Emergency Response

By Mark Bridge

LEARNING OBJECTIVES

The arborist will be able to

- describe Han Seyles' General Adaptation Syndrome (GAS) regarding the stages of human response to high-stress situations
- discuss the four levels of high-angle rescue for tree climbers
- explain the use of standard types of climbing equipment in emergency response scenarios
- identify the benefits of investing in aerial rescue training

CEUs for this article apply to Certified Arborist, Utility Specialist, Municipal Specialist, Tree/Worker Climber, and the BCMA science category.

*You've just finished cutting up the hefty limb that your climber lowered out of the big elm (*Ulmus*) behind you. You shut off the saw and, before dragging the brush to the back of the chipper, take a quick glance over your shoulder to see if he has the next limb rigged and ready to go. Something's wrong! The climber is just hanging there. What happened? What do you do next?*

Any emergency situation is a high-stress environment in which minutes can mean the difference between life and death, and the initial response can be crucial in determining the outcome.

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Figure 1. One of the first responses to an emergency situation is a "shock" or "alarm" phase.

Hans Seyle, a Canadian doctor of medicine and chemistry who researched the effects of stress in the 1950s, developed the model of GAS, the General Adaptation Syndrome. GAS describes a response to a stressful situation in three stages. The first is the Shock or Alarm Phase, which Seyle describes as an initial "freezing," followed by a slowing of metabolic functions and reactions at a reflex level (Figure 1). This is followed by an activation of all available energies and reserves; the production of catecholamines (i.e., "stress hormones" such as dopamine, adrenaline, and noradrenaline), then stimulation of breathing, circulation, the muscular system, and metabolism.

The second Resistance Phase will occur if the stress situation continues. In this phase, the body attempts to match the available energies to the situation and to either "fight" against the source of stress or to "flee" from the danger area. If one of these measures can successfully resolve the situation, the level of stress hormone production and metabolic functions return to normal. If this is not the case, it can lead to the third level, the Exhaustion Phase. Under continuous stress, the body remains in constant alarm mode, which can lead to exhaustion and stress-related conditions, such as stomach ulcers, asthma, chronic headaches, or migraine.

Of these three phases, the Shock Phase and the Resistance Phase are especially relevant to one's ability to respond well in a high-stress situation. In an evolutionary context, the response at a reflex level temporarily blocks higher thought functions to increase response efficiency. In our modern world, things are not quite that easy. A misdirected initial response can make an already bad situation worse by delaying a reaction or, in the worst case, causing more people to get hurt.

This is why organizations such as the military, emergency services, aviation, or medical facilities—which place people in high-stress environments—put a lot of thought, training, and effort into preparing personnel to respond correctly under pressure. One tool these organizations employ to this end are flow charts that follow a yes/no pathway to help people make the right decisions in difficult situations. In an emergency, a team will only be able to respond in a coordinated and safe fashion if the team has discussed the relevant issues and received training beforehand. This is as true of an arborist team as it is of a crew aboard the International Space Station.

Organizing and Understanding Rescue Scenarios

One way of visually depicting risk—used by health and safety organizations, for example—are risk matrices. The matrix shown in Figure 2 models an arborist emergency response: the horizontal axis represents the condition of the casualty, with the condition becoming successively worse towards the right. The vertical axis describes the complexity of the situation, becoming more complex toward the top of the grid. The curve superimposed over the matrix shows the level of competence or training within the team.

One could place examples in this matrix as follows: A climber is three meters off the ground with a minor handsaw injury. The climber is conscious and able to descend (A). The same climber as in the example before, but he is dehydrated, which leads to the climber losing consciousness (B). Or, what if the same climber with a minor handsaw injury is working in the top of a canopy of a tall forest tree (C)? If the situation is compounded by profuse bleeding or disorientation, this would lead to a shift to the right on the horizontal axis (D).

Such models don't pretend to reflect reality on a 1:1 basis, but they can act as visual aids facilitating a primary assessment of a situation or when discussing scenarios. Matrices also have an advantage in that you can model fluid, dynamic processes where a previously defined position can change rapidly. An emergency response is without a doubt one such situation. There is such a wide range of scenarios that could conceivably occur during tree care operations that it can be hard to decide where to begin.

The various scenarios can be organized into four generic groups:

- Level One – Self Rescue
- Level Two – Basic Rescue
- Level Three – Complex Rescue
- Level Four – Assisted Rescue

An injured climber will often be able to get to the ground even after sustaining serious injuries; this would be grouped into a Level One rescue. Basic Rescue, Level Two, involves an injured climber who is incapacitated in the tree and unable to get to the ground without assistance, requiring rescue by another climber.

