As a follow-up to my last article, I will continue to discuss the major stressors of honey bee colonies. I covered the main biotic stressors (pest, pathogen, predator, parasite) of honey bee colonies in my July article. Now, I will discuss the other major stressors of honey bee colonies: managed-related stressors, nutrition, queen-related stressors, and weather-related stressors.

Many of the stressors that I discuss herein are more significant stressors than some of the biotic ones I discussed in my July column. In fact, one or two of these stressors are among the main problems that beekeepers have to address throughout their beekeeping careers.

My strategy for discussing these stressors will closely mimic the one I used when discussing biotic stressors in my previous article. [*The remainder of the introductory text that follows is from my July article with minor modifications as needed.* Ellis 2016] For each stressor, I will briefly discuss its role in colony health and mortality. I also note the overall potential threat it poses to colonies (low, moderate, significant). It is important to realize that I ranked the stressors in Table 1 simply based on my views of how they impact colonies. In general, any stressor can have low, moderate, or significant impact on affected colonies and the level of the severity of the impact can vary widely by time of year or location. Consequently, my ranking of each stressor is only for reference purposes and not intended to be a static designation.

- **Low threat** – The stressor can kill bees or colonies, but usually does not. Thus, the beekeeper must be aware of its potential to cause harm and remedy the situation if necessary. Usually, stressors that are present as low threats do not need to be addressed with regularity, though the beekeeper needs to be aware of the threat it poses and be able to address it should the need arise. Stressors in this category usually only affect a small number of colonies in an apiary. In severe circumstances, low threat stressors can manifest as moderate threats and, correspondingly, would need to be addressed.

Table 1: Ranking the other stressors of honey bee colonies by the threat they pose to the bees. Within the threat level (significant, moderate or low), the stressors are ranked from most significant (higher on the list) to least significant (lower on the list) based on their distribution and impact on colonies when present in an area. A given stressor's impact on a colony can vary according to many factors, meaning that most listed stressors are capable of being low, moderate, or significant threats at certain times or under certain circumstances. Thus, the ranking system that follows is general and somewhat fluid. Stressors that are near to one another on the list affect colonies similarly and may be more/less important in certain areas.

Significant threat - when present, you *must* address the issue and sometimes this is best done prophylactically	
Starvation	Beekeepers around the U.S. consistently rank this a significant colony stressor, even more so than some biotic stressors such as various pests and pathogens.
Poor quality queen or queen failure	Similar to starvation, this stressor receives high rankings in yearly beekeeper surveys on causes of colony collapse.
Low quality or quantity of nectar forage	This stressor can be mitigated by finding nectar-rich locations to site ones apiaries.

