WESTERN (EUROPEAN) HONEY BEES (APIS MELLIFERA) ON TEXAS PARKS AND WILDLIFE DEPARTMENT LANDS MANAGED FOR NATIVE BIODIVERISTY

ISSUE BRIEFING PAPER/ POSITION STATEMENT

ISSUE:
Recommendation Against Managed Colonies of Western (European) Honey Bees (*Apis mellifera*) on Texas Parks and Wildlife Department Lands Managed for Native Biodiversity

APPROVED:
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COMMUNICATION GUIDANCE:
This document provides information to Texas Parks and Wildlife Department (TPWD) staff on the potential impacts of the non-native western (European) honey bee (*Apis mellifera*) (referred to here as 'honey bee') on native ecosystems and guidance regarding the exclusion of managed honey bee colonies on TPWD lands established for the conservation of native plant communities and associated native wildlife.

TPWD POSITION:
The placement of managed honey bee colonies on TPWD lands managed wholly or in part for native biodiversity is incompatible with the protection of native biodiversity and should be avoided.

SUMMARY:
Western (European) honey bees (*Apis mellifera*) have the potential to negatively impact populations of native pollinator species. They may also facilitate establishment, reproduction, and expansion of non-native invasive plant species. Consequently, establishment of managed honey bee colonies on TPWD lands is not compatible with the conservation and management of native plant communities and associated wildlife. Exclusion of managed hives would help reduce establishment of feral honey bee populations that can potentially pose a nuisance or threat to visitors and staff. Although the importance of non-native honey bees for honey production and agricultural pollination is certainly substantial, establishment of managed and resulting feral colonies on TPWD lands managed wholly or in part for native biodiversity should be avoided.

BACKGROUND:

NON-NATIVE SPECIES, HONEY BEES, AND NATIVE BIODIVERSITY

Non-native animals and plants have the potential to negatively impact native ecosystems[1,2]. Lands designated and managed for the conservation of native biodiversity are especially at risk from the negative effects of non-native species[3]. Natural areas, parks, and other protected sites often contain habitats that have become rare in the surrounding landscape, comprising critical refugia for native wildlife. Introduction of non-native species to these sites often results in the decline of native species and/or influence ecosystem processes[4]. Honey bees are essential agricultural pollinators that contribute significantly to the U.S. economy and which have experienced population declines across much of North America. Managed as semi-free ranging agricultural animals, honey bees can serve as crop pollinators, honey producers, and as an enjoyable avocation for hobbyists. However, honey bees are non-native species and research indicates that they may compete with native pollinators for floral resources, alter pollination processes in native plant communities, and facilitate the reproduction of non-native, invasive plants.

STATUS OF MANAGED HONEY BEE COLONIES IN THE U.S.

The honey bee was first introduced to North America in the early 17th century[5] and now occurs across a substantial portion of the continent. Confined to bee-keeper maintained colonies, the honey bee constitutes a semi-free ranging, managed agricultural animal[6]. Honey bees pollinate over 50 of the world's 115 leading food crops[7] and are essential to the production of U.S. agricultural commodities valued at several billions of dollars annually[8].

Since the 1950s, there has been a steep decline in the number of managed honey bee colonies in the U.S. from 5.9 million colonies in 1947 to 2.3 million in 2013[9]. This long-term decline, coupled with recent, elevated annual losses reported by U.S. bee-keepers, has been the topic of much media attention and has generated an overall concern regarding honey bee health and human food supplies. However, the long-term decline in managed honey bees, partially reflects changing political and socioeconomic factors rather than a systemic, pervasive threat to honey bee health[6].

After the end of World War II honey demand and prices fell, making bee-keeping less profitable. Eroding profitability was further compounded in the 1960s by increased importation of honey from Asian and South American nations. A ban on importation of U.S. honey bee stock into Canada in 1987 and a suspension of federal subsidies for honey in 1996 also resulted in long-term decline in U.S. managed honey bees[6].

Conversely, annual honey bee colony losses have been attributed to environmental conditions, genetic vigor, nutritional deficiencies, parasites, and pathogens. High annual losses (ranging from 22%-36%) have been reported by bee-keepers in this country for overwintering periods starting in 2006[10]. The majority of losses in the U.S. have generally been attributed to one or more reported causes such as weather events, starvation, queen failure, and parasitic mites[11].

