hampshire Wildlife Action Plan.

7.1 DEVELOPMENT AND SPRAWL

The NHWAP ranks development as New Hampshire's single greatest threat to wildlife and wildlife habitat (NHFGD, 2005). Whether the development is residential, commercial, industrial, mining, or recreational, it causes habitat destruction, fragmentation, reduced water quality, and increased air pollution. Sprawl is the random spread of development into formerly rural areas. Sprawl consequently results in additional roads built to connect people to services, creating communities that rely heavily on the automobile. Sprawl is a domino effect ending in increased air and water pollution, fragmentation and habitat loss, and higher municipal costs to provide services to outlying areas.

Grantham's Rural Residential District II, with a minimum lot size of 4.5 acres, is a good example of how large lot sizes promote sprawl.

Traditional New Hampshire communities were characterized by town centers with denser development and mixed uses surrounded by rural residential areas, farms, and forests.

Grantham, like many New Hampshire communities, has unintentionally promoted sprawl with zoning ordinances that prohibit traditional development patterns. Intending to limit growth, Grantham's zoning ordinance requires large tracts of one to five acres in its rural residential zones. These large lot sizes result in open space fragmented by miles of roads and dozens of suburban homes spread out across the landscape. The town should amend current zoning regulations to include innovative land use regulations. One such example may be found in the City of Dover, New Hampshire, where subdivision regulations have standardized cluster development in the city. Instead of the more common method of subdividing land into conventional-sized lots, Dover allows the arrangement of building units to be suited to the site topography and other natural features. The remaining undeveloped land is set aside as open space and protected from further subdivision or development. Dover's subdivision regulations may be viewed on the City of Dover's web site, http://www.ci.dover.nh.us/planning/Zoning/zoning.htm, or the New Hampshire Office of Energy and Planning (NHOEP) web site at http://www.nh.gov/oep/resourcelibrary/referencelibrary/c/clusterregulationsordinances/index.htm.

Another example of combating sprawl can be seen in the Town of Lyme, NH. Lyme has a designated Mountain and Forest Conservation District similar to Grantham's Forest Lands Conservation District with the exception that Lyme has extended their district beyond lands already conserved to include those remote areas with little to no development. For Grantham, these areas might include the land north of the Town Forest/Sherwood Forest complex and perhaps the area south of the currently zoned Rural Residential District II and west of the developed Route 10 area thereby concentrating development in areas already fragmented by roads and buildings.

The New Hampshire Audubon Society provides Wildlife Habitat and Natural Resource Protection reviews of municipal land use planning documents. These reviews evaluate the town's Master Plan, zoning ordinance, site plan review regulations, subdivision regulations, and application checklists. The current level of protection for wildlife habitat and natural resources is assessed and additional opportunities for regulatory protection are identified. They also offer build-outs with alternative scenarios based on current regulations, natural resources, and the town's Master Plan. For more information on these services, contact Vanessa Jones, New Hampshire Audubon, at 603-224-9909 x 311 or vjones@nhaudubon.org. For more information on sprawl, download a copy of NHOEP's *Achieving Smart Growth in New Hampshire* online at http://www.nh.gov/oep/programs/SmartGrowth/index.htm. Review the *Innovative Land Use Planning Techniques: A Handbook for Sustainable Development* for resourceful zoning and site-level design techniques.

7.2 ROADS AND HIGHWAYS

"Roads kill everything" (Dakai, 2008). Transportation infrastructure is among the top five threats to species and wildlife habitat identified in the NHWAP. Grantham has approximately fourteen miles of interstate highway, five miles of U.S. and state highway, thirty-seven miles of town maintained roads, and sixty-one miles of privately maintained roads.

Wildlife road mortality, or "road-kill," is the most visible impact roads have on wildlife. Slow moving species, such as many reptiles and amphibians, have little chance of safely crossing busy roads. Slow maturing species whose survival depends on high adult survivorship, such as all turtle species, can suffer severe population impacts if too many breeding-age adults are killed. Species, whose populations are limited, such as the timber rattlesnake, can be devastated if just one or two individuals are killed. Long range dispersers and species with large home ranges, such as the fisher, must risk crossing roads to establish new territories or maintain current ones. For abundant species, such as the white-tailed deer, road mortality may not have a significant impact on local populations. However, existing data on road-killed wildlife is scattered and inconsistent; the potential for population impacts should not be discounted for any species. None of New Hampshire's threatened or endangered species are currently monitored for road mortality. Vehicle collisions with large mammals can also be a safety hazard to people. In Grantham, there is a high incidence of moose/vehicle collisions on I-89 from exit 13 south toward Stocker Pond (Dakai, 2008).

The "road zone effect" refers to the width of land on either side of a road that is impacted by the road. A 1976 study by the Council on Environmental Quality reported that up to forty-eight acres of habitat is impacted with the construction of just one mile of interstate highway (White and Ernst 2003). Along the seven mile stretch of I-89 in Grantham, the road zone impact amounts to 336 acres! Roads leading into forested tracts can become pathways for exotic plant and pest species. Studies have indicated that many species of animals will avoid roads due to traffic volume and noise. For example, studies of bird populations have shown that population densities and species variability is reduced up to 60% from distances of 2,500 to 4,000 feet depending on surrounding habitat (forest vs. grassland) (Forman, et al. 2003). Conversely, roadside habitat may benefit some species by providing new nesting sites or foraging areas. Bats may find suitable roosting sites beneath bridges or scavengers may forage on road-killed animals. However, animals living near roads are at an increased risk of human impacts (feeding wildlife or automobile collisions) that may ultimately end in death. The risks of roadside habitation far outweigh the benefits.

Roadside management often relies on removing vegetation during road construction and replacing native plants with faster growing, non-native species. Roadsides are often maintained with mowing regimes which reduce biodiversity and spread seeds of invasive species into disturbed areas. Herbicides used to control roadside vegetation could seep into groundwater or enter surface waters with storm-water runoff. Traditional drainage ditch maintenance promotes erosion and increases sediment. Implementing improved best management practices (BMP) for roadsides could reduce some environmental impacts and potentially decrease long term maintenance costs. For example, the "lower-third method" of roadside drainage ditch maintenance digs out only the bottom of the ditch, leaving the banks intact and conserving the natural vegetation growth. By allowing vegetation to grow, erosion and sedimentation are decreased, maintenance costs are decreased and roadsides are more visually pleasing (Gagne, 1997).

Roads have an enormous chemical impact. The most widely studied chemical impact is rock salt, heavily used in the Northeast during winter. Salt alters the chemical composition of soil and water, impacting the vegetation that can survive along the roadside and opening sites to invasive plants. Salt may become concentrated at locations some distance from major roads when snow management practices remove snow to snow-dump sites. Salt seeps into groundwater or is dispersed by the wind, settling in streams and ponds, altering habitat for aquatic species. Salt corrodes road infrastructure and vehicles adding heavy metals to storm water runoff entering streams and wetlands. In addition, automotive fluids leak onto road surfaces where they too, wash into surface waters or seep into groundwater. Accidental (or illegal) chemical spills and herbicide spraying on roadside vegetation only add to the mix.

Habitat fragmentation is one of the greatest threats to wildlife today. Fragmentation occurs when roads bisect blocks of land, reducing the size of unfragmented tracts and separating areas of habitat. Animal species that require large continuous blocks of land suffer when their habitat is reduced and their young may not be able to find suitable sized habitat to establish their own territories. Other species that may not require a large amount of land may be cut off from other local populations, reducing genetic diversity and putting individual populations at higher risk of natural or human-made disasters such as fire or flood. The smaller the fragment of land, the less biodiversity it can support. The greater the number of fragments, the more forest edge exists resulting in greater opportunities for songbird nest predation, invasive species intrusion, and access to the forest interior by people for recreation, hunting, or other habitat disrupting activities (Forman, et al. 2003 and White and Ernst 2003).

7.2.1 UNPAVED VS. PAVED ROADS

Paved roads are a greater source than unpaved roads for heavy metals, oils and other toxins associated with higher traffic volumes and steel infrastructure (see chemical impacts above) and, mile for mile, usually contribute to greater areas of impervious surface. The primary environmental impact of unpaved roads, typically constructed for rural areas with lower traffic volume, is dust and sediment.

"Fugitive dust" is fine particles made airborne by wind. Paved and unpaved roads combined, provide the single largest global source of fugitive dust, with paved roads accounting for 15% and unpaved roads 28% (Foreman et al. 2003). According to both MacDonald et. al. 1997 and Foreman et al. 2003, "an often-cited rule of thumb for road material loss from untreated, unpaved roads states that one car, making one pass daily at 35 mph on 1 mi of road, can generate 1 ton of dust per year." Dust on leaf surfaces may increase temperature and water loss in the plant and block photosynthesis (Frazer, 2003). Dust from roads can also bond with contaminant metals or other chemicals which then concentrate on roadsides or roadside vegetation before being washed by rain into surface and groundwater. Contaminated dust may also drift great distances through the air to settle in rivers and lakes far from the road surface (Forman et al. 2003).

Dust covered vegetation along the dirt portion of Old Farm Road.

Sediment washed from unpaved or gravel roadbeds into streams blocks photosynthesis in aquatic plants, kills aquatic animals and essentially acts as sandpaper, scouring natural stream bottoms. Discharging stormwater runoff directly into streams exacerbates the situation. The shoulders of secondary paved roads, such as town-maintained roads, are usually unpaved and can contribute a significant amount of sediment to surface waters. Flow velocity of storm-water running over paved surfaces has substantial erosive power (Forman et. al., 2003).

The problems with road salt treatment on paved surfaces are well documented (Section 7.2) but there is a lack of detailed studies on the effectiveness and environmental hazards of treating unpaved roads for dust. Dust is treated on unpaved roads with a number of products including surfactants, adhesives, electrochemical stabilizers, petroleum products, and chloride salts. In some cases, the environmental impacts of the treatment may be worse than the dust itself (Frazer, 2003). New products, such as Dust Stop (http://www.cypherltd.com/duststop.html), are made with completely biodegradable starches. The town may want to re-evaluate road treatments for both paved and unpaved roads to consider more environmentally sensitive products.

7.3 STREAM HABITAT AND CONTINUITY

Like habitat connectivity, streams require continuity to support the movement of aquatic organisms. Many species require different habitats for feeding, breeding, and shelter, and access to new habitats is required for the natural dispersal of individuals. Disruption of stream continuity can result in the loss and degradation of habitat, block wildlife movement, and disrupt the ecological processes that occur in streams over time (Jackson, 2003). For example, woody debris that would have naturally been distributed throughout the stream corridor, providing nutrients and habitat for plants and animals downstream may be blocked by a barrier such as a dam, bridge, or culvert.

7.3.1 DAMS

As highly visible structures that deliberately block the flow of water, dams are possibly the most obvious barrier to stream continuity. Habitat is altered when the natural flow of water upstream of the dam is impounded, sediment builds up, water temperatures increase, and dissolved oxygen decreases. Impoundments can result in the flooding of wetlands upstream along the river's edge resulting in the alteration, degradation or loss of riparian habitat (NHDES). Active dams are a 100% barrier to fish moving up—and usually down—stream (Magee, 2008). Some dams, however, can create habitat or provide alternate fisheries as in the case of Butternut and Miller Ponds.

Grantham has ten active dams within the town boundary (Table 7-1, Figure 2-2, Appendix A, and Figure 7-1). Of these, the Miller Pond and Butternut Pond Dams provide recreational value and have created important wildlife habitat. The privately owned Eastman Pond Dam, also built for recreational purposes, is the only dam within Grantham with a “High Hazard Structure” classification. A High Hazard Structure is defined by the probable loss of life; high economic costs due to structural damage of buildings and roads and the interruption of public safety services; and the probable release of hazardous industrial, agricultural, or commercial wastes, septage, or contaminated sediment in case of dam failure. Environmental impacts to sensitive areas and extreme alteration of habitat, although not defined, would likely also occur in the occasion of a High Hazard dam failure. Butternut Pond Dam, the only state-owned dam in town, is classified as a “Low Hazard Structure” indicating no loss of life, low economic costs and reversible environmental losses to environmentally-sensitive areas. Washburn Corner Dam, impounding McDaniel’s Marsh in Springfield, is also a Low Hazard dam that could potentially impact Grantham if it failed.

All remaining active dams in Grantham are privately owned and, with the exception of two fire ponds, used for recreational value. The adverse impacts to stream continuity and natural ecological processes at these sites should be carefully weighed against any possible wildlife benefits.

The current NHDES process for new dam permits takes local input from municipalities into account. It is recommended that permit requests for any additional dams for personal recreation be closely evaluated for environmental impacts. Support for private recreational dams is not advised.

The New Hampshire River Restoration Task Force was formed to explore opportunities to selectively remove dams for the purposes of restoring rivers and eliminating public safety hazards. According to the NHDES, after the removal of a dam, a river heals quickly; previously submerged lands revegetate rapidly, fish populations and species diversity commonly increase in the restored stretch of river within the first year after a dam is removed and significant water quality improvements are often seen in a similarly short amount of time. Removing some dams may restore recreational opportunities such as fishing (with the restoration of fish populations) and canoeing or kayaking. If the owners of existing dams are receptive, the town may consider reviewing the environmental impacts of individual dams to determine if the ecological benefits of removing them would be cost effective. If the removal of a dam is determined to be beneficial, the GCC may consider providing technical and monetary assistance to complete the project and restore that stretch of river.

For information and guidance on the dam removal process, visit the Dam Removal and River Restoration Program at: http://des.nh.gov/organization/divisions/water/dam/damremoval/index.htm. The River Restoration Coordinator is available to provide information on the permitting process and assist in identifying potential funding sources to offset the costs of dam removal.

Eastman Pond Dam is considered to be a "High Hazard Structure."

Table 7-1 Dams in Grantham

NAME	HAZARD CLASS	RIVER	STATUS	TYPE	USE	OWNERSHIP	ACRES IMPOUNDED
Eastman Lake Dam	H	Eastman Brook	Active	Earth	R	P	435.00
Butternut Pond Dam	L	Butternut Brook	Active	Stone/Earth	R	S	50.00
Miller Pond	NM	Tributary to Skinner Brook	Active	Stone/Earth	R	P	40.00
Stoney Brook Pond Dam	NM	Stoney Brook	Active	Concrete	R	P	2.50
Lindell Pond Dam	NM	Unnamed Stream	Active	Concrete	R	P	0.67
Golf Course Pond	NM	Tributary to Eastman Brook	Active	Earth	R	P	0.50
Martin Dam	NM	Tributary to Sawyer Brook	Active	Earth	R	P	0.40
Grantham Indoor Fire Pond	NM	Unnamed Stream	Active	Earth	P	P	0.24
Gulas Pond	NM	Sawyer Brook	Active	Earth	R	P	0.12
Fire Pond	NM	Tributary to Sawyer Brook	Active	Earth	P	P	0.10
Heinlein Fire Pond Dam		Natural Swale	Exempt	Earth	P	P	0.50
9^{th} Fairway Pond Dam		Tributary to Eastman Brook	Exempt	Earth	R	P	0.20
Skinner Brook Dam		Skinner Brook	Not Built	Timbercomb	R	P	0.90
Fowler Recreation Pond Dam		Runoff	Not Built	Earth	R	P	0.50
Recreation Pond Dam		Skinner Brook	Not Built		R	P	0.00
Mill Pond Dam		Skinner Brook	Ruins	Stone/Earth	M	P	3.70
Recreation Pond Dam		Skinner Brook	Ruins	Earth	R	P	0.00
Croydon Branch Sugar River Dam		North Branch Sugar River	Ruins	Stone/Earth	M	P	0.00
Stocker Brook Dam		Stocker Brook	Ruins	Stone/Earth	M	P	0.00

Hazard Class: NM=Non Menace Structure, L=Low, H=High
Status: Active=currently impounding water, Exempt=no longer meets NHDES dam definition, Not Built=permitted but not built, Ruins=no longer impounds water
Use: C=Conservation/Agriculture, M=Mill, P=Fire Protection, R=Recreation
Ownership: P= Private, S= State

7.3.2 CULVERTS AND BRIDGES

Surpassing the number of dams, intersections of streams and roads—or stream crossings—have been historically designed to pass water under a road without consideration of stream continuity. Flow variability, natural sediment transport, and aquatic organism passage are overlooked. Characteristic problems of culverts include undersized, shallow, or perched crossings resulting in low or high flow, unnatural bed materials, scouring, erosion, clogging, and ponding (Singler and Graber, 2005). Bridges generally have the least impact on streams but, if improperly designed, can still result in sediment deposition and/or streambed degradation (NHFGD, 2008).

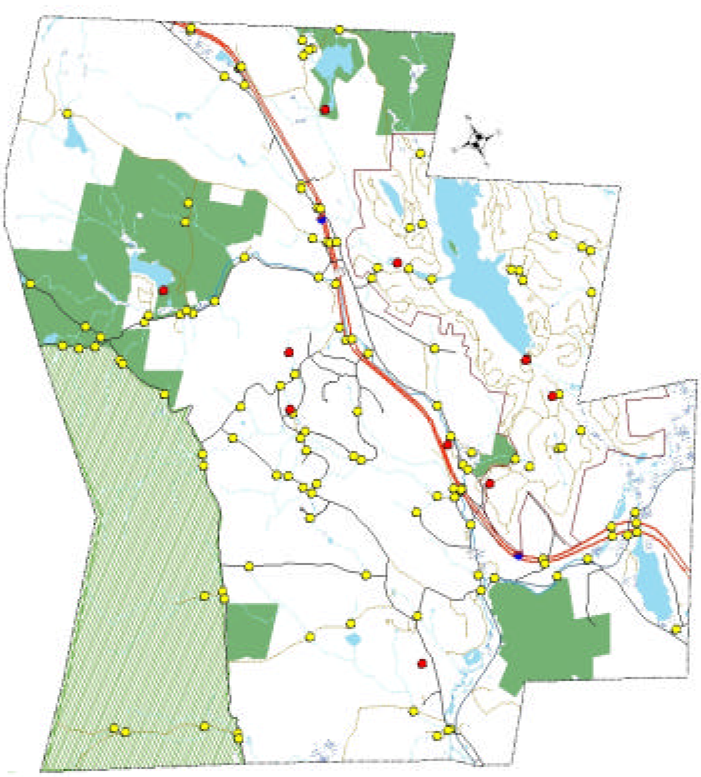

Figure 7-1 Stream crossings and dam locations in Grantham. Culverts indicated by and active dams indicated by .

A GIS analysis of road and stream intersections found one-hundred and thirty-two road crossings in the Town of Grantham (Figure 7-1). Skinner Brook is the most heavily affected named stream with fourteen crossings. That's roughly one disruption of the brook less than every half mile! Eighty-five crossings are over unnamed tributaries. It is important to remember that even intermittent streams provide habitat, migration corridors, and forage opportunities for fish, insects and other wildlife species. It can be expected that, as the population in Grantham increases, so too will the number of roads and consequently, the number of stream crossings.

In September, 2008, NHFGD and NHDES adopted the *New Hampshire Stream Crossing Guidelines*. The Guidelines recognize the impact of stream crossings on stream connectivity and are intended to minimize impacts on streams and their associated riparian ecosystems. The *NH Stream Crossing Guidelines* will likely result in higher initial costs for proper culvert design and installation but long term maintenance and replacement/repair costs will be lower, ecosystem health and water quality will be improved, and safer infrastructure will result in reduced costs to public and personal property. Currently, NHDES is taking steps to integrate the guidelines into rules. These rules will likely categorize stream crossings into three tiers based on the watershed size above the stream crossing. Steep slopes would lower the threshold and bump the crossing up a tier. The lowest tier will be for minimum impact crossings and will only have to meet best management practices criteria. Minor impacts, or Tier 2 crossings, will require both new and replacement crossings to meet the design criteria in the *Stream Crossings Guidelines.* Mitigation will be required for all Tier 3 (major impacts) crossings and where Tier 2 crossings cannot meet standards. Because these rules are still in early draft form, they will not be further detailed here. For more information, contact Mary Ann Tilton at the NHDES Wetlands Bureau (603-271-2929).

This perched culvert on Olde Farms Road over Sawyer Brook exhibits perching, low flow, and unnatural streambed conditions that restrict the passage of fish and other aquatic organisms.

To understand the full impact of stream crossings in Grantham, the town may consider partnering with neighboring municipalities, local watershed groups, and other regional organizations to spearhead a regional culvert inventory. For an example, see *The Ashuelot River Continuity Study* (http://www.nature.org/wherewework/northamerica/states/newhampshire/ under "Projects"), conducted by the New Hampshire Chapter of The Nature Conservancy (TNC) and funded by NHDES Watershed Assistance Grant, Moose Plate Grant, and the US Fish and Wildlife Service. This study combined field inventory and GIS analysis to prioritize stream restoration plans with a focus on reconnecting free-flowing river habitat. Crossings were graded based on field data collected by volunteers and restoration areas prioritized based on the most fragmenting features in the highest quality habitat. In other words, crossings were identified for replacement or retrofitting to restore stream continuity. TNC is planning on writing a "how-to" guide on culvert inventory to be released in 2010. For questions regarding the Ashuelot River study, a copy of the full report, and information on the status of the "how-to" guide, contact Doug Bechtel, TNC Director of Conservation Science, at 603-224-5853 x16.

The New Hampshire Department of Safety, Homeland Security and Emergency Management has offered Emergency Management Performance Grants and Mitigation Assistance Program funds for distribution to local communities through a competitive grant process in previous years. The primary purpose of the grants are to fund local efforts that will improve hazard planning and preparedness activities, including mitigation, preparedness, response, and recovery initiatives and for hazard mitigation planning and the implementation of cost effective mitigation projects prior to a disaster event. A culvert inventory and possibly culvert replacement projects could potentially be funded under these grants.

7.4 EXOTIC AND INVASIVE SPECIES

Invasive species include exotic terrestrial or aquatic plants or animals that compete with native species for food and habitat. Invasive species often alter the physical environment that they inhabit, making it inhospitable to natives. Typically, invasives tolerate a wide variety of environmental conditions and grow unchecked by natural predators or other controls. Invasive species are the greatest threat, second only to habitat destruction, to species nationwide (NHFGD, 2005).

In New Hampshire, forty-eight plants and fifteen insect species are currently recognized as invasive species (Tables 7-2, 7-3, and 7-4). New Hampshire RSA 430:55 and RSA 487:16-a prohibit any person from knowingly collecting, transporting, selling, distributing, propagating, transplanting, or releasing any living and viable portion of any plant species or any living insect species in this list. In addition, the Invasive Species Committee of the New Hampshire Department of Agriculture, Markets and Food, lists an additional sixteen plant species of concern on their “Watch List” (Table 7-5).

Three habitat types existing in Grantham are potentially threatened by invasive species (Table 7-6). There are no wildlife species existing in Grantham currently known to be significantly threatened by invasive species. However, the impacts of invasives on many species is not well understood (NHFGD, 2005).

Invasive species can be introduced purposely through horticultural practices, the release of one exotic species to control another, or the illegal release of captive animals. Accidental introductions may occur through aquatic pathways as hitchhikers on boat hulls or in ballast water discharges. Invasive species can spread quickly on sites disturbed by development or other land use practices (NHFGD, 2005). Once established, invasives are nearly impossible to eradicate and expensive to manage; preventing introduction and spread is key to their control.

Table 7-2 New Hampshire Prohibited Terrestrial Invasive Plant Species List.

Common Name	Scientific Name
Norway maple	*Acer platanoides*
tree of heaven	*Ailanthus altissima*
Garlic mustard	*Alliaria petiolata*
Japanese barberry	*Berberis thunbergii*
European barberry	*Berberis vulgaris*
Oriental bittersweet	*Celastrus orbiculatus*
black swallow-wort	*Cynanchum nigrum*
pale swallow-wort	*Cynanchum rossicum*
autumn olive	*Elaeagnus umbellata*
Burning bush	*Euonymus alatus*
giant hogweed	*Heracleum mantegazzianum*
Water-flag	*Iris pseudacorus*
blunt-leaved privet	*Ligustrum obtusifolium*
showy bush honeysuckle	*Lonicera bella*
Japanese honeysuckle	*Lonicera japonica*
Morrow's honeysuckle	*Lonicera morrowii*
Tatarian honeysuckle	*Lonicera tatarica*
Japanese knotweed	*Polygonum cuspidatum*
common buckthorn	*Rhamnus cathartica*
Glossy buckthorn	*Rhamnus frangula*
multiflora rose	*Rosa multiflora*

Japanese knotweed along the shoreline of Stocker Brook.

Table 7-3 New Hampshire Prohibited Aquatic Invasive Plant Species List.

milfoils or feather-foils	All *Myriophyllum* species
fanworts	All *Cabomba* species
Hydrilla or Anacharis	*Hydrilla verticillata*
water chestnut	All *Trapa* species
curly-leaf pondweed	*Potamogeton crispus*
purple loosestrife	*Lythrum salicaria*
common reed	*Phargmites australis* or *P.communis*
Brazilian elodea	*Egeria densa*
European frogbit	*Hydrocharis morsus-ranae*
flowering rush	*Butomus umbellatus*
European naiad	*Najas minor*
yellow floating heart	*Nymphoides peltata*
swamp stonecrop	*Crassula helmsii*
great willow herb or hairy willow herb	*Epilobium hirsutum*
reed sweet grass or manna grass	*Glyceria maxima*
East Indian Hygrophila	*Hygrophila polysperma*
water spinach	*Ipomoea aquatica*
yellow iris or yellow flag iris	*Iris pseudocarus*
African oxygen weed	*Lagarosiphon major*
ambulia	*Limnophila sessiliflora*
water fern	*Marsilea quadriflora*
water forget-me-not	*Myosotis scorpioides*
double flowering arrowhead, Japanese arrowhead, or Old World arrowhead	*Sagittaria japonica*
giant sagittaria	*Sagittaria sagittifolia*
slender cattail	*Typha gracilis*
dwarf cattail or Laxman's cattail	*Typha laxmanii*
miniature cattail or micro-mini cattail	*Typha minima*

Table 7-4 New Hampshire Prohibited Invasive Insect Species List.

Common Name	Scientific Name
honeybee tracheal mite	*Acarapis woodi*
hemlock woolly adelgid	*Adelges tsugae*
city longhorn beetle	*Aeolesthes sarta*
Asian longhorned beetle	*Anoplophora glabripennis*
cedar longhorned beetle	*Callidiellum rufipenne*
Siberian silk moth	*Dendrolimus sibiricus*
redhaired bark beetle	*Hylurgus lingniperda*
European spruce bark beetle	*Ips typographus*
Asian gypsy moth	*Lymantria dispar*
Japanese beetle	*Popillia japonica*
viburnum leaf beetle	*Pyrrhalta viburni*
European chafer	*Rhizotrogus majalis*
nun moth	*Symantria monacha*
brown spruce longhorned beetle	*Tetropium fuscum*
varroa mite	*Varroa destructor*

Table 7-5 Proposed New Hampshire Restricted Species (Watch List Species)

Common Name	Scientific Name
Plants	
porcelain berry	*Ampelopsis brevipedunculata*
spotted knapweed	*Centaurea maculosa*
Canada thistle	*Circium arvens*
crown vetch	*Coronilla varia*
Russian olive	*Elaeagnus angustifolia*
wintercreeper	*Euonymus fortunei*
sweet reedgrass	*Glyceria maxima*
common privet	*Ligustrum vulgare*
amur honeysuckle	*Lonicera maakii*
moneywort	*Lysmachia nummularia*
Japanese stilt grass	*Microstegium vimineum*
reed canary grass	*Phalaris arundinacea*
white poplar	*Populus alba*
kudzu	*Pueraria lobata*
black locust	*Robinia pseudoacacia*
Siberian elm	*Ulmus pumila*

Source: New Hampshire Department of Agriculture, Markets & Food
http://www.nh.gov/agric/divisions/plant_industry/plants_insects.htm
Accessed July, 2008

Table 7-6 Habitat types in Grantham potentially threatened by invasive species

Habitat Type	Threat Level *	Threats
Hemlock-Hardwood-Pine Forest	3	Hemlock Wooly Adelgid (*Adelges tsugae*) Currently occurring in Rockingham County, the adelgid is predicted to spread north and west throughout the southern half of New Hampshire by 2025
Floodplain Forest	2	Floodplain habitats are especially vulnerable to invasive plants because the frequent disturbances from flooding and because of the nutrient rich soils characteristic of floodplains. Several exotic plants are problematic in floodplain habitats, including Oriental bittersweet (*Celastrus orbiculatus*), Japanese knotweed (*Polygonum cuspidatum*) and black swallow-wort (*Vincetoxicum nigrum*).
Marsh and Shrub Wetlands	2	Examples of invasive wetland plants include purple loosestrife (*Lythrum salicaria*), common reed (*Phragmites australis*), Japanese knotweed (*Polygonum cuspidatum*), shining buck-thorn (*Rhamnus frangula*),water chestnut (*Trapa natans*), variable milfoil (*Myriophyllum heterophyllum*), Eurasian milfoil (*Myriophyllum spicatum*), and fanwort (*Cabomba carolinina*)

* Scores are categorized from 1-4, with 4 indicating highest possible risk. See NHWAP, Chapter 4 for more information on ranking process.
Source: NHFGD, 2005.

7.5 RECREATION

Recreational activities have the potential to alter soil, vegetation, and aquatic ecosystems, thereby impacting wildlife habitat and behaviors (Cole and Landres, 1995). For example, the ATV use in the Grantham Town Forest, as discussed in Section 4.1.1, compacts soils, alters hydrology, and destroys vegetation. But even hikers can trample vegetation and, over time, compact soils and increase erosion. The severity of impact is dependant upon the amount and type of recreational activity (Cole and Landres, 1995). These habitat disturbances may alter food availability or vegetation characteristics impacting breeding or sheltering habitat and some wildlife species may simply be intolerant of human presence.

Recreational activities foster an appreciation and respect for open space and the outdoors. Recreation is economically beneficial when people spend money on activities and jobs are created. Recreation provides opportunities to educate on the value of conserving large tracts of land and provide a sense of stewardship for wildlife and the landscape.

Outdoor recreational activities within the Town of Grantham should continue to be encouraged as they are today. However, consideration should be given to restricting types of use and areas of use. Restricting ORV use to specific trails and seasons to minimize damage is strongly encouraged. Routing hiking trails away from rare plant communities and important wildlife habitats such as ridgelines or riparian corridors will help to protect the integrity of those areas. Nature trails may provide wildlife viewing areas overlooking wetlands or meadows without entering and disrupting these areas. Grantham's increasing population will most certainly result in greater long-term impacts to the town's open space—applying restrictions now will reduce the severity of impacts in the long run.

7.6 NON-POINT SOURCE POLLUTION

Non-point source pollution comes from sediment, fertilizers, chemicals and other materials picked up in stormwater runoff of developed and agricultural areas. Potentially harmful substances such as road salt, fertilizers, pesticides, and herbicides are flushed into water bodies by rain or snowmelt (NHFGD, 2005) or leach through the soil into groundwater. Table 7-7 lists the habitat types in Grantham potentially threatened by non-point source pollution.

Table 7-7 Habitat types in Grantham potentially threatened by non-point source pollution

Habitat Type	Threat Level *	Threats
Lowland Spruce-Fir Forest	3	Pest management strategies include shorter rotations and pre-salvage harvesting, which may create extensive even-aged stands that are increasingly vulnerable to future pest outbreaks.
Hemlock-Hardwood-Pine Forest	2	Not specified.
Peatlands	2	Increased nutrient input through runoff or hydrologic alterations can alter the nutrient content of the water in peatlands, increasing the rate of peat decomposition, eventually changing the peatland to a non-peat wetland.
Southern Upland Watersheds	2	Historically, pollutants from point and nonpoint sources have caused fish kills in the Sugar River. Water quality has improved since the implementation of the Clean Water Act but non-point source pollution remains unregulated.

* Scores are categorized from 1-4, with 4 indicating highest possible risk. See NHWAP, Chapter 4 for more information on ranking process.
Source: NHFGD, 2005.

7.6.1 LAWN CARE

While point source pollution is currently regulated by the Clean Water Act, non-point source pollution is still widely unregulated. Commercial herbicide and pesticide use is controlled but use of these products by homeowners is not. According to the U.S. Fish and Wildlife Service, nearly 80 million pounds of pesticides are used on U.S. lawns annually—ten times more chemical pesticides per acre than farmers use on crops (Wargo et. al. 2003). Pesticides have been linked to increased incidents of certain types of cancer in families that use pesticides at home. The National Institute of Health reported that children may be more susceptible to the carcinogenic effects of pesticide use (McDonald, 1999).

According to the National Coalition for Pesticide Free Lawns (NCPFL), seventeen of the thirty most commonly used lawn pesticides are frequently detected in groundwater; twenty-three have the ability to leach into drinking water sources; twenty-four are toxic to fish and other aquatic organisms; eleven are toxic to bees and other insect pollinators; and sixteen are toxic to birds. The impact of pesticide use varies widely based on the chemical, or mix of chemicals, used and the duration of exposure. Fish species that can survive higher concentrations of pesticides in the short term, for example, may be susceptible to disruptions in their immune system, hormonal system, stress responses, or reproductive system with longer term exposure at lower concentrations (McDonald, 1999). Reaction to exposure to the "chemical cocktail" of multiple chemicals that accumulate in the water is unknown and understudied. Fish may concentrate toxins in their tissues, called bioconcentration, so that their toxicity level is many times higher than that of the water body they live in. As the fish are preyed upon, the pesticides bioaccumulate in organisms farther up the food chain (McDonald, 1999).

The GCC could take the initiative to educate townspeople on maintaining lawns with alternatives to pesticides. A municipal-based land care policy to eliminate the use of toxic chemicals on municipal properties, including school and recreational fields, could set a good example. Refer to the NCPFL, accessible online at http://www.beyondpesticides.org for examples of successful grassroots efforts, municipal policy enactments, and opportunities to receive training on organic land care. The University of New Hampshire's local Cooperative Extension office and Master Gardener program are another good source.

7.7 CORBIN PARK

The threat of Corbin Park to natural resources is unique to the towns which harbor the Park's boundaries. The advantage of the Park is that it is unlikely to be developed and theoretically affords habitat protection for birds, small mammals, fish, reptiles and amphibians. Not all native species are welcome, however. Moose for example are extirpated when they manage to breach the fence and find themselves on the inside of the Park (Dakai, 2008).

NHFGD has voiced concern that the elk in the Park could transfer disease to wild cervids either by nose to nose contact through the fence or due to escapees mingling with wild deer (Rines, 2008). In other parts of the country, captive elk have been implicated in the spread of chronic wasting disease and tuberculosis. The elk in Corbin Park have not been implicated in disease transmission and, because the population is self-contained (no new imports), they pose an improbable threat. The Park is further enrolled in the USDA's Chronic Wasting Disease Monitoring Program (Gustafson, 2008). Wild pigs as disease vectors are discussed below in Section 7.7.1.

Because the owners/members of the Blue Mountain Game Preserve are guarded against public knowledge of their activities, the population size and extent of habitat impacts by game herds in Corbin Park are unknown. Observations made during a one-time visit to the Park by the author noted severe over-browsing of the understory. Because the area visited was near a feeding station, it should not necessarily be assumed that the entire interior of the park is subject to as high an impact. Still, the herd size of elk and the population size of the wild boar are subject to the sole management of the Park and are managed exclusively for the hunting privileges of Park members. Because they are a native species, white-tailed deer in the Park remain under State management rules but the population inside the fence is fed and protected from predators, so it is possible that the deer herd is over-populated.

The fence is an imposing barrier to wildlife. Pieced together with wire mesh and chain link, the fence is approximately eight feet high, strung between posts and trees, and topped in sections with strands of barbed wire. It is nearly 40 miles in length and runs the entire circumference of the park. While cutting off habitat from development pressures, the fence also cuts habitat off from many native wildlife species. What NHFGD's unfragmented lands analysis data identified as the second largest unbroken tract of land south of the White Mountain National Forest is actually broken up into greater than one dozen smaller parcels by the fence. The Grantham Town Forest actually ranks 35th largest south of the Whites, the area south of the Park ranks 29th, Corbin Park itself ranks 12th, and the remaining parcels east and west of the fence are all less than 5,000 acres (Figure 7-2, Appendix A). The fence blocks natural wildlife travel corridors, potentially cutting smaller ranging species populations off from one another and forcing larger ranging species to seek alternate routes or change direction.

7.7.1 *SUS SCROFA*, THE WILD BOAR

The wild boar is an opportunistic feeder with a wide ranging diet including hard and soft mast, vegetation and roots, and animal matter. Boars are partial to wetlands and riparian areas for food and cover where rooting behavior can alter soil composition, nutrient cycling and hydrology resulting in erosion and changes in vegetative structure and biodiversity. They compete with native wildlife for food sources, most notably with white-tailed deer and turkey during the fall acorn season but also with waterfowl, fox, bobcat, bear, and rodents. Boars will feed on carrion but can also be an efficient predator, taking newborn fawns, injured deer, snakes, salamanders, bird eggs and nestlings. Feral pigs may prey on species assumed to be protected from development in the parks boundaries and pig foraging behaviors alter and degrade the habitat (McCann et al, 1996 and Stevens, 1999).

Wild boar escapes happen frequently despite the best maintenance efforts of the park. It is noted that feral pigs are adept at finding their way through any kind of fence (Stevens, 1996) and an average of fifty pigs are shot outside the Corbin Park fence yearly (Musante, 2008). Fortunately, the pigs have not established a free-ranging population outside the fence. It is likely they are unable to survive New Hampshire winters on their own due to sensitivity to severe temperature changes and limited mobility in deep snow impacting their ability to travel and find food (Dewey, 2002). However, Michigan, which has potentially severe winters, has recently begun to see problems with feral pig populations (Musante, 2008) and, with the uncertain effects of global warming, New Hampshire weather may someday be less hostile to pigs. In the meantime, they are well-fed within the park boundaries and likely have had a severe impact on the habitat within the fence over the last century.

Feral hogs can also serve as vectors of disease—most notably pseudorabies—and parasites to wild mammals such as raccoon, skunk, fox, black bear, coyote, and mink (Clay, 2004). Like the elk, however, local officials are not greatly concerned that the self-sustaining population inside the fence poses an imminent threat. Note that, although not discussed in detail here because of the focus on natural resources, wild boar can also have severe economic impacts when they find their way to agricultural crops and are potential disease vectors to domesticated livestock (pigs, horses, cattle, goats, and sheep), cats and dogs (Stevens, 1999), and even people (USDA, 2005). Boars may prey on calves, kids, or lambs and with large tusks in their lower jaw, are a potentially dangerous animal to encounter and could cause human injury.

7.8 SUMMARY OF RECOMMENDATIONS

- Review zoning ordinances for instances of supporting sprawl and consider financing a Wildlife Habitat and Natural Resource Protection Audit to assess the level of natural resource protection provided by current town legislation.
- Review current road maintenance practices for environmentally harmful practices and research and implement more environmentally sensitive practices.
- Closely evaluate the ecological impact of all requests for new dam permits.
- Conduct a region/watershed-wide inventory of stream crossings to identify and prioritize culvert replacement/retrofitting, potential dam removal, and stream restoration areas.
- Enact policy establishing pesticide-free parks and organic playing fields, and otherwise restrict pesticides on municipal lands; educate the public on the dangers of pesticides.
- Encourage wise recreational use of wild places; minimize high-impact usage; and avoid sensitive areas.