A Complex Rescue, Level Three, is any situation in which an injured climber has to be lifted before being lowered to the ground. This will be the case when the climber is hanging in system under tension, such as during an ascent, working on a stem, or working on a ladder while secured by a lanyard. Another example would be if the climber has fallen into a crotch or cannot be lowered from that position. In all these cases, the climber will have to be lifted up before being lowered down.

An Assisted Rescue will take place when the team is unable to respond due to lack of technical competence, for medical reasons, or due to the situation on-site. In such a case, the team assists emergency service personnel. In most urban environments, emergency services will be on-site within a short period of time after the call for help has been made. There are, obviously, geographical differences as well. In Europe, unlike many cities in the U.S., cities tend to be very densely built-up so that access to gardens and yards from the road is often impossible. In such cases, access with a bucket truck will not be feasible, so specialized high-angle rescue teams will have to be mobilized. This increases the response time considerably.

Even if a tree crew is not able to extract an injured climber from the tree, it is likely they can access the climber to offer assistance when emergency services arrive on site. The response time is much shorter if an access system is preinstalled in the tree as a matter of course. This can be an access line that can be footlocked, an SRT system, or a doubled line for body thrusting, depending on the techniques used by the team members.

It is important to remember that a safe response will be coordinated and calm. Using the traffic light model, a response happens in three steps: Check (red), Plan (yellow), and Act (green). The situation must be thoroughly assessed before charging in; tunnel vision is the last thing needed. Throughout the rescue there will be a constant process of re-checking, re-planning, and acting, as more information is received. The following is an example technique for each of the four generic levels of rescue described earlier.

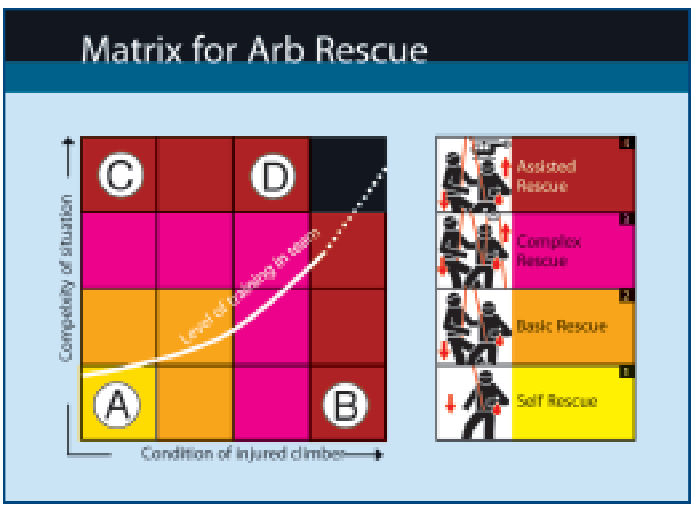

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Figure 2. A Risk Matrix is helpful in understanding the amount of training specific types of aerial rescue may require.

Level One: Self Rescue

The climber has injured himself with his handsaw. His climbing system is intact and he is able to descend on his own. The potential rescuer on the ground halts all work on-site, informs the rest of the team, and puts on her harness, ready to ascend into the tree should it prove necessary. She then installs a figure-eight descender on the tail end of the injured climber's climbing line to control the speed of descent in case the climber should panic or lose control over his descent speed.

Level Two: Basic Rescue

The climber has cut herself with a handsaw, is bleeding profusely, disorientated, and unable to descend

►

on her own. The potential rescuer on the ground stops all work on-site and communicates the situation to the other team members. While establishing the mechanism of injury and checking the tree for further hazards, emergency services (911 in the U.S., 112 in Europe) are called. The crew confirms that the tree is structurally sound, clear of power lines, and without any limbs or branches suspended in the tree that might endanger the assisting climber. The access line is intact. The rescuer decides to access the canopy. During the access he remains in constant contact with the injured climber and the team on the ground; this will help to spot any change of the injured climber's condition.

The assisting climber ascends above the injured climber to a suitable anchor point and descends to the injured climber, redirecting his climbing line if necessary. Once he reaches the injured climber, he will assess her condition and communicate it to the team on the ground. Then he establishes a load-bearing connection between himself and the injured climber. To do so, he uses a short "rated" sling with two carabiners between the two main attachment points, taking care not to chain-link the connectors (Figure 3). He checks the condition and length of the injured climber's rope, and then the rescuer and injured climber descend on both climbing systems.