Despite these losses, the USDA National Agricultural Statistics Service estimated that honey bee colony numbers increased from 2.39 million in 2006[12] to 2.64 million in 2013[13]. Bee-keepers are able to compensate for large overwintering losses by splitting surviving colonies and/or by purchasing packages of honey bees[14]. While U.S. honey bee colonies managed for pollination service or honey production certainly face husbandry-related challenges, the situation is not as dire as has been depicted by many media outlets. A catastrophic loss of managed honey bees in the U.S. is not on the horizon based on currently available data.

BIOLOGICAL DIFFERENCES BEWTEEN HONEY BEES AND NATIVE BEES

The US and Canada hosts approximately 4,000 described native bee species. These bees evolved in the absence of the honey bee. Establishment of honey bees across the continent potentially increases resource competition for native bees and other flower-visiting taxa that rely upon nectar and pollen for food.

The honey bee is a social insect that lives in colonies populated by a queen and a contingent of daughter workers. Colonies can host tens of thousands of workers, roughly a third of which leave the colony to forage for nectar and pollen. Honey bees are generalist foragers capable of visiting a hundred or more different plant species within a given geographic region[15,16]. The species has been recorded visiting nearly 40,000 different plant species globally[17]. Foraging workers have the ability to communicate the location of nectar and/or pollen sources on the landscape to one another, thereby increasing foraging efficiency[18]. Individual workers are capable of flying over six miles to search for food[19]. Given a queen's reproductive capacity and sizeable work-force, honey bee colonies require large amounts of nectar and pollen. An individual colony can harvest 22-132 lbs. of pollen and requires 44-330 lbs. of honey per year[20]. Honey bee colonies may persist for several years.

In contrast, over 90% of native bee species occurring in Canada and the U.S. are solitary, establishing nests and foraging for food on an individual basis. Many native solitary bees are generalist flower visitors, but several species in Texas, including some Species of Greatest Conservation Need (http://tpwd.texas.gov/huntwild/wild/wildlife_diversity/nongame/tcap/sgcn.phtml), exhibit obligate foraging preferences for a small number of plant species. Available data suggests that foraging range for many species is far less than six miles and that some species fly less than 200 yards from the nest to forage[21]. Most solitary bees exhibit an annual life cycle.

The closest native equivalents to the honey bee north of Mexico are bumble bees, another group of social bees. Bumble bee colonies typically contain less than 1,000 workers. While a honey bee queen and her colony may persist for several years, the colonies of bumble bees are annual and must be established each year through the efforts a single queen in the absence of workers.

POTENTIAL ECOLOGICAL EFFECTS ON NATIVE BEES

Research suggests that honey bee monopolization of food resources can displace native bees to less preferred plant species, suppress reproductive success, and reduce abundance. Both feral and managed honey bee colonies are capable of removing a substantial portion of nectar and pollen from a given site to the detriment of native bee populations[22-33]. Sites where honey bees are absent support greater numbers of native bees than sites where they occur, suggesting competitive displacement of native bees by honey bees[34]. In addition to bees, other species dependent upon nectar and/or pollen (butterflies, hummingbirds, moths, etc.) may also be impacted due to competition for limited floral resources.

Where bumble bee and honey bee colonies co-occur, bumble bees can experience food scarcity due to competition for floral resources[35-39]. Bumble bee colonies compensate by increasing nectar foraging at the expense of pollen collection, resulting in production of fewer larvae and reduced body size for larvae that develop into adults. Colonies with fewer, smaller workers are less likely to produce queens because smaller workers bring back less food than their larger sisters. Small bumble bee colonies often produce only males and no queens at all. Queen production is a critical determinant of the number of bumble bee colonies on the landscape on an annual basis.

Over 30 flower-visiting insects have been identified as Species of Greatest Conservation Need (SGCN) in TPWD's Texas Conservation Action Plan (Appendix I). This group includes several native solitary, Texas endemic bee species that exhibit narrow foraging preferences. Species with very limited ranges and dependence on only a few flowering plant species could be negatively impacted by resource competition with honey bees[40]. Three bumble bee species native to Texas (American bumble bee, Sonoran bumble bee, and variable cuckoo bumble bee) have also been denoted as SGCN. The American bumble bee (*Bombus pennsylvanicus*) has experienced a range-wide decline across the eastern U.S. and now only remains abundant in a small number of Gulf Coast and Midwestern states including Texas[41].

