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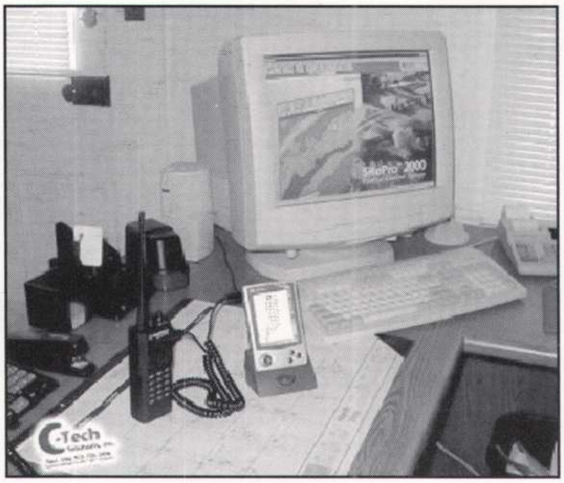

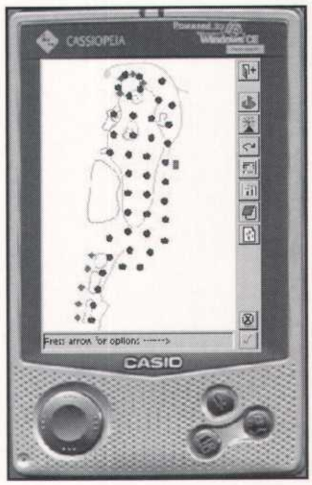

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Going, Going, Gone: Diagnosing Tree Decline

Avoid the "Ah-Ha!" trap. The cause of a tree's decline is not always the first thing you see.

By JOHN BALL
South Dakota State University

Decline often stems from multiple causal agents. Broze birch borer, turf competition and heat stress all played a role in the decline of this European white birch.

Imagine yourself as a young child being dressed by your mother in boots and a blue, hooded, nylon coat. As she struggles with your boots, you remember that whenever your mom has put this blue coat on you, it's been raining. As you step outside and see that, once again, it is raining, you logically conclude that putting on your blue coat causes it to rain. This type of confusion--mistaking association with causation-is a common mistake.

Now, as an adult, you've arrived at a tree-diagnosis appointment to find a mature oak covered with dead and dying branches. It was a beautiful tree until a couple of years ago, the concerned homeowner remarks. Why is it now dying and what can you spray? As you walk around the tree, you observe small, round holes on a lower dead branch. As luck would have it, you also find some small brownish-black beetles with yellowish wing tips beginning to bore into the branch. This must be the cause of the decline, you surmise! Unfortunately, the conclusion you just reached as an adult was as far off as that of the child, and for much the same reason.

Cause and effect is not always an obvious relationship. Our natural reaction when faced with a perplexing set of symptoms is to look for something--anything--and assume we have correctly diagnosed the problem. This is what I call the "ah-ha" syndrome--a fixation on the first obvious clue as the reason for a tree's decline. Diagnosing tree decline can be a challenging and frustrating task. Everyone wants the answer within 10 minutes of your inspection, if not sooner! But keep in mind that it may have taken 10 years or more for the tree to decline to its present condition. It's going to take you more than 10 minutes to properly identify the agent or agents responsible and probably a lot longer than 10 months to reverse the trend, if you can reverse it at all. Remind yourself, and your client, that when caring for mature trees, patience is a virtue.

Defining Decline

What is true decline? It often begins only with patches of leaves being smaller than normal and perhaps discolored. These same leaves may drop, or abscise, prematurely. Shoot growth also slows and, as the distance between leaves decreases, the canopy develops a more tuft-like appearance. Eventually, the canopy becomes smaller and its shape more irregular as individual branches gradually die. Watersprouts and suckers may develop, but this growth is deceptive and the dieback continues for years or perhaps decades until the tree finally dies.

To diagnose tree decline, you must first understand the needs of the tree rather than try to identify possible pests. First, why do trees die? Trees die when they no longer have the ability to acquire or mobilize sufficient resources to sup-

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STIMPMETER
Instructions

Introduction

One of the most significant aspects of a golf course is the uniformity of its greens. Variations is speed- whether from one green to the next or on different parts of the same green – can do more to negate a player's skill than can ragged fairways or unkempt bunkers.

