



ISSUE TWO TOPIC:

Diagnosing & Managing Abiotic Factors that Cause Disease

In each issue of *The Arboricultural Consultant*, a new topic related to the practice of arboricultural consulting is examined. The topic is discussed through the proposal of questions followed by responses from ASCA members.

The topic for Issue Two of 2006, **Diagnosing & Managing Abiotic Factors that Cause Disease** poses issues that a consulting arborist may encounter through his or her practice. Following are the questions which were posed to members and responses to those questions.

Q: Are biotic and abiotic factors that cause tree problems managed differently?

A: Yes

— John Sugg

A: Yes and no. Managing biotic factors—pests—focuses on those organisms, while managing abiotic factors does not. But managing all tree problems involves maintaining tree vitality.

— Guy Meilleur

A: Abiotic factors are frequently the precursor to biotic problems. It is often the soil condition, environmental condition, injury or some other factor outside the tree's ability to adapt that leads to the onset of decline syndrome. Most of the time (not always) insects and disease are symptoms of decline. Healthy trees are remarkably well suited to deal with biotic disorders, that is why most insect and disease pests are host specific and why almost all trees that are free of stress and strain are also mostly free of pests. It is only the strongest that survive in nature. When

a tree becomes weak, the pests will attack. Treatment of such trees should be balanced by addressing both the abiotic conditions causing stress, while dealing with pests at the same time. Abiotic factors are treated by removing or minimizing the condition, as in watering, fertilizing, mulching, providing drainage, reducing compaction etcetera. I like to tell clients that we should get to the root of the problem if we really want to solve it. Minimizing stress will not always be enough to restore tree health. Most of the time, the fastest path back to health is to kill or minimize the effects of pests that result from stress. Neglecting either the biotic or abiotic factors can make the difference between life, death and health of trees. Most clients want healthy and beautiful trees.

— Marty Shaw

A: Biotic agents, living organisms that infest or infect plants, can sometimes be managed by chemical treatments that directly control the offending organism. Various pesticides can be applied to relieve the particular stresses induced by the pests. In contrast,

abiotic factors are those which are non-living, caused by influences of the environment, either natural or caused by human activity. Since these factors affect the environment of the tree or plant, their influence is often secondary. Relief from these factors usually involves either prevention of the stress factor, or treatments to remediate the negative influence by manipulating the tree's environment.

— Russ Carlson, RCA #354

A: Biotic and abiotic factors that cause tree problems are managed differently. An abiotic disease such as caused by salt spray may only be managed by removing the species and replacing it with a salt tolerant species, whereas the biotic diseases such as DED or BBB may be managed with chemical treatment and keeping the tree intact.

— Ken Johnner: RCA #406

A: The approach to managing biotic and abiotic factors may vary, but the relationship between the two should always be taken into consideration. Most if not all biotic factors have



an abiotic element, usually a stress factor such as drought, cold, construction damage, or pesticide damage. So it's necessary to look at the whole picture when making management decisions.

— Tina Cohen

A: Biotic and abiotic factors should be handled differently in that understanding the life cycle of a living organism often leads to control of the inciting agent. There is no life cycle in an abiotic factor to be exploited.

— T. Davis Sydnor, RCA #349

A: Since abiotic tree problems are not caused by a pathogen their management could be different than tree problems caused by biotic problems. Often biotic problems involves a pathogen and management may be directed at managing the pathogen.

— Charles McCarthy

A: Yes

— Ken Six

A: Specific treatments may obviously vary. Treatments are one aspect of management. If we consider management as broad approaches, biotic and abiotic factors are probably managed similarly. Sometimes, and ideally, we manage causes while at other times we manage effects whether they are biotic or abiotic.

— Scott Cullen, RCA #348

A: Rarely are abiotic factors and biotic factors separable from a tree management standpoint. It is, in my opinion, better to look at them in the context of how they affect decline, as in the concept of primary versus secondary or tertiary stresses. It is always important to identify and treat the primary causes of stress and prevent and treat secondary or tertiary stresses as necessary, whether biotic or abiotic. The whole system must be managed, not just one factor. A tree may become stressed due to an abiotic factor such as soil compaction, but while treating the compaction, we must also prevent insects or diseases from attacking the stressed tree.

— Don Zimar

Q: “People Pressure Diseases” are abiotic disorders. Are there other abiotic disorders?

A: Yes, injuries inflicted by wildlife.

— John Sugg

A: There are many; some more obvious than others. Excessive shade causes disorders such as dieback, and can be managed by pruning nearby trees. Soil acidification and other subterranean problems are harder to diagnose and manage.

— Guy Meilleur

A: I'm not sure I agree that all “People Pressure Diseases” are abiotic. People are biological organisms. Sometimes when exotic pests are introduced by man into a new ecosystem, the results can be devastating to the entire ecosystem. I would certainly consider that “People Pressure”.