POTENTIAL IMPACTS ON NON-NATIVE, INVASIVE PLANT SPECIES

Honey bees can serve as important pollinators of some non-native invasive plants, contributing to production of viable seed[42]. In some cases, invasive mutualisms have been noted between honey bees and non-native plants. Invasive mutualism occurs when a flower-visitor benefits from a floral resource, and plant reproduction is improved by the relationship between a non-native pollinator and a non-native plant[43].

In Australia, the invasive plant Scotch broom (*Cytisus scoparius*) was found to be entirely dependent upon honey bees for successful pollination and production of viable seed[44]. In California, honey bees played a critical role in maintaining high pollination rates for yellow star thistle (*Centaurea solstitialis*), perhaps contributing to over 50% of the seed set in some areas[45].

Introduced populations of lantana (*Lantana camara*) in Australia were only visited by honey bees, and seed set was highest at sites where honey bees were present. Lantana is one of the most problematic invasive plant species in natural and semi-natural areas in Australia[46]. Goulson and Derwent (2003), note that populations of lantana were readily located in or close to a large number of National Parks and state:

> "Apiarists routinely station hives next to and sometimes within National Parks. There is a clear conflict of interest. It seems certain that the presence of hives will enhance seed set of nearby populations of *L. camara*. It is not known whether seed-set limits population growth in *L. camara*, but common sense suggests that increasing seed set likely to make the plant more invasive. Vast expense is incurred attempting to control this weed, generally with limited success. Our data suggest that a simple and effective means of improving control of *L. camara* may be to remove honeybee hives from the vicinity of infestations."

CONCLUSION:

Non-native western (European) honey bees have the potential to negatively impact populations of native pollinator species. They may also facilitate establishment, reproduction, and expansion of non-native invasive plant species. Seed set and population size of some non-native, invasive plants could potentially be reduced by excluding managed honey bees from TPWD lands. The importance of non-native western (European) honey bees for honey production and agricultural pollination is certainly substantial. However, active establishment of managed hives of non-native western (European) honey bees, which has the potential to result in the escape and subsequent establishment of feral colonies on TPWD lands managed for native plant communities and associated wildlife, should be avoided. Prohibiting the establishment of managed hives of non-native western (European) honey bees (e.g. for educational purposes, for honey production, or for pollination) would also help reduce opportunities for either managed or feral non-native western (European) honey bees to pose a nuisance or threat to visitors and staff. The purposeful establishment of non-native western (European) honey bee hives on TPWD lands is hence not compatible with the conservation and management of native plant communities and associated wildlife, and should be avoided.

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APPENDIX I

Native Pollinator/Flower-visitor Species of Greatest Conservation Need in Texas.

Scientific Name	Common Name
Andrena scotoptera	A mining bee
Apodemia chisosensis	Chisos metalmark
Bombus pensylvanicus	American bumblebee
Bombus sonorus	Sonoran bumblebee
Bombus variabilis	Variable cuckoo bumblebee
Celotes limpia	Scarce streaky-skipper
Cisthene conjuncta	A lichen moth
Coelioxys piercei	a cuckoo leaf-cutter bee
Colletes bumeliae	A cellophane bee
Colletes saritensis	A cellophane bee
Decinea percosius	Percosius skipper
Eucera birkmanniella	A longhorned bee
Euphyes bayensis	Bay skipper
Eupseudomorpha brillians	Brilliant forester moth
Holcopasites jerryrozeni	A cuckoo bee
Macrotera parkeri	A mining bee
Macrotera robertsi	A mining bee
Megachile parksi	a leaf-cutting bee
Oxyelophila callista	A snout moth
Perdita atriventris	A mining bee
Perdita dolanensis	A mining bee
Perdita fraticincta	A mining bee
Perdita tricincta	A mining bee
Petrophila daemonalis	A snout moth
Piruna haferniki	Chisos skipperling
Protandrena maurula	A mining bee
Pygarctia lorula	A tiger moth
Satyrium polingi	Poling's hairstreak
Sphinx eremitoides	Sage sphinx
Stallingsia maculosus	Manfreda giant-skipper

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