In the event of a "pick-off rescue," where the line of the injured climber cannot be used due to damage or for other reasons, the rescuer may have to transfer the injured climber onto his climbing system. Because in this configuration the friction hitch is loaded with the weight of two people, additional friction has to be added. This will prevent heat damage to the hitch, seizing up, or slipping. This

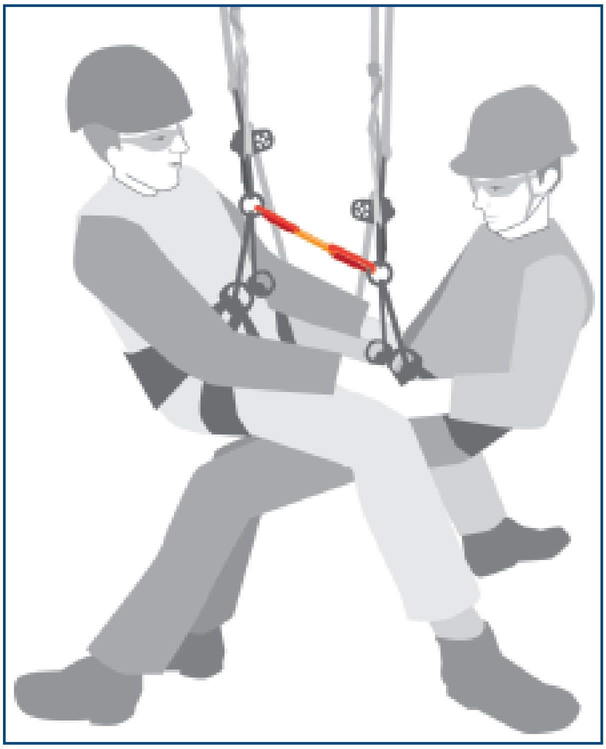

Figure 3. Some scenarios will require the rescuer to connect directly with the injured climber, so that they may both descend safely.

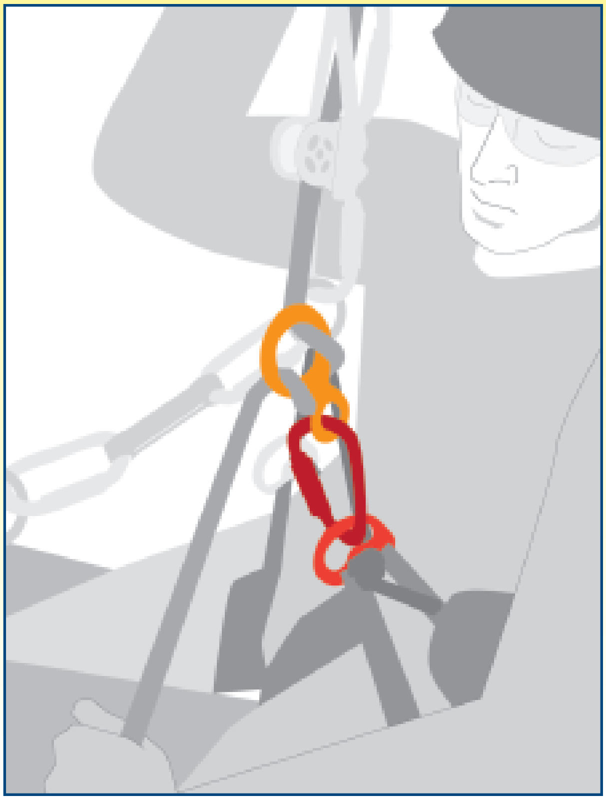

Figure 4. A rescuer adding friction for a pick-off emergency response.

can be achieved in a number of ways. One method is to back up the hitch using a figure-eight descender below the hitch that is attached to a side D-ring or leg-loop, depending on the exact configuration of the harness (Figure 4). (Note: This possibility should be taken into account when selecting the primary tie-in point. In case of a rescue, it may have to be sufficiently strong to cope with the weight of two climbers.)

Level Three: Complex Rescue

The climber was ascending the tree on an access-line on a pair of double ascenders. He didn't spot a large dead limb that the line was rubbing against. The movement of his ascent dislodged the limb, which slid down the line, hitting him on the head and leaving him suspended unconscious. The crew calls 911/112, checks the tree and site for hazards, and verifies that the access line is undamaged. With other potential hazards eliminated, the team decides to attempt a rescue due to the fact that the climber is unconscious.

What makes this scenario complicated is the fact that the injured climber is suspended in a tensioned system. This means that the climber has to be lifted and detached from his climbing system before he can be lowered to the ground. There are many ways to achieve this. A fairly easy way is to counter-balance him. To do this, the rescuer climbs the access line up to the ascenders of the injured person, installs an anchor point above the ascenders (e.g., Prusik sling set round both parts of the access line), and then attaches a pulley or a carabiner or a combination thereof (such as a DMM "Revolver," which is a carabiner with an integrated sheave). This attachment is the rescuer's anchor point into which he then installs his climbing system. The ascenders below the Prusik now act as a back-up that will prevent the Prusik from slipping. For the time being, the rescuer remains attached to his access system. The rescuer descends to the injured climber, assesses his condition, and determines that there are no visible injuries.