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Low quality or quantity of pollen forage	This stressor can be mitigated by finding pollen-rich locations to site ones apiaries. Remember, not all pollens are created equal. Abundant pollen does not necessarily mean high quality pollen.
Cold	Winter is a time of very high colony mortality.
Dead or missing queen	Most colonies recover from this, but a small number of colonies fail to produce a new queen.
Laying workers	This condition is difficult to remedy and can spell certain doom for a colony unless it is addressed appropriately.
Lack of preparation, not ready to keep bees, naiveté	As much as we hate to admit it, sometimes we just do not know how or are not prepared to address colony maladies.
Moderate threat - can be a stressor, sometimes even serious, in certain areas and under certain circumstances	
Pesticides	Can be a significant problem for bees. Many colonies contain residues of pesticides to which they were exposed.
Apiary site selection	This management-related issue can, when properly addressed, mitigate the impact of many of the other stressors.
Drought	Impacts bee forage availability and colony ability to thermoregulate.
Rain	Floods and excessive rain can impact colonies through physical damage associated with floods and indirect impact on bee forage.
Heat	Excessive heat damages colonies.
Limited access to queens and extra bees	The inability to access queens and bees can make it difficult to remedy other colony maladies.
Robbing	Robbing bees can completely destroy weak colonies.
Moving bees	Moving bees is a stress for the bees and the beekeeper.
Queen supersedure	This process does not always result in quality queens and it is not failsafe.
Limited or no access to clean water	Bees need water to thermoregulate. Polluted water or the lack of water altogether can be a detriment to bees.
African honey bees	Obviously a problem only where they are present, African bees can impact colony demeanor and manageability.
Natural disasters	A huge problem for colonies when they happen, but most beekeepers do not have to experience these.
Fire	Fires can destroy entire apiaries.
Wind	Wind is not usually a problem for colonies.
Nest ventilation	Poor ventilation can cause colonies to overheat or promote diseases.
Low threat - rarely a major problem, but can significantly stress a colony when conditions are right	
Small colonies	Small colonies are vulnerable to other stressors.
Swarming	Though a natural phenomenon, it usually happens during production season and ultimately makes the colony queenless for a short period of time.
Feeding bees	Improper feeding of bees can lead to robbing and spread colony pathogens.
Toxic nectar	Not particularly common, but can kill colonies.
Working bees too much/too little	Usually not a problem, but should be addressed nevertheless.
Limited access to beekeeping equipment/ supplies	Often not a problem in developed countries, thanks to the internet and home delivery services.
Smoking bees	One can over-smoke a colony so smoke should be used judiciously. Use chemical free smoker fuels.
Multiple queens	This is only a problem when it ultimately results in a queenless colony, as can happen when the two queens fight to the death.

- **Moderate threat –** Stressors that present as moderate threats often are common (i.e. in/affect a high percentage of colonies) and can cause significant damage if not addressed appropriately. Often, moderate threat stressors can be managed with regular effort. Moderate threat stressors can escalate into serious threats in some areas and in certain circumstances. Consequently, beekeepers must monitor for and actively manage moderate threat stressors to limit their overall impact on colonies.
- **Significant threat –** Significant threats are those threats that usually are widespread and typically kill colonies if the threat is not managed actively. In fact, these stressors must receive the full attention of beekeepers who may or may not have a viable list of management-related mitigation options available for the stressors. This list includes a couple of stressors that are believed to harm colonies significantly, even if the level of threat they pose is not known with certainty.

Management-related stressors

Management-related stressors are those that manifest based on how beekeepers manipulate their colonies through the normal processes associated with keeping honey bees. One could argue that bee colonies in their natural state are less stressed than managed colonies, but I am not convinced that this is the truth. That said, there is no doubt that management adds certain levels of stress into the colony's life. Thus, it behooves beekeepers to be aware of and use best management practices to ensure that what they are doing poses as little threat as possible to the health and fecundity of the hive.

1) Apiary site selection: Inappropriate siting of apiaries (Figure 1) can be a detriment to colony health and prolificacy. Thus, I consider it a ***moderate*** threat to the health of honey bee colonies. I only consider it a moderate threat rather than a significant one because beekeepers are in complete control of this potential stressor, meaning that they need to do their homework and choose appropriate sites for their bee colonies. Apiary location dictates the floral and water resources available in an area, the threat natural phenomena (such as flooding) pose to the colonies, the likelihood that their colonies will be a nuisance to others, the threat of vandalism, etc. For example, how easy is it to manage the apiary site? Do neighbors operate heavy duty equipment near the bees? Are trees likely to fall on the colonies (Figure 2)? Does your apiary location put your colonies in the path of bears? Just like in real estate, good apiary sites are about location, location, location, and they can make all the difference between a ho-hum beekeeping experience and extremely productive colonies.

2) African honey bees: African bees (Figure 3) pose a ***moderate*** threat to colonies, but obviously only in areas where they are present. For example, African bee swarms can infiltrate managed colonies through a process called usurpation, whereby the swarm

Figure 1 – Location, location, location. The site you pick for your apiary dictates a lot about the future health and longevity of your colony(ies). Photograph: University of Florida.