Most golf course superintendents are well aware of this problem, and constantly seek better ways to establish consistent speed on all their greens. The problem they face, however, is extremely complex. There are a host of variables that affect the speed with which a ball rolls on a putting surface.

Some 60 years ago, Edward S Stimpson, the 1935 Massachusetts Amateur Champion, addressed himself to precisely this problem: how to achieve accurate, objective, statistically valid measurements of the speed of a putting green.

The result of his efforts was the Stimpmeter. Mr. Stimpson's device was modified by the USGA's technical department in the mid-1970's and made available to golf course superintendents and course officials in 1978.

The Stimpmeter is a simple, accurate device manufactured by the USGA that allows one to make a standard measurement of – and place a numerical figure on – the speed of a putting green. It has proven to be an invaluable asset to the game of golf and a helpful management tool for the golf course superintendent, but it is not intended for course comparisons.

What is a Stimpmeter?

The Stimpmeter is an extruded aluminum bar, 36 inches long, with a V-shaped groove extending along its entire length. It has a precisely milled ball-release notch 30" from the tapered end (the end that rests on the ground). The underside of the tapered end is milled away to reduce bounce as a rolling ball makes contact with the green.

The V-shaped groove has an included angle of 145 degrees, thereby supporting a golf ball at two points ½" apart. A ball rolling down the groove has a slight overspin, which is thoroughly consistent and has no deleterious effect on the ensuing measurments.

The ball-release notch is designed so that a ball will always be released and start to roll when the Stimpmeter is raised to an angle of approximately 20 degrees. This feature

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Diagnosing Tree Decline--

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port life. Trees must fulfill several essential life functions: reproduction, maintenance, growth, storage and defense. They cannot meet these needs all at once. Instead, trees allocate resources by a priority system, with maintenance typically the highest. Trees must have the resources to maintain all their parts. If they lack the resources to achieve this, they must die back to a size they can support. Thus, while dieback appears alarming, it can serve as a survival mechanism. Trees cannot get up and move when environmental conditions change, so their only recourse is to alter their size to conform to the resources available.

Take, for example, the bristlecone pines on some of the high mountains in the western United States. These trees, reputed to be among the oldest living trees at more than 4,000 years old, are not tall, wide-spreading majestic trees. Instead, these small, stunted trees have trunks and branches that have been wind-sculpted for centuries, resulting in contorted branches that are mostly barren of needles and bark.

So why do trees decline in the urban environment? Take a moment and think of the environment in which most tree species evolved: a forest. It may seem as though I'm stating the obvious, but the forest environment is quite different from the environment in which we plant trees and expect them to thrive. The forest is a humid environment where trees receive shelter from, and may share resources with, the surrounding trees. The primary stresses that impact mature trees in their forest environment are windthrows and decay fungi. Now take the environment most urban trees face. They are planted as isolated individuals, often surrounded by one of their toughest competitors -- turfgrass--and exposed to foreign stresses such as compaction, irrigation systems, string trimmers and many others. It is not a surprise that trees decline in urban environments; it's more a miracle that they survive at all.

This harsher environment is composed of numerous stresses that trees have not evolved to combat. Tree decline is not usually due to a single causal agent, but instead is a long-term process that may involve a multitude of agents. Each alone may not cause a tree to decline, but collectively they can result in tree mortality.

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Diagnosing Tree Decline–

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Decline often is due to a predisposing factor, usually a long-term stress agent that reduces the tree's defenses, that makes it more vulnerable to another stress agent that accelerates the decline. Often, the predisposing factor is non-living, or abiotic, while the contributing factor may be abiotic or biotic (there can be more than one predisposing and contributing factor). The question in many cases is not what is the causal agent, but how many are there.