The next step is to put on an improvised chest harness to bring the injured climber into a more upright position. To do so, he uses a 120 cm (47.2 in) webbing sling that he passes around the back of the injured climber, crossing it into a figure-eight between the victim's shoulder blades. The sling is brought around the front and attached with a carabiner to the injured climber's main attachment point. The rescuer then opens up his split-tail system—still tied in to his access system—and attaches the spliced or knotted end of the line to the injured climber, the friction hitch remaining on his harness. Using his body weight, he can now counter-balance the victim out of his system.

Before detaching the injured climber from his double ascenders, a load-bearing connection is established between the two climbers (Figure 3). The rescuer must then detach and descend, backing up the friction hitch with extra friction as in Level Two (Figure 4). Obviously, the injured climber's attachment to his ascenders could be cut instead of lifting him out of his system. But remembering that this is a high-stress situation and that the rescuer has a number of lines under tension around him (some of which may even be the same color), there is an unacceptable risk of cutting the wrong line. Cutting lines is an option of last resort; the alternatives, such as the one described above, are worth attempting first.

Level Four: Assisted Rescue

The climber has taken a severe pendular swing and impacted the stem, is conscious, and is complaining of severe pain in the lower back. Spinal injuries are suspected. After calling 911/112, the team decides to access the injured climber but not to move him, and to wait for the arrival of emergency services. If the rescuer is in the tree, he can reassure the victim and he may be able to assist emergency personnel in immobilizing and extracting the injured climber from the tree. Immobilization in the tree is complex, but possible if given the proper training.

The obvious question when discussing such a scenario is whether to attempt to move the climber oneself. In urban areas where most tree work is done response times can be short, 10 minutes or less, depending on the location. Nevertheless, the location of the accident also determines the most appropriate response. If access by a bucket truck isn't possible, there is the risk that getting the climber to the ground may take a long time. In a number of documented cases in both the U.S. and Europe, this can easily take up to two hours or more, depending on the position of the climber. If unsure, the best choice is to access the climber and wait. Emergency personnel may not allow another climber to enter the tree once they have arrived and have taken control of the situation. At the same time, they may not be trained or equipped to perform a high-angle rescue.

Most first-aid procedures will require the injured climber to be on the ground. A major guideline is ABC (Airways, Breathing, Circulation). According to ABC, if the climber in the example above weren't breathing, it would be necessary to bring him to the ground despite the suspected spinal injuries. So whether to leave an injured climber in the tree or whether to move him is not a question with a straightforward answer; a paramedic or doctor may choose to "load and go" or to "stay and play" based on a much higher degree of medical training than a team of arborists.

Nevertheless, with proper training in rescue techniques and first aid, as well as discussions with the local rescue department, a tree crew working as a team should be able to respond in a coordinated fashion to an emergency situation (Figure 5). The aim isn't for every crew to go out with spineboards and neck braces or for every arborist to become a part-time paramedic, ready to respond to complex medical situations. But the team should know its level of competence and limitations, and the highest level to which they are able to respond to safely without risking additional injuries. This may even be as basic as knowing how to call 911/112, the relevant information that needs to be communicated, and the exact location of the accident.

Emergency planning also happens at an organizational level: Are there two climbers on site? Are there two sets of climbing gear on site? Is the second climber able to perform a rescue? It makes sense to use equipment that the crew is used to handling. Specialized tools could lead to confusion, misunderstanding, or misconfiguration, which can create new risks. For most scenarios, it is possible to achieve a lot with the equipment many climbers routinely carry:

- a 120-cm sling for redirects or to use as an improvised chest-harness.
- a short, rated sling with two carabiners for a load-bearing connection.
- a figure-eight descender,

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Figure 5. Some methods of first aid, such as CPR, require specialized training, and should only be carried out after appropriate training.

- a small Prusik-minding pulley for rigging mechanical advantage systems, and
- a first-aid pack with a blood stopper dressing.

There are so many aspects to emergency response that it's hard to cover them all in one article. The first step to take though is to consider the working environment and to create a framework in which response to emergency situations is possible. A climber can do this by reviewing and researching the company safety policies and training, the trees commonly worked in, and the tools and techniques that are employed in emergency response scenarios.

It is also important to know that discussing and training for aerial rescue isn't only about immediate emergency response. The time and effort invested in training pays off, not only in the event of an accident, but also in preventing one in the first place. Discussing pertinent issues with the team and creating an awareness and a level of competence in team members can instill a safe working philosophy that may just prevent accidents from occurring.

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