Figure 2 – How easy is it to manage your apiary and what negative events are prone to happen where you have located your bees? In this photograph, an oak tree fell onto my colonies. I had to reassemble them and put them back on their stand. Remarkably, they all survived. Photograph: Jamie Ellis.

Figure 3 – A feral colony of African honey bees nesting exposed on a tree limb. African honey bees pose a threat to managed colonies. Beekeepers living in areas where African honey bees are present must take special precautions to limit the impact of these bees on their managed colonies. Photograph: Eileen Buss.

overtakes a managed colony and replaces the managed colony's queen. Furthermore, having African bee colonies in an area means that there is a healthy population of African bee drones in the surrounding landscape. This matters because the new queens in your colonies will mate with these drones and produce Africanized offspring. Though African bees rarely are a threat to colony fecundity, they do pose a risk to the beekeeper, his/her neighbors, friends, family, and other bystanders. I consider them only a moderate threat because management strategies exist for minimizing the threat they pose to colonies.

3) Feeding bees: Nearly all beekeepers end up feeding their colonies at some point (Figure 4). The physical act of feeding bees can pose a ***low*** threat to colonies if not done properly because it can cause colonies to get unwanted attention from robber bees or other pests hoping to gain access to the sugar water. It also can facilitate the spread of pests and pathogens between colonies. However, the low threat posed to colonies by feeding usually is justified because feeding bees is a remedy for colony starvation or inadequate nutrition, both of which are significant threats to colonies. Nevertheless, beekeepers should feed bees responsibly to minimize any side effects posed by the physical process of feeding colonies.

Figure 4 – A row of nucs with half pound feeder jars on their lids. Most beekeepers end up feeding their bees at some point. Photograph: University of Florida.

4) Lack of preparation, not ready to keep bees, naïveté: In my opinion, lack of appropriate knowledge of bees and beekeeping poses a ***significant*** threat to colony health. This, certainly, is not intended to be condescending in any way. However, I believe it is important for all beekeepers and would-be beekeepers to know that beekeeping can be a complicated endeavor. In fact, there are many moving parts to managing colonies; there is a lot to know. Thus, it is important that beekeepers take the necessary steps to read books/periodicals, be trained by a mentor, join local bee clubs, etc. in an attempt to know how to keep bees properly. It is equally important that beekeepers (and bee researchers for that matter) continue to receive training (Figure 5) throughout their beekeeping careers. One of the best ways to combat colony stressors is to know *how* to combat colony stressors.

5) Limited access to beekeeping equipment/supplies: These days, most beekeepers in developed countries have reasonable access to beekeeping equipment/supplies. Thus, I consider this a ***low*** threat stressor. However, beekeepers in many developing countries have little-to-no access to similar equipment, making this lack of access a significant problem for them. Why would this be a problem? Imagine finding damaging levels of *Varroa* in your colonies but not being able to purchase reasonable remedies, or colonies that are starving but not being able to purchase feeders. Thus, access to beekeeping equipment and supplies can make the difference between being able to remedy another colony malady or losing the compromised colony.

6) Limited access to queens and extra bees: Having limited access to queens and/or extra bees is a ***moderate*** threat to honey bee colonies. Occasionally, beekeepers need to purchase queens (Figure 6), nucs, or package bees (Figure 7) to remedy other colony

problems, to grow their operations, etc. Having limited access to these can be a problem because the production and sale of bees and queens is a seasonal endeavor, meaning that beekeepers often do not have access to them during much of the year. I will discuss issues related to queens in points 19-25.

7) Moving bees: Moving bees (Figure 8) is usually a ***moderate*** stressor to colonies, though it certainly can be a significant stressor in certain circumstances. Colonies that are moved usually are unable to fly for hours, or even days, depending on how far the new apiary site is. Furthermore, airflow often is restricted when colonies are moved, thus making colonies prone to overheating. Beekeepers should know that moving colonies is a stress on the bees and they, correspondingly, should take precautions to minimize this stressor.