— Marty Shaw

A: Abiotic factors are classified as non-living. Any environmental influence that adversely affects a tree of plant is considered as abiotic. Flooding, drought, wind, erosion, among others, are natural abiotic disorders.

— Russ Carlson, RCA #354

A: Yes. Salt spray from the ocean, extreme temperatures, and lightning are a few.

— Ken Johnner: RCA #406

A: Environmental problems such as drought or flooding, excessive heat or cold, hail, and ice storms are examples of abiotic disorders that wouldn't be considered People Pressure Diseases. I prefer the term ‘cultural problems’ to describe disorders caused by humans such as excessive irrigation, improper site preparation and planting, or misapplication of pesticides.

— Tina Cohen

A: Certainly, an abiotic factor is simply an inciting agent that is



not living. Nutrient deficiencies, soil compaction, soil temperature extremes, low or high air temperatures, moisture extremes, pesticide abuse, air pollution, road salt damage, storm damage, and a host of other inciting agents are abiotic factors.

— T. Davis Sydnor, RCA #349

A: Of course there are other abiotic disorders besides PPD (People Pressure Diseases). Sounds like the author of the questions was a student of Dr. Tatter.

— Charles McCarthy

A: (Construction, Lighting, Irrigation Installation, etc) Drought, Fire, Flood, Acid Rain. The right tree in the wrong place etc.

— Ken Six

A: People Pressure Diseases (PPD) were described by Tattar Circa 1974. Blanchard and Tattar later listed construction and chemical injury as examples of PPD while distinguishing temperature and moisture extremes and nutrient abnormalities as other “non-infectious” disorders. So there are obviously abiotic disorders in addition to PPDs. If we also consider the factors that cause disease or disorders then there are additional examples such as fire.

— Scott Cullen, RCA #348

A: Abiotic factors can most certainly be induced by people or by nature. Flooding can result from beavers damming a stream or by engineers changing drainage patterns. Storm damage and drought are typically natural abiotic sources of stress.

— Don Zimar

Q: In general, when dealing with “People Pressure Diseases”, do we manage the disease, the abiotic stress, or both?

A: Both initially, then the abiotic stress permanently

— John Sugg

A: Both, though dealing with the human stressor is usually more important. For instance, if people are growing defective root systems, planting deep, volcano mulching and overpruning, those behaviors must be changed. Otherwise, managing the resulting diseases is not effective, because they will only recur.

— Guy Meilleur

A: These are the most challenging problems because you are not only dealing with the pest and the site conditions, you also have to manage the people- fixing trees is easy compared to getting people on board to do the right thing.

— Marty Shaw

A: The best results are usually achieved when both aspects are

managed. Relief from the stress is important, as it is often very difficult to overcome a stress factor that continually affects a tree. However, without remedial treatments to improve the tree’s condition, survival and recovery may not be possible. Each case must be evaluated on its own merits, to determine the best combination of treatments.

— Russ Carlson, RCA #354

A: We manage both. For example, compaction from foot traffic can be managed by rerouting people away from the compacted site, as well as using an aerating device to ameliorate the condition.

— Ken Johnner: RCA #406

A: Although abiotic in origin, People Pressure Diseases often have biotic contingencies. Thus, both the abiotic stress and the resulting biotic insect or disease problems must be addressed.

— Tina Cohen

A: It is amusing to ponder the question, Is people pressure a biotic (people are living) or abiotic (low soil oxygen [caused by humans???) is abiotic) concern? Success, in my experience, is much more likely and lasting if the problem is addressed from more than one angle and needs to at least consider the human problem and imposition. Simplistically the answer is all of the above.

— T. Davis Sydnor, RCA #349



A: Yes.

— Charles McCarthy

A: When you are called to deal with “People Pressure Diseases” you sometimes end up dealing with both.

— Ken Six

A: I doubt there is a general case. As noted above, ideally we would address the cause. But in many situations the cause cannot be eliminated, say reflected light from an office building or traffic at a busy intersection.

— Scott Cullen, RCA #348

A: Yes. We manage the disease, the abiotic stress, or both. We manage the system that may include any of the factors affecting the health of the tree including primary, secondary, and tertiary sources of stress as well as the ownership objectives in treating the stress. There are many things that affect the treatment that is prescribed.

— Don Zimar

Q: Competition with invasive or artificial species such as turf grasses can cause tree problems, should this however, be considered a biotic or abiotic stress?

A: Abiotic

— John Sugg

A: According to the ISA’s Glossary of Arboricultural Terms, it is biotic because it is living. However, I tend to refer to any stressor that is human-caused as abiotic

— Guy Meilleur

A: Clearly turf is a living organism. If we go down to the molecular level, all living organisms have biological chemistry that interacts with all other living and non-living things around them. Some of these chemical interactions are innocuous and some are not. If organisms mutually produce something that interacts beneficially with each other, it is considered healthful or synergistic. If an organism produces something negative in it’s neighbor for its own benefit, we call that parasitic or a biotic disorder. If the organisms interact innocuously, we call it saprophytic. If the organism competes with its neighbor but is not parasitic, synergistic, or saprophytic, it is still as much alive and biotic. Such is life.