This combination of agents makes it difficult to identify, and then manage, tree decline. Take our example of the declining oak. The brownish-black insect is the red-shouldered bostrichid *(Xylobiops basilaris)*, an insect that colonizes dying and dead wood (including rustic outdoor furniture). You could treat the borer by applying pesticide to the bark, but this is only treating a minor part of the problem. Why was the oak tree covered with dying and dead branches in the first place? What were the predisposing factors that made the tree vulnerable to colonization by this insect?

It's probably becoming clear that diagnosing decline is not a simple task. It requires you to examine the entire tree and the environment in which the tree is growing. Many of the predisposing factors in tree decline have their "roots" in the site conditions, something you cannot determine without a visit. During the summer, I regularly receive brown envelopes with plastic bags enclosed. These plastic bags, full of dried needles or now-moldy leaves, have notes attached to them inquiring, "What's wrong with the tree?" How can you be expected to accurately diagnose a decline from an old sample like this?

It is helpful to have the client there when you conduct your inspection so they can answer questions regarding the timing and progression of symptoms. This type of detective work is going to take some time if you do it right. I recommend that commercial tree-care companies charge for their initial consultation and provide the client with an estimate of the total cost to properly diagnose the problem. The tree owner may refuse to invest the money and instead decide to either live with the problem or remove the tree. But there is no point in cutting corners or doing the work for free. When customers asked why our company would charge a fee for a site visit when our competitors would come for free, I would respond that that's what they think their time is worth. Generally, if the tree owners are not interested in paying a nominal fee for your expertise in diagnosing the problem, they probably are not willing to pay for the treatments to reverse or slow the decline. So start charging, if you already do not, and give yourself the time to do it right.

When on the site, here are the steps that I follow when investigating the reasons for the decline of the tree. You can use several methods or procedures to diagnose a problem. The exact procedure is less important than always following a systematic approach to diagnosing the problem. Routinely following a procedure keeps you from jumping steps and falling into the "ah-ha" trap.

Who's the Patient?

As surprising as it sounds, many people attempt to diagnose declines and other problems without being able to identify the tree. It is impossible to properly diagnose the problem unless you know the tree, its growth characteristics and the environmental conditions to which it is best adapted.

Some declines are not declines at all, merely characteristics of the particular cultivar of the plant.

Where is the Tree Growing?

The environmental conditions in which the tree is growing can provide valuable clues as to why the decline may be occurring. Microclimate and soil have a tremendous, though often under-appreciated, influence on a tree's health. Does the species perform best in light shade or full sun? Does it require an acidic soil or does it tolerate alkaline conditions? Sometimes something as simple as a soil-pH test can indicate the problem. I once was asked to explain to a landscape architect why the 200 Eastern pin oaks he had incorporated into a development 4 years ago were declining. Eastern pin oak is sensitive to alkaline soils and performs best in a soil with a pH of less than 6.2. With the use of a simple pocket pH tester, I was able to show that the

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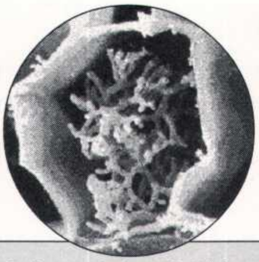

A micrograph shows the intricate anatomy of mycorrhizae within the plant root.

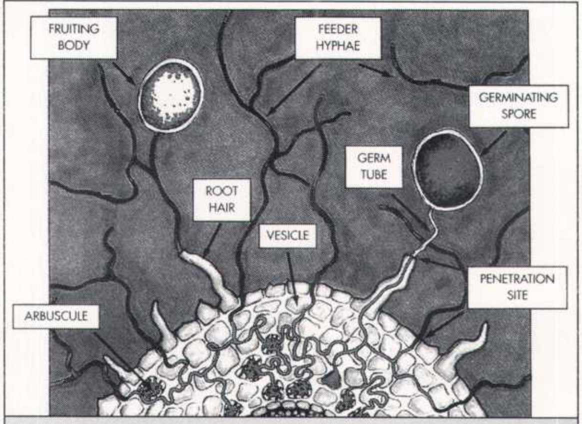

Diagram of mycorrhizae extending root surface area.

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Diagnosing Tree Decline–

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average pH on the site was 8.2! This is one instance where the decline was due to a single stress agent (two, if you want to count the landscape architect).

Another, relatively new, urban-stress agent exists and is becoming the primary stress for many declines: lawn-irrigation systems. These days, it is common to incorporate an irrigation system when installing a new landscape. This may seem to be a positive rather than a negative, but many trees have evolved to tolerate a slight moisture stress in mid-summer. However, so many people now expect their lawn to stay a bright, lush green throughout the summer that we now are over-irrigating our trees. A simple test of placing a soil probe into the ground 8 to 12 inches and checking the moisture can tell you a lot. If the soil is consistently moist, it is probably too wet for the tree. I usually advise people to cut back on their watering during the summer months to avoid overwatering their trees.

What is the Pattern of the Decline Symptoms?

Again, you need to see the tree on site to evaluate the decline. The pattern can give you much information about why the tree is declining.

First, are similar symptoms appearing on any of the surrounding trees and shrubs? And if so, are they limited to only this species or are other species involved? If similar symptoms are appearing on many different trees and shrubs, that's an indication that the primary stress is abiotic because few pests can infest or infect a wide range of hosts.

If a nearby spruce and birch look similar to the declining oak, the problem probably is underground and could be anything from misapplied herbicide to a raised soil grade in the lawn. If only the oak is suffering while the nearby trees appear healthy, the stress, though still perhaps soil-related, is specific to the oak.

Next, are the symptoms spreading through the tree or to different trees, or do they appear to have stopped? If the symptoms suddenly appeared but did not worsen, this again tends to point to an abiotic source-misapplication of herbicide or an unusual weather event, for example-rather than a biotic one. Symptoms that rapidly develop and then stop are not characteristic of a true decline. However, they can be due to stresses that may initiate or hasten a decline.

Finally, is the dieback occurring throughout the entire canopy or major portions of the canopy, or is it limited to scattered branches? If the entire canopy is affected by dieback, this tends to indicate the problem is in the lower trunk or roots. Scattered branches mean the problem may not be a general decline but limited to only certain branches. This usually requires closer inspection and perhaps even climbing into the canopy to examine individual branches. I once was asked to explain why the leaves on scattered branches throughout a hackberry were turning yellow. When I climbed the tree to look at the branches more closely, I found squirrels had girdled them!

Now What?

Once you've identified the contributing and predisposing agents, you may find that treatment is difficult or impractical. You must manage the contributing factors to reduce the stress on the tree, but you also must manage the predisposing factors. If one of the stresses is compaction, perhaps radial trenching or vertical mulching can be employed as part of an overall strategy. Sometimes, managing predisposing factors is not possible, so you either resign yourself to providing additional care or opt to remove the tree.

Regardless, many declines are not easy to define as to predisposing and contributing factors, nor are they identified in time to do much about them. Probably one of the best lessons you can learn in the management of decline is that tree care must be proactive rather than reactive. Ensuring that the tree's requirements correctly match the site conditions will eliminate many of the most difficult predisposing factors. Further, routine inspections, at least annually, can catch contributing factors while in the early stages of decline. Take the time to thoroughly investigate the decline before proclaiming the cause and the cure.

* * * *

(Editor's Note: Dr. John Ball is associate professor of forestry at South Dakota State University (Brookings, S.D.).

Stimpmeter Instructions--

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ensures that the velocity of the ball will always be the same when it reaches the tapered end.

Although the Stimpmeter is sturdily built, it is a precision instrument and should be protected from damage. When not in use, it should be stored in a plastic tube or case. Even relatively slight damage to the release notch or to the groove may cause errors.

Assuming the balls stop within the prescribed 8- inch limit, insert a second tee in the green at their average stopping point. The distance between the two tees is the length of the first series of rolls.

Step 4 Repeat Step 2, using the second tee as a starting point and the first tee as an aiming point. (In other words, roll a series of three balls along the same line, but in the opposite direction.)

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How to Use a Stimpmeter

Equipment Required:

*Stimpmeter
*Three golf balls
*Three tees
*10- or 12-foot measuring tape
*One Data Sheet

Step 1 Select a level area on the green, approximately 10 feet by 10 feet. (A simple means of checking for al evel area is to lay the stimpmeter on the green and place a ball in the V-shaped groove – the movement of the ball will indicate whater or not the area is reasonably level).

Step 2 Insert a tee in the green, near the edge of the area selected, to serve a a starting point. Holding the Stimpmeter by the notched end, rest the tapered end on the ground beside the tee, and aim it in the direction you intend to roll the ball. Put the ball in the notch and slowly raise the end until the ball starts to roll down the groove. Hold the Stimpmeter steady until the ball reaches the putting surface.

Repeat the same procedure with two more balls, keeping the tapered end on the same spot.

Step 3 All three balls should come to rest not more than 8 inches apart. (Should they be farther apart than that, the Stimpmeter may have moved too much during the series, the balls may be damaged or of inferior quality, or unusual conditions may exist. In any event, a pattern larger than 8 inches is of dubious accuracy, and the three-roll series should be repeated.)

Stimpmeter Instructions--

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Step 5 Repeat Step 3, thereby establishing the length of the second series of rolls.

Step 6 Measure the two distances – for the first series and the second series – and calculate their average. Record this as the speed of the green.

Note: Should the difference in length between the first and second series be greater than 18 inches, the accuracy of the resulting average may be questionable. The area selected for the test may not have been sufficiently level – or sufficiently representative of the green – in which case it is advisable to select another area and repeat the test. Sometimes a green may be so severely undulating or sloping that a level area is simply not available (which the data record should indicate).

Key Things to Remember

Selecting a reasonably level test area is important. Measurements taken up or down a slope, over mounds, etc., will result in misleading data.

Conditions during a test are important. Initially , test your greens under optimum conditions – a cleanly mowed, dry, smooth surface on a calm day. Once this basic speed has been established, you can then document speeds as they vary under unusual conditions: windy days, wet surfaces, non-mowed, recently topdressed , time of day, before and after fertilizer applications, etc. The data thus accumulated will lead to a better understanding of how different management practices affect the speed and consistency of each green on your golf course.

Practice makes perfect. A relatively small amount of practice in using the Stimpmeter will increase the accuracy and consistency of your data.

Keep thorough records. Obviously, complete and accurate record, maintained over extended periods, are the most useful.

The Potential of the Stimpmeter

Once the Stimpmeter is put into use at your course and the resulting information is analyzed and acted upon, the possibilities for improved playing conditions are virtually endless. Speed charts have been developed, based on data from tests performed by the USGA Green Section agronomists over the years. The charts are presented for general information only; it is NOT the intention of the USGA to attempt to standardize green speeds, which should remain up to the course officials, with the input of the superintendent, of each facility.

Speeds of Regular Membership Play 1
Fast > 8' 6"
Medium = 7' 6" – 8' 6"
Slow < 7' 6"

Speeds for Tournament Play 2
Fast > 9' 6"
Medium = 8' 6" – 9' 6"
Slow < 8' 6"

1 Bermudagrass putting greens typically are slower.

2These speeds can be used as a guide for club events. National competitions may require higher speeds.

The Effects of Management Practices

The manner in which putting greens are managed has a tremendous influence on their speed and consistency. Most of these factors are known to some degree, but almost all are worthy of research. Following are some of the major variables that using the Stimpmeter will help us to understand more effectively:

Mowing height and frequency of cut are extremely important considerations. The mower's bench setting is no guarantee that greens are cut at a prescribed height. More over the condition of the mowers; the type of mowers (floating or rigid cutting units); attachments such as Wiehle rollers, groomers, brushes, and combs; all can make a difference in the cut and green speed. So does double-cutting, verticutting and rolling. The precise effect of each of these factors can be measured with the Stimpmeter.

Watering practices and surface moisture (dew) are crucial to green speeds. Moist turf will be slower than dry turf at any mowing height.

Fertilizing practices can be studied, such as the effects of rate and frequency of application, nitrogen source, and nutrient balance.

Grain is sometimes a deterrent to uniformity of speed. How grain is affected by changes in direction of cut, use of vertical mowing equipment, riding versus single unit mowers, etc., can be studied a they relate to green speed.

The effects of aeration, spiking, and topdressing can be measured, both before and after treatments.

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