Figure 5 – A lot of people jump into the world of beekeeping without being properly prepared. Education and experience are keys to keeping colonies alive and healthy. *Photograph: University of Florida*.

Figure 6 – Queen honey bees, like those seen in individual cages here, can be hard to get at certain times of the year. *Photograph: University of Florida*.

Figure 7 – Installing a package of bees. Packages can be difficult to obtain for much of the year. Not all beekeepers have easy access to them. *Photograph: University of Florida.*

Figure 8 – Moving bees can be a necessary evil of beekeeping. It also can be a significant stress to colonies if not done correctly. Photograph: *University of Florida*.

8) Nest ventilation: Nest ventilation poses a ***moderate*** threat to honey bee colonies. Typically, standard managed nests have large enough entrances to ensure adequate ventilation. However, unsuspecting beekeepers may reduce the entrance too much or nests not otherwise be ventilated properly. This can cause the moisture to build up in the nest or the nest to become overheated. The former is important because some pathogens, such as chalkbrood, thrive in higher nest humidities.

9) Pesticides: Many beekeepers may disagree with me here, but I consider pesticides a ***moderate*** threat to honey bee colonies, though the *potential* threat posed by pesticides to bee colonies is significant. Why do I say that? Well, there is no doubt that pesticides can kill entire colonies, sometimes even all of the colonies in an apiary or multiple apiaries. However, I would argue that the problem of pesticides is not as chronic and systemic as most people think (again, I know this is debated currently, and I certainly may be wrong). With all of that said, I believe it is the most significant of the moderate stressors (Table 1). Bees can be exposed to pesticides while foraging in the field, via agricultural and non-agriculture use of pesticides, via mosquito control programs, and by beekeepers who use in-hive treatments to control many of the maladies that colonies face. The best ways to minimize the threat of pesticides to bees include: (1) keeping your colonies away from areas where pesticides of any kind are used regularly, (2) using pesticides in/around your own colonies as judiciously as possible, and (3) following all pesticide label instructions: the label is the law.

10) Robbing: Robbing bees, bees that try to enter a nest that is not their own in order to steal honey from the foreign nest (Figure 9), can be considered a ***moderate*** colony stressor. Generally speaking, robbing is a seasonal issue, with bees being more prone to rob other colonies in late summer/early fall than they are in spring/early summer. Correspondingly, robbing is a significant threat during the former time of year and only a low threat during the latter one.

11) Small colonies: Small colonies, nucs/baby nucs/etc. (Figure 10), have a higher chance of succumbing to other stressors than do larger, more populated ones. Despite this, many of the stressors affecting small colonies can be managed adequately, making the threat to small colonies otherwise ***low***.

12) Smoking bees: Believe it or not, you can over-smoke your bees, though the threat of doing this is very ***low***. People have been using smoke to calm bees for thousands of years. Bees and smoke go hand-in-hand. That said, you should be careful when considering what type of smoker fuel to use. For example, burning pine straw and grass clippings generally is safe for bees, unless, of course, the substrate had been sprayed with pesticides prior to use. Other substances, such as burlap sacks or old rags, should be cautioned

Figure 9 – Bees guarding a void between two supers. Openings like this make wonderful attack points for robbing bees. *Photograph: University of Florida*.

Figure 10 – Small colonies, such as the 5-frame nucs seen here, are especially vulnerable to colony stressors and can succumb quickly if not managed closely. *Photograph: University of Florida*.

against given that they can contain any number of residues that may be detrimental to the bees if used in a smoker.

13) Working bees too much/too little: Beekeepers can work their bees too much or too little, though the threat posed by either usually is quite ***low***. The beginning beekeeper often wants to work his/her colonies every day. Of course, this is not ideal but it does not seem to stress colonies significantly, though it does make colonies somewhat vulnerable to other colony stressors. In contrast, beekeepers can work their bees too little, not giving the colonies the attention they need to thrive. The truth is that managed colonies need to be, well, managed in order for the beekeeper to stay ahead of the stressors that can cause colony demise.