— Marty Shaw

A: In the strictest sense, competition with other plant species is abiotic, since it neither infests nor infects the tree directly. The presence of highly competitive species affects the tree by altering its environment, through reduction of sunlight, water, nutrients, or by the production of harmful compounds in the case of allelopathic plants. Sometimes these stresses can be overcome by managing and strengthening the

subject tree, other times by control of the abiotic factor, or both.

— Russ Carlson, RCA #354

A: This invasive species is living and is therefore biotic stress.

— Ken Johnner: RCA #406

A: Turf grass and the accompanying chemical applications initially create an abiotic stress because it’s a problem induced by humans.

— Tina Cohen

A: Allelopathy or simple competition from turfgrass would be an example of a stress cause by a living organism (turfgrass) and thus a biotic factor. Turfgrass weaknesses can be exploited to kill the inciting agent.

— T. Davis Sydnor, RCA #349

A: An invasive species is living and it would be considered a biotic disorder.

— Charles McCarthy

A: Abiotic stress

— Ken Six

A: If the troublesome species is a result of current human activity - say managed turfgrass - it is a PPD issue. And it may or may not be addressed at that level. If the practice cannot or will not be abandoned then we still have to address it as a biotic stress. Once a



troublesome species is established in an environment independent of human activity it is a biotic stress. On a policy level we can certainly consider the introduction or propagation of troublesome species as an abiotic factor.

— Scott Cullen, RCA #348

A: Good question. Is competition with other native plants biotic or abiotic? I am not certain what you call it really matters so long as the source of stress is properly identified and treatments are prescribed appropriately.

— Don Zimar

Q: Are the majority of abiotic disorders related to water stress? (Too much or too little).

A: Yes, too little even though too much is much more lethal in the short term.

— John Sugg

A: My experience is that the great majority of abiotic disorders are caused by People Pressure. Most are related to moisture stress, but that is not usually a primary stressor.

— Guy Meilleur

A: No. Water stress is certainly a major abiotic disorder and may be number one, but by no means is it the majority of abiotic disorders. I would rank lack of pore space and organic material in the top 5

along with poor site selection and nutrient deficiency. Together, these would almost certainly constitute a majority of abiotic disorders.

— Marty Shaw

A: Without statistical data, it is hard to say what the relative ratios might be. However, water stress can be caused by many different factors, including climatic conditions, competition, erosion, compaction and by the loss of effective roots. Any human activity that reduces the amount of available soil volume or that physically reduces the root system creates water stress. In many instances, this is the beginning of a series of compounding factors that lead to decline of tree vigor. Treatment of water stress involves far more than simply providing additional water. Unless the underlying cause of the stress is corrected, adding water will seldom improve the condition of the tree, and may even add to the stresses affecting it.

— Russ Carlson, RCA #354

A: Let us look at them. Ice, snow, moisture extremes, temperature extremes, auto emissions, fluorides, sulfur dioxide, ozone, dust, herbicides, pesticides, growth regulators, radiation, mineral deficiencies and excesses, salt, lightning, air pollutants, natural gas, compaction and wind. No, I wouldn't say the majority abiotic disorders are related to water stress.

— Ken Johnner: RCA #406

A: Perhaps, but I think it will vary in different parts of the country. In the Seattle area I also see many problems with improper planting and mal-pruning.

— Tina Cohen

A: Water extremes are one of many non-living factors leading to landscape maintenance concerns and thus not a majority. Are moisture extremes the most commonly occurring abiotic factor causing damage to landscape plants? If you asked the bolded question, you might get a different answer. Even here the vast number of abiotic factors and ecosystems in the US argues for the answer that water extremes are common but not the majority.

— T. Davis Sydnor, RCA #349

A: Some are and some are not. That is why the diagnosis of a tree problem is very important. We have problems when we try to generalize.

— Charles McCarthy

A: No

— Ken Six

A: If the troublesome species is a result of current human activity - say managed turfgrass - it is a PPD issue. And it may or may not be addressed at that level. If the practice cannot or will not be abandoned then we still have to address it as a biotic stress. Once a



troublesome species is established in an environment independent of human activity it is a biotic stress. On a policy level we can certainly consider the introduction or propagation of troublesome species as an abiotic factor.

— Scott Cullen, RCA #348

A: Many abiotic disorders may lead to or cause water stress either directly or indirectly, but so may many biotic disorders. Water management certainly is a very

important component of treating any form of stress and is frequently overlooked. Regardless of whether the abiotic problem is directly water related, proper water management should be considered within the recommended treatments. I do not think I am qualified to assess whether a majority of abiotic disorders relate to water stress and am not comfortable making such a broad general assumption without some research to support it.

— Don Zimar

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