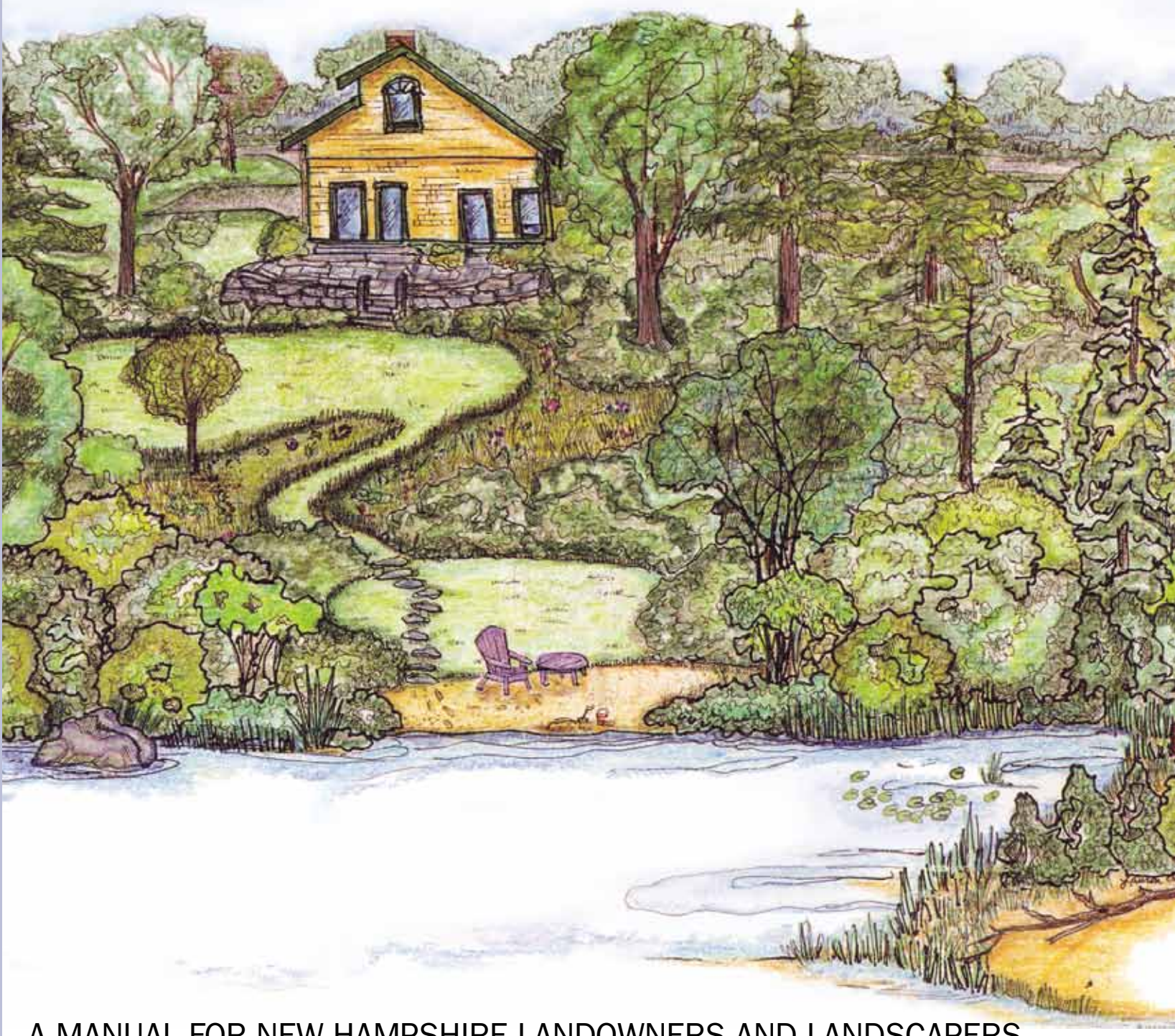
University of New Hampshire
Cooperative Extension

LANDSCAPING at the Water's Edge

AN ECOLOGICAL APPROACH



A MANUAL FOR NEW HAMPSHIRE LANDOWNERS AND LANDSCAPERS

Environmentally-Friendly Lawn Care

Most property owners appreciate a well-designed landscape that includes areas of green, open space to picnic, gather and play. Like all plant communities, lawns offer a number of environmental benefits:

- They help purify water entering underground aquifers by acting as a filter to capture and break down many types of pollutants and nutrients.
- With up to 90 percent of the weight of a grass plant in its roots, a healthy lawn efficiently prevents soil erosion and also helps remove soil particles from runoff water, absorbing 15 times more runoff than bare ground.
- Turfgrasses absorb carbon dioxide (one of the primary gases associated with global warming) and release oxygen. A 50-foot by 50-foot lawn releases enough oxygen to meet the needs of a family of four.
- An average-size lawn (10,000 square feet) has twice the cooling effect of the average-sized central air conditioning unit.
- Lawns absorb and reduce noise.

Designing and maintaining a lawn on a shoreland site entails some special considerations to help protect the quality of the water. The key is to use proper cultural practices so your lawn will sustain itself with a minimum amount of inputs such as fertilizers, water and pest management products.

Low maintenance construction and landscaping is preferred to a no maintenance approach such as this.

The fibrous root system of turfgrass absorbs nutrients and pesticides and helps reduce soil erosion.

Selecting grass varieties

Grasses vary in the climate they prefer, the amount of water and nutrients they need, their resistance to pests, their tolerance for shade, and the degree of wear they can withstand. Choose types of grass well adapted to your site and your needs. The correct selection of grass species and subsequent proper maintenance will improve your chances of growing a dense, healthy lawn.

What do we mean by a "high quality" lawn? Generally, it is a fine-textured dark green monoculture of grass. To achieve this "green carpet" requires the correct grass choice and high maintenance levels – water, fertilizer, mowing and other cultural practices. Most people are satisfied with less perfect lawns in return for more moderate maintenance requirements – less mowing, less inputs. On shoreland properties, high quality, high maintenance lawns should be limited to small areas separated from the water by a vegetative buffer.

Listed in Table 6-1 are suggestions for grass mixtures (including partial listing of varieties) recommended for use in our area. The mixtures combine the four common grass types listed here, and some contain white clover. White clover is a broadleaf legume that adds diversity and will help provide nitrogen to the grasses; it should not be used where broadleaf herbicides will be used on the lawn.

Tall fescue: With very good tolerance to wear, drought, heat and water, this grass is adapted to a range of uses in various general purpose areas. Tall fescue has moderate shade tolerance and a bunch-type growth habit. It survives on low-maintenance sites. (Varieties; Silverstar, Jaguar 3, Turbo, Apache, Forte)

Fine-leaf fescue: Grows well in shade or sandy soils. It has a very fine leaf blade and is a frequent component in lawn mixtures for sunny and shaded sites. Since the fescues (both fine-leaf and tall) are considered low-maintenance species, their use is especially encouraged near the waterfront. (Varieties; Berkshire, Musica, Oxford, Ambassador, Longfellow II)

Perennial ryegrass: Forms a dense, medium-textured turf with moderate shade tolerance, rapid establishment, bunch-type growth habit. It is used in overseeding (seeding on top of an existing lawn) and in high traffic areas. (Varieties: Mach 1, Brightstar SLT, Pizzazz, Citation Fore, SR 4420).

Kentucky bluegrass: Provides a high-quality lawn with moderate-to-high maintenance. It is slow to germinate in cool soils and requires at least four hours of full sun per day. It is often included with other grass species to produce a multipurpose lawn. The varieties listed are those which perform well under lower maintenance levels. (Varieties: Moonlight, Midnight II, Bluemax, Perfection, Quantum Leap, Tsunami).

Caring for your shorefront lawn

Fertilizing

To maximize a lawn's environmental benefits, it's important to maintain soil fertility and turf health so the grasses will produce a dense mat of roots. Start by getting your soil tested to determine its nutrient status and pH value. Keep in mind that a soil test doesn't indicate the amount of nitrogen present. Fertilizer recommendations for nitrogen are based on previous field studies and experience under local conditions.

Few New Hampshire soils contain enough natural nitrogen and other essential nutrients to maintain high turfgrass quality and recuperative ability throughout the growing season. Nitrogen is the nutrient most needed by turfgrasses, but the nitrate form of nitrogen is mobile in soils and can leach into groundwater, as discussed in Chapter 1. Here are a few suggestions to help prevent or reduce nitrate leaching from lawn areas:

Table 6-1: Suggested Grass Seed Mixes for New Hampshire Lawns

Use	Species Mix (% by weight)	Seeding Rate (Lbs/1,000 sq/ft)
Sun: Low to moderate maintenance	80% Tall Fescue 20% Kentucky bluegrass **or** 50% Fine leaf fescue 20% Perennial ryegrass 20% Kentucky bluegrass 10% Dutch White Clover	6-8 lbs 1-2 4-5
Sun: Moderate to high maintenance	75% Kentucky bluegrass 25% Perennial ryegrass **or** Sod (90% Kentucky bluegrass, 10%Fine leaf fescue)	3-4
Sun/shade: Moderate maintenance	80% Tall Fescue 20% Kentucky bluegrass **or** 33% Kentucky bluegrass 33% Perennial ryegrass 33% Fine leaf fescue	6-8 1-2 3-4
Shade: (Less than 4 hours full sun/day)	60% Fine leaf fescue 30% Perennial ryegrass 10% Dutch White Clover	3-4

Reduce quantity of nitrogen fertilizers. Nature supplies some nitrogen via rain, snow, lightning, and the decomposition of thatch and clippings. Dutch White Clover is a legume capable of using nitrogen from the atmosphere and can provide a source of nitrogen in a lawn. For low-maintenance lawns (those receiving infrequent mowing, and little or no additional water or fertilization), these nitrogen sources alone might suffice. However high-maintenance lawns (receiving three fertilizations per year, irrigated as needed to maintain a green turf, mowed twice per week, and given additional attention) need about three pounds of added nitrogen per 1,000 square feet per year.

Use slow-release nitrogen sources. There are a number of slow-release nitrogen fertilizers on the market from either natural or manufactured (synthetic) sources. Nitrogen from natural organic sources, such as composts, manures and leguminous cover crops, is converted to the nitrate form at a slower, more gradual rate than nitrogen from inorganic fertilizers such as ammonium sulfate. Synthetic organics (Nitroform, Nutralene, etc.) also

offer a slower, more gradual release of nitrogen, similar to that of natural organic fertilizers. On the back of a fertilizer bag, slow-release nitrogen is listed as "water insoluble nitrogen." We recommend that at least 50 percent of the nitrogen be water insoluble to protect against surges of nitrate leaching.

Reduce application rates. Most fertilizer applications typically deliver one pound of nitrogen per 1,000 square feet. An alternative to using slow-release sources that also lessens the potential for nitrate leaching involves applying between 0.25 and 0.5 pounds of nitrogen per 1,000 square feet at any one time. By applying these lower amounts more frequently, smaller amounts are available at any one time to be carried off by rain or irrigation water. This is an alternative to using slow-release sources.

Don't apply fertilizer to frozen ground or whenever the lawn isn't actively growing. The fall fertilizer application should be made by mid-September.

Calibrate spreaders. Most fertilizer bags tell you how to set your spreader to deliver the recommended amount of nutrients. If you want to double-check your spreader calibration, refer to the fact sheet "Does Your Lawn Measure Up?" (Appendix B).

Fill granular fertilizer spreaders on a level hard surface, away from the water, where you can easily sweep up any spills.

Return grass clippings. Don't mow or rake clippings into street gutters or onto sidewalks and driveways where they may be carried in runoff to surface water areas. And never use stream beds or banks or surface waters as places to dispose of clippings and leaves! Leave the clippings on the lawn to decompose and recycle nutrients by using a mulching mower or a regular mower without the bag attachment. If you prefer to remove the clippings from the lawn, compost them for later use as mulch in the garden or landscape.

Irrigate lightly (1/4 inch of water) when necessary to avoid water movement beyond the root zone. Deeper watering is usually recommended for most turf areas, but this lighter rate reduces the likelihood of nutrient or pesticide leaching, while still helping to promote a healthy root system.

Space fertilizer applications at least 21 days apart to avoid overloading the system with excess nutrients.

Never wash off fertilizer spreaders on hard surfaces such as driveways or sidewalks where the wash water may carry residues into storm sewers or nearby water. Clean the spreaders over turf.

As mentioned earlier, nitrogen isn't the only nutrient of concern in shoreline landscaping. To protect water quality, don't add phosphorus-containing fertilizers unless a soil test indicates a phosphorus deficiency. Low- or no-phosphorus fertilizers are becoming more readily available; ask your fertilizer dealer or landscape company to use them!

Mowing

Most home lawns should be mowed at a height of 2 1/2 -3 inches every five to seven days during the growing season. In midsummer, a mowing height of three inches helps prevent drought injury. To avoid "scalping" the lawn, don't remove more than a third of the leaf blade at one time.

Leave your grass clippings on the lawn to decompose and recycle nutrients and water back to the turf area. The clippings help feed soil microbes, important for maintaining a healthy soil.

Irrigating

Most lawns require an inch of water per week during the summer to remain green and healthy. Use a rain gauge or place a coffee can on the site being irrigated to monitor the amount of rain and irrigation water the lawn receives each week.

When irrigating, use light (1/4-inch) application rates to help reduce the threat of nitrate leaching through the root zone. Sloped areas may require more frequent, but smaller, amounts of water per application as they are more vulnerable to runoff.

The most efficient time to water is early morning. While evening irrigations are often more convenient for homeowners, they increase the potential for disease infection. Mid-day waterings don't injure the grass, but they lose more water to evaporation.

A professionally designed irrigation system, if operated efficiently, can save water by ensuring uniform application rates. Have maintenance performed on the irrigation system each year to fix broken heads, leaks, etc. If your system is on a timer, install a rain shut-off device to prevent it from running when not needed.

Lawns go semi-dormant and turn brown during hot, dry periods of summer if they aren't irrigated, though they generally make a full recovery once temperatures cool and the turf receives irrigation or rainfall.

Dethatching and aerifying

As part of the natural growth cycle, turfgrasses annually produce new roots that gradually die and are decomposed by soil bacteria to form a layer of organic matter known as thatch. Moderate thatch layers up to half an inch thick are beneficial for improving lawn quality and also serve as an effective filter for absorbing certain pesticides and nutrients.

It is a common misperception that leaving clippings on the lawn contributes to excess thatch; however, that is not the case. Clippings decompose very quickly and, unless excessive, are not a problem.

Thick thatch layers may build up over time on heavily fertilized and watered lawns. Excess thatch promotes shallow rooting, which makes turf more susceptible to drought and pest problems. When thatch levels exceed an inch, power rakes (dethatchers or vertical thinning machines) are effective in removing excess organic matter. Early spring or fall mechanical thinning permits turf to recover faster than summer thinning.

Soils high in clay are especially vulnerable to compaction. Compaction reduces turfgrass vigor, resulting in impaired growth and increased pest pressure, as well as increasing the likelihood of nutrient and pesticide runoff. You can loosen compacted soils with aerifiers (machines that poke holes approximately three inches deep in the soil). Aerification can be done successfully anytime during the growing season, but spring aerification promotes infestation of crabgrass and other weeds germinating during that period and taking advantage of the open spots created by aerifying.

Seeding and sodding

Whether you're seeding a new lawn or installing sod, follow this sequence of soil preparation steps:

1. Till the soil deeply (six inches).
2. Add necessary amendments and fertilizers.
3. Grade and level for a smooth surface.
4. Remove all debris.
5. Lightly pack and moisten.

Once the soil has been tilled, do the remaining preparation and seed the ground as quickly as possible. The soil is vulnerable to erosion at this point, especially on slopes or if heavy rains occur. After seeding, especially if your lawn is on a slope, apply an organic mulch (straw, paper, etc.) to the surface to reduce erosion and runoff. Apply mulch to bare ground before or if a late fall seeding hasn't fully established itself.

To hasten germination and allow time for a fibrous root system to develop, seeding should be done between August 15 and September 10. The warm soil temperatures, abundant moisture, and lack of weed competition at this time create ideal conditions for turf establishment.

One advantage of sod, besides the immediate beauty of a mature lawn, is its ability to accept heavy rain without erosion and reduce the threat of runoff into lakes and streams. In addition, sod can successfully be installed from early spring to late fall, even on frozen ground.

Turf Pest Management

Weed control

Effective weed management involves the use of recommended cultural practices, producing a dense and healthy turf that can out-compete weeds. Most weeds are opportunistic and will invade and eventually dominate areas of thin or unhealthy turf. Mechanical removal of weeds (hand-weeding) is effective in certain situations, such as on small turf areas or where weed invasion is light.

Research continues to explore alternative strategies to replace conventional herbicides. Examples include the use of herbaceous groundcovers as alternatives to grass, certain cultivars of fine and course fescues, corn-gluten-meal-based products, clove oil derivatives and mixtures of acetic acid and lemon juice. Generally these alternative products (and others not mentioned) either have not provided a satisfactory degree of weed control or have other limitations that restrict their use.

Manufactured herbicides generally provide excellent weed control as long as you follow label directions. While research has shown that pollution of surface and ground water from turfgrass pesticides is uncommon, herbicides do vary in their longevity and leaching potential. Herbicides that are highly water-soluble, relatively persistent, and not readily absorbed by soil have the greatest potential for leaching.

Leaching is only one of many considerations in selecting a pesticide. Some pesticides with low leaching potential may be highly toxic to fish and other wildlife, necessitating extra precautions when using them on shoreland properties. The label should note these precautions. Always follow setbacks and other restrictions and when applying chemicals near water or wells (Appendix A).

For a list of herbicides with low leaching potential, landscape professionals can call their local UNH Cooperative Extension office. Individual landowners should call the toll-free Info Line at Extension's Family, Home & Garden Education Center: 1-877-398-4769.

Quick establishment of turfgrass is critical on this recreational area along a river to prevent further soil erosion and runoff.

Preventing and controlling disease

As with weed prevention, sound cultural practices serve as the foundation of disease management. Under a balanced, low-to-moderate maintenance program, most turfgrass diseases will be held in check. This balance may become disrupted by extreme weather conditions, or improper fertilization, watering or mowing practices, as well as disease-susceptible grass varieties. In addition, soil compaction, inadequate soil preparation, poor drainage and thatch buildup also weaken the turf and provide a greater opportunity for disease invasion.

Research has shown that compost has the potential to reduce the severity and incidence of a wide variety of turfgrass diseases, particularly when applied either as a topdressing, a dormant turf cover or a root zone amendment. In studies conducted at Cornell University, amending sand-based root zones with either municipal biosolids compost, brewery sludge compost, or reed sedge peat was effective in suppressing pythium root-rot disease. One of the greatest obstacles to the widespread use of compost for turfgrass disease control has been its inconsistent performance from site to site, batch to batch, and year to year.

Fungicides should never be a routine part of lawn and grounds care, but sometimes disease-conducive environmental conditions overcome even the best cultural practices. If a turf sample diagnosis reveals a serious disease and the plant health specialist recommends treating with a fungicide, make sure to use one with low leaching and runoff potentials. UNH Cooperative Extension operates a Plant Diagnostic Lab that can identify problems and recommend appropriate management strategies. (Appendix B).

Dealing with lawn insects

Environmentally-friendly insect control on lawns relies on the principles of Integrated Pest Management (IPM). IPM involves using a variety of techniques, including cultural, biological, mechanical and chemical controls to reduce pests below damaging levels with the least impact to the environment.

The first step in IPM is proper identification of the problem. Many arthropods (insects and spiders) found in and around turf aren't serious lawn pests. Be sure to get the organism properly identified before you decide to treat.

Before deciding to use a pesticide, ask yourself: Do I know what pest I am trying to control? Are there other cultural strategies I should try first? Are the environmental risks worth it? Damaged lawns can always be reseeded or converted to ground cover or other vegetation.

If you do use a pesticide, make sure to follow all label directions and comply with all applicable federal and state laws. Choose the lowest-risk treatment whenever possible. Use extreme care when applying any pesticide near water. Don't use pesticides on steep slopes. Don't apply pesticides to saturated soils or when heavy rain is forecast. Observe a pesticide-free buffer that extends further than the legal minimum of 50 feet from the shoreline. Although New Hampshire has no required buffer around private drinking wells, the NH Department of Environmental Services recommends maintaining a pesticide-free zone 100 feet in all directions from shallow (dug) wells.

Because pesticides change from year to year, if you do decide to use a chemical control, call your UNH Cooperative Extension county educator or Extension's toll free Info Line at our Family, Home & Garden Education Center (1-877-398-4769) for the latest recommendations for controlling your problem insect. They can also help with pest identification.

Three groups of insects have the potential to cause significant harm to lawns in New Hampshire. Each is described here, along with potential control measures and the appropriate times and ways to use them.

Grubs

Grubs are white, C-shaped larvae that live in the soil. Grubs feed on organic matter and grass roots and can completely destroy a lawn if they are numerous. The three most important species in New Hampshire are the Japanese beetle, Oriental beetle and the European chafer. The Asiatic garden beetle grub is of lesser importance, although it's often found in home lawns.

These grubs have a one-year lifespan. They overwinter as large grubs in the soil. In April and May they rise to the surface and begin feeding. The adults emerge in June or July to lay eggs, and a new generation of larvae emerges to feed until late fall, when they go deep in the soil to overwinter.

European chafer adults are brown beetles about 5/8-inch long. They fly at night and don't feed much, so they often go undetected by homeowners. The Japanese beetle adult flies by day. Well known for its voracious appetite, it feeds on more than 300 species of plants. The adult beetle is about 1/2-inch long and metallic green with copper-colored wings. The Oriental beetle is about four-tenths of an inch long, buff colored with black markings. It flies during the day and feeds little. The Asiatic garden beetle adult is brown, about the size and shape of a coffee bean. It flies and feeds at night and hides in the soil by day.

Most home lawns can tolerate about five European chafer and ten Japanese beetle or Oriental beetle grubs per square foot before they do visible damage. However, skunks and crows may tear up turf to feed on grubs and do more damage than the grubs. Moles also feed on grubs, but trying to reduce mole damage by controlling grub populations may not work, since moles also feed on other soil organisms. They especially enjoy earthworms, so moles often appear in fertile soils with high earthworm populations. We don't suggest trying to control earthworms, of course, since they are so beneficial to the soil.

The Asiatic garden beetle grub is usually less damaging to lawns than the European chafer, Japanese beetle, or Oriental beetle because it is smaller, feeds deeper, and often prefers weeds. The Asiatic garden beetle adult hides during the daylight hours and emerges at night. It can be a serious pest of flowers, other ornamentals and vegetables by feeding on the leaves. It can also be a nuisance by flying into lighted areas at night.

- **Cultural controls for grubs:** Well-watered lawns can tolerate higher grub populations, as the lawn is less likely to show drought stress from fewer roots as a result of grub feeding. It's best to increase mowing height to three inches or more. Taller grass has a more extensive root system and can tolerate more feeding than short grass.
- **Mechanical control:** The Japanese beetle adult is attracted to an artificial sex lure in commercially available traps. Although these traps will catch many beetles, traps placed close to ornamental shrubs will increase adult feeding damage. If you do buy traps, place them away from valuable plants. Large captures of beetles in traps do nothing to reduce turf damage from grubs. There are no traps available for the European chafer, Oriental beetle or Asiatic garden beetle. Fortunately, European chafer and Oriental beetle adults do very little feeding.
- **Biopesticides and biological controls:** Biopesticides (biological pesticides) are reduced-risk products based on biological or naturally derived chemicals. Biological controls are living organisms used to control pests. Milky disease (*Bacillus popillae*), sometimes called milky spore, is a bacterium that infects and sometimes kills Japanese

Turf pulled back to expose grubs.

European chafer grub.

European chafer adult.

Life stages of the Japanese beetle, from left to right: egg, 3 larval stages, pupa, adult.

beetle and European chafer grubs. However, based on UNH research, milky disease doesn't work well in New Hampshire because our spring soils are so cold. The Oriental beetle grub is not controlled by milky disease. New strains of *Bacillus thuringiensis* are in development that were very effective against grubs in our trials. These *B.t.* strains should be in the marketplace soon.

Asiatic garden beetle adults. The larvae are grubs similar to other beetle larvae.

Presently, the most practical biological control for grubs is nematodes, small roundworms that are parasitic on many insect larvae. These are not the same nematodes that feed on plant roots. The nematodes swim through the soil searching for the grubs. Once inside of the grub, the nematode releases bacteria which kill the grub. The nematode feeds on the dying grub and reproduces. Unfortunately, the nematode species currently available don't overwinter well in our climate and must be reapplied every year.

Based on various university studies, grub control by nematodes varies widely, from 50 percent to 90 percent. A 70 percent level of control is usually adequate for most home lawns. Nematodes are also more costly than traditional chemicals.

Nematodes are most effective if you follow these procedures:

1. Buy what you need and use them that season; nematodes are living organisms and don't store well. Store them in a refrigerator, not in the freezer or in the garage.
2. Because nematodes are killed by sunlight and heat and dry up quickly, apply them in the morning or evening. Water them into the soil with at least 1/4-inch of water.
3. Keep soil moist so nematodes can swim to their prey. Water the lawn well at least once weekly for four weeks after application, but don't saturate soils.
4. Ideally, apply them in August or September, when soil temperatures are warm but not hot.
5. Once the nematodes are mixed with water, apply them immediately to the lawn. Nematodes left in a spray tank too long will die from lack of oxygen.

- **Synthetic chemical control:** Use a chemical grub control only if the lawn has a history of grub damage or when you have confirmed large numbers of grubs are present. Most home lawns have low grub populations. Make sure you have a problem before you apply a grub control.

  Timing is critical for grub control. Over-wintering grubs emerge to feed in April or May. These spring grubs are large and difficult to control, even with chemicals. June through mid-August is a better time to apply chemical grub controls, because the chemical will be in the soil while the summer generation of grubs are small and easily controlled. By September and October the grubs have grown large and may cause visible lawn damage. Visible damage is first noticed as patches of dying grass that can be easily pulled up due to a lack of roots. In September it's more difficult to get good control. By late fall, grubs have grown too large for effective chemical control.

  There is good news. The new synthetic chemicals are less hazardous to the environment. For example, chlorantraniliprole, when used as a turf insecticide, states on the label "when used as directed does not present a hazard to humans or domestic animals."

Chinch Bugs

Chinch bugs are small, sucking insects that feed on fescues, ryegrass and Kentucky bluegrass. Adults are about 1/16-inch long, black with white wings. Nymphs (immatures) are much smaller and appear red. There are two generations per year in New Hampshire. Adults overwinter at the edges of lawns and emerge in May to mate and lay eggs. The nymphs feed until they mature in July. A second generation of nymphs feeds from late July through September. The most turf damage occurs in late June and early July for the first generation and in August for the second generation. The nymphs do the most damage.

At first the damage appears as small patches of yellow grass; eventually the entire lawn may die. Chinch bugs prefer dry, sunny areas. Chinch bug damage is different from grub damage. Grubs sever the roots and grass can be pulled up like a rug.

- **Cultural Controls:** Avoid drought-stressed lawns. Chinch bugs prefer dry lawns. A well-irrigated lawn rarely has chinch bug damage and can withstand any feeding damage better than a drought-stressed lawn. Fertilize sensibly, as over-fertilization will encourage chinch bugs. Check for excessive thatch and control if needed. Thatch provides a hiding place for the young nymphs.

  Choose endophytic ryegrass and fescue varieties that are resistant to chinch bug. Endophytes are fungi that live within the leafy portion of the turf and make the plants less attractive to chinch bugs. You don't need to seed the entire lawn to an endophytic variety. If half the seed mix has endophytes, the lawn will have some chinch bug resistance. Kentucky Bluegrass doesn't contain endophytes but you can include it in the mix.

- **Biopesticides and biological controls:** Several biopesticides will help control chinch bugs, but all these products are short-lived, so you may need to apply them more than once.

  The fungus *Beauvaria bassiana* has done reasonably well in a UNH trial, providing 70 percent chinch bug control, sufficient for most home lawns. This fungus requires moisture, so the applicator must:

  1. Water the turf before application.
  2. Apply the fungus diluted in water.
  3. Water the turf after the application.
  4. Not allow the turf to dry out for two weeks.

  Neem oil, an extract from the neem tree from India, contains azadirachtin, a natural chemical which acts as a repellent as well as an insecticide to control insects.

Pyrethrum is an extract from the chrysanthemum plant from Africa. Although it is a botanical insecticide, it is still slightly toxic and should be used with caution.

Insecticidal soaps and soap/neem oil combinations are also available.

Sod webworms

Sod webworms are caterpillars that feed on grass foliage. The caterpillars are grey/black and may grow to an inch long. The first sign of damage is small brown spots scattered throughout the lawn. You may find the caterpillar hidden in a tunnel at the center of the dead area. Birds may tear up the lawn searching for the webworms. The adults are moths about 1/2-inch long, tan, and fly in an erratic pattern over the lawn. There are two periods when damage occurs. Over-wintering larvae will start causing damage in late June. The offspring of these larvae will again cause damage in August.

- **Cultural controls:** Use resistant turf varieties which contain endophytes as described under chinch bugs.
- **Biopesticides and biological controls:** Use nematodes, neem oil, or pyrethrum as previously described. The bacterium *Bacillus thuringiensis* variety *kurstaki* is also effective. Spinosad, a chemical derived from a soil microorganism and is one of the few chemicals approved for organic food production will provide excellent control.
- **Synthetic chemical control:** Homeowners should call UNH Cooperative Extension's toll-free Info Line at 1-877-398-4769 for up-to-date recommendations of pesticides that will control sod webworms. Developers or commercial landscapers should call their county UNH Cooperative Extension office and ask for the agricultural resources educator.

Sod webworm adult, right, and larva (caterpillar) top.