Nutrition

Nutrition-related stressors are those that relate to a bee colony's collection, storage, and use of forage resources available in the environment. It also includes the value of the food source to the bees. Nutrition-related stressors are a topic of considerable discussion internationally. Beekeepers and bee scientists alike believe that bee nutrition is very important to overall colony function. My guess is that we will become increasingly aware of the importance of quality forage over the next 1-2 decades.

14) Limited or no access to clean water: Inability to access good quality water can be a ***moderate*** threat to honey bee colonies. Bees need water, among other reasons, to use to keep colonies cool during summer months. The water they collect should be abundantly available, accessible year-round, and free of any contaminants that otherwise would harm the colony.

15) Low quality or quantity of nectar forage: This is a ***significant*** threat for many bee colonies. Bees must have good access to abundant nectar in order to make and store copious amounts of honey (Figure 11). Honey is the fuel bees need in order carry out all of the activities of life. Without honey, the colony is doomed. It is important to know that you cannot just site a colony of bees anywhere you want and the bees make honey. Thus, low quality or quantities of nectar in an area can doom a colony or cause the beekeeper to invest heavily in feeding bees.

Figure 11 – A bee foraging on a citrus blossom. Not all locations have adequate food reserves for bees. *Photograph: University of Florida*.

16) Low quality of quantity of pollen forage: Likewise, bees also need access to good qualities and quantities of pollen out of which they make bee bread (Figure 12) that they consume. Not all pollens are created equal. Just because a site contains lots of pollen-rich flowers does not mean that the available pollen is good for the bees. Because of this, lack of quality pollen in an area can be a ***significant*** threat to colonies.

Figure 12 – Stored bee bread. Honey bees need good access to quality pollen sources. Otherwise, they will not be able to rear brood. *Photograph: Jamie Ellis*.

17) Starvation: Flowing naturally from points 15 and 16, starvation can be a ***significant*** stressor for honey bee colonies (Figure 13). In fact, starvation is regularly listed in the top 5 reported reasons that beekeepers lose colonies. Starvation results from bee inability to access food in the nest or the overall lack of food in the nest. The latter is somewhat intuitive: bees starve when they do not have enough food in the nest. However, the former can be a bit more difficult to understand given that bees can still starve even if food is in the nest. This happens usually during winter when it is too cold for the bees to break cluster to move to the stored food that can be even within a few inches of the cluster. The good news about starvation is that it is something that is completely avoidable given that the remedy for a lack of food is feeding bees.

Figure 13 – A comb of stored nectar and honey. Bees can starve quickly if they do not have adequate supplies of nectar. Apiaries should be cited in areas that support a diverse community of nectar-bearing, flowering plants. Photograph: University of Florida.

18) Toxic nectar: Occasionally, bees have access to plants that produce a toxic nectar. Colonies in areas where plants producing toxic nectar exist are at moderate risk of suffering due to exposure. However, toxic nectar likely affects few colonies in general, making it typically a ***low*** impact stressor.

Queen related stressors

I regularly tell beekeepers, especially new ones, that queen-related issues are the biggest threat to colonies, and probably the least considered threat to colonies. My guess is that nearly all colonies have a "queen-related crisis" every year. I think you will agree once you read the list of queen-related stressors that follows. I cannot stress enough that beekeepers need to master queen management, nearly as much as they need to master disease/pest control. Queen-related issues happen year-after-year, in every apiary around the world. My feelings about this are substantiated by nationwide surveys that reinforce the idea that poor quality queens and the problems that accompany them are a big threat to bee colonies.

19) Dead or missing queen: The loss of a queen (Figure 14) in a colony, whether she is dead or simply missing, is a ***significant*** threat to colony health and fecundity. I suspect that most colonies go queenless every year or every other year, meaning that this threat will affect nearly every colony at least every two years. Of course, colonies go queenless all the time. It is a part of natural colony existence. However, some fraction of all colonies ultimately fail to requeen themselves, meaning that queenelessness can/will doom a subset of colonies yearly.

Figure 14 – A queen honey bee. Queen management is key to colony health and longevity. *Photograph: Mike Bentley*..

20) Multiple queens: Colonies can occasionally have multiple queens, though this usually only poses a ***low*** threat to their health and survivorship. I see colonies with multiple queens regularly. In these situations, one of the queens usually is the "dominant" queen, meaning that she is the one the bees in the colony recognize and she is the one laying eggs, and the other often is one that is not noticed at all. In the latter case, the queen may/may not be laying. Either way, I suspect this happens when the old queen in the colony becomes unrecognizable (i.e. perhaps her pheromone output has decreased or stopped altogether) and she is replaced, without actually being killed. Regardless of how this happens, this situation usually remedies itself, though sometimes the two queens can fight to the death, leaving the colony ultimately queenless.

21) Poor quality queen or queen failure: Poor quality queens and/or queen failure represent a ***significant*** threat to colonies. What is a poor quality queen or a queen that has failed? It can be any number of things: a drone laying queen (that either mated improperly or ran out of semen); an inbred queen that is laying inbred eggs causing the workers to abort the eggs, leading to a spotty brood pattern (Figure 15); a maimed queen, such as one that has a hurt leg or is otherwise physically compromised; a queen that has gotten too old and can no longer keep up her original egg output; or even a queen that simply confers undesirable traits to her worker offspring, leading to an unproductive colony. These and other factors can impact colonies significantly.

Figure 15 – A spotty brood pattern. Brood patterns such as this can suggest that a queen is inbred or failing. *Photograph: Jamie Ellis*.

22) Supersedure: Queen supersedure is when the bees in the colony work to replace the existing queen who they have determined to be inferior for whatever reason or they have to produce a new queen in an emergency situation when the old queen is dead or lost. In both examples, the bees usually use female larvae that were in route to becoming a worker, and switch her destiny to that of becoming a queen. Thus, supersedure queen cells (Figure 16) often occur on the face of the comb, somewhere in the brood pattern, because the workers have to select their next queen from among the larvae originally destined to become workers. This is in contrast to swarm cells that typically occur on the perimeter of the brood comb. Queen supersedure represents a ***moderate*** threat to colonies, mainly because inferior queens can be produced from larvae that once were in route to becoming workers and because, sometimes, the queen rearing process fails.

Figure 16 – A supersedure queen cell from which a queen emerged. There is a "ripe" supersedure cell just to the right of my finger. *Photograph: University of Florida*.

23) Swarming: Swarms (Figure 17) are a natural part of colony life and, consequently, usually only pose a ***low*** threat to colonies. The reason they can be a problem for colonies lies mainly in colony productivity (colonies that swarm cease being productive during the recovery from swarm process) and because colonies that issue the swarm now have to produce a new queen, which I have already noted is not a fail-proof process.

Figure 17 – A swarm of honey bees is a natural occurrence. However, swarms can be detrimental to colony productivity as colonies typically issue swarms immediately before and during the major nectar flow. *Photograph: Bill Kern, University of Florida*.

24) Laying workers: Laying workers are workers that lay eggs when a colony goes queenless and fails to produce a new queen. In this scenario, the ovaries of some workers develop such that the workers can lay eggs. These workers are unable to mate and, thus, only produce unfertile, or male, offspring. Colonies headed by laying workers are doomed. Unfortunately, the problem of laying workers is difficult to address, making this threat, when it occurs, a ***significant*** colony stressor. This is because workers that lay eggs also begin producing pheromones associated with a queen, causing a colony to think that it is queenright. The unsuspecting beekeeper proceeds to introduce caged queen after caged queen, only to have each one rejected by the colony. Nearly every beekeeper who keeps bees for any length of time will encounter a colony with laying workers at some point.

Weather and other natural phenomena

All colonies around the world experience weather extremes yearly. The good news is that colonies are built to survive extremes through a complicated series of behaviors employed by the bees to ensure nest homeostasis. That said, Mother Nature is a hard foe to conquer and she regularly has her way with bees and their colonies. The threat of some of the weather extremes was difficult to classify accurately. All weather extremes can kill colonies and wipe out entire apiaries, making them all fully capable of being significant stressors. However, I did not rate them all as significant stressors because some of the weather conditions are more likely to affect more colonies with greater regularity than are other weather conditions. For example, nearly every colony in temperate regions is impacted by the effects of cold weather yearly while most colonies will not experience droughts yearly.

25) Cold: Cold weather can be a ***significant*** stressor for honey bee colonies, particularly in the more extreme temperate climates. Of course, colonies come front loaded with the ability to thermoregulate but winter, in general, is pretty hard on bees and often when the greatest number of bee colonies is lost. In fact, many beekeepers consider the stress imposed by winter on colonies to be among the most significant stressors affecting bees. Colonies that become too cold usually manifest as dead adult bees, head first in cells (Figure 18), and dead bees between the combs where they would have been clustering. The cold weather can outright freeze bees, but it also can

Figure 18 – Chilled and/or starved bees, like those seen here, often die headfirst in cells. *Photograph: University of Florida*.

cause them to starve if they are unable to break cluster to access the honey stores contained within the nest.

26) Drought: Drought is a significant colony stressor when it occurs, but usually does not occur at a level that a high percentage of colonies are affected. Thus, I consider drought a ***moderate*** colony stressor. Droughts affect colonies two main way, they (1) make it difficult for bees to access the water they need to cool the nest and (2) impact the flowers on which the bees rely so heavily.

27) Fire: Fire is a significant colony stressor, when it happens, but fortunately, it is not common to all beekeepers, allowing me to rate it only a ***moderate*** stressor. Many colonies, no doubt, are lost to fires yearly. However, few beekeepers will experience colony losses to fire.

28) Heat: Like cold weather, hot weather can be a significant stressor for colonies. However, colony losses during summer are not typically as high as those during winter. Colonies seem to be able to handle hot weather better than they are able to handle cold weather, a comment I make based solely on colony loss data for both times of the year. As a result, I rate the impact of heat to colonies as a ***moderate*** stressor, though it certainly can be significant in areas where high temperatures are common.

29) Natural disasters (tornadoes, tropical storms, flooding, hurricanes, etc.): As for other conditions in the weather category, natural disasters can be a significant threat when they strike because a large number of bee colonies can die as a result. However, natural disasters usually affect only a fraction of bee colonies every year. Thus, I rate them as a ***moderate*** threat. Probably the most common natural disaster, or the one I see happening most where I live, is flooding due to excessive rain. I discuss that occurrence in the next point.

30) Rain: Too much rain can be a ***moderate*** problem for bees when it results in flooding, affects flower bloom, or impacts a queen's ability to go on a mating flight when she otherwise would be ready to mate. Oddly enough, it is the latter two issues that I see happening most. Sometimes, it rains so much during honey production season that bees are unable to leave the colony to forage for nectar. Likewise, queens that fail to mate during the time they would otherwise mate, due largely to rainy conditions, often become drone layers, thus sealing the fate of the colony. One way to mitigate the impacts of flooding it to site apiaries on higher ground that has good drainage.

31) Wind: Wind is a ***moderate*** threat to honey bee colonies. It can topple hives, blow off their lids, etc. Furthermore, it can affect bee flight, most notably the mating flight of queens. That said, most beekeepers do not experience any problems associated with wind on a yearly basis so it likely is the least impactful of all the weather-related stressors.

